27th Annual ACCM Research Day

Hosted by the Johns Hopkins Department of Anesthesiology and Critical Care Medicine (ACCM)

Poster Session

Electronic Posters, Presentations, and Awards

Wednesday, December 3rd, 2025
3:00 PM to 6:30 PM

Chevy Chase Conference Room
Zayed 2117

Visiting Professor & Keynote Speaker:

Dr. Saumya Das, MD, PhD

"Integrative Extracellular Vesicle Transcriptomics: towards a liquid biopsy for chronic diseases."

Professor of Medicine at Harvard Medical School, faculty member of the Cardiac Arrhythmia Service, and co-Director of the Inherited Arrhythmia Service at Massachusetts General Hospital

JOHNS HOPKINS
MEDICINE

27th Annual ACCM Research Day
December 3, 2025

On behalf of the Department of Anesthesiology & Critical Care Medicine at Johns Hopkins University, it is our pleasure to welcome you to the 27th Annual ACCM Research Day. This time each year we gather to share our research with each other in a forum full of collegiality and collaboration. Amidst truly unprecedented upheavals in the research community, these researchers continue to strive for excellence in discovery, innovation, and education.

Our program this year features over 130 presentations, spanning the areas of Basic Sciences (Neuroscience, Cardiovascular, and Pulmonary), Clinical Research, Pain Medicine, Medical Education, Critical Care, Informatics and Artificial Intelligence, Technology and Engineering, Peri-Operative Care, Quality Improvement, and Safety. We encourage you to engage with your colleagues – this is fertile ground for new and exciting collaborations! Ask questions, be inquisitive, and support our ACCM researchers on this special occasion.

This year, we are honored to host Dr. Saumya Das as our keynote faculty guest. Dr. Das is a Professor of Medicine at Harvard Medical School and a leading physician-scientist at Massachusetts General Hospital, where he serves as the Co-Director of the Resynchronization and Advanced Cardiac Therapeutics Program. His research focuses on the discovery and identification of RNA biomarkers in plasma that may prognosticate outcomes related to heart failure and arrhythmic events.

Dr. Das's team is currently validating a newly discovered set of RNA markers in over 4,000 patients as part of a large-scale, NIH-funded study. He hopes that specific sets of RNA markers will eventually translate into clinical tests to assist in stratifying patients based on risk for earlier and more definitive interventions. We are delighted that Dr. Das will deliver our Research Day Grand Rounds on Thursday, December 4th at 7:00 am in Hurd Hall, with his talk entitled: "Integrative Extracellular Vesicle Transcriptomics: Towards a Liquid Biopsy for Chronic Diseases." During his visit, Dr. Das will meet with faculty, residents, fellows and students in ACCM, the division of Cardiology, and members of our research community, offering insights into multidisciplinary collaboration and bench-to-bedside translation.

We encourage attendees to engage actively — our visiting faculty and local investigators are eager to discuss emerging science and develop new collaborations.

We extend sincere thanks to our researchers, mentors, and trainees, without whom we would not be able to offer this excellent slate of research posters. It is through collective effort that we can foster the next generation of clinician-scientists and advance our field. We greatly appreciate Dr. Lakshmi Santhanam for her leadership, and Dr. Katie O'Connor, Josh Rudnicki, Chrissy Jackson, and Sarah Danihel for organizing this wonderful event. Lastly, our sincere thanks to our ACCM Director, Dr. Jochen Daniel Muehlschlegel and his office for their enthusiastic support and investment in departmental resources, allowing us to consistently lead the world in discovery and innovation.

ACCM RESEARCH DAY 2025

Please join us in welcoming Dr. Das and in celebration of the vibrant research enterprise of our department. We look forward to productive conversations, fruitful networking, and an inspiring afternoon of scholarship.

Warm regards,

Sam Das, PhD
ACCM Research Day Faculty Host
Assistant Professor

Joseph Walpole, MD PhD
ACCM Research Day Faculty Host
Assistant Professor
Division of Cardiac Anesthesia

Department of Anesthesia and Critical Care Medicine
Johns Hopkins University

ACCM RESEARCH DAY 2025

We would like to offer our special thanks to Dr. Srinivasa Raja, MBBS, MD Professor Emeritus, Department of Anesthesiology and Critical Medicine, and former Division Chief for the Division of Pain Medicine, for his generous donation in support of this year's ACCM Research Day.

Dr. Raja's extraordinary trajectory in academic medicine began in India, where he completed his medical school. He then came to the U.S. and completed his residency in Anesthesiology at the University of Washington, Seattle. Dr. Raja then undertook postdoctoral research training at the University of Virginia School of Medicine in Charlottesville. Dr. Raja then joined Johns Hopkins as faculty and established a pre-eminent research program focused on Pain medicine.

Dr. Raja is the recipient of numerous awards and honors. He was awarded the Diplomate of the American Board of Anesthesiology in 1982, added Qualifications in Pain Management in 1993, and was recertified in 2002. He became a diplomate of the American Board of Pain Medicine in 2015 and, in recognition of his invaluable contributions to the advancement of Pain Medicine, was awarded honorary membership to the International Association for the Study of Pain in 2022.

Dr. Raja's research focuses on understanding how the nervous system sends pain signals and why every person experiences pain differently. His contributions have been crucial to the development and refining of pain management strategies at Hopkins and beyond. His sponsorship of this year's Research Day is yet another demonstration of his commitment to ACCMs research mission.

ACCM and Dr. Raja are proud to support the 27th annual ACCM Research Day in recognition of its enduring impact on our entire community and reflecting an ongoing commitment to our faculty, researchers, trainees, and to the Johns Hopkins' tripartite mission.

Thank you, Dr. Raja, for your full sponsorship of this important event!

Danny Muehlschlegel
Lakshmi Santhanam
Sam Das
Joe Walpole
Josh Rudnicki

Contents

Schedule at a Glance

3:00 - 3:30

Opening Statements & Poster Viewing

3:30 - 6:00

Time	Monitor 1	Monitor 2	Monitor 3	Monitor 4	Monitor 5	Monitor 6	Monitor 7
15:30	BN 1.1	CP 1.1	CR 1.1	CR 3.1	QH 1.13	CC 1.1	AIT 1.1
15:36	BN 1.2	CP 2.5	CR 1.2	CR 3.2	QH 1.2	CC 1.2	AIT 1.2
15:42	BN 1.3	CP 1.3	CR 1.3	CR 3.3	QH 1.3	CC 1.3	AIT 1.3
15:48	BN 1.4	CP 1.4	CR 1.4	CR 3.4	QH 1.4	CC 1.4	AIT 1.4
15:54	BN 1.5	CP 1.5	CR 1.5	CR 3.5	QH 1.5	CC 1.5	AIT 1.5
16:00	BN 1.6	CP 2.6	CR 1.6	CR 3.6	QH 1.6	CC 1.6	AIT 1.6
16:06	BN 1.7	CP 1.7	CR 1.7	CR 3.7	QH 1.7	CC 1.7	AIT 1.7
16:12	BN 1.8	CP 1.8	CR 1.8	CR 3.8	QH 1.8	CC 1.8	AIT 1.8
16:18	BN 1.9	**BREAK**	CR 1.9	CR 3.9	QH 1.9	CC 1.9	**BREAK**
16:24	**BREAK**	**BREAK**	CR 1.10	CR 3.10	QH 1.10	CC 1.10	**BREAK**
16:30	**BREAK**	**BREAK**	**BREAK**	CR 3.11	QH 1.11	CC 1.11	QH 2.1
16:36	BN 2.1	CC 2.1	**BREAK**	**BREAK**	QH 1.1	CC 1.12	QH 2.2
16:42	BN 2.2	CC 2.2	CR 2.1	**BREAK**	**BREAK**	**BREAK**	QH 2.3
16:48	BN 2.3	CC 2.3	CR 2.2	PRA 1	**BREAK**	**BREAK**	QH 2.4
16:54	BN 2.4	CC 2.4	CR 2.3	PRA 2	**BREAK**	CP 2.1	QH 2.5
17:00	BN 2.5	CC 2.7	CR 2.4	PRA 3	AIT 2.1	CP 2.2	QH 2.6
17:06	BN 2.6	CC 2.6	CR 2.5	PRA 4	AIT 2.2	CP 2.3	QH 2.7
17:12	BN 2.7	CC 2.5	CR 2.6	PRA 5	AIT 2.3	CP 2.4	QH 2.8
17:18	BN 2.8	CC 2.8	CR 2.7	PRA 6	AIT 2.4	CP 1.2	QH 2.9
17:24		CC 2.9	CR 2.8	PRA 7	AIT 2.5	CP 1.6	QH 2.10
17:30		CC 2.10	CR 2.9	PRA 8	AIT 2.6	CP2.8	QH 2.11
17:36		CC 2.11	CR 2.10	PRA 9	AIT 2.7		QH 2.12
17:42							
17:48							
17:54							

Presentation Schedule

Category Schedules

Basic Cardiovascular & Pulmonary 1

Presenter	Poster Title	Poster ID	Estimated Time
Diego Almodiel BS	Macrophage Targeting of Dendrimer Conjugated PPAR-a/y Agonist Prompts Metabolic and Cognitive Improvement	Basic CP 1.1	15:30
Maria Bauer MD	Female sex is protective against diastolic dysfunction and HFpEF in the ZSF I rat model	Basic CP 2.5	15:36
Travis Brady B.S.	Meta-analysis of aging mouse aortic smooth muscle cell transcriptome	Basic CP 1.3	15:42
Atsushi Miyagawa MD	The effect of microRNA-330-3p in developing postoperative delirium in cardiac surgery	Basic CP 1.4	15:48
Diego Quiroga PhD	MicroRNA landscape of postoperative atrial fibrillation after cardiac surgery	Basic CP 1.5	15:54
Marta Martinez Yus B.S.	Loxl2+/- females are protected from the detrimental vascular remodeling caused by aging and ovariectomy	Basic CP 2.6	16:00
Saanvi Sudhir	The effectiveness of dendrimer-Tesaglitazar therapy in fatty liver and liver inflammation in both male and female ApoE knockout mice	Basic CP 1.7	16:06
Mahin Gadkari BEng, MSE	Effect of sex on pulmonary vascular properties in pulmonary arterial hypertension	Basic CP 1.8	16:12

Basic Cardiovascular & Pulmonary 2

Presenter	Poster Title	Poster ID	Estimated Time
Diego Almodiel BS	Coadministration of Dendrimer-Tesaglitazar with Semaglutide Increases Therapeutic Benefit and Blunts Weight Regain After GLP-1 Receptor Agonist Termination	Basic CP 2.1	16:54
Travis Brady B.S.	Quantifying extracellular matrix turnover in vivo in the arterial milieu	Basic CP 2.2	17:00
Atsushi Miyagawa MD	GRK2 activates the Translin/Trax RNase complex: A novel molecular pathway in the pathophysiology of Large-Artery Stiffness	Basic CP 2.3	17:06
Diego Quiroga PhD	Argonaute 2 phosphorylation at Ser388 modulates mitochondrial microRNA trafficking and preserves cardiac function in heart failure	Basic CP 2.4	17:12
Winson Lam BA	Human resistin is critical to SARS-COV-2 induced cytokine storm and predicts mortality	Basic CP 1.2	17:18
Marta Martinez Yus B.S.	Role of LOXL2 and shift to androgen signaling in the post-menopausal female vasculature	Basic CP 1.6	17:24
Rituparna Chakrabarti Ph.D.	Resistin blockade reduces lipid burden in foam cells and attenuates atherosclerosis	Basic CP 2.7	
Palak A Bafna MSc	In Silico and Functional Analysis of Cysteine 238 Variants in human Lysyl Oxidase	Basic CP 2.8	17:30

Basic Neuroscience 1

Presenter	Poster Title	Poster ID	Estimated Time
Miriam E. Quinlan MD, MPH, MS	Pre-hospital management of non-traumatic intracerebral hemorrhage: Analysis of pre-hospital blood pressure and time metrics in a state-wide EMS system	BN 1.1	15:30
Raymond C. Koehler PhD	The poly(ADP-ribose) polymerase inhibitor veliparib improves sensorimotor recovery after transient middle cerebral artery occlusion in aging mice	BN 1.2	15:36
Zengjin Yang MD PhD	Sex-specific role of CYP4A isoforms in ischemic stroke: a target for male-specific neuroprotection	BN 1.3	15:42
George Kuo	Mitigation of Sevoflurane-Linked Cytokine Responses Using MSC-Derived EVs in Neonatal Glial Cultures	BN 1.4	15:48
James Sowers MD, PhD	Metabolism of Dendrimer-Conjugated N-Acetyl Cysteine Shows Multiple Neuroprotective Responses in a Rabbit Model of Cerebral Palsy	BN 1.5	15:54
Lincoln Summers	96x Grid vs FIJI ImageJ Analysis of Laser Speckle Contrast Imaging (LSCI) in a Neonatal Pig Middle Cerebral Artery Occlusion (MCAO) Model	BN 1.6	16:00
Ahmed O. Bakare PhD	T Cell–Dependent Modulation of Pain Behaviors in a Rat Model of Recurring Paclitaxel-Induced Peripheral Neuropathy	BN 1.7	16:06
Swati Agarwal Ph.D.	Synaptic PDZ2-Mediated Interactions in Anesthetic Neurotoxicity: Mechanisms Linking Inflammasome Activation, BBB Integrity, and Cognitive Dysfunction	BN 1.8	16:12
George Hong MD PhD	MAP Augmentation with Phenylephrine Improves Perfusion and Preserves Penumbral Tissue in a Novel Piglet Model of Neonatal Arterial Ischemic Stroke	BN 1.9	16:18

Basic Neuroscience 2

Presenter	Poster Title	Poster ID	Estimated Time
Nicole Beaubien	Mechanistic Insights into Anesthesia-Induced Synapse Loss in Murine Neuron–Glia Co-cultures	BN 2.1	16:36
Varsha Arun BA	Evaluating the efficacy of glucose-dendrimer–conjugated cannabidiol (GD-CBD) in a rat paw edema model of inflammatory pain	BN 2.2	16:42
Preeti Vyas PhD	Glucose dendrimer Creatine conjugates for treatment of Creatine Transporter Deficiency disorder.	BN 2.3	16:48
Theresa Aguilar	Glucose Dendrimer-Based N-Acetylcysteine (GD-NAC) and Creatine Combination Therapy Improves Motor Functions in a Rabbit Model of Cerebral Palsy.	BN 2.4	16:54
Indira Paddibhatla PhD, MS, MSc	Pial arteriole responses in an in vitro model of ischemia: implications for therapeutic interventions in ischemia	BN 2.5	17:00
Eva Anchekova	Effects of Focal Cerebral Ischemia and Phenylephrine on CO_2 Coupling and Cerebral Perfusion in Neonatal Piglets	BN 2.6	17:06
Mytreyi Trivedi	Glucose dendrimer-Cannabidiol conjugate (GD-CBD) decreases inflammation in a paw edema model of inflammatory pain	BN 2.7	17:12
Tré Diemer MSN RN	Characterization of Cerebrospinal Fluid Lymphatic Drainage Pathways in a Neonatal Swine Model	BN 2.8	17:18

Clinical Research 1

Presenter	Poster Title	Poster ID	Estimated Time
Sarvin Sasannia MD	Blood-Brain Barrier Permeability and Plasma Volume Patterns in White Matter Lesion Penumbra	CR 1.1	15:30
Alexis Motz MD	What flavor can I get you - the effect of pre-oxygenation mask scent on anxiolysis and patient satisfaction in adults and adolescents undergoing anesthesia	CR 1.2	15:36
Kristen Joseph MD	Outpatient pediatric hypoxemia prevalence and pulse oximetry implementation in Malawi	CR 1.3	15:42
Chinwendu Amazu MD, PhD	The effects of one-time intra-operative dose of Methadone during minimally invasive hysterectomy in reducing opioid prescription	CR 1.4	15:48
Sarvin Sasannia MD	White Matter Hyperintensity and Brain Volume Changes are Associated with Cognitive Decline	CR 1.5	15:54
Cherry Lam BA	Platelet transfusion practice variability	CR 1.6	16:00
Tianyue Zhu BS	Improve STS Risk Score Prediction for Postoperative Length of Stay after Major Cardiac Surgery with Liver and Metabolic Disease Parameters	CR 1.7	16:06
Anisha Nadkarni MD, MHS	Characteristics, management, and outcomes of pediatric perioperative cardiac arrest: A scoping review	CR 1.8	16:12
Julie Xian MD	Epigenetic biomarkers of brain injury in critically ill children on extracorporeal membrane oxygenation (ECMO)	CR 1.9	16:18
Sarvin Sasannia MD	Ten Year Increases in White Matter Hyperintensity Volume Correlates with the Severity of Ongoing Blood Brain Barrier Permeability when Measured with Dynamic Susceptibility Contrast MRI	CR 1.10	16:24

Clinical Research 2

Presenter	Poster Title	Poster ID	Estimated Time
Victoria Surma MD, MS	Effect of RBC transfusion on cerebral metabolic rate of oxygen after congenital cardiac surgery.	CR 2.1	16:42
Mingfeng Cao MSc	Temporal Dynamics of Cerebrovascular Autoregulation and Its Association with Acute Brain Injury in VA-ECMO Patients	CR 2.2	16:48
Pooja D O'Neil MD MBA	Chocolate or Sevoflurane? Facilitating More Pleasant Inhalational Inductions	CR 2.3	16:54
Sarvin Sasannia MD	Blood Brain Barrier Permeability and Mean Transit Time are Higher in the Penumbra of Ischemic White Matter Lesions	CR 2.4	17:00
Amy (Shi Nan) Feng BSPH	Impact of left ventricular venting on acute brain injury in patients with cardiogenic shock: an Extracorporeal Life Support Organization registry analysis	CR 2.5	17:06
Nicholas Andrade MD	Rolling into perfect position for spinal anesthesia: Beach balls and baby backs	CR 2.6	17:12
Anisha Nadkarni MD, MHS	Pediatric intraoperative cardiac arrest: Data from the American Heart Association Get With The Guidelines-Resuscitation Registry	CR 2.7	17:18
Victoria Surma MD, MS	Difference in proteomic profiles of pediatric cardiac ECMO patients with versus without acute brain injury.	CR 2.8	17:24
Sarvin Sasannia MD	Microscopic diffusion anisotropy as a predictor of cognitive decline in asymptomatic adults	CR 2.9	17:30
Medha and Ernesto Majety and Marin MS, BS	Temporal variability in Near-Infrared Spectroscopy asymmetry is associated with Acute Brain Injury in Venoarterial ECMO	CR 2.10	17:36

Clinical Research 3

Presenter	Poster Title	Poster ID	Estimated Time
Jose A Nino-Medina MD	Intraoperative renal venous doppler by TEE during CPB in CABG: feasibility and preliminary association with postoperative AKI	CR 3.1	15:30
Nicholas Andrade MD	Maximizing the experience of anesthesiology residents on early rotations in pediatric anesthesia: Developing a "crash course"	CR 3.2	15:36
Daniel Forsman MD	Noninvasive multimodal monitoring links hypoperfusion to early microcirculatory dysfunction after aneurysmal subarachnoid hemorrhage	CR 3.3	15:42
Cherry Lam BA	The effect modification between kidney function and peri-operative opioid dosing in relationship to post-operative delirium onset	CR 3.4	15:48
Tianyue Zhu BS	Impact of ECMO initiation timing on acute brain injury and in-hospital mortality in VA ECMO Patients	CR 3.5	15:54
Kenneth N. Mansfield BS	The predictive value of psychosocial determinants for change in functional outcomes 1-month after cardiac surgery	CR 3.6	16:00
Alexis N. Thompson MD	Survey of Sedation Practices in the Care of Severe Pediatric Traumatic Brain Injury	CR 3.7	16:06
Laura Chin MD MPH	Suprazygomatic maxillary nerve blocks and opioid reduction in primary palatoplasty	CR 3.8	16:12
Grace Wayson BS	The effects of perceived self-efficacy level on postoperative mobility after coronary artery bypass graft surgery	CR 3.9	16:18
Andrea Chernau D.O.	Intraoperative ketamine use and postoperative outcomes in children with obstructive sleep apnea undergoing adenotonsillectomy: A retrospective chart review	CR 3.10	16:24
Diba Ramezan BS	Preoperative Joint Physical-Cognitive Phenotypes and Post-CABG Recovery Trajectories	CR 3.11	16:30

Critical Care 1

Presenter	Poster Title	Poster ID	Estimated Time
Sidharth Raghavan	Rethinking Pediatric Sedation Assessment: A Statistical Evaluation of the State Behavioral Scale	CC 1.1	15:30
Jake Hoffmann	Continuous Physiological Monitoring Reveals Poor PRN Sedation Efficacy in Pediatric Critical Care	CC 1.2	15:36
Lisa Hwang BS	Patterns of NAT recognition in young children: a single-center report	CC 1.3	15:42
Michaela Bostwick BA	Prevalence and impact of clinicians' early open-ended questions in neurocritical care clinician-family prognostication meetings	CC 1.4	15:48
Kerry Devlin PhD, LPMT, MT-BC	TEMPO: Establishing Practice Guidelines for Delivery of Music Therapy in Neurocritical Care Settings	CC 1.5	15:54
Jinnesse Taylor MD, MPH	Perspectives from the PICU: Interprofessional Views on Screening for Health-Related Social Needs	CC 1.6	16:00
Celine Arar B.A.	Framing the Conversation: Patterns of Nudging Language in Neurocritical Care Goals of Care Discussions	CC 1.7	16:06
Victoria Huang MD	Patterns of multiple organ dysfunction in children on extracorporeal membrane oxygenation support	CC 1.8	16:12
Lisa Hwang BS	Association of hemolysis with major adverse kidney events in children on ECMO	CC 1.9	16:18
Eleni Panagopoulos BA	Differences in Communication Between Clinicians and Families in Neurocritical Care Family Meetings	CC 1.10	16:24
Riley O'Neil MD	Barriers and Facilitators to Implementing an Intensivist-led Pediatric Sedation Service	CC 1.11	16:30
Alyssa Eckert MD	An evaluation of pediatric critical care fellows' clinical skills and knowledge at a multicenter senior fellow bootcamp.	CC 1.12	16:36

Critical Care 2

Presenter	Poster Title	Poster ID	Estimated Time
Talia Lehrer	Empathy from clinicians in the Neurocritical Care Unit: Using Vr-CoDES to investigate family decision-making meetings	CC 2.1	16:36
Tarek Zieneldien BS	Global Disparities in Neonatal Sepsis Mortality Across Socio-Demographic Index Levels	CC 2.2	16:42
Leon Fan BS	Hospital Frailty Risk Score as a Predictor of Key Clinical Outcomes in ECMO Patients	CC 2.3	16:48
Sophia Ma B.S.	Global Patterns of Neonatal Sepsis Disability-Adjusted Life Years Across Socio-demographic Index Levels Reflect Gaps in Critical Care Equity	CC 2.4	16:54
Zoe Soule BS MS	Energy Expenditure in the ECMO Patient: Validation of Bedside Capnometry and Fick-Based Methods for Individualized Nutrition Assessment	CC 2.5	17:12
Riley O'Neil MD	Targeted Pediatric Procedural Sedation Curriculum for Pediatric Intensivists	CC 2.6	17:06
Hyun Yi (Jacqualine) Woo MD MPH	Seizures in Adult Patients on Venovenous Extracorporeal Membrane Oxygenation Support: Analysis of the Extracorporeal Life Support Organization Registry	CC 2.7	17:00
Leon Fan BS	Early Hemodynamic Signatures and Acute Brain Injury in VA ECMO: The Role of Systolic Blood Pressure	CC 2.8	17:18
Kpehe Jig Maimie M.D.	Use of ETCO2 – Directed Cardiopulmonary Resuscitation in a Pediatric Swine Model of Ventricular Fibrillation Cardiac Arrest	CC 2.9	17:24
Kelsea Smith MD	Optimizing oxygen administration in the Pediatric ICU through a collaborative quality improvement initiative	CC 2.10	17:30
Hyun Yi (Jacqualine) Woo MD, MPH	CO2 and pH changes and their impact on acute brain injury in VV-ECMO: Analysis of the Extracorporeal Life Support Organization Registry	CC 2.11	17:36

Informatics, AI, Engineering, & Technology 1

Presenter	Poster Title	Poster ID	Estimated Time
Candace Collins MD	Processed electroencephalograms for sedation monitoring in the pediatric intensive care unit: a scoping review	AIT 1.1	15:30
Chang Liu MSc	NeuroTex: Functionalized Hybrid Polymer-Metal Textile for Soft, Robust, and Dry Auricular Neural Interfaces	AIT 1.2	15:36
Yiyang You MS	Deep learning-based rapid mechatronic ultrasound scanning for longitudinal monitoring of fetal health and labor progress during labor	AIT 1.3	15:42
Siyu Wang Msc	Digital Holographic Imaging as a Noninvasive Alternative to Arterial Lines: Comparative Validation Over Intact Skin and Exposed Arteries	AIT 1.4	15:48
Keshuai Xu PhD	Continuous intrapartum fetal monitoring using a wearable ultrasound and photoacoustic device	AIT 1.5	15:54
Beichen Shen BS	Quantitative EEG Assessment for ABI Detection in ECMO Patients	AIT 1.6	16:00
Siyu Wang Msc	Auricular-Cardiogram: A Novel Strategy for Unobstructive Cardiac Monitoring	AIT 1.7	16:06
Chris Acha BS	Tubular biosensors for critical medicine	AIT 1.8	16:12

Informatics, AI, Engineering, & Technology 2

Presenter	Poster Title	Poster ID	Estimated Time
Ananya Tandri MS	Towards modular ultrasound and photoacoustic based monitoring in critical care: feasibility studies	AIT 2.1	17:00
Alessandro Ascani Orsini B.S.	Binaural beats as Bedside Arousal Probe for Conscious Perception Across Hemispheres	AIT 2.2	17:06
Jenny Schramm MD	Machine learning predicts post-operative necrotizing enterocolitis in neonates with congenital heart disease	AIT 2.3	17:12
Caroline R. Wensel PhD, MSPH, RDN	Enrichment of Mucosa-Associated Sutterella spp. Characterizes Biofilm-Positive Colorectal Cancer	AIT 2.4	17:18
Yaman Ahmad M.D.	Identification of Apolipoprotein-Related Coagulation & Complement Pathway Genes Linked to VA-ECMO Outcomes	AIT 2.5	17:24
Shreyas F Sailesh	A robust AI pipeline for analysis of various animal behavioral tests through DeepLabCut computer vision	AIT 2.6	17:30
Katie O'Conor MD MBA	Multicenter Perioperative Outcomes Group (MPOG) x JHM ACCM	AIT 2.7	17:36

Pain & Regional Anesthesiology

Presenter	Poster Title	Poster ID	Estimated Time
Ethel E.A. Agordekpe MD, ScM	Access to Epidural Analgesia in Ghana: A Patient-Centered Pilot Study	PRA 1	16:48
Elizabeth M Pham MD	Survey of Pain Assessment and Management Practices in Pediatric Intensive Care Units Across the US	PRA 2	16:54
Ankit Uniyal Ph.D.	Targeting Tmem100-Mediated TRPA1 Regulation at Central Terminals of DRG Neurons for Neuropathic Pain Relief	PRA 3	17:00
Maria Sckaff BS	Dorsal penile vs. caudal nerve blocks in pediatric circumcision: a meta-analysis of pain and recovery outcomes	PRA 4	17:06
Qun Li MD, Ph.D	Opioid-escalated chronic postsurgical pain: role of DNA methylation in developing brain pain circuitry	PRA 5	17:12
Kelsea Smith MD	Regional analgesia use in the pediatric intensive care unit outside of the peri-operative period: a scoping review	PRA 6	17:18
Grace Lee	Effect of a novel Adalimumab-conjugated PAMAM hydroxyl dendrimer on the gait of humanized mice with symptoms of Rheumatoid arthritis.	PRA 7	17:24
Maria Paula Avalos PhD	Efficacy studies of Adalimumab-conjugated PAMAM hydroxyl dendrimer in a humanized mouse model of Rheumatoid arthritis	PRA 8	17:30
Javier Allende Labastida MD, PhD, MPH	The novel glucose dendrimer ketorolac conjugates are safe and effective in treating inflammatory pain in a rat model of paw edema	PRA 9	17:36

Quality Improvement & Health Systems/Services 1

Presenter	Poster Title	Poster ID	Estimated Time
Harry Flaster MD	ECPR vs CPR at JHH: Single Institution Retrospective Review	QH 1.13	15:30
Elena Bertolino DNP, CPNP-AC, PPCNP-BC, CCRN, WCC	Knowledge Acquisition and Retention Following a Multi-Modal Educational Curriculum for Pediatric Critical Care Medicine Senior Fellows: A Pilot Study	QH 1.2	15:36
Austin Wang MD	The Pediatricians Providing Perioperative Care Project (P4): What are the educational needs of pediatric residents to optimize perioperative care of children?	QH 1.3	15:42
Laura Getchell MD	Evaluation of a cardiology-focused simulation curriculum to augment pediatric resident education in the face of new curricular requirements	QH 1.4	15:48
Harry Flaster MD	Implementation of a new Maryland prehospital protocol for cardiac arrest secondary to refractory ventricular fibrillation and tachycardia	QH 1.5	15:54
Riley R. Hales MD MBA	Intravenous methergine and periprocedural blood pressures during cesarean section	QH 1.6	16:00
Kerry Devlin PhD, LPMT, MT-BC	Live interactive music therapy across the perioperative continuum: A scoping review	QH 1.7	16:06
William Bennett MD	Firearm Safety Counseling with and without Providing a Safe Storage Device: A Systematic Review	QH 1.8	16:12
Divya Manikandan B.S.	Uncertain Steps: Gaps in Documentation and Adherence in a Pediatric ICU Early Mobility Program	QH 1.9	16:18
Phillip D. Cohen MD, MHS	Optimizing Non-Emergent NICU-to-PICU Transfers: Perspectives of Pediatric Intensivists	QH 1.10	16:24
Alexis Thompson MD	Meeting the Need: Feasibility of Implementing a Pediatric Sedation Service	QH 1.11	16:30
Jeffrey B Wang MD PhD	WikiAnesthesia: an open-source mobile app for point of care clinical decision support and emergency management	QH 1.12	N/A
Sophia Yu BS	Development of A Novel Ophthalmic Anesthesia Curriculum for an Ophthalmology Residency Program	QH 1.1	16:36

Quality Improvement & Health Systems/Services 2

Presenter	Poster Title	Poster ID	Estimated Time
Natasha Houshmand MD	Designing a web-based firearm safety curriculum for clinicians: insights from a diverse focus group	QH 2.1	16:30
Lauren D. Booth MSN	Exploring Unmet Healthcare Needs of Children in the U.S. Before and After COVID-19: A Cross-sectional Study of the National Survey of Children's Health	QH 2.2	16:36
Gifty Agyemang MD	Improving Pediatric Anesthesia Outcomes in The Gambia through Equipment Modernization and Outcome Monitoring	QH 2.3	16:42
Anisha Nadkarni MD, MHS	Weaning high flow nasal cannula in pediatric bronchiolitis: A PICU quality improvement project	QH 2.4	16:48
Jacob Pickle MD, MBA	What's in a Name: A Comparative Analysis of Pediatric Palliative Program Naming Conventions	QH 2.5	16:54
Lauren D. Booth MSN	Content Analysis of Communications to Front-line Staff from a Novel Adverse Event Voluntary Reporting Program	QH 2.6	17:00
Divya Manikandan B.S.	Tethered in Place: Equipment-Related Barriers to Early Mobility in PICUs	QH 2.7	17:06
Ifeyinwa Ojukwu MSc	PICU Up! rounds: An ICU liberation quality improvement initiative	QH 2.8	17:12
Hyun Yi (Jacqualine) Woo MD, MPH	Complication as a Determinant of Hospital Mortality in Adult ECMO Support	QH 2.9	17:18
Katie O'Conor MD MBA	Multicenter Perioperative Outcomes Group (MPOG) Health Equity Initiative Phase I	QH 2.10	17:24
Lauren D. Booth MSN	Bridging a Gap in Microbiological Testing Overuse: Perceptions and Values of Caregivers of Chronically, Critically Ill Children	QH 2.11	17:30
Lori-Ann M. Edwards MB,BS	Implementation of universal quantitative neuromuscular blockade monitoring in an academic pediatric center	QH 2.12	17:36

Presenter Schedule (by Name)

Presenter	Poster Title	Category	Estimated Time
Chris Acha BS	Tubular biosensors for critical medicine	Informatics, AI, Engineering, & Technology	16:12
Swati Agarwal Ph.D.	Synaptic PDZ2-Mediated Interactions in Anesthetic Neurotoxicity: Mechanisms Linking Inflammasome Activation, BBB Integrity, and Cognitive Dysfunction	Basic Neuroscience	16:12
Ethel E.A. Agordekpe MD, ScM	Access to Epidural Analgesia in Ghana: A Patient-Centered Pilot Study	Pain & Regional Anesthesiology	16:48
Theresa Aguilar	Glucose Dendrimer-Based N-Acetylcysteine (GD-NAC) and Creatine Combination Therapy Improves Motor Functions in a Rabbit Model of Cerebral Palsy.	Basic Neuroscience	16:54
Gifty Agyemang MD	Improving Pediatric Anesthesia Outcomes in The Gambia through Equipment Modernization and Outcome Monitoring	Quality Improvement & Health Systems/Services	16:42
Yaman Ahmad M.D.	Identification of Apolipoprotein-Related Coagulation & Complement Pathway Genes Linked to VA-ECMO Outcomes	Informatics, AI, Engineering, & Technology	17:24
Javier Allende Labastida MD, PhD, MPH	The novel glucose dendrimer ketorolac conjugates are safe and effective in treating inflammatory pain in a rat model of paw edema	Pain & Regional Anesthesiology	17:36
Diego Almodiel BS	Macrophage Targeting of Dendrimer Conjugated PPAR-a/y Agonist Prompts Metabolic and Cognitive Improvement	Basic Science: Cardiovascular & Pulmonary	15:30

Presenter	Poster Title	Category	Estimated Time
Diego Almodiel BS	Coadministration of Dendrimer-Tesaglitazar with Semaglutide Increases Therapeutic Benefit and Blunts Weight Regain After GLP-1 Receptor Agonist Termination	Basic Science: Cardiovascular & Pulmonary	16:54
Chinwendu Amazu MD, PhD	The effects of one-time intra-operative dose of Methadone during minimally invasive hysterectomy in reducing opioid prescription	Clinical Research	15:48
Eva Anchekova	Effects of Focal Cerebral Ischemia and Phenylephrine on CO_2 Coupling and Cerebral Perfusion in Neonatal Piglets	Basic Neuroscience	17:06
Nicholas Andrade MD	Rolling into perfect position for spinal anesthesia: Beach balls and baby backs	Clinical Research	17:12
Nicholas Andrade MD	Maximizing the experience of anesthesiology residents on early rotations in pediatric anesthesia: Developing a “crash course”	Clinical Research	15:36
Celine Arar B.A.	Framing the Conversation: Patterns of Nudging Language in Neurocritical Care Goals of Care Discussions	Critical Care	16:06
Varsha Arun BA	Evaluating the efficacy of glucose-dendrimer–conjugated cannabidiol (GD-CBD) in a rat paw edema model of inflammatory pain	Basic Neuroscience	16:42
Alessandro Ascani Orsini B.S.	Binaural beats as Bedside Arousal Probe for Conscious Perception Across Hemispheres	Informatics, AI, Engineering, & Technology	17:06
Maria Paula Avalos PhD	Efficacy studies of Adalimumab-conjugated PAMAM hydroxyl dendrimer in a humanized mouse model of Rheumatoid arthritis	Pain & Regional Anesthesiology	17:30

Presenter	Poster Title	Category	Estimated Time
Palak A Bafna MSc	In Silico and Functional Analysis of Cysteine 238 Variants in human Lysyl Oxidase	Basic Science: Cardiovascular & Pulmonary	17:36
Ahmed O. Bakare PhD	T Cell–Dependent Modulation of Pain Behaviors in a Rat Model of Recurring Paclitaxel-Induced Peripheral Neuropathy	Basic Neuroscience	16:06
Maria Bauer MD	Female sex is protective against diastolic dysfunction and HFpEF in the ZSF1 rat model	Basic Science: Cardiovascular & Pulmonary	15:36
Nicole Beaubien	Mechanistic Insights into Anesthesia-Induced Synapse Loss in Murine Neuron–Glia Co-cultures	Basic Neuroscience	16:36
William Bennett MD	Firearm Safety Counseling with and without Providing a Safe Storage Device: A Systematic Review	Quality Improvement & Health Systems/Services	16:12
Elena Bertolino DNP, CPNP-AC, PPCNP-BC, CCRN, WCC	Knowledge Acquisition and Retention Following a Multi-Modal Educational Curriculum for Pediatric Critical Care Medicine Senior Fellows: A Pilot Study	Quality Improvement & Health Systems/Services	15:36
Lauren D. Booth MSN	Exploring Unmet Healthcare Needs of Children in the U.S. Before and After COVID-19: A Cross-sectional Study of the National Survey of Children's Health	Quality Improvement & Health Systems/Services	16:36
Lauren D. Booth MSN	Content Analysis of Communications to Front-line Staff from a Novel Adverse Event Voluntary Reporting Program	Quality Improvement & Health Systems/Services	17:00
Lauren D. Booth MSN	Bridging a Gap in Microbiological Testing Overuse: Perceptions and Values of Caregivers of Chronically, Critically Ill Children	Quality Improvement & Health Systems/Services	17:30

Presenter	Poster Title	Category	Estimated Time
Michaela Bostwick BA	Prevalence and impact of clinicians' early open-ended questions in neurocritical care clinician-family prognostication meetings	Critical Care	15:48
Travis Brady B.S.	Meta-analysis of aging mouse aortic smooth muscle cell transcriptome	Basic Science: Cardiovascular & Pulmonary	15:42
Travis Brady B.S.	Quantifying extracellular matrix turnover in vivo in the arterial milieu	Basic Science: Cardiovascular & Pulmonary	17:00
Mingfeng Cao MSc	Temporal Dynamics of Cerebrovascular Autoregulation and Its Association with Acute Brain Injury in VA-ECMO Patients	Clinical Research	16:48
Rituparna Chakrabarti Ph.D.	Resistin blockade reduces lipid burden in foam cells and attenuates atherosclerosis	Basic Science: Cardiovascular & Pulmonary	
Andrea Chernau D.O.	Intraoperative ketamine use and postoperative outcomes in children with obstructive sleep apnea undergoing adenotonsillectomy: A retrospective chart review	Clinical Research	16:24
Laura Chin MD MPH	Suprazygomatic maxillary nerve blocks and opioid reduction in primary palatoplasty	Clinical Research	16:12
Phillip D. Cohen MD, MHS	Optimizing Non-Emergent NICU-to-PICU Transfers: Perspectives of Pediatric Intensivists	Quality Improvement & Health Systems/Services	16:24
Candace Collins MD	Processed electroencephalograms for sedation monitoring in the pediatric intensive care unit: a scoping review	Informatics, AI, Engineering, & Technology	15:30

Presenter	Poster Title	Category	Estimated Time
Kerry Devlin PhD, LPMT, MT-BC	Live interactive music therapy across the perioperative continuum: A scoping review	Quality Improvement & Health Systems/Services	16:06
Kerry Devlin PhD, LPMT, MT-BC	TEMPO: Establishing Practice Guidelines for Delivery of Music Therapy in Neurocritical Care Settings	Critical Care	15:54
Tré Diemer MSN RN	Characterization of Cerebrospinal Fluid Lymphatic Drainage Pathways in a Neonatal Swine Model	Basic Neuroscience	17:18
Alyssa Eckert MD	An evaluation of pediatric critical care fellows' clinical skills and knowledge at a multicenter senior fellow bootcamp.	Critical Care	16:36
Lori-Ann M. Edwards MB,BS	Implementation of universal quantitative neuromuscular blockade monitoring in an academic pediatric center	Quality Improvement & Health Systems/Services	17:36
Leon Fan BS	Hospital Frailty Risk Score as a Predictor of Key Clinical Outcomes in ECMO Patients	Critical Care	16:48
Leon Fan BS	Early Hemodynamic Signatures and Acute Brain Injury in VA ECMO: The Role of Systolic Blood Pressure	Critical Care	17:18
Amy (Shi Nan) Feng BSPH	Impact of left ventricular venting on acute brain injury in patients with cardiogenic shock: an Extracorporeal Life Support Organization registry analysis	Clinical Research	17:06
Harry Flaster MD	Implementation of a new Maryland prehospital protocol for cardiac arrest secondary to refractory ventricular fibrillation and tachycardia	Quality Improvement & Health Systems/Services	15:54

Presenter	Poster Title	Category	Estimated Time
Harry Flaster MD	ECPR vs CPR at JHH: Single Institution Retrospective Review	Quality Improvement & Health Systems/Services	16:42
Daniel Forsman MD	Noninvasive multimodal monitoring links hypoperfusion to early microcirculatory dysfunction after aneurysmal subarachnoid hemorrhage	Clinical Research	15:42
Mahin Gadkari BEng, MSE	Effect of sex on pulmonary vascular properties in pulmonary arterial hypertension	Basic Science: Cardiovascular & Pulmonary	16:12
Laura Getchell MD	Evaluation of a cardiology-focused simulation curriculum to augment pediatric resident education in the face of new curricular requirements	Quality Improvement & Health Systems/Services	15:48
Riley R. Hales MD MBA	Intravenous methergine and periprocedural blood pressures during cesarean section	Quality Improvement & Health Systems/Services	16:00
Jake Hoffmann	Continuous Physiological Monitoring Reveals Poor PRN Sedation Efficacy in Pediatric Critical Care	Critical Care	15:36
George Hong MD PhD	MAP Augmentation with Phenylephrine Improves Perfusion and Preserves Penumbral Tissue in a Novel Piglet Model of Neonatal Arterial Ischemic Stroke	Basic Neuroscience	16:18
Natasha Houshmand MD	Designing a web-based firearm safety curriculum for clinicians: insights from a diverse focus group	Quality Improvement & Health Systems/Services	16:30
Victoria Huang MD	Patterns of multiple organ dysfunction in children on extracorporeal membrane oxygenation support	Critical Care	16:12

Presenter	Poster Title	Category	Estimated Time
Lisa Hwang BS	Patterns of NAT recognition in young children: a single-center report	Critical Care	15:42
Lisa Hwang BS	Association of hemolysis with major adverse kidney events in children on ECMO	Critical Care	16:18
Kristen Joseph MD	Outpatient pediatric hypoxemia prevalence and pulse oximetry implementation in Malawi	Clinical Research	15:42
Raymond C. Koehler PhD	The poly(ADP-ribose) polymerase inhibitor veliparib improves sensorimotor recovery after transient middle cerebral artery occlusion in aging mice	Basic Neuroscience	15:36
George Kuo	Mitigation of Sevoflurane-Linked Cytokine Responses Using MSC-Derived EVs in Neonatal Glial Cultures	Basic Neuroscience	15:48
Winson Lam BA	Human resistin is critical to SARS-CoV-2 induced cytokine storm and predicts mortality	Basic Science: Cardiovascular & Pulmonary	17:18
Cherry Lam BA	Platelet transfusion practice variability	Clinical Research	16:00
Cherry Lam BA	The effect modification between kidney function and peri-operative opioid dosing in relationship to post-operative delirium onset	Clinical Research	15:48
Grace Lee	Effect of a novel Adalimumab-conjugated PAMAM hydroxyl dendrimer on the gait of humanized mice with symptoms of Rheumatoid arthritis.	Pain & Regional Anesthesiology	17:24

Presenter	Poster Title	Category	Estimated Time
Talia Lehrer	Empathy from clinicians in the Neurocritical Care Unit: Using Vr-CoDES to investigate family decision-making meetings	Critical Care	16:36
Qun Li MD, Ph.D	Opioid-escalated chronic postsurgical pain: role of DNA methylation in developing brain pain circuitry	Pain & Regional Anesthesiology	17:12
Chang Liu MSc	NeuroTex: Functionalized Hybrid Polymer-Metal Textile for Soft, Robust, and Dry Auricular Neural Interfaces	Informatics, AI, Engineering, & Technology	15:36
Sophia Ma B.S.	Global Patterns of Neonatal Sepsis Disability-Adjusted Life Years Across Socio-demographic Index Levels Reflect Gaps in Critical Care Equity	Critical Care	16:54
Kpehe Jig Maimie M.D.	Use of ETCO2 – Directed Cardiopulmonary Resuscitation in a Pediatric Swine Model of Ventricular Fibrillation Cardiac Arrest	Critical Care	17:24
Medha and Ernesto Majety and Marin MS, BS	Temporal variability in Near-Infrared Spectroscopy asymmetry is associated with Acute Brain Injury in Venoarterial ECMO	Clinical Research	17:36
Divya Manikandan B.S.	Uncertain Steps: Gaps in Documentation and Adherence in a Pediatric ICU Early Mobility Program	Quality Improvement & Health Systems/Services	16:18
Divya Manikandan B.S.	Tethered in Place: Equipment-Related Barriers to Early Mobility in PICUs	Quality Improvement & Health Systems/Services	17:06
Kenneth N. Mansfield BS	The predictive value of psychosocial determinants for change in functional outcomes 1-month after cardiac surgery	Clinical Research	16:00

Presenter	Poster Title	Category	Estimated Time
Marta Martinez Yus B.S.	Role of LOXL2 and shift to androgen signaling in the post-menopausal female vasculature	Basic Science: Cardiovascular & Pulmonary	16:00
Marta Martinez Yus B.S.	Loxl2+/- females are protected from the detrimental vascular remodeling caused by aging and ovariectomy	Basic Science: Cardiovascular & Pulmonary	17:24
Atsushi Miyagawa MD	The effect of microRNA-330-3p in developing postoperative delirium in cardiac surgery	Basic Science: Cardiovascular & Pulmonary	15:48
Atsushi Miyagawa MD	GRK2 activates the Translin/Trax RNase complex: A novel molecular pathway in the pathophysiology of Large-Artery Stiffness	Basic Science: Cardiovascular & Pulmonary	17:06
Alexis Motz MD	What flavor can I get you - the effect of pre-oxygenation mask scent on anxiolysis and patient satisfaction in adults and adolescents undergoing anesthesia	Clinical Research	15:36
Anisha Nadkarni MD, MHS	Weaning high flow nasal cannula in pediatric bronchiolitis: A PICU quality improvement project	Quality Improvement & Health Systems/Services	16:48
Anisha Nadkarni MD, MHS	Characteristics, management, and outcomes of pediatric perioperative cardiac arrest: A scoping review	Clinical Research	16:12
Anisha Nadkarni MD, MHS	Pediatric intraoperative cardiac arrest: Data from the American Heart Association Get With The Guidelines-Resuscitation Registry	Clinical Research	17:18
Jose A Nino-Medina MD	Intraoperative renal venous doppler by TEE during CPB in CABG: feasibility and preliminary association with postoperative AKI	Clinical Research	15:30

ACCM RESEARCH DAY 2025

Presenter	Poster Title	Category	Estimated Time
Katie O'Conor MD MBA	Multicenter Perioperative Outcomes Group (MPOG) Health Equity Initiative Phase I	Quality Improvement & Health Systems/Services	17:24
Katie O'Conor MD MBA	Multicenter Perioperative Outcomes Group (MPOG) x JHM ACCM	Informatics, AI, Engineering, & Technology	17:36
Ifeyinwa Ojukwu MSc	PICU Up! rounds: An ICU liberation quality improvement initiative	Quality Improvement & Health Systems/Services	17:12
Riley O'Neil MD	Barriers and Facilitators to Implementing an Intensivist-led Pediatric Sedation Service	Critical Care	16:30
Riley O'Neil MD	Targeted Pediatric Procedural Sedation Curriculum for Pediatric Intensivists	Critical Care	17:06
Pooja D O'Neil MD MBA	Chocolate or Sevoflurane? Facilitating More Pleasant Inhalational Inductions	Clinical Research	16:54
Indira Paddibhatla PhD, MS, MSc	Pial arteriole responses in an in vitro model of ischemia: implications for therapeutic interventions in ischemia	Basic Neuroscience	17:00
Eleni Panagopoulos BA	Differences in Communication Between Clinicians and Families in Neurocritical Care Family Meetings	Critical Care	16:24
Elizabeth M Pham MD	Survey of Pain Assessment and Management Practices in Pediatric Intensive Care Units Across the US	Pain & Regional Anesthesiology	16:54

Presenter	Poster Title	Category	Estimated Time
Jacob Pickle MD, MBA	What's in a Name: A Comparative Analysis of Pediatric Palliative Program Naming Conventions	Quality Improvement & Health Systems/Services	16:54
Miriam E. Quinlan MD, MPH, MS	Pre-hospital management of non-traumatic intracerebral hemorrhage: Analysis of pre-hospital blood pressure and time metrics in a state-wide EMS system	Basic Neuroscience	
Diego Quiroga PhD	MicroRNA landscape of postoperative atrial fibrillation after cardiac surgery	Basic Science: Cardiovascular & Pulmonary	15:54
Diego Quiroga PhD	Argonaute 2 phosphorylation at Ser388 modulates mitochondrial microRNA trafficking and preserves cardiac function in heart failure	Basic Science: Cardiovascular & Pulmonary	17:12
Sidharth Raghavan	Rethinking Pediatric Sedation Assessment: A Statistical Evaluation of the State Behavioral Scale	Critical Care	15:30
Diba Ramezan BS	Preoperative Joint Physical-Cognitive Phenotypes and Post-CABG Recovery Trajectories	Clinical Research	16:30
Shreyas F Sailesh	A robust AI pipeline for analysis of various animal behavioral tests through DeepLabCut computer vision	Informatics, AI, Engineering, & Technology	17:30
Sarvin Sasannia MD	Blood-Brain Barrier Permeability and Plasma Volume Patterns in White Matter Lesion Penumbra	Clinical Research	15:30
Sarvin Sasannia MD	White Matter Hyperintensity and Brain Volume Changes are Associated with Cognitive Decline	Clinical Research	15:54

Presenter	Poster Title	Category	Estimated Time
Sarvin Sasannia MD	Ten Year Increases in White Matter Hyperintensity Volume Correlates with the Severity of Ongoing Blood Brain Barrier Permeability when Measured with Dynamic Susceptibility Contrast MRI	Clinical Research	16:24
Sarvin Sasannia MD	Blood Brain Barrier Permeability and Mean Transit Time are Higher in the Penumbra of Ischemic White Matter Lesions	Clinical Research	17:00
Sarvin Sasannia MD	Microscopic diffusion anisotropy as a predictor of cognitive decline in asymptomatic adults	Clinical Research	17:30
Jenny Schramm MD	Machine learning predicts post-operative necrotizing enterocolitis in neonates with congenital heart disease	Informatics, AI, Engineering, & Technology	17:12
Maria Sckaff BS	Dorsal penile vs. caudal nerve blocks in pediatric circumcision: a meta-analysis of pain and recovery outcomes	Pain & Regional Anesthesiology	17:06
Beichen Shen BS	Quantitative EEG Assessment for ABI Detection in ECMO Patients	Informatics, AI, Engineering, & Technology	16:00
Kelsea Smith MD	Optimizing oxygen administration in the Pediatric ICU through a collaborative quality improvement initiative	Critical Care	17:30
Kelsea Smith MD	Regional analgesia use in the pediatric intensive care unit outside of the peri-operative period: a scoping review	Pain & Regional Anesthesiology	17:18
Zoe Soule BS MS	Energy Expenditure in the ECMO Patient: Validation of Bedside Capnometry and Fick-Based Methods for Individualized Nutrition Assessment	Critical Care	17:12

Presenter	Poster Title	Category	Estimated Time
James Sowers MD, PhD	Metabolism of Dendrimer-Conjugated N-Acetyl Cysteine Shows Multiple Neuroprotective Responses in a Rabbit Model of Cerebral Palsy	Basic Neuroscience	15:54
Saanvi Sudhir	The effectiveness of dendrimer-Tesaglitazar therapy in fatty liver and liver inflammation in both male and female ApoE knockout mice	Basic Science: Cardiovascular & Pulmonary	16:06
Lincoln Summers	96x Grid vs FIJI ImageJ Analysis of Laser Speckle Contrast Imaging (LSCI) in a Neonatal Pig Middle Cerebral Artery Occlusion (MCAO) Model	Basic Neuroscience	16:00
Victoria Surma MD, MS	Effect of RBC transfusion on cerebral metabolic rate of oxygen after congenital cardiac surgery.	Clinical Research	16:42
Victoria Surma MD, MS	Difference in proteomic profiles of pediatric cardiac ECMO patients with versus without acute brain injury.	Clinical Research	17:24
Ananya Tandri MS	Towards modular ultrasound and photoacoustic based monitoring in critical care: feasibility studies	Informatics, AI, Engineering, & Technology	17:00
Jinnesse Taylor MD, MPH	Perspectives from the PICU: Interprofessional Views on Screening for Health-Related Social Needs	Critical Care	16:00
Alexis Thompson MD	Meeting the Need: Feasibility of Implementing a Pediatric Sedation Service	Quality Improvement & Health Systems/Services	16:30
Alexis N. Thompson MD	Survey of Sedation Practices in the Care of Severe Pediatric Traumatic Brain Injury	Clinical Research	16:06

Presenter	Poster Title	Category	Estimated Time
Mytreyi Trivedi	Glucose dendrimer-Cannabidiol conjugate (GD-CBD) decreases inflammation in a paw edema model of inflammatory pain	Basic Neuroscience	17:12
Ankit Uniyal Ph.D.	Targeting Tmem100-Mediated TRPA1 Regulation at Central Terminals of DRG Neurons for Neuropathic Pain Relief	Pain & Regional Anesthesiology	17:00
Preeti Vyas PhD	Glucose dendrimer Creatine conjugates for treatment of Creatine Transporter Deficiency disorder.	Basic Neuroscience	16:48
Austin Wang MD	The Pediatricians Providing Perioperative Care Project (P4): What are the educational needs of pediatric residents to optimize perioperative care of children?	Quality Improvement & Health Systems/Services	15:42
Jeffrey B Wang MD PhD	WikiAnesthesia: an open-source mobile app for point of care clinical decision support and emergency management	Quality Improvement & Health Systems/Services	N/A
Siyu Wang Msc	Digital Holographic Imaging as a Noninvasive Alternative to Arterial Lines: Comparative Validation Over Intact Skin and Exposed Arteries	Informatics, AI, Engineering, & Technology	15:48
Siyu Wang Msc	Auricular-Cardiogram: A Novel Strategy for Unobstructive Cardiac Monitoring	Informatics, AI, Engineering, & Technology	16:06
Grace Wayson BS	The effects of perceived self-efficacy level on postoperative mobility after coronary artery bypass graft surgery	Clinical Research	16:18
Caroline R. Wensel PhD, MSPH, RDN	Enrichment of Mucosa-Associated Sutterella spp. Characterizes Biofilm-Positive Colorectal Cancer	Informatics, AI, Engineering, & Technology	17:18

Presenter	Poster Title	Category	Estimated Time
Hyun Yi (Jacqualine) Woo MD, MPH	Complication as a Determinant of Hospital Mortality in Adult ECMO Support	Quality Improvement & Health Systems/Services	17:18
Hyun Yi (Jacqualine) Woo MD MPH	Seizures in Adult Patients on Venovenous Extracorporeal Membrane Oxygenation Support: Analysis of the Extracorporeal Life Support Organization Registry	Critical Care	17:00
Hyun Yi (Jacqualine) Woo MD, MPH	CO2 and pH changes and their impact on acute brain injury in VV-ECMO: Analysis of the Extracorporeal Life Support Organization Registry	Critical Care	17:36
Julie Xian MD	Epigenetic biomarkers of brain injury in critically ill children on extracorporeal membrane oxygenation (ECMO)	Clinical Research	16:18
Keshuai Xu PhD	Continuous intrapartum fetal monitoring using a wearable ultrasound and photoacoustic device	Informatics, AI, Engineering, & Technology	15:54
Zengjin Yang MD PhD	Sex-specific role of CYP4A isoforms in ischemic stroke: a target for male-specific neuroprotection	Basic Neuroscience	15:42
Yiyang You MS	Deep learning-based rapid mechatronic ultrasound scanning for longitudinal monitoring of fetal health and labor progress during labor	Informatics, AI, Engineering, & Technology	15:42
Sophia Yu BS	Development of A Novel Ophthalmic Anesthesia Curriculum for an Ophthalmology Residency Program	Quality Improvement & Health Systems/Services	15:30
Tianyue Zhu BS	Improve STS Risk Score Prediction for Postoperative Length of Stay after Major Cardiac Surgery with Liver and Metabolic Disease Parameters	Clinical Research	16:06

Presenter	Poster Title	Category	Estimated Time
Tianyue Zhu BS	Impact of ECMO initiation timing on acute brain injury and in-hospital mortality in VA ECMO Patients	Clinical Research	15:54
Tarek Zieneldien BS	Global Disparities in Neonatal Sepsis Mortality Across Socio-Demographic Index Levels	Critical Care	16:42

Research Day Ambassadors

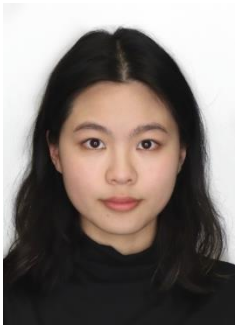
Freda Agyei-Dwarko
MPH candidate
Johns Hopkins Bloomberg School of Public Health

Leya Chambo
MPH candidate
Johns Hopkins Bloomberg School of Public Health

Eimee L. Co, MD-MBA
MPH candidate
Johns Hopkins Bloomberg School of Public Health

Mehjabin Haque
MBBS| M.Phil. (Clinical Psych)|MPH candidate
Johns Hopkins Bloomberg School of Public Health

Kojo Kusi
MPH candidate
Johns Hopkins Bloomberg School of Public Health



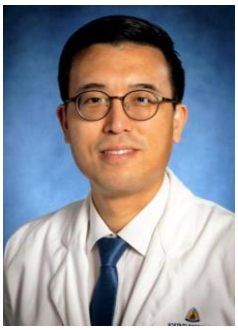
Angela R. Zheng
MS Student - Cellular & Molecular Medicine
Johns Hopkins School of Medicine

Research Day Moderators

Ravie Abozaid
MBBCh, MHPE
Clinical Research 3

Maria Bauer MD
Quality Improvement & Health Systems/Services 2

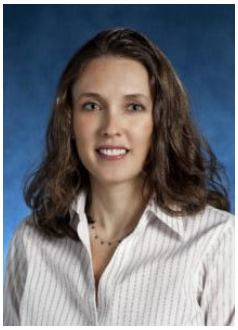
Ima Chinedozi,
MD, MPH, PhD
Clinical Research 1



Sung-Min Cho
DO, MHS
Informatics, AI, Engineering, & Technology 2

Jeffrey Dodd-o,
MD, PhD
Informatics, AI, Engineering, & Technology 1

Lori-Ann Edwards, MBBS
Clinical Research 3



Nadia Hensley MD
Quality Improvement & Health Systems/Services 2

Jeeun Kang, PhD
Critical Care 2

Sujatha Kannan, MBBS
Clinical Research 1

Raymond Koehler, PhD
Pain & Regional Anesthesiology

Laeben Lester MD
Pain & Regional Anesthesiology

Cyrus David Mintz, MD, PhD
Quality Improvement & Health Systems/Services 1

Daniel Nyhan, MD, MMBCh
Basic Neuroscience 2

Kristen Penberthy, MD, PhD
Basic Cardiac/Pulmonary 2

Kate Rosenblatt MD, MHS
Quality Improvement & Health Systems/Services 1

John Sampson MD
Critical Care 1

Lakshmi Santhanam, PhD
Basic Neuroscience 1

Susanna Scafidi, MD
Basic Cardiac/Pulmonary 1

Kara Segna MD
Clinical Research 2

Eellan Sivanesan, MD, FASA
Critical Care 2

Jochen Steppan, MD, DESA, FAHA, FASA
Basic Neuroscience 2

Henrique Doria de Vasconcellos, MD, PhD
Informatics, AI, Engineering, & Technology 2

Emmett Whitaker MD, FAAP
Critical Care 1

Qin Zheng PhD
Basic Cardiac/Pulmonary 2

Abstracts: Basic Science: Cardiovascular & Pulmonary

BASIC NEUROSCIENCE

CP 1.1 - Almodiel

Macrophage Targeting of Dendrimer Conjugated PPAR-a/g Agonist Prompts Metabolic and Cognitive Improvement

Diego Almodiel[1] BS, Wathsala Luyanage[2] PhD, Preet Vyas[3] PhD Kannan Rangaramanujam[1,2] PhD, Sujatha Kannan[3,] MD, and Lakshmi Santhanam[1,3] PhD

[1]Department of Chemical and Biomolecular Engineering, Whiting School of Engineering, The Johns Hopkins University, Baltimore, MD

[2]Department of Ophthalmology, The Johns Hopkins University School of Medicine, Baltimore, MD

[3]Department of Anesthesiology and Critical Care Medicine, The Johns Hopkins University School of Medicine, Baltimore, MD

Introduction: Cardiovascular disease (CVD) predisposes individuals to conditions such as obesity and vascular cognitive impairment (VCI). To date, there are no therapies that can address these chronic inflammatory conditions that often present simultaneously. Obesity and VCI share a key similarity in that their pathogenesis in that they are fueled by inflammatory macrophages. Because of this, we leverage dendrimer technology to target PPAR agonism to macrophages to combat inflammation in the white adipose tissue (WAT) and the brain. We hypothesize that systemic administration of dendrimer conjugated Tesaglitazar (D-Tesa) will allow us to target inflammatory macrophages these sites of pathology detrimentally affected by CVD and address the root cause of disease progression. We posit that targeted PPAR agonism in activated macrophages in the WAT and brain will decrease inflammation and lead to improvements in body weight and cognition.

Methods: We use the Apoe-/- mouse model of atherosclerosis, as these mice develop CVD, obesity, and VCI. Male Apoe-/- mice were fed high fat diet (HFD) for 16 weeks. Mice were then randomized into three groups that were administered treatment twice a week for six weeks via oral gavage: 1) Vehicle (DI water), 2) Free Tesaglitazar (20µg/kg), and 3) D-Tesa (20µg/kg). During the six-week treatment period, the mice were maintained on HFD. Body weight measurements were taken twice weekly. Metabolic function was assessed via indirect calorimetery (CLAMS). Mice were also subjected to spatial recognition paradigm of Y-maze as well as Barnes maze to test short term and working memory, respectively.

Results: Atherosclerotic Apoe-/- mice treated with D-Tesa had a significant reduction in weight, despite continued consumption of HFD. Indirect calorimetry showed that D-Tesa treated mice has significantly higher VO2, VCO2, and energy expenditure compared to vehicle and free Tesaglitazar treated mice. Histological analysis of WAT revealed that D-Tesa treated mice had significantly reduced adipocyte size compared to vehicle treated mice. The improvement in metabolic function and decreased adipocyte size were due to increased browning of adipose tissue, indicated by an increase in UCP-1 protein expression. D-Tesa treated mice also demonstrated significant improvements in short term memory, with modest improvements in long term memory.

Conclusion: This data demonstrates D-Tesa's multifaceted ability to improve metolblic function and VCI by quiescing inflammation from macrophages in the adipose tissue and the brain. This study provides foundational work in establishing D-Tesa a viable exercise mimetic to treat complex systemic inflammation experienced with CVD and obesity.

CP 2.1 - Almodiel

Coadministration of Dendrimer-Tesaglitazar with Semaglutide Increases Therapeutic Benefit and Blunts Weight Regain After GLP-1 Receptor Agonist Termination

Diego Almodiel[1] BS, Wathsala Luyanage[2] PhD, Kannan Rangaramanujam[1,2] PhD,

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Introduction: Current obesity treatment focuses heavily on glucagon like peptide-1 receptor agonists (GLP-1RAs), the benefits of which are primarily due to decreased caloric intake through appetite suppression. Although this allows for the benefit of rapid weight loss, it incurs the well-established phenomenon of weight regain due to a state of hyperphagia upon termination of GLP-1RA treatment. We previously report that dendrimer conjugated Tesaglitazar (D-Tesa) leads to the benefit of weight loss through browning of adipose tissue. We hypothesize that D-Tesa mediated weight loss through adipose browning will provide a complimentary mechanism that can be used in parallel with GLP-1RAs to increase the magnitude of weight loss of either monotherapy alone.

Methods: 12-week-old male C57BL/6J mice are fed a high fat diet (HFD) for 16 weeks. Mice were then randomized into one of four groups: 1) vehicle (DI water P.O.; saline S.Q.), 2) D-Tesa monotherapy (20 μg/kg D-Tesa P.O., saline S.Q.), 3) semaglutide monotherapy (DI water P.O., 100 μg/kg semaglutide S.Q.), and 4) Combination treatment (20 μg/kg D-Tesa P.O., 100 μg/kg semaglutide S.Q.). Mice were treated and weighed daily for 5 weeks during the treatment period. After this treatment period, mice in groups 3 and 4 stopped receiving semaglutide to investigate the rebound of weight experienced after the termination of semaglutide. Pulse wave velocity (PWV), blood pressure (BP), and food intake were measured throughout the experiment. Quantitative NMR (qNMR) was conducted on the mice before treatment, after 5 weeks of treatment initiation, and 10 weeks into the rebound period. Glucose tolerance test (GTT) and insulin tolerance test (ITT) were conducted at the end of the rebound period.

Results: Mice that received a combination of D-Tesa and semaglutide lost significantly more weight than mice that received D-Tesa or semaglutide monotherapy alone. Combination treated mice experience the same appetite suppression and loss of lean mass as semaglutide monotherapy treated mice but lost significantly more fat mass. Both semaglutide and combination treated mice experienced a decrease in BP, as reported in prior literature with GLP-1RAs. D-Tesa and semaglutide monotherapy treated mice experienced a significant decrease in PWV, with combination treated mice having significantly improved PWV compared to monotherapy treated mice. During the rebound period, semaglutide monotherapy treated mice rebounded to back to and beyond their initial body weight, due to hyperphagia that persisted at 8 weeks after termination of semaglutide treatment. Combination treated mice did not rebound to their baseline bodyweight after termination of semaglutide and had significantly lower body weight than vehicle and semaglutide treated mice. At the end of the rebound treatment, mice in the combination group had superior glucose tolerance and insulin sensitivity than mice that were in the vehicle and semaglutide monotherapy groups.

Conclusion: Coadministration of D-Tesa with GLP-1RA therapy incurs a greater magnitude of benefit in weight loss and cardiovascular function than monotherapy alone. Additionally, when mice are continued on D-Tesa treatment after the termination of semaglutide, mice avoid prolonged hyperphagia, leading to less weight regain and sustained benefit on glucose tolerance and insulin sensitivity.

CP 2.8: Palak

In Silico and Functional Analysis of Cysteine 238 Variants in human Lysyl Oxidase

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Introduction: Lysyl oxidase (LOX) is an extracellular enzyme essential for crosslinking collagen and elastin, thus preserving the integrity of connective tissue and blood vessels. Changes in LOX have been associated with thoracic aortic aneurysms and dissections. Earlier studies in our lab revealed that replacing cysteine with serine in LOX resulted in diminished protein levels and stability because of impaired disulfide bonding. This project utilizes a computational method to investigate how cysteine missense mutations affect LOX folding, stability, and possible pathogenicity, expanding these findings.

Methods: The canonical human LOX sequence was obtained, and conserved cysteine residues were determined based on structural annotations. Wild-type and specific cysteine missense variants were simulated using AlphaFold2, enhancing multiple sequence alignment depth to enhance disulfide prediction. Predicted structures were examined in ChimeraX to evaluate disulfide connectivity, distances between residues, and changes in local secondary structure. Complementary wet-lab experiments confirmed these predictions by expressing wild-type and mutant LOX constructs in HEK293T cells, evaluating protein levels, degradation, and enzymatic activity through Western blot analysis, proteasome inhibition, and in situ activity assays.

Results: AlphaFold predictions suggested that cysteine residues create stable disulfide bonds essential for preserving LOX's catalytic domain. Replacing these residues disrupted disulfide linkages and led to local deformation around the copper-binding site. The C→S variant demonstrated slight unfolding, whereas C→G mutations resulted in larger RMSD deviations, indicating increased instability. Experimental findings indicated that this variant possesses a half-life approximately 37% shorter than the wild type, enhanced degradation through proteasomes, and diminished enzymatic activity in situ.

Discussion: Computational studies indicate that cysteine missense mutations destabilize LOX by interfering with conserved disulfide bonds crucial for correct folding and catalytic activity. The reduction of cysteine-mediated bonding probably facilitates misfolding and breakdown, which adds to the pathology of aortic disease. This creates a structure for combining silico modeling with experimental confirmation. Upcoming research will broaden investigations to more cysteine variants, utilize molecular dynamics simulations for enhanced stability predictions, and empirically validate their impacts on secretion and functionality.

BASIC NEUROSCIENCE

BP 2.5: Bauer

Female sex is protective against diastolic dysfunction and HFpEF in the ZSF1 rat model

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Background: Diastolic dysfunction is an important clinical parameter in the diagnosis and assessment of HFpEF. We have previously shown that LOXL-2 inhibition using PAT-1251 is protective in the pathogenesis of HFpEF in male ZSF-1 rats. In this study we tested if selective LOXL-2 inhibition reverses HFpEF in female ZSF-1 rats, given that female sex is protective against HFpEF in pre-menopausal women.

Methods: We included 27 female rats in our experiments (group 1: lean controls n=7, group 2: obese rats with HFpEF n=6, group 3: obese ovariectomized rats with HFpEF (OVX) n=8, and group 4: obese OVX rats with HFpEF that received the LOXL2 inhibitor PAT-1251 n=6). OVX was performed at 8 weeks of age, PAT-1251 (30mg/kg per oral gavage) was started after HFpEF manifested at 16 weeks of age, and endpoint measurements were done at 24 weeks of age. Echocardiographic parameters (diastolic function and left ventricular remodeling), blood pressure, heart rate, pulse wave velocity (PWV), and weight were recorded in all animals.

Results: End-point measurements comparing lean controls with HFpEF rats showed that weight and isovolumic relaxation time (IVRT) were significantly increased in the obese HFpEF cohort at the conclusion of the experimental period and this was even more pronounced in ovarectomized animals. PWV and global longitudinal strain (GLS) did not increase significantly between lean controls and intact obese animals, but it did so between lean controls and ovarectomized animals.
Tissue Doppler of diastolic dysfunction parameter E/e' was not significantly different between any of the groups. Similarly, ejection fraction (EF) remained preserved in all groups. LOXL2 inhibition with PAT-1251 showed a trend toward normalization of GLS (p=0.07), though there was no change in weight, PWV, or IVRT with LOXL2 inhibition.

Conclusions: Our data indicates that the ZSF1 model of HFpEF manifests diastolic dysfunction in obese female rats, though to a lesser extent than in males (which is consistent with human physiology). Interestingly, surgically induced menopause is not enough to fully remove the protective effect of female sex with only worsening some diastolic parameters. Hence, menopause by itself is not sufficient to fully induce the HFpEF phenotype in females and aging, which is a risk factor itself, overpowers the effect of surgical menopause. Out next step is to conduct an aging study to determine its contribution to HFpEF in females.

Mini abstract: Inhibiting the collagen crosslinking enzyme LOXL2, using PAT-1251, partially reverses echocardiographic indices of diastolic dysfunction in the female ZSF-1 rat model of HFpEF.

CP 1.3: Brady

Meta-analysis of aging mouse aortic smooth muscle cell transcriptome

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Introduction: Vascular smooth muscle cells (VSMCs) retain extraordinary plasticity throughout adulthood to maintain arterial homeostasis. Aging perturbs this homeostasis resulting in VSMC dedifferentiation that is generally marked by loss of contractile protein expression and pathological extracellular matrix (ECM) remodeling. While historically thought of as two distinct states, the contractile and synthetic (ECM-remodeling) phenotypes are now considered a continuum of cellular behaviors that are disease and context dependent. To better understand the precise changes in aortic VSMCs, we performed a meta-analysis of bulk and single-cell RNA sequencing (RNAseq) analyses to quantify the relative abundance of key VSMC transcripts across multiple timepoints in the aging context. We further validated specific results with targeted quantitative polymerase chain reaction (qPCR) and examined physiological and functional consequences using *in vivo* techniques.

Materials and Methods: Bulk and single-cell RNA-seq datasets were obtained in FASTQ format from the Gene Expression Omnibus (GEO) or pre-processed compressed files from the relevant repositories. Further processing was conducted in *R* using the DESeq2 (bulk) and Seurat (single-cell) packages. Studies considered were limited to those within the past decade, explicitly featuring aortic smooth muscle cells in isolation or bulk tissue. Distinct scRNAseq datasets were integrated using Seurat's "merge" function and standard preprocessing was performed. These datasets were then used to identify differentially expressed genes as well as track the evolution of canonical regulators of VSMC phenotype. Mouse aortic smooth muscle cells (maSMCs) were isolated from mice aged 3, 6, 9 and 18 months. Fluorescent collagen substrates were used to assess type I collagen (Col-I) integration and degradation in 2D cell culture. Cells of each age were further treated with MMP inhibitor, LOXL2 inhibitor or TGF-β1 to measure the impacts on Col-I turnover, as well as expression of relevant matricellular proteins and their associated transcripts. Finally, a spatiotemporal knockout of *Loxl2* in a mouse model was used to gauge the therapeutic potential *in vivo*.

Results: Meta-analysis of RNAseq datasets containing differently aged maSMCS reveals downregulation of major collagen subtypes at the transcript level. We additionally note increased expression in the TGF-β family of genes in aged cells. Targeted qPCR on isolated maSMCs shows a similar trend in untreated maSMCs. We confirmed aged maSMCs were sensitized to TGF-β1 and expressed significantly higher levels of ECM-remodeling transcripts than age-matched untreated counterparts. Collagen integration by isolated maSMCS peaks at 9mo, while collagen degradation progressively decreases with age. Treatment with LOXL2 inhibitor effectively limits collagen integration in all age groups. MMP inhibitor treatment causes a marked decrease in Col-I cleavage, though this effect is muted in the oldest maSMCs which show impaired Col-I cleavage even in the absence of MMPi.

Conclusions: RNAseq analysis confirmed increased expression of senescence markers and downregulation of contractile apparatus genes in aged maSMCs. Of note, key players in the TGF-β signaling pathway were upregulated, hinting at its role in age-related VSMC dysregulation. ECM-crosslinking enzyme *Loxl2* was upregulated in both meta-analysis and targeted qPCR making it a suitable target for therapeutic interventions. Inhibition or knockout of *Loxl2*/LOXL2 was effective in mitigating collagen integration and limiting the severity of arterial stiffening. Together, these data highlight the role of *Loxl2*/LOXL2 in arterial stiffening and the differential response of key collagen transcripts in the aging arterial milieu.

CP 2.2: Brady

Quantifying extracellular matrix turnover in vivo in the arterial milieu

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Introduction: The extracellular matrix (ECM) in the arterial microenvironment is continuously regulated through a host of enzymatic processes. These processes are carried out in large part by vascular smooth muscle cells (VSMCs) which modulate their behavior to maintain homeostasis in response to short- and long-term changes to hemodynamic profile. In the context of aging, VSMCs are thought to transition to a synthetic, pro-fibrotic phenotype, that contributes to changes in arterial ECM structure and composition. What remains poorly understood, however, are how the relative rates of protein synthesis, deposition, and degradation contribute to overall homeostasis in the vascular milieu, particularly as it pertains to key vascular ECM constituents such as collagen, elastin and crosslinking enzymes. In order to quantify the relative rates of deposition and clearance, we used a non-canonincal amino acid and fluorescent labeling to gauge the incorporation of newly synthesized proteins into the vascular ECM. Additionally, we performed immunofluorescent and immunohistochemical (IF/IHC) staining and second harmonic generation (SHG) imaging of fixed aortic tissue in several age groups to visualize age-related alterations to the composition and structure of the arterial ECM.

Materials and Methods: Male C57Bl6/J mice aged 3mo, 6mo, 9mo, or greater than 18mo were assessed for *in vivo* cardiovascular function via blood pressure (BP) and pulse wave velocity (PWV). Mouse aortic smooth muscle cells (maSMCs) were isolated from mice at each age group and characterized for protein turnover using a non-canonincal amino acid (L-azidohomoalanine; L-AHA). Young (3mo), old (>18mo) and hypertensive (3mo + angiotensin II) mice were injected intraperitoneally with L-AHA before their aortic tissue was harvested. Tissue collection was performed following one week of daily injections or one week after daily injections ceased. CLICK chemistry was performed on fixed tissue and cells to fluorescently label and subsequently quantify signal intensity in aortic tissue. Formalin-fixed paraffin-embedded (FFPE) aortic cross-sections were rehydrated and stained (IF/IHC) for relevant ECM markers. Another set of sections were coverslipped without any additional staining to prevent interference during multiphoton/second harmonic generation (SHG) imaging.

Results: At the cellular (*in vitro*) and organism (*in vivo*) level, there is less integration of L-AHA into nascent proteins seen with increasing age. This is observed intracellularly as well as extracellularly in decelullarized aortic tissue. IF/IHC staining shows accumulation of collagen in the aorta, particularly preferentially deposition of collagen type IV towards the intima of the aged aorta. Furthermore, aging increases fiber alignment in aortic tissue, as revealed by SHG imaging.

Conclusions: There is a progressive decrease in protein synthesis activity seen in aging maSMCs. As aged aortic tissue becomes stiffer, this discrepancy is likely caused by increased production or activity of ECM-crosslinking enzymes, which would still result in stiffened tissue despite decreases in protein production. This is confirmed by IHC of aortic cross sections, which show increased collagen content when compared to younger tissue. IF staining of FFPE aorta shows altered expression of key collagen subtypes, quite notably Col-IV in the aortic intima. SHG imaging also suggests increased fibrotic activity, as fiber alignment increased in aged aorta likely due to increased crosslinking of nascent fibrils.

CP 2.7: Rituparna

Resistin blockade reduces lipid burden in foam cells and attenuates atherosclerosis

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Introduction: Atherosclerosis is a chronic inflammatory disease in which macrophage biology dictates whether plaques remain stable or rupture with life-threatening consequences. Acute cardiovascular diseases (CVD), including myocardial infarction, ischemic stroke, and unstable angina, are driven by atherosclerotic CVD (ASCVD), the leading cause of mortality worldwide. Despite the success of lipid-lowering therapies, the global incidence of ASCVD continues to rise, reflecting the need for novel approaches that directly target immune and inflammatory drivers of disease. Resistin, a macrophage-derived adipokine, has emerged as a robust biomarker of cardiovascular risk and is implicated in multiple inflammatory disorders including insulin resistance, rheumatoid arthritis, and pulmonary arterial hypertension (PAH). In human macrophages, resistin promotes foam cell formation - a central hallmark of early atherogenesis - amplifying arterial inflammation. Additionally, macrophages are the major source of resistin secretion in humans. These findings position resistin as a key driver of molecular dysregulation that fuels vascular inflammation and dysfunction. Our group has developed and patented a first-in-class therapeutic antibody that selectively neutralizes human resistin. This antibody has shown efficacy in experimental models of PAH, prolonging survival and attenuating both vascular and cardiac remodeling, thereby establishing translational feasibility of resistin as a therapeutic target. Based on this foundation, we hypothesize that resistin inhibition will attenuate the foam cell phenotype in human monocyte -derived macrophages (hMDMs).

Methods: Leukopaks from deidentified healthy donors were processed by layering over Ficoll. Monocytes were negatively selected by using MACS (Pan monocyte isolation kit, human; Miltenyi Biotec). Macrophages (hMDMs) were obtained by culturing monocytes for 6 days in 20ng/mL MCSF. HMDMs were treated with oxidized LDL (oxLDL) in combination with the resistin, IgG control antibody and atorvastatin (as a comparator of current lipid-lowering treatment). After 24hours of treatment the cells were lysed, and the total cholesterol content of the cells were estimated to assess the foam cell phenotype using commercially available kit (RayBiotech).

Results: The first set of results from the study depicts reduction of cholesterol content when treated with resistin antibody in combination with oxLDL compared to only oxLDL treatment.

Discussion: The present study provides preliminary evidence that resistin inhibition attenuates foam cell formation in hMDMs, as reflected by the reduction in intracellular cholesterol accumulation. Importantly, our study demonstrates the translational potential of targeting resistin as an immune-modulatory approach to complement current lipid-lowering therapies. While statins primarily reduce circulating LDL cholesterol, resistin blockade may directly.

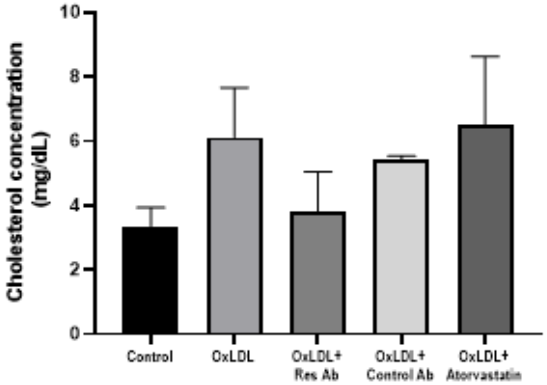

Figure 1 - Total cholesterol content in hMDMs after 24-hour treatment with oxLDL alone or in combination with resistin antibody, IgG control, or atorvastatin

CP 1.8: Gadkari

Effect of Sex on Pulmonary Vascular Properties in Pulmonary Arterial Hypertension

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Introduction: Pulmonary arterial hypertension (PAH) is an incurable and deadly condition with a 3-year mortality for 55% of high-risk patients. The pathophysiology of PAH is defined by increased pulmonary vascular contractility, vascular remodeling, and endothelial dysfunction, which contribute to elevated pulmonary arterial pressure (PAP), right heart failure, and death. PAH is more prevalent in females, yet males experience worse clinical outcomes. However, the mechanisms underlying this sex difference remains poorly understood. The goal of this study is to elucidate the impact of biological sex on pulmonary artery properties in PAH.

Methods: We first evaluated the ex-vivo mechanical properties of the pulmonary artery (PA) using uniaxial mechanical testing. Subsequently, endothelial-dependent and -independent vasorelaxation responses were assessed by administering varying concentrations of acetylcholine (Ach) and sodium nitroprusside (SNP), respectively. These experiments were conducted both with and without the application of indomethacin (Indo), a cyclooxygenase (COX) inhibitor, to elucidate its role in modulating vascular function.

Results: At baseline, female PAs were stiffer than those from males; however, with PAH, this relationship reversed, with males exhibiting greater stiffness. Vascular reactivity assays showed that females had enhanced ACh- and SNP-mediated relaxation compared to males at baseline, effects that were attenuated by COX inhibition. In PAH, COX inhibition significantly increased the ACh EC_{50} in females but not in males, suggesting that COX-derived prostanoids play a greater protective role in female endothelial function. No differences were observed in SNP responses with or without COX inhibition.

Discussion: These findings demonstrate that biological sex distinctly modulates pulmonary vascular mechanics and COX-dependent endothelial signaling. We found that trends in PA stiffness reverse with disease, that COX signaling exerts sex- and disease-specific effects on pulmonary vascular reactivity. Under healthy conditions, COX activity contributes to contractile tone primarily in males, while in PAH, females develop COX-dependent modulation of endothelial relaxation. This sex-specific regulation of vascular tone may contribute to the improved clinical outcomes observed in females with PAH and highlights COX pathways as potential therapeutic targets for sex-tailored interventions.

CP 1.2: Lam

Human Resistin Is Critical to SARS-CoV-2 Induced Cytokine Storm and Predicts Mortality

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Introduction: The coronavirus disease 2019 (COVID-19) is caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). Despite extensive research, key aspects of the inflammatory response to SARS-CoV-2 remain incompletely understood, limiting the development of effective therapeutic interventions. Human resistin (Hresistin) and its rodent homolog (RELMα) have been linked to the priming and activation of the NLRP3 inflammasome, a critical component in COVID-19 inflammation. Our aim is to elucidate the role of Hresistin in SARS-CoV-2 induced inflammation.

Methods: Hresistin was measured in patient serum, and patients were grouped based on their peak disease severity as classified by the WHO Max Scale. A GWAS was conducted to analyze variants of the Hresistin gene (*RETN*) in hospitalized infected patients with varying severity of disease. Autopsy lung tissues were analyzed for Hresistin and its binding partner, Bruton's Tyrosine Kinase (BTK). A humanized mouse model and a mouse adapted virus model of human COVID-19 were utilized for *in vivo* studies. Mice were infected with the viruses for five days in the presence and absence of RELMα gene knockout or in the presence of a blocking antibody. Their lungs and serum were collected for analysis via western blot, qPCR, H&E staining, and ELISA.

Results: Hresistin in patient serum was found to be more elevated than other analytes associated with viral infection and was predictive of disease severity and mortality. Intronic and promotor variants of *RETN* were found to be associated with COVID severity and hospitalization phenotype. Hresistin and BTK were upregulated and colocalized in infected patient lung tissues. Similarly in mice, RELMα was highly upregulated in both COVID-19 mouse models. Infection with SARS-CoV-2 increased the protein and gene expression of key inflammatory molecules like NLRP3; however, inhibiting RELMα using an antibody or total genetic knock-out reduced levels closer to the control groups. H&E staining on mice lungs revealed significant reductions in mononuclear cell infiltration when RELMα was inhibited prior to infection.

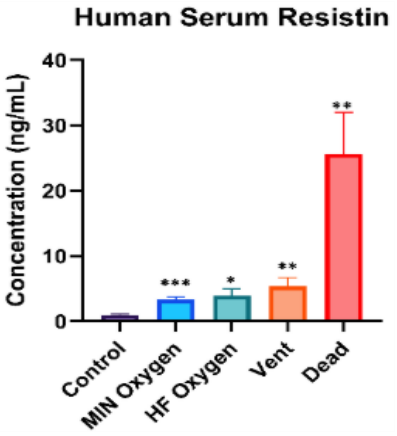

Figure 1: Correlation of serum Hresistin with disease severity in patients with COVID-19
Serum specimens were obtained from healthy individuals (Control; n=12) and patients with COVID-19 whose peak disease severity matched one of the four WHO COVID-19 stages: oxygen only (nasal cannula or face mask; MINO2; n=20), high-flow oxygen (HFO2; n=17), mechanical ventilation (Vent; n=13), and death (n=17). *p<0.05, **p<0.01, ***p<0.001 (with respect to the control group)

Discussion: Our results show that Hresistin is a key molecule in the inflammatory response to SARS-CoV-2 infection and is predictive of disease severity and mortality. Genetically knocking out the rodent homolog and pre-treating them with a blocking antibody significantly reduced the cytokines activated by the NLRP3 inflammasome (i.e., IL-1β, IL-18). All together, these results demonstrate the importance of Hresistin in SARS-CoV-2 induced cytokine storm and may be a future therapeutic target in this and other similar diseases.

CP 1.6: Martinez Yus

Role of LOXL2 and shift to androgen signaling in the post-menopausal female vasculature

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Introduction: Cardiovascular disease (CVD) is the number one cause of death for both men and women. Even though pre-menopausal women are relatively protected from CVD, a disproportionate increase in risk and incidence occurs after menopause. The hormonal shift, particularly loss of estrogen, present in post-menopausal women has been widely studied; however, it is increasingly clear that estrogen loss alone is not responsible for the elevated CVD risk. We hypothesize that a shift towards androgen signaling significantly contributes to post-menopausal CVD. We identified ECM-remodeling enzyme lysyl oxidase-like 2 (LOXL2) as a potential therapeutic target against vascular deterioration in aged females. Here we investigated how sex hormones vary and modulate LOXL2 in the female vasculature.

Methods and Results: Aortae from male and female C57Bl/6J WT mice were extracted, cleaned, and prepared for western blotting. LOXL2 showed increased protein levels with age in males and females, with an even higher rise in old females compared to old males. Sex hormone receptors were also investigated: androgen receptor (AR) expression was elevated in young males compared to females, with old females reaching similar levels. Estrogen receptor α (ERα) and ERβ were both increased in the aged females. We next assessed whether these changes were also seen *in vitro* using vascular cells: human aortic smooth muscle cells (HASMC) from a young (39 years old (yo)) and old (82 yo) woman; and human aortic endothelial cells (HAEC) from a young (38 yo) and old (75 yo) woman. Western blotting revealed an increase in secreted LOXL2 protein into the culture media with age in both cell types, and elevated ECM-LOXL2 expression in the old HASMC. AR expression was lower in the young HAEC compared to remaining groups. ERα and ERβ expression was augmented in the old HASMCs. These results support the findings from the tissue samples. Next, we examined whether shifts from high estradiol (E2) in menstruating females to a relative dihydrotestosterone (DHT) excess in post-menopausal women impacts LOXL2 protein expression. We used young and old HASMC only. LOXL2 expression was increased in media and ECM HASMC from young and old women when exposed to DHT/E2 ratio mimicking the post-menopausal circulation compared to premenopausal DHT/E2 and E2 alone. AR expression was similar among conditions in the young HASMC, but increased in the post-menopausal E2/DHT ratio condition in old HASMC. ERα and ERβ were augmented in the young HASMC only when exposed to the menstruating DHT/E2 ratio. This could be explained by the old female cells reaching high levels of estrogen receptors at baseline, with no room for an even higher increase. Alternatively, young female cells were able to accommodate greater levels of ERα and ERβ.

Conclusion: LOXL2 protein significantly increases in the post-menopausal female vasculature, and sex hormones AR and ERs, which also augment with age, modulate its expression. Future studies will continue to: 1) determine the molecular mechanisms underlaying increased arterial stiffness in females after menopause, 2) test therapeutic targets to stop and/or reverse this increase in vascular stiffening, and 3) study the role of hormonal shift in old females in arterial aging.

CP 2.6: Martinez Yus

Loxl2+/- females are protected from the detrimental vascular remodeling caused by aging and ovariectomy

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Introduction: Aging associated arterial stiffening is a major contributing component to cardiovascular deterioration, with noted sexual dimorphisms. In males, arterial stiffening and resultant increase in cardiovascular disease (CVD) risk is initiated by middle age. However, while women are relatively protected from CVD risk in their reproductive years, they suffer a significant risk acceleration after menopause. Remodeling of the vascular extracellular matrix (ECM) and vascular smooth muscle cell (VSMC) derangements jointly drive arterial stiffening. However, specific molecular and cellular mechanisms that drive post-menopausal vascular dysfunction and stiffening in the early and late phase following menopause remain unknown. Within the context of ECM remodeling, the activation of matrix crosslinking enzymes is essential. Lysyl oxidase-like 2 (LOXL2), a member of the LOX family of amine oxidases, has emerged as a promising target in male arterial stiffening, and elevated LOXL2 activity in the aortic extracellular matrix of older male mice has already been shown. The goal of the study is to examine the effect of aging, OVX, and LOXL2 on female vascular wall.

Methods: Aortic rings from young (4 months old) and old (18 months old), sham vs OVX, WT vs Loxl2+/- mice were extracted, fixed in 4% formaldehyde, paraffin embedded, sectioned with visible vessel lumen, and mounted onto slides. Hematoxylin and eosin (H&E), Masson's trichrome, and Movat pentachrome stains were performed using standard methods. We also performed Second Harmonic Generation (SHG) to measure collagen deposition and Two-photon Excited Fluorescence (2PEF) to measure elastin.

Results: In WT females, aging resulted in increased wall thickness and intralamellar distance, with no change in lumen diameter. Collagen content increased, and elastin content was unchanged in the aged state when compared with youth. OVX in WT mice did not impact lumen diameter, wall thickness, or intralamellar distance in the early phase. Wall thickness and intralamellar distance in aged OVX WT were similar to aged sham WT, suggesting aging as the primary mediator of these macroscopic structural changes. A markedly higher collagen content was noted in the early phase following OVX, similar to that of aged females. Collagen content in aged OVX aorta was similar to young OVX and aged sham groups. Interestingly, elastin content was significantly higher in the early phase following OVX compared to every other group.
Young *Loxl2*$^{+/-}$ females exhibited similar wall thickness and intralamellar distance as young WT. Wall thickness and intralamellar distance did not change with aging or OVX in the *Loxl2*$^{+/-}$ female aorta. Collagen content did not change with aging alone in the *Loxl2*$^{+/-}$ females and was similar to that of young WT sham. Collagen content was unchanged in the early phase following OVX but was higher in the aged OVX. Despite this, all four *Loxl2*$^{+/-}$ female groups had significantly lower collagen content compared to their WT counterparts. Elastin content was unchanged with aging and OVX in the *Loxl2*$^{+/-}$ female aorta and lower than WT counterparts in every group.

Conclusion: Aging more than OVX, is the primary mediator of vascular structural changes. *Loxl2*$^{+/-}$ females are protected from this remodeling. Future studies will continue to investigate LOXL2 as a therapeutic target against arterial stiffening in the aging female vasculature

CP 1.4: Miyagawa

The effect of microRNA-330-3p in developing postoperative delirium in cardiac surgery

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Introduction: Postoperative delirium (POD) is a frequent and severe neurocognitive complication following cardiac surgery, associated with both short- and long-term poor outcomes. Many studies have been conducted to reveal the pathophysiology of POD, but the underlying molecular mechanisms remain poorly understood. For early diagnosis objective biomarkers are urgently needed, and our preliminary study has shown that perioperative change in plasma small extracellular vesicle (sEV)-associated microRNA-330-3p (miR-330-3p) was significantly greater in patients who developed POD compared with those who did not in cardiac surgeries using cardiopulmonary bypass. In order to support the genomic contribution to the pathogenesis for POD, the functional impact of the miR-330-3p was investigated in vitro by assessing tau protein phosphorylation and cell viability in neuronal cells.

Methods: The HT-22 mouse hippocampal neuronal cells were transfected with either an HSA-miRNA-330-3p mimic or a scramble control, and incubated for 48 hours. Total RNA, including miRNA, was isolated from the cell lysates and cDNA was synthesized to identify upregulation of miR-330-3p in the cells with quantitative polymerase chain reaction (qPCR). The effects of miR-330-3p transfection on tau phosphorylation were assessed by western blot of the isolated proteins using primary antibodies against phospho-Tau (Ser199), phospho-Tau (Ser396), total Tau, and GAPDH. The result of western blot was assessed by densitometric analysis. In order to assess the cytotoxic effects of miR-330-3p on HT22 cells, MTT assay was performed with either an HSA-miRNA-330-3p mimic or a scramble control.

Results: We confirmed the successful and significant upregulation of miR-330-3p in transfected cells via q-PCR. Western blot analysis revealed that miR-330-3p transfection resulted in a marked increase in the phosphorylation of tau protein at both the Ser199 and Ser396 sites, while total tau protein levels remained unchanged. Densitometric quantification confirmed that the ratio of phospho-tau (Ser199) to total tau was significantly elevated in miR-330-3p transfected cells ($P < 0.0001$), as was the ratio of phospho-tau (Ser396) to total tau ($P < 0.001$). No significant differences in total tau expression were observed among the three groups. An MTT assay was performed to demonstrate the toxic effects of DMSO on the HT22 cells incubated with either an HSA-miRNA-330-3p mimic or a scramble control. The results showed that transfection of miR-330-3p significantly decreased cell viability of HT22 compared to that of control and scramble ($P < 0.001$), indicating that elevated levels of miRNA-330-3p are detrimental to neuronal cell survival.

Discussion: In this study we combined our preliminary finding of miR-330-3p upregulation in POD with in vitro functional experiments to explore the role of circulating sEV-miR-330-3p in the pathogenesis of POD in cardiac surgery. Although previous studies on miR-330-3p have revealed the involvement of miR-330-3p in neurocognitive diseases such as Alzheimer's Disease and the involvement of abnormal tau phosphorylation in inducing cognitive impairment through synaptic dysfunction, our in vitro data are the first study to demonstrate that miR-330-3p can directly induce hyperphosphorylation of tau at Ser199 and Ser396 and reduce neuronal cell viability. Further studies will be needed to explore the therapeutic possibility to inhibit the signaling pathway of miR-330-3p in the paradigm. Our findings indicate that miR-330-3p could be a novel biomarker of POD as a potential pathogenic mediator which develops a systemic signal to tau phosphorylation- related neuronal injury after surgery.

CP 2.3: Miyagawa

GRK2 activates the Translin/Trax RNase complex: A novel molecular pathway in the pathophysiology of Large-Artery Stiffness

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Introduction: Large artery stiffening (LAS) is a major and independent risk factor of cardiovascular morbidity and mortality. Our previous studies have shown that blockade of adenosine A_{2A} receptors may have therapeutic potential in treating LAS through the inhibition of the translin (TN)/trax (TX) microRNA-degrading complex formation, which degrades miR-181b, in vascular smooth muscle cells (VSMCs). However, there remain important gaps in our understanding of how TN/TX activity is regulated, as well as its role in the pathobiology of LAS. Herein, we hypothesize that G-protein coupled receptor kinase 2 (GRK2) triggers formation of TN/TX complex through phosphorylation of TN and/or TX. The formation of TN/TX RNase complex ultimately leads to LAS by degrading miR-181b.

Methods: GRK2 was overexpressed in VSMC-derived from rat aorta (A7r5) using an adenovirus vector. Paroxetine, used clinically as an antidepressant, is a selective inhibitor of GRK2, and was used to inhibit GRK2 activity in A7r5. Immunoprecipitation was performed from the A7r5 lysates after GRK2 overexpression to assess formation of the TN/TX complex. qPCR was performed to examine miR-181b degradation, and phospho-protein enrichment was performed to access TN and TX phosphorylation using western blot and mass spectroscopy. In silico analysis predicted several candidates of GRK2 phosphorylation sites on TN and TX, which promote the which formation of the complex. Phospho-proteomic approach was implemented to confirm the phosphorylation sites. In addition, we also checked whether GRK2 inhibition might confer from high-salt water-induced aortic stiffening. To this end, we assessed the impact of daily intraperitoneal (IP) injection of paroxetine in mice for 3 weeks with measurement of pulse wave velocity (PWV), tensile testing and histology using aortic segment harvested from treated and normal mice.

Results: GRK2 overexpression in VSMCs significantly downregulated miR-181b, and induced phosphorylation of both TN and TX, and increased association of TN with TX. In silico analysis showed 2 sites in TN and 4 sites in TX that can be potential interaction sites. In addition, paroxetine treatment (10μM) of VSMCs blocks vasopressin induced miR-181b degradation. In vivo, we also found that paroxetine treatment (5mg/kg/day) blocked aortic stiffening induced by high-salt water.

Discussion: We found that GRK2 overexpression triggers activation of the TN/TX RNase, as monitored by degradation of miR-181b. Furthermore, our finding supports our hypothesis that GRK2 elicits TN/TX activation by phosphorylating TN and TX, and promoting formation of the TN/TX complex. We also found that paroxetine inhibits degradation of miR-181b induced by chronic high-salt water treatment. These findings suggest that further studies are warranted to evaluate whether inhibition of GRK2 phosphorylation of either Translin or Trax may have therapeutic potential in treating LAS.

CP 1.5: Quiroga

MicroRNA landscape of Postoperative Atrial Fibrillation After Cardiac Surgery

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Introduction: Nearly 33% of patients who present for cardiac surgery in normal sinus rhythm suffer from postoperative atrial fibrillation (poAF), the most common complication. A number of risk factors (older age, obesity), comorbidities (prior AF, hypertension, chronic kidney disease), and surgical features (valve surgery, increased aortic cross-clamp time) are associated with poAF. Even after adjusting for these factors, the underlying molecular mechanism driving poAF remain poorly understood. Emerging evidence suggests that non-coding RNAs, particularly microRNAs (miRNAs), play crucial roles in the pathophysiology of poAF. Therefore, we hypothesized that dysregulated miRNAs in the myocardium might provide an early indication of poAF development.

Methods: Left atrial tissue samples were obtained from a larger cohort of patients who were in sinus rhythm at the time of mitral valve surgery. From this population, we selected a subset of matched samples comprising 12 patients who subsequently developed poAF (poAF group) and 12 who maintained sinus rhythm postoperatively (Control group). miRNA-enriched fraction was extracted using the miRNeasy Mini Kit (QIAGEN). Small RNA-Seq was performed using libraries prepared by the QIAseq miRNA Library Kit (QIAGEN). Primary and secondary analysis were performed by CLC Genomics Workbench (Qiagen) (FDR-adjusted P < 0.1 using Benjamini-Hochberg correction).

Results: Unbiased miRNA profiling revealed a total of 15 differentially expressed miRNAs between patients who developed poAF and those who remained in sinus rhythm. As shown in the volcano plot (Fig. 1A), the following miRNAs were significantly upregulated in poAF samples: hsa-miR-27a-5p, hsa-miR-155-5p, hsa-miR-148a-5p, hsa-miR-100-5p, hsa-miR-135a-5p, hsa-miR-146b-3p, hsa-miR-34c-5p, and hsa-miR-3620-5p, while the following were downregulated: hsa-miR-216a-5p, hsa-miR-217-3p, hsa-miR-187-3p, hsa-miR-187-5p, hsa-miR-299-5p, hsa-miR-144-3p, and hsa-miR-204-5p.
The GO enrichment analysis of predicted miRNA targets revealed a significant overrepresentation of biological processes including apoptotic signaling, transcriptional regulation, oxidative stress response, and cell cycle control. These pathways are all mechanistically relevant to atrial structural remodeling and arrhythmogenesis, processes central to poAF development. The analysis revealed that several of the differentially expressed miRNAs have established associations with poAF. miR-155-5p has been shown to regulate the calcium channel gene CACNA1C, and its inhibition reduces AF burden. miR-100-5p and miR-204-5p were previously identified as components of miRNA signatures predictive of poAF following coronary artery bypass graft (CABG) surgery. miR-144-3p/5p, miR-135b-5p, and miR-187-3p are involved in the regulation of structural remodeling genes within atrial tissue, while miR-146b-5p has been implicated in atrial fibrosis, which contributes to arrhythmogenesis.

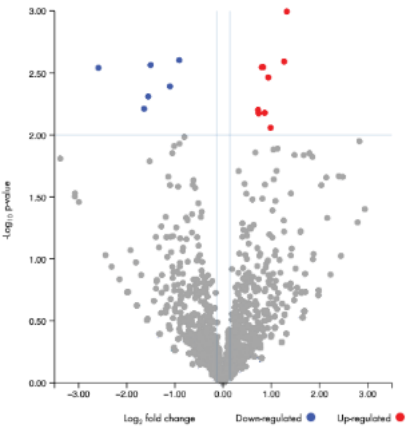

Figure 1. (A) volcano plot comparing miRNA expression, p-value<0.01(FDR-adjusted P < 0.1 using Benjamini-Hochberg correction).

Discussion: Successful completion of this project will improve our mechanistic knowledge of poAF by identifying miRNA(s) and miRNA-regulated pathways associated with poAF. A better understanding of this molecular mechanism might develop new pharmacological targets for the prevention and treatment of poAF. Resulting insights could benefit both surgical and non-surgical AF patients, potentially improving the lives of millions of patients.

CP 2.4: Quiroga

Argonaute 2 Phosphorylation at Ser388 Modulates Mitochondrial microRNA Trafficking and Preserves Cardiac Function in Heart Failure

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Introduction: Cardiovascular diseases (CVDs) represent the leading cause of death globally, posing a persistent and growing threat to public health and sustainable development. Heart failure (HF) has emerged as a major contributor to morbidity and mortality, placing a substantial burden on healthcare systems worldwide. Mitochondrial microRNAs (MitomiRs) regulate mitochondrial gene expression and contribute to HF pathogenesis. miR-181c, a stress-inducible MitomiR, impairs mitochondrial redox signaling and calcium handling via repression of mt-COX1 and MICU1. Its mitochondrial localization is regulated by Argonaute 2 (AGO2), whose phosphorylation at Ser388 inhibit miRNA trafficking to the mitochondria. We hypothesized that mimicking AGO2 phosphorylation at Ser388 will reduce mitochondrial miR-181c translocation and confer protection against HF.

Methods: We generated a knock-in mouse model bearing the AGO2S388D phosphomimetic mutation, using CRISPR/Cas9 technology, these animals are hereafter referred to as $_{S388D}AGO2^{tg/tg}$. We subjected wild-type (WT) C57bl and $_{S388D}AGO2^{tg/tg}$ mice to transverse aortic constriction (TAC) or sham surgery. Cardiac function was assessed by echocardiography, and miRNA expression was analyzed by small RNA sequencing, qPCR, and digital PCR. Protein levels of mt-COX1, Sp1, MICU1, and phosphorylation of pyruvate dehydrogenase (PDH) at Ser293 [p(S293)PDH], were evaluated by Western blot.

Results: Small RNA sequencing of total cardiac tissue and isolated mitochondrial fractions revealed that miR-181c levels were unchanged in total heart lysates between wild-type (WT) and $_{S388D}AGO2^{tg/tg}$ mice, indicating that global expression is unaffected by the phosphomimetic mutation. However, analysis of the mitochondrial fraction showed that mitochondrial miR-181c was significantly reduced, by approximately 3.5-fold, in $_{S388D}AGO2^{tg/tg}$ hearts compared to WT ($p < 0.05$), indicating a selective impairment in mitochondrial localization.
Functionally, both genotypes exhibited significant increases in the heart weight-to-tibia length ratio following TAC, consistent with hypertrophic remodeling. However, while WT mice developed a robust hypertrophic response, this was significantly attenuated in $_{S388D}AGO2^{tg/tg}$ mice, indicating partial protection from pressure overload–induced cardiac hypertrophy. Furthermore, $_{S388D}AGO2^{tg/tg}$ animals demonstrated significantly higher left ventricular ejection fraction (LVEF) and fractional shortening (FS) under TAC compared to WT, reflecting preserved systolic performance.
After TAC, WT mice showed increased mitochondrial miR-181c along with decreased expression of its protein targets mt-COX1, Sp1, and MICU1. In contrast, $_{S388D}AGO2^{tg/tg}$ mice maintained higher levels of these proteins, reflecting protection from the miR-181c-mediated repression observed in WT. Additionally, p(S293)PDH levels were significantly higher in $_{S388D}AGO2^{tg/tg}$ mice post-TAC, consistent with reduced mitochondrial calcium overload and preserved metabolic regulation.

Discussion: Phosphomimetic $_{S388D}AGO2^{tg/tg}$ mice selectively impair miR-181c mitochondrial import without affecting global expression, protecting against mitochondrial dysfunction and maladaptive remodeling. This strategy may enable precise modulation of miRNA activity in subcellular compartments, offering a novel therapeutic approach in HF.

CP 1.7: Sudhir

The effectiveness of dendrimer-Tesaglitazar therapy in fatty liver and liver inflammation in both male and female ApoE knockout mice

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Non-Alcoholic fatty liver disease (NAFLD) is the most common type of liver disease, affecting approximately 38% of the global population. The pathogenesis of NAFLD is largely due to a dysfunctional fat metabolism that results in increased an level of lipids such as triglycerides or cholesterol (hyperlipidemia) as well as increased inflammation driven by macrophage activation in the liver. The current treatment for NAFLD is comprised of lifestyle modifications and weight-loss drugs and may involve THR-β agonists or liver transplants as NAFLD progresses into metabolic dysfunction-associated steatohepatitis (MASH). Although no current medications exist for early-stage NAFLD, peroxisome proliferator–activated receptors (PPARs) are a promising avenue in ameliorating the Kupffer Cell (liver-resident macrophage) driven pro-inflammatory environment of the liver implicated in NAFLD pathogenesis. However, an important consideration in exploring PPAR-agonist therapies is the safety profile of the drug and protection against possible genotoxicity and malignancy that may result from PPAR overactivation in off-target cells. Previous studies on other inflammatory diseases have suggested that dendrimer-conjugation of Tesaglitazar (a dual PPARα/γ agonist) enables targeted delivery of the drug to macrophages, which are heavily involved NAFLD progression. Serum analysis on wild-type mice indicates that D-Tesa at high doses avoids acute liver toxicity seen with administration of the free drug at the same dose. Western blotting on liver samples from in-vivo studies on *Apoe*$^{-/-}$ mice with NAFLD showed promising trends of upregulation of PPARs and cholesterol efflux transporters in the liver. Western blotting also reveals trend of downregulation of pro-inflammatory markers (from M1 macrophages) and upregulation of anti-inflammatory markers (from M2 macrophages) in *Apoe*$^{-/-}$ mice liver tissue. This suggests that further work should aim optimize D-Tesa dosage for NAFLD treatment to yield a more significant therapeutic effect while maintaining safety from hepatotoxic side effects.

Abstracts:
Basic Neuroscience

BN 1.8: Agarwal

Synaptic PDZ2-Mediated Interactions in Anesthetic Neurotoxicity: Mechanisms Linking Inflammasome Activation, BBB Integrity, and Cognitive Dysfunction

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Background: Over the past two decades, concerns have mounted that general anesthetics may adversely affect the immature brain; however, clinical findings remain mixed, with some studies linking early exposure to later neurodevelopmental deficits and others showing no association. In parallel, converging evidence indicates that inflammatory insults perturb early brain development and that the nervous system is particularly vulnerable to systemic inflammation. Yet the interactive impact of surgical inflammation and anesthesia on developmental neurotoxicity is poorly defined. We have shown that inhalational anesthetics disrupt PSD-95–PDZ2–NMDAR–nNOS coupling, suppressing synaptic nitric oxide (NO) signaling, reducing dendritic spine density, and impairing memory. Because NO is also a negative regulator of NLRP3, these observations point to a synapse–immune–neurovascular axis as a plausible driver of perioperative neurotoxicity. Prior studies demonstrate that inhibiting the NLRP3 inflammasome preserves BBB integrity in murine stroke, implicating NLRP3 as a key neurovascular–immune mediator; still, how anesthesia and surgery jointly alter BBB permeability and cognition, and by what mechanisms, remains unclear.

Results: Neonatal exposure to 1.5% isoflurane in the presence of systemic inflammation (LPS) resulted in a robust increase in hippocampal NLRP3 protein levels. In vitro, primary endothelial cell monocultures subjected to a 4-hour isoflurane challenge showed a significant reduction in trans-endothelial electrical resistance compared with control gas. This effect was reproduced by wild-type PSD95-PDZ2 peptides indicating synaptic PSD95-PDZ2-dependent barrier disruption. Ultrastructural analysis using transmission electron microscopy further revealed impaired blood–brain barrier integrity, including basement membrane thickening and capillary lumen narrowing in the neonatal hippocampus following isoflurane exposure. In P7 rodent pups, right carotid artery surgery under isoflurane anesthesia led to a significant elevation of hippocampal IL-1β 24 hours post-surgery, consistent with NLRP3 activation. Treatment with the NLRP3 inhibitor MCC950 prevented Evans Blue extravasation, preserving vascular integrity under conditions of anesthesia and inflammation. Similarly, administration of a nitric oxide donor attenuated isoflurane- and LPS-induced NLRP3 upregulation. Isoflurane combined with inflammation reduced hippocampal VE-cadherin and occludin expression, effects that were mitigated by MCC950. Behavioral testing demonstrated impaired novel object recognition memory in PND7 mice exposed to isoflurane and LPS—deficits that were rescued by either the NO donor or MCC950. Finally, in preliminary screening of human iPSC-derived cerebral organoids, combined exposure to isoflurane and LPS induced NLRP3 upregulation, which was abolished by MCC950 treatment. Together, these findings indicate that anesthesia and inflammation synergistically activate the NLRP3 inflammasome, disrupt endothelial and synaptic integrity, and impair cognition. Nitric oxide and pharmacologic inhibition of NLRP3 effectively prevent these changes.

Discussions: Our findings support a model in which anesthetic- and inflammation-induced disruption of PSD-95–NMDAR–nNOS interactions reduces nitric oxide (NO) signaling, NLRP3 inflammasome activation and triggering a cascade that compromises blood–brain barrier integrity, impairs synaptic maturation, and leads to lasting cognitive deficits. Isoflurane exposure under systemic inflammation increased hippocampal NLRP3 expression, disrupted endothelial junctional proteins, and caused BBB structural abnormalities. MCC950, a selective NLRP3 inhibitor, prevented barrier leakage, and restored cognitive performance. Together, this work defines the novel NO–NLRP3 signaling axis as a key mechanism in anesthesia-induced neurotoxicity and highlights mechanism-based strategies—enhancing NO signaling or inhibiting NLRP3—as promising therapeutic approaches to reduce perioperative neurodevelopmental risk in children.

BN 2.4: Aguilar

Glucose Dendrimer-Based N-Acetylcysteine (GD-NAC) and Creatine Combination Therapy Improves Motor Functions in a Rabbit Model of Cerebral Palsy.

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Cerebral palsy (CP) is a complex neurodevelopmental disorder resulting from brain injury or abnormal development occurring before or around birth. Its pathogenesis involves glial and astrocytic activation in immature white matter, which impairs myelination and damages the communication pathways. This disruption in developing brains leads to significant deficits in motor function, as well as cerebellar learning and memory. The drug N-acetylcysteine (NAC) shows preclinical potential for treating perinatal brain injury; however, its clinical application is limited by low bioavailability and minimal blood-brain barrier penetration. Glucose dendrimer platforms are used as nanocarriers for targeted delivery of NAC and Creatine. Building upon our prior work showing the therapeutic potential of a polyamidoamine hydroxyl dendrimer-conjugated NAC (HD-NAC) in a rabbit model of CP, we now determined if novel glucose dendrimer (GD)-conjugated therapies could further improve the motor function and show better efficacy. We investigated the efficacy of GD-NAC and a combination of GD-NAC + GD-Creatine in a rabbit model of perinatal inflammation. For this, the pregnant rabbits underwent laparotomy on gestational day 28 (G28) and received an *in-utero* injection of lipopolysaccharide to trigger maternal inflammation. On G30, the labor was induced and kits that were born exhibited key phenotypic characteristics of CP. On postnatal day 1 (PND1), these kits underwent baseline neurobehavioral assessments followed by the intravenous administration of either GD-NAC (10 mg/kg), the combination of GD-NAC + GD-Creatine (10 mg/kg each), or equivalent volumes of saline. Neurobehavioral assessments were conducted at PND1 (baseline), PND 2, PND 4, and PND 5. Brains were harvested on PND5 to quantify markers of neuroinflammation in periventricular regions. Our study revealed that both GD-NAC alone and the combination of GD-NAC + GD-Creatine resulted in substantial and significant improvement in motor function by PND5. This study suggests that the targeted delivery of therapeutic agents using glucose dendrimers may be an effective strategy for treating neuroinflammatory disorders like cerebral palsy.

Key words: Cerebral Palsy, Motor function, Glucose dendrimers, Glucose Dendrimer Conjugated N-acetylcysteine (GD-NAC), Glucose Dendrimer conjugated creatine (GD-Creatine)

BN 2.6: Anchekova

Effects of Focal Cerebral Ischemia and Phenylephrine on CO_2 Coupling and Cerebral Perfusion in Neonatal Piglets

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Introduction: Cerebral blood flow (CBF) is sensitive to arterial carbon dioxide (pCO_2), which regulates vascular tone and oxygen delivery. In neonates, autoregulation and CO_2 responsiveness are still developing, increasing vulnerability to ischemic injury. During stroke, coupling between systemic CO_2 and cerebral perfusion may become impaired. This study examined whether the relationship between pCO_2 and end-tidal CO_2 ($EtCO_2$) remains stable after middle cerebral artery occlusion (MCAO) in neonatal piglets and how phenylephrine (PE)-induced hypertension affects CO_2–perfusion coupling across sham, MCAO, and MCAO + PE groups. We hypothesized that ischemia would weaken CO_2 coupling over time, while PE would partially restore vascular responsiveness.

Methods: Neonatal piglets (3-8 days old) underwent sham surgery (n=8), MCAO (n=8), or MCAO + phenylephrine treatment (n=8). Phenylephrine was administered to increase mean arterial pressure (MAP) by approximately 20%. Physiologic parameters such as MAP, arterial blood gases (pCO_2, PO_2, pH), and $EtCO_2$ were continuously recorded throughout the study. Laser Speckle Contrast Imaging (LSCI) was used to quantify perfusion in ischemic and non-ischemic regions. Data were analyzed at four timepoints, baseline, 1-, 2-, and 3-hrpost-occlusion. Pearson correlations assessed the relationships between pCO_2 and $EtCO_2$, as well as between pCO_2 and perfusion.

Results: The sham group showed significant instability in pCO_2–$EtCO_2$ coupling. After a moderate baseline correlation ($r = 0.64$, $p = 0.085$)[1], the relationship was lost at 1–2 hrs ($r = -0.07$ to -0.12, ns) before recovering by 3 hrs ($r = 0.88$, $p = 0.004$). Contrary to our hypothesis, MCAO animals maintained consistent pCO_2–$EtCO_2$ correlations throughout all time points (Baseline: $r = 0.71$, $p < 0.05$[4]; Post-MCAO: $r = 0.71$–0.83, all $p \leq 0.05$)[5]. The MCAO+PE group, which also had a strong baseline correlation ($r = 0.78$, $p = 0.021$)[6], showed a loss of coupling at 1-2hrs that did not show statistically significant recovery by 3 hrs ($r = 0.63$, $p = 0.095$)[7].

Discussion: These results demonstrate that surgery itself introduces significant pCO_2–$EtCO_2$ uncoupling. Unexpectedly, MCAO did not further disrupt this coupling, which remained strong and significant. However, the most critical finding is that this preserved pCO_2–$EtCO_2$ coupling did not translate to vascular responsiveness. Cerebrovascular reactivity (CO_2–perfusion coupling) was found to be decisively impaired after MCAO. Furthermore, phenylephrine-induced mean arterial pressure (MAP) augmentation failed to restore this CO_2–perfusion coupling. This is a key finding, as it suggests that any potential therapeutic benefit of MAP augmentation is not mediated by a restoration of active, CO_2-based reactivity. We propose that the benefits of PE-induced MAP augmentation are likely mediated by a pressure-driven, passive perfusion of the ischemic territory. In this model, the brain's intrinsic, CO_2-driven vasoreactivity is lost, but raising the systemic perfusion pressure can successfully bypass this impaired system. This increased pressure likely forces blood into at-risk, viable tissue via collateral pathways. This would clarify that the therapeutic benefit is pressure-dependent, rather than a restoration of intrinsic vascular function.

BN 2.2: Arun

Evaluating the efficacy of glucose-dendrimer–conjugated cannabidiol (GD-CBD) in a rat paw edema model of inflammatory pain

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1Bloomberg School of Public Health, Johns Hopkins University, 2Center for Nanomedicine, Johns Hopkins School of Medicine, 3Anesthesiology and Critical Care Medicine, Johns Hopkins School of Medicine, 4Biomedical Engineering, Johns Hopkins University

Inflammatory pain poses a major healthcare challenge as one of the most prevalent and debilitating symptoms across acute and chronic diseases. Despite its frequency and impact on quality of life, current treatment options remain limited in both efficacy and safety. Opioids carry significant risks of tolerance, dependence, and addiction that have contributed to the opioid epidemic. Alternatively, nonsteroidal anti-inflammatory drugs (NSAIDs) can cause gastrointestinal, renal, and cardiovascular side effects, particularly with prolonged or high-dose use. Cannabidiol (CBD), a non-psychoactive component of Cannabis sativa, has emerged as a promising alternative due to its anti-inflammatory and analgesic properties mediated through endocannabinoid, serotonergic, and TRPV1 receptor pathways. However, CBD is limited by low bioavailability due to poor solubility, and safety studies have linked CBD to adverse effects and clinically relevant drug interactions. Delivery of CBD through a glucose dendrimer (GD) platform can address these limitations by improving efficacy through targeted delivery, reducing off-target effects, and enhancing safety.

This study aims to determine the efficacy of GD-CBD conjugate in reducing inflammatory pain assessed in a rat paw edema model. 7–9-week-old male Sprague-Dawley rats received a hind limb intraplantar injection of 1% Carrageenan and administered IP treatment 1 hour later (saline or GD-CBD 0.3 and 3mg/kg). Mechanical and heat mediated allodynia and hyperalgesia were assessed using the Von Frey and Hargreaves tests, respectively, at baseline, 3, 24, 48 and 72 hours post-treatment. GD-CBD showed a decrease in mechanical allodynia at 24 hours post-treatment that lasted until 72h when compared to saline and a decrease in heat mediated sensitivity by 3h reaching baseline levels by 72h.

These preliminary results suggest that GD-CBD is a promising alternative to the current treatment options for inflammatory pain. Currently, the titration and timing of the optimal dose is underway. Additionally, molecular analyses of the tissues are ongoing to determine the mechanisms through which GD-CBD is exerting the reduction in inflammatory pain.

BN 1.7: Bakare

T Cell–Dependent Modulation of Pain Behaviors in a Rat Model of Recurring Paclitaxel-Induced Peripheral Neuropathy

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Background: Over the past two decades, substantial progress has been made in cancer treatment; however, this is often accompanied by chemotherapy-induced peripheral neuropathy (CIPN), which currently lacks effective treatments. Furthermore, susceptibility to and resolution of CIPN after multiple cycles of chemotherapy has not been well investigated. This study aimed to investigate the role of T cells in a rat model of recurring paclitaxel (PTX)-induced peripheral neuropathy (PIPN).

Methods: Seven-week-old homozygous (T cell–deficient) and heterozygous (T cell–competent) RNU rats were used. PTX (8 mg/kg total intraperitoneal dose) was administered in two consecutive cycles to induce and re-establish PIPN. Pain hypersensitivity was assessed longitudinally using von Frey filaments (mechanical allodynia), and dry-ice and acetone spray tests (cold hypersensitivity: cold hyperalgesia and allodynia respectively). Neural (dorsal root ganglia [DRG] and sciatic nerves) and systemic (spleen) immune cell populations were evaluated by flow cytometry and immunohistochemistry.

Results: Mechanical allodynia developed during both PTX cycles regardless of T cell status but with reduced intensity at the onset in T cell–competent rats relative to T cell–deficient counterparts during the first cycle. Mechanical allodynia resolved after the first PTX treatment independent of T cell status. Recurrent PIPN was characterized by reduced mechanical allodynia in both rat strains during the second treatment cycle. Cold allodynia developed exclusively in T cell–competent rats after both PTX cycles, whereas T cell–deficient rats showed a significant delay in the onset of cold hyperalgesia. Cold allodynia resolved while cold hyperalgesia did not resolve after either PTX treatment cycle in both T cell–competent and –deficient rats.
Flow cytometric analysis revealed consistent reductions in T cell ($CD45^+CD3^+$) frequencies in the sciatic nerve and spleen, accompanied by a transient decrease in the DRG after the first PTX cycle. M2 macrophages ($CD45^+CD11b/c^+CD163^+$) were consistently reduced across both cycles, independent of T cells. In contrast, M1 macrophages ($CD45^+CD11b/c^+CD86^+$) remained unchanged after the first cycle but increased significantly following the second cycle in a T cell–dependent manner. Immunohistochemical analysis showed decreased M2γ ($CD68^+CD206^+$) and M2a ($CD206^+$) macrophage populations in the DRG after the first PTX cycle, with a more pronounced reduction of M2γ in T cell–deficient rats. Both M2γ and M2a macrophages increased following the second cycle, with negligible modulation by T cells.

Conclusions: Together, these findings indicate that in recurrent PTX treatment, distinct pain characteristics—such as mechanical and cold allodynia—can resolve between treatment cycles, whereas cold hyperalgesia persists regardless of T-cell status. T cells shape distinct trajectories of pain behavior by promoting cold allodynia and hyperalgesia. These effects are associated with altered T cell infiltration and macrophage polarization in the DRG and sciatic nerve. This study establishes a novel model of recurring PIPN that provides insights into T cell–mediated neuroimmune mechanisms underlying chemotherapy-induced neuropathic pain.

BN 2.1: Beaubien

Mechanistic Insights into Anesthesia-Induced Synapse Loss in Murine Neuron–Glia Co-cultures

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Introduction: Inhalational anesthetics disrupt PDZ2 domain–mediated protein interactions of PSD-95 at excitatory synapses. Building on this, previous work from the Johns laboratory demonstrated that isoflurane uncouples the PSD-95–NMDAR–nNOS complex, suppressing NO–guanylate cyclase–cGMP–PKG signaling and leading to reduced dendritic spine maturation, impaired synaptic plasticity, and cognitive deficits in mice. The public health implications are substantial—each year, approximately 1.5 million neonates in the United States undergo general anesthesia, and cumulative evidence links such exposures to long-term cognitive, behavioral, and emotional dysfunction. Converging evidence also implicates the NLRP1 and NLRP3 inflammasomes as key mediators of neuroinflammation in the central nervous system. Their activation promotes the release of pro-inflammatory cytokines IL-1β and IL-18, contributing to synaptic loss and axonal degeneration observed in disorders such as Alzheimer's disease. Pilot studies from Dr. Johns' laboratory reveal that neonatal exposure to isoflurane, particularly under systemic inflammatory conditions, upregulates hippocampal NLRP3 expression and worsens long-term cognitive impairments in mice. These findings identify inflammasome activation as a critical mechanism underlying anesthesia-associated neurotoxicity and highlight the therapeutic potential of restoring NO–PKG signaling and inhibiting inflammasome activity to preserve synaptic integrity and cognitive function.

Methods: Primary hippocampal neurons, astrocytes, and microglia are isolated from postnatal C57BL/6 mouse pups and plated on poly-D-lysine–coated plates in a mixed co-culture at a 5:2:1 (neurons:astrocytes:microglia) ratio. Cultures receive either LPS (inflammatory stimulus) or PBS (vehicle). For rescue conditions, cultures are exposed to 1.5% isoflurane and treated with MCC950 or ADS032. Cells are immunostained with MAP2 (neurons), drebrin (dendritic spines), and synaptophysin/PSD-95 (pre-/post-synaptic puncta). Confocal images are analyzed using ImageJ Puncta Analyzer (synapse quantification) and Imaris 9.3 (spine density and length). Archived hippocampal samples from prior Johns lab experiments (control and treated) are lysed; total protein is quantified by BCA and normalized for equal loading. Samples are prepared in 4× Laemmli buffer with 2-mercaptoethanol, separated by SDS-PAGE, transferred to PVDF, and probed for NLRP3 (with β-actin/α-tubulin as loading controls). Band intensities are quantified by ImageJ densitometry.

Discussions: In mixed neuron–astrocyte–microglia co-cultures, 1.5% isoflurane is anticipated to produce significant decreases in synaptic puncta (synaptophysin/PSD-95 colocalization) and reduced dendritic spine density (drebrin/MAP2), aligning with prior primary-culture findings. Compared with neuron-only systems, triple co-cultures are expected to exhibit more mature neuronal morphology and greater PSD-95 abundance, consistent with glial support of synaptic development. Treatment with MCC950 or ADS032 is predicted to normalize NLRP3 levels and restore synaptic metrics to values comparable to vehicle controls, indicating prevention of isoflurane-induced synaptic injury. These data will support NLRP3 as a mechanistic driver of anesthesia-related synaptic loss and demonstrate that inflammasome inhibition can preserve synaptic structure in glia-supported neuronal networks. Targeting the NLRP3 signaling will offer a translational, mechanism-based strategy to protect the developing brain.

BN 2.8: Diemer

Characterization of Cerebrospinal Fluid Lymphatic Drainage Pathways in a Neonatal Swine Model

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Introduction: The discovery of central nervous system (CNS) lymphatics has redefined our understanding of how the brain clears interstitial and cerebrospinal fluid (CSF). In humans and mice, CSF drains to the deep cervical lymph nodes, providing a pathway for immune surveillance and waste clearance. Research in rodent models has suggested that dysfunction of the CNS lymphatic system exacerbates neurodegenerative disorders and traumatic brain injury.
hile CNS lymphatic drainage patterns have been thoroughly characterized in rodents, fewer studies have been performed in large animal models such as the pig. Piglets represent an excellent translational model for the study of pediatric brain injury as their CNS closely resembles that of humans. Our group has used piglets as a translational model to study
post-cardiac arrest brain injury and we hypothesize that CNS lymphatic dysfunction contributes to pediatric post-cardiac arrest brain injury. However, the CNS lymphatic drainage patterns of pigs have not been characterized. Establishing the fundamental pathways of porcine CNS lymphatic drainage is essential for investigating our central hypothesis of whether impaired CNS lymphatic drainage contributes to post-cardiac arrest brain injury.

Experiment 1 uses a stepwise approach to characterize lymphatic drainage from the porcine CNS. In Experiment 1a, methylene blue is injected into the cisterna magna to visually identify lymph nodes draining CSF. Experiment 1b optimizes fluorescent dextran injections to quantify tracer distribution in CNS-draining lymph nodes and CSF. Experiment 1c evaluates drainage timing by collecting lymph nodes at defined intervals.

Model: Twelve- to fourteen-day-old Yorkshire piglets (3–5 kg) are anesthetized with isoflurane and endotracheally intubated. Piglets are positioned in right lateral recumbency, and the cisterna magna is accessed percutaneously using a landmark based technique with a 23-gauge spinal needle. Once accessed, dye is injected to trace CSF drainage. Animals remain under general anesthesia for an additional 6 hours and are subsequently euthanized. Following euthanasia,deep neck dissection is performed and lymph nodes are identified.

Results: With our landmark based, percutaneous technique- we can reliably access the isterna magna of piglets and inject fluorescently labeled dextrans and we have thoroughly characterized the anatomic locations of the lymph node chains of the neck.

Future Directions: We are currently trialing the use of fluorescent dextrans to determine which lymph nodes drain the CNS. The fluorescent dextran technique requires terminal analysis and is not amenable to live imaging. We are currently working to employ indocyanine green for live in vivo imaging to characterize the time course of drainage from the CNS to the lymph nodes.

BN 1.9: Hong

MAP Augmentation with Phenylephrine Improves Perfusion and Preserves Penumbral Tissue in a Novel Piglet Model of Neonatal Arterial Ischemic Stroke

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Background: Neonatal arterial ischemic stroke (NAIS) refers to infarction resulting from arterial large vessel occlusion in the first 28 days of life. Long term sequelae of NAIS are severe and can include cerebral palsy, epilepsy, and the need for lifelong care. Despite a clear need for effective therapies, there are currently no approved treatments that can improve outcomes for infants with NAIS. Research to better understand cerebral blood flow dynamics following neonatal stroke is essential, the understanding of which could provide insights into potential therapeutic targets. In the present study, we used our clinically relevant piglet model of middle cerebral artery occlusion (MCAO) to trial the impact of MAP augmentation with phenylephrine (PE), a safe and clinically available pressor agent. The overall goal of the study was to assess changes in perfusion and size of ischemic territory following MCAO.

Methods: 16 piglets (mean age = 5.88 +/- 0.35 days) were randomly assigned to undergo either MCAO alone (control, n=8) or MCAO followed by PE administration to raise MAP by 20% (experimental, n=8) to assess changes in blood flow and area of ischemic region. Blood flow was measured using laser speckle contrast imaging (LSCI) of the entire exposed cortex, as well as within the ischemic penumbra and core. LSCI data were recorded every hour for 3 hours post-MCAO. The area of the core and penumbra (expressed as the percent of the full hemisphere) were also measured to assess for changes in the size of ischemic regions following MCAO.

Results: MCAO produced an acute reduction in relative cerebral blood flow (rCBF) in both groups (68.7% +/- 1.6% [PE] vs. 70.4% +/- 1.2% [control] at 0hr, expressed as percent change from baseline). During PE administration, perfusion to the ischemic core significantly improved and remained markedly improved across all time points measured compared to perfusion at 0hr (54.0% at 1hr [mean difference = 14.8 +/- 2.7%, $p<0.05$], 51.8% at 2hr [mean difference = 17.0 +/- 3.5%, $p<0.05$], 52.1% at 3hr [mean difference = 16.6 +/- 4.3%, $p<0.05$]). In comparison, there was no significant change observed in perfusion to core in the control group (69.1% [mean difference = 1.3 +/- 1.9%], 69.3% [mean difference = 1.1 +/- 2.0%], and 65.9% [mean difference = 4.5 +/- 2.4%] at hours 1, 2, and 3, respectively). MCAO induced a large ischemic core in both groups (45.7% [PE] vs. 58.2% [control] at 0hr, mean difference = 12.5%). After administration of PE, the core area significantly decreased compared to control at 1hr and 2hr (mean difference = 26.4% at 1hr ($p<0.05$)] and 25.1% at 2hr [$p<0.05$]). The area of the penumbra significantly increased in the group receiving PE compared to control at 2hr and 3hr post-MCAO (59.1% [PE] vs. 34.6% [control] at 2hr [$p<0.05$) 58.3% [PE] vs. 34.4% [control] at 3hr [$p<0.05$)]).

Conclusions: Phenylephrine administration increases rCBF to the core compared to baseline post- MCAO and reduced ischemic core area with a concomitant expansion of the penumbral region. These findings suggest that PE-induced MAP augmentation may be a viable therapy to preserve at- risk but viable brain regions during the acute phase of MCAO. Future studies should examine the dose-response relationship between incremental increases in MAP and cerebral perfusion in the ischemic brain, the effect of phenylephrine on ischemic cerebral vessels, and the role of autoregulation.

BN 1.2: Koehler

The poly(ADP-ribose) polymerase inhibitor veliparib improves sensorimotor recovery after transient middle cerebral artery occlusion in aging mice

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BACKGROUND: The Stroke Preclinical Assessment Network tested six therapeutic interventions initiated at the time of reperfusion after focal ischemic stroke in young mice, aging mice, obese mice, and spontaneously hypertensive rats (SHRs). This randomized, controlled trial was conducted across six sites with concealed treatment and blinded neurobehavior assessments. The trial had an adaptive design with preset levels of efficacy and futility interrogated after each of four stages. The primary outcome was turning preference on the corner test at one month. The poly(ADP-ribose) polymerase (PARP) inhibitor, veliparib, was considered futile after the second stage when pooling all animal models (n=231 veliparib; n=344 placebo).

METHODS: A secondary analysis was performed to evaluate veliparib treatment on primary and secondary outcomes in individual subgroup models.

RESULTS: Intravenous injection of veliparib at reperfusion failed to show a benefit on the corner test at 7 or 30 days of recovery in young mice, obese mice, or SHRs. However, in aging mice (15-18-months-old), veliparib significantly improved performance on the corner test at 7 (P=0.007) and 30 (P=0.03) days and reduced foot-faults on the grid walk test at 7 (P=0.024) and 30 (P=0.008) days. These effects were independent of sex. Treatment had no effect on MRI-determined lesion volume. The survival was similar with placebo and veliparib treatments across subgroups, although mortality was high in aging mice.

CONCLUSION: Veliparib improved functional outcome in aging mice. Because ischemic stroke predominantly occurs in the aging population, further research into the benefit of PARP inhibitors in aged animal models of stroke is warranted.

BN 1.4: Kuo

Mitigation of Sevoflurane-Linked Cytokine Responses Using MSC- Derived EVs in Neonatal Glial Cultures

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Background: Volatile anesthetics such as sevoflurane are indispensable in modern perioperative medicine and are extensively administered to neonatal and pediatric patients during critical periods of neurodevelopment. Mounting preclinical evidence has raised concerns that prolonged exposures may provoke maladaptive neuroimmune activation, leading to lasting neurodevelopmental sequelae. However, the precise exposure parameters under which neonatal glial inflammatory responses occur remain incompletely defined, and there is a lack of physiologically relevant in vitro models to systematically interrogate these dynamics. Moreover, cell-free interventions capable of modulating this neuroinflammatory cascade are of significant translational interest.

Methods: We established a primary neonatal glial culture model to investigate the temporal and dose- dependent cytokine responses to clinically relevant sevoflurane exposures, measure pro-inflammatory cytokine levels, and evaluate the therapeutic potential of mesenchymal stem cell- derived small extracellular vesicles (MSC-EVs). Cultures were exposed to 2.5% sevoflurane for 4 h, 4% for 6 h, or 4% for 12 h in a sealed, humidified 37 °C chamber. Sham controls were air- equilibrated. Low-dose LPS treatment was employed to verify cytokine responsiveness and establish a calibrated “two-hit” inflammatory model. MSC-EVs, harvested from 3D MSC cultures and purified via size exclusion chromatography, were standardized by particle number and applied as treatment (1×10^9/ml). Secreted IL-6, IL-1β, and TNF-α were quantified by ELISA, and statistical significance was assessed via one- and two-way ANOVA.

Results: A distinct inflammatory window emerged at 4% sevoflurane for 12 h, which elicited a significant increase in microglial IL-6 secretion *($p<0.05$)* and upward trends in IL-1β and astrocytic IL-6, whereas shorter exposures were non-significant. In the two-hit model, MSC-EV administration resulted in a significant attenuation of IL-6 *($p<0.05$)* and downward trends in IL-1β and TNF-α, demonstrating their anti-inflammatory activity.

Discussions: This study defines a clinically relevant threshold for sevoflurane-induced glial pro-inflammatory cytokines responses and establishes a rigorous in vitro platform for examining anesthetic-driven neuroimmune activation. Furthermore, these findings underscore the promise of MSC-EVs as a novel, cell-free immunomodulatory approach for mitigating perioperative neuroinflammation in the developing brain.

BN 2.5: Paddibhatla

Pial Arteriole Responses in an in vitro Model of Ischemia: Implications for Therapeutic Interventions in Ischemia

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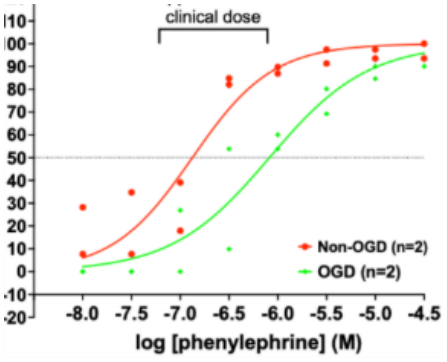
Background: During neonatal arterial ischemic stroke (NAIS) there is an interruption in cerebral perfusion leading to focal ischemia and vascular dysfunction. Our pilot study aims to define how the functional and mechanical properties of pial arterioles in the middle cerebral artery (MCA) territory are affected by ischemic conditions. We hypothesized that ischemia impairs both endothelial and vascular smooth muscle cell (VSMC) function and changes MCA biomechanical properties. Such structural and functional changes could have significant implications in NAIS and potentially present therapeutic opportunities.

Methods: To determine ischemia-induced changes in vascular structure and function we studied 4th order pial branches of the MCA from 5–7-day old piglets. In this study we utilized pressure myography with arterioles pressurized physiologically, which enables reliable measurement of myogenic tone, vasoreactivity and assessment of endothelial and VSMC function under physiological conditions [Non-Oxygen-glucose deprivation (Non-OGD) conditions]. OGD conditions (2mM glucose and pO_2 5-10 mmHg) were used to mimic ischemic stress. We assessed myogenic tone and cumulative dose-response relationships to phenylephrine (PE) and sodium nitroprusside (SNP) to measure vascular smooth muscle reactivity under physiological vs. OGD conditions. Biomechanical properties were assessed under fully passive conditions following ~ 5 hours of OGD exposure.

Results: This pilot study demonstrated that OGD substantially blunts *in vitro* responses to PE and SNP when compared to physiologic conditions. The PE dose response curve was shifted rightward by approximately five-fold (EC_{50}: 3.2 x 10^{-7}M versus 3.16 x 10^{-6}M) with a maximal constriction decrease from 24.1 ± 2.8% to 10.3 ± 1.9% (**figure)**. SNP treatment showed a significant reduction in the percentage dilation under OGD vs. physiologic conditions (maximal dilation reduced from 27.6 ± 3.2% to 7.1 ± 1.4 %). Wall strain increased with pressure (highest at 0.52 ± 0.05 under physiological conditions versus 0.36 ± 0.04 in OGD conditions), wall stress rose from 3x10^5 to 1.3 x 10^7 dynes/cm^2. Similar results were obtained for wall tension where it increased from 1.2 x 10^3 under physiologic conditions to 5.5 x 10^3 dyne/cm in OGD. Mechanical assessment, therefore, demonstrated that pial arteries exposed to OGD for ~5 hours stiffened and showed impaired pressure mediated compliance.



Conclusions: We conclude that OGD decreases reactivity to PE and SNP, potentially reflecting impaired vascular smooth muscle function. Further, our findings suggest that even a brief exposure to an ischemic environment can increase vascular stiffness. These findings, if present *in vivo,* could support the hypothesis that NAIS creates an environment in which pial arterioles become pressure-passive “pipes” that lack myogenic tone and are stiffer than healthy vessels. As such, mean arterial pressure augmentation may be a reasonable therapeutic approach to support perfusion to ischemic tissue until spontaneous recanalization occurs. This study is limited by small sample size and the lack of assessment of endothelial-dependent functional mechanisms, which may play a significant role in our findings. Future studies will include more animals and expand upon mechanisms studied.

BN 1.1: Quinlan

Pre-hospital management of non-traumatic intracerebral hemorrhage: Analysis of pre-hospital blood pressure and time metrics in a state-wide EMS system

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Objective: Prehospital reduction of blood pressure in the ambulance may decrease the odds of a poor functional outcome among patients with hemorrhagic stroke (ICH). Current practice for emergency medical service (EMS) providers in Maryland does not include administration of medications to treat blood pressure.

Methods: This retrospective observational study identified ICH patients from a comprehensive stroke center database from February 1, 2019 to December 31, 2024 who were matched to prospectively collected data from the EMS system in Maryland, USA. Vital signs and time metrics were extracted from EMS dispatch to completion of hospital transfer. Primary outcomes were systolic blood pressure (SBP) and time metrics. Secondary outcomes were ICH volume and in-hospital mortality. We used generalized estimating equations for analyzing repeated measures data and logistic regression models.

Results: A total of 303 patients transported by ambulance were included and 1121 SBP readings were analyzed. Mean age (SD) was 65(15) years and 53.8% were male. Current antihypertensive medication and antithrombotic medication use was 52% and 40%, respectively, and 15.5% of patients were on anticoagulants. Median time [interquartile range] from last known well to ambulance dispatch was 85.5 [18-490] minutes. Time from dispatch to first SBP reading was 19 [14-27] minutes. Total transport time was 55 [43-72] min excluding 55 (18%) of patients who were transported from an outside hospital and had been started on intravenous antihypertensives in 69%. Median [IQR, SD] of first SBP was 172 [149-200, 38.8] and 180.5 [160–205, 36.9] mmHg in all and non-transferred patients, respectively. SBP was >150 mmHg in 221 (73%) patients on initial BP reading of which 44 (14.5%) had SBP≤150 mmHg at hospital arrival. Median number of BP readings per patient was 3 [2-5] at an interval of 5 [5–9] min. Initial ICH and IVH volume was 16 [8-43] and 0 [0-14] mL, respectively in 107 patients, and was not associated with SBP measurements. In-hospital mortality was 28% and was associated with SD of all SBP measures (OR 1.04; 95%CI: 1.002 - 1.07; p=0.03) in adjusted analysis.

Conclusion: Pre-hospital SBP is frequently elevated above guideline recommendations in ICH patients with infrequent control in absence of medications. Total management time of almost 1 hour may offer an opportunity for improved BP control. High SBP variability but not absolute values was associated with in-hospital mortality.

BN1.5: Sowers

Metabolism of Dendrimer-Conjugated N-Acetyl Cysteine Shows Multiple Neuroprotective Responses in a Rabbit Model of Cerebral Palsy

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Cerebral palsy has a worldwide prevalence of 1-4 per 1,000 live births and is the most common cause of childhood disability. Classic sequela of cerebral palsy includes impaired/abnormal movement and coordination due to poor neuromuscular development and delayed cognition. Diverse etiologies contribute to the development of cerebral palsy; however, common pathologic sequelae of the disease are neuroinflammation and periventricular leukomalacia likely driven by activation of microglia and astrocytes. To better understand the pathophysiology of cerebral palsy at the molecular level, we utilized multiple mass spectrometry approaches to elucidate metabolic perturbations in a rabbit model of cerebral palsy. Our metabolomics results identified significant alterations in arginine metabolism, reduction in glutamate as well as glutamate related metabolites, and a near unilateral reduction in lipid species. Together this may help explain why glutamate dysregulation and poor white matter development persist in cerebral palsy. Furthermore, our lab has previously shown that a dendrimer-based N-acetylcysteine therapy decreases neuroinflammation and improves motor function through specific targeting of activated glia in this experimental cerebral palsy model. Here we utilized MALDI-mass spectrometry imaging to identify that a novel glucose-dendrimer mediated N-Acetyl Cysteine (GD-NAC) therapy is expectedly able to increase glutathione levels, but also augments taurine levels in a brain region specific manner. This suggests a possible dual therapeutic role for GD-NAC as an antioxidant via glutathione and a multifaceted cytoprotectant via taurine. Future work will be aimed at exploring the therapeutic efficacy of GD-NAC.

BN 1.6: Summers

96x Grid vs FIJI ImageJ Analysis of Laser Speckle Contrast Imaging (LSCI) in a Neonatal Pig Middle Cerebral Artery Occlusion (MCAO) Model

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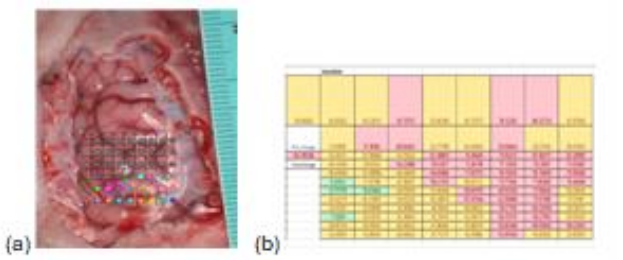
Introduction: The neonatal piglet middle cerebral artery occlusion (MCAO) model is anatomically and physiologically ideal for studying perinatal ischemic stroke. The piglet's skull geometry and gyrencephalic cerebrum mantle are similar to that of the human newborn. However, analyzing differences in cerebral blood flow (CBF) can be time consuming and inefficient. There are two primary methods of analyzing CBF from laser speckle contrast imaging (LSCI) created from the MCAO model: FIJI ImageJ and 96x grid. Measuring CBF using ImageJ requires millions of data points. We developed a 96x grid method which averages millions of data points into 96 data points, simplifying the analysis process. We hypothesized that the simpler 96x grid method would identify changes in CBF comparable to the more complex FIJI ImageJ method after MCAO.

Methods: Two anesthetized neonatal piglets underwent unilateral MCAO. A baseline LSCI was taken. Then the left middle cerebral artery (MCA) was clipped to induce unilateral ischemic injury. LSCI images were taken immediately and at, 1-hour, 2-hours, and 3-hours after MCAO. For FIJI ImageJ analysis, the four LSCI images for each piglet were scaled, pre-processed, and aligned to the baseline image to create a perfusion drop map. Using the percentage decrease in CBF from baseline, each image was divided into three zones: core (>57% decrease from baseline), penumbra (17-57%), and preserved tissue (<17%). Regions of interest (ROIs) were accordingly outlined in ImageJ and averaged to define the perfusion drop for each region. For the 96x grid method, two boxes containing 48 ROIs each were overlayed onto the LSCI image using cortical anatomic landmarks. Each ROI averaged the data points to create a 96-point grid for each timepoint. The data from each grid were compared to baseline to create a 96-point percent decrease in perfusion map. Using the above defined percentages of the core, penumbra, and preserved tissue, we isolated data points within each region. The perfusion drop from baseline was calculated by averaging the respective isolated data points for each region.



Piglet Brain CBF Analysis (a) 48-ROI grid overlayed onto a LSCI. (b) 96-point grid defining core and penumbra with averages in the left column.

Results: The 96x grid method identified changes in CBF within one margin of error from FIJI ImageJ. The regions of core and penumbra were distinguishable by the 96x grid method to a similar degree as that observed with FIJI ImageJ. The maximum difference in CBF between the two methods was <7% at each time point. The 96x grid required 1.5-2.5 hours less time than the ImageJ method for each piglet.

Discussion: Compared to FIJI ImageJ, the 96x grid method is substantially more time efficient and has an acceptable margin of error in the neonatal piglet MCAO model. Thus, future experiments will be conducted with the 96x grid method to identify the core and penumbra.

BN 2.7: Trivedi

Glucose dendrimer-Cannabidiol conjugate (GD-CBD) decreases inflammation in a paw edema model of inflammatory pain

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Background: Chronic pain and inflammation remain major clinical challenges, with current therapeutic strategies often limited by poor efficacy, off-target toxicity, and inadequate central delivery. Cannabidiol (CBD), a non-psychoactive phytocannabinoid, has demonstrated anti-inflammatory and analgesic properties, yet its clinical translation is restricted by poor solubility and limited bioavailability. To overcome these barriers, we generated a glucose dendrimer-CBD conjugate (GD-CBD) designed for targeted delivery and controlled release.

Methods: In this study, we evaluated the biodistribution of Glucose dendrimer conjugated to the Cy5 (GD-Cy5) fluorophore on different models of pain. Glucose dendrimer showed distinct co-localization based on the model and organ of interest. In the Chronic constriction injury (CCI) model of neuropathic pain GD-Cy5 showed preferential neuronal co-localization in the DRGs but macrophage co-localization in the injured area of the nerve. Alternatively, in the flank incision model of surgical pain, GD-Cy5 had a stronger predilection for macrophages within the DRG and some neuronal uptake. These results support the targeted nature of the delivery platform.

Results: The efficacy of GD-CBD was evaluated in a Carrageenan-induced paw edema model in rats, a well-established paradigm for peripheral inflammation and pain. Briefly, young adult Sprague Dawley rats 7-9 weeks-old received an intraplantar injection of 1% Carrageenan to induce inflammation and paw edema. Paw thickness was measured with calipers at baseline (before irritant-injection), 1-hour post-irritant, and three, 24, 48 and 72h post-treatment. Rats were administered saline or GD-CBD (0.3 or 3 mg/kg) as treatment after the 1-hour post-irritant paw measurement. Ours results indicate a significant reduction in paw volume and edema formation following GD-CBD (0.3 and 3 mg/kg) administration compared to Saline-treated controls, suggesting potent anti-inflammatory activity.

Discussions: These findings highlight GD-CBD as a promising nanotherapeutic for managing inflammatory pain, with the potential to improve drug stability, reduce systemic side effects, and enhance site-specific efficacy. Ongoing studies aim to further elucidate dose-dependent responses and molecular pathways underlying the observed therapeutic effects.

BN 1.3: Yang

Sex-specific role of CYP4A isoforms in ischemic stroke: a target for male-specific neuroprotection

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Introduction: Sex differences in ischemic stroke outcomes have been widely observed, with males exhibiting greater engagement of programmed necrosis pathways. However, the molecular mechanisms underlying this disparity remain poorly understood. We identified that cytochrome P450 (CYP4A) isoforms are selectively expressed and upregulated in male neurons following ischemic injury. This study explores the role of CYP4A isoforms in ischemic stroke and their potential as a sex-specific therapeutic target.

Methods: 3-month-old Sprague-Dawley rats underwent middle cerebral artery occlusion with interventions including castration (CAST), CAST with androgen replacement, or ovariectomy. Rats were treated with HET0016 (1 mg/kg intraperitoneally) or vehicle prior to reperfusion and at 3 hours post-reperfusion. Quantitative RT-PCR analysis was performed on ipsilateral cerebral hemispheres to assess CYP4A isoform expression (4A1, 4A2, 4A3, 4A8) at 6 hours post-reperfusion. Turning preference on the corner test and infarct volume measured with 2,3,5-triphenyltetrazolium chloride staining was assessed at 3 days post-reperfusion.

Results: CYP4A8 was uniquely expressed in male brains and induced following ischemic injury across all male groups (sham, CAST, CAST with androgen replacement). No significant changes in CYP4A2 or CYP4A3 expression were observed in either sex. HET0016 treatment significantly reduced infarct volume and improved neurobehavioral outcomes (corner test) in males but not in females. CAST males treated with HET0016 showed trends toward reduced infarct volume and improved behavior, indicating that CYP4A8-mediated effects are sex-dependent rather than strictly androgen-dependent.

Conclusion: CYP4A8 exhibits a sex-dependent expression pattern and may mediate male-specific vulnerability to ischemic injury in rats. Inhibition of CYP4A activity with HET0016 provides neuroprotection in males, as demonstrated by reduced infarct volume and improved neurobehavioral performance, but has no significant effect in females. These findings highlight CYP4A8 as a promising therapeutic target for addressing ischemic brain injury in male patients.

Abstracts: Clinical Research

CR 1.4 Amazu

The effects of one-time intra-operative dose of Methadone during minimally invasive hysterectomy in reducing opioid prescription

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The relief of postoperative pain in surgeries continues to pose a major therapeutic dilemma. The most common therapy is the administration of short-acting opioid analgesics at intervals every 3-4 hours. However, the use of these types of opioids may lead to various fluctuating drug concentrations in plasma, and side effects including inadequate pain relief, respiratory issues, and potential avenues for abuse. Identifying a more efficient and safer therapy for intraoperative pain analgesia can be helpful in controlling pain requirements in the post-operative setting. In major surgeries, intraoperative single-dose methadone has been shown to produce better analgesia, reduce opioid use, and minimize adverse side effects compared with short-acting opioids. Methadone is theorized to be a noncompetitive NMDA receptor antagonist, which may contribute to its increase in analgesic potential. Finally, it has been shown to improve ambulation in the post-operative setting and pain control in chronic pain patients. Although these studies in gynecologic surgeries are limited, one study showed a decrease in mean opioid consumption post-operatively after receiving one dose of intra-operative methadone compared to shorter acting opioids in same-day laparoscopic myomectomy.

Design and Patients: Randomized single-blinded clinical trial in 2 high-volume academic hospitals, actively recruiting. Patients undergoing minimally invasive hysterectomy with ovarian preservation for benign indication were approached for inclusion. Patients with chronic pain syndromes, severe OSA, pregnant/breastfeeding patients, allergies to trial-prescribed medications, and chronic use of opioids, buprenorphine, SSRIs, and MOAI were excluded.

Interventions: Patients were blinded and randomized (1:1) to intraoperative use of IV methadone (single dose of 0.15 mg/kg IBW, ("M")) or shorter acting opioids ("SAO") at induction. All patients were discharged with standardized prescriptions. The primary outcome was total post-operative opioid requirements in oral morphine equivalents (MME) on POD7. Additionally, pain score, opioid use, and side effects were evaluated in PACU and on postoperative days (POD) 1&7 via telephone survey.

Primary Results and Conclusion: Interim analysis of 36 enrolled patients (M=17, SAO=19) for the primary outcome, total MMEs used through POD7, was not significantly different between groups (mean M-26.91, n=17 v SAO-20.33, n=19, p=0.7282). This trial is ongoing with anticipated completion in February 2026, only **1/3** of power study has been recruited. Therefore, the data above is preliminary. While our trial is still ongoing, a preliminary analysis indicates that one-time intra-operative dose of methadone did not significantly reduce outpatient use of oxycodone following minimally invasive hysterectomy compared to short-acting opioids.

Rolling into perfect position for spinal anesthesia: Beach balls and baby backs

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Introduction: Infant spinal anesthesia provides significant benefits over general anesthesia for surgeries of short duration. However, it presents unique challenges compared to adult spinal anesthesia. In addition to smaller anatomic structures, infant patients are unable to cooperate with positioning and cannot easily be coached through moments of discomfort.

The traditional method of positioning infant patients for spinal anesthesia involves placing the patient in a seated position and having one provider fold the patient forward and hold tightly, a position that often upsets the infant and promotes movement and straining prior to needle insertion. Due to the focus on flexing the patient's back, it is also difficult to adequately prevent the patient from rotating their torso, making the procedure more challenging.

Methods: We sought to develop a positioning method for infant spinal anesthesia that optimizes the proceduralist's conditions in addition to minimizing both discomfort severity and length of time for the patient. Factors considered included success in preventing movement, re-usability, cost, and effect on patient experience.

Results: Our final positioning protocol includes a single re-usable inflatable beach ball toy and the readily accessible OR supplies. First, an infant size blanket is rolled up and placed under the legs to encourage hip flexion. Depending on patient size, one or two strips of 2-3 inch width 3M™ Coban™ self-adherent wrap are then placed over the roll with the beach ball in front (Figure 1). The patient is placed with legs over the rolled blanket and with buttocks on the OR bed, flexing the hips. The beach ball is placed in front of the patient, and the patient is encouraged to "hug" the beach ball, flexing the back (Figure 2). The Coban™ is then extended from under the legs and over the patients shoulders and around the beach ball, helping to secure the patient in the "beach ball hug" position (Figure 3). Finally, the positioning provider lightly holds the patient in this position while the proceduralist performs the spinal (Figure 4).

Figure 1.

Figure 2.

Figure 3.

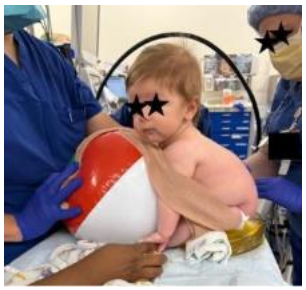
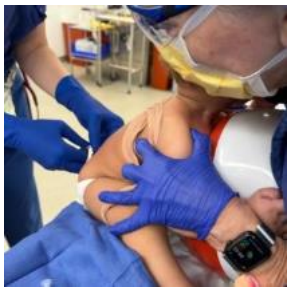


Figure 4.



Discussion: Our positioning protocol provides several advantages over the traditional method of forcefully holding patients in flexed position. Multiple proceduralists endorsed less movement and better procedure conditions as well as more time for the procedure before the patient became too upset. Multiple positioning providers endorsed feeling that it was easier to keep the patient still, that they had to apply significantly less force to the patient, and that the patients were less upset or not at all prior to skin puncture. The positioning method uses low cost, readily available OR materials (Coban™ and a rolled blanket) and a reusable, low cost, easily cleanable inflatable beach ball. We recommend utilizing this positioning method to improve patient experience and procedure success.

CR 3.2: Andrade

Maximizing the experience of anesthesiology residents on early rotations in pediatric anesthesia: Developing a "crash course"

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Introduction: Anesthesiology residents rotating in pediatric anesthesia often endorse increased anxiety and discomfort compared to their adult anesthesia rotations due to significant differences in caring for children in the operating room. These differences include vital sign differences in pediatric patients, weight-based dosing for medications, differences in complications in children under anesthesia (e.g., laryngospasm), procedural nuances in small patients, involvement of parents in care, and more. Pediatric anesthesiology is a gratifying career option, but negative early experiences on rotations could dissuade residents from pursuing fellowship training in our specialty. We hypothesize that a "crash course" – a short form, pre-rotation asynchronous educational material – could improve early resident rotation experience and potentially lead to increased interest in the subspecialty down the road.

Methods: We assess pediatric anesthesiology resident rotators prior to starting their rotation, at the end of their first week, and at the end of their rotation. The assessment includes a survey portion assessing their level of comfort and interest in pediatric anesthesiology, as well as a knowledge check of pediatric concepts (e.g., drug doses, intra-op emergencies). We asked residents at the follow-up points what their sources of worry were and what they wished they knew before starting the rotation. Next, we plan to develop an asynchronous educational video material of short duration for residents to view prior to starting their pediatric anesthesiology rotation. We will then assess the effectiveness of this video by giving residents the same surveys as prior to the intervention, in addition to questions regarding their opinions of the material, and comparing results.

Results: While we have not yet completed and implemented our intervention, the "crash course," we have survey data from several rotating junior residents (n=8) that will inform our educational product. Though a small sample, the average rating of level of interest in pediatrics pre-rotation was 2/5. Stated reasons included: "not much exposure in caring for sick children," "the emotional fatigue of taking care of sick children," and "overall general discomfort with taking care of sick children in a healthcare provider role." Residents rated their overall level of comfort going into the rotation, after completing the knowledge check questions, at an average of 2.5/5. They rated the potential helpfulness of a "crash course" at an average score of 4.4/5. In terms of desired content for the course, residents listed interest in content on pediatric anesthesia workflow and equipment differences, pediatric emergencies (especially laryngospasm), deep extubations, and pertinent medication dosing.

Discussion: At this time, we have preliminary data supporting our hypothesis that residents have discomfort in starting their early pediatric anesthesiology rotations, and that they would find a "crash course" helpful prior to starting. We have some guidance on what content they find helpful in retrospect, reported after they completed some or all of the rotation. Our next steps are to develop the asynchronous crash course video content, deploy it to incoming resident rotators, and evaluate its effect on resident experience.

CR 2.2: Cao

Temporal Dynamics of Cerebrovascular Autoregulation and Its Association with Acute Brain Injury in VA-ECMO Patients

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Background: Cerebrovascular autoregulation (CVAR) maintains stable cerebral blood flow despite changes in systemic pressure. Its impairment during venoarterial extracorporeal membrane oxygenation (VA-ECMO) may predispose patients to acute brain injury (ABI).

Methods: A retrospective cohort of 59 VA-ECMO patients (14 with ABI) was analyzed. CVAR was quantified by the Cerebral Oximetry Index (COx), the moving Pearson correlation between mean arterial pressure (MAP) and regional cerebral oxygen saturation (rSO_2). Impaired CVAR was defined as COx > 0.3. Arterial $PaCO_2$ changes ($\Delta PaCO_2$) and pulse pressure (PP) were evaluated within 24 h post-cannulation.

Results: ABI + patients demonstrated significantly higher COx during the first 12 h post-cannulation, indicating early CVAR impairment. Patients with impaired CVAR had larger $\Delta PaCO_2$ and lower PP. Temporal COx analysis revealed oscillatory behavior (~0.3–0.5 h period) and bifurcation between ABI + and ABI – groups beginning around hour 5–6.

Conclusion: Early CVAR impairment predicts subsequent ABI in VA-ECMO patients. Rapid $PaCO_2$ reduction and reduced pulse pressure are key contributors, underscoring the need for controlled CO_2 management and hemodynamic stability during early ECMO support.

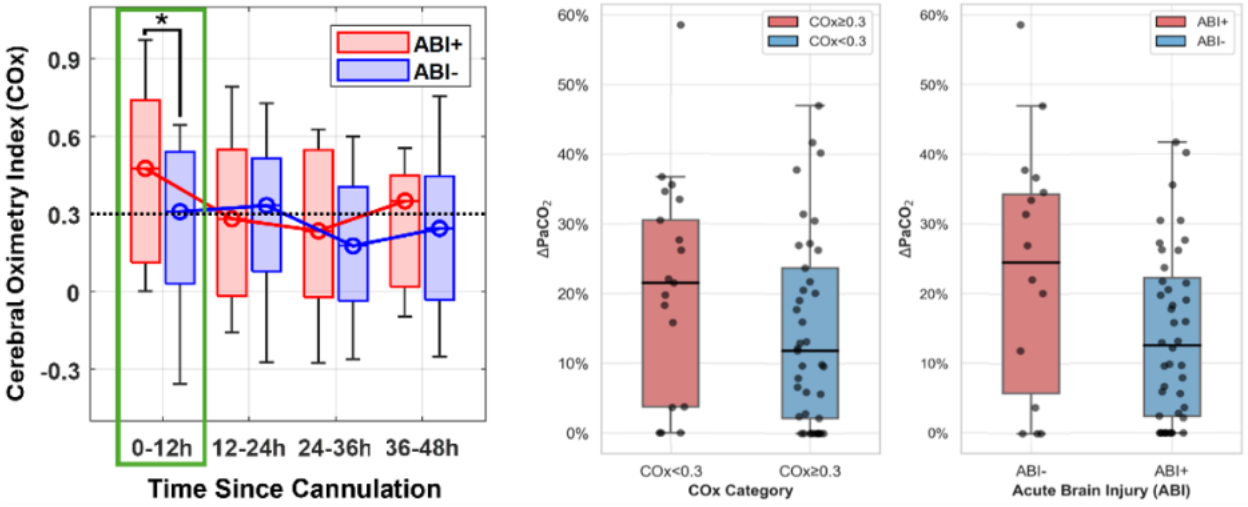

Figure 1. Early cerebrovascular autoregulation (CVAR) impairment and its association with $PaCO_2$ changes and acute brain injury (ABI) in VA-ECMO patients.

CR 3.10: Chernau

Intraoperative ketamine use and postoperative outcomes in children with obstructive sleep apnea undergoing adenotonsillectomy: A retrospective chart review

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Background: Obstructive sleep apnea (OSA) is a common and severe form of sleep-disordered breathing. It is characterized by episodic upper airway obstruction during sleep, disrupted sleep patterns, and impaired gas exchange. Untreated OSA in children can have negative effects on the cardiovascular, metabolic, and neurocognitive systems that carry through adulthood. Adenotonsillectomy (AT) is the primary treatment for pediatric OSA and is often curative but carries risks of respiratory compromise and postoperative pain. Patients with severe OSA are particularly vulnerable to perioperative respiratory complications and exhibit increased sensitivity to opioids. Ketamine provides analgesia while preserving respiratory drive and airway patency, making it an appealing alternative to opioids in this population. Despite these physiologic advantages, limited data exist on the clinical use and outcomes of intraoperative ketamine in children with OSA undergoing AT.

Objectives: To compare postoperative pain and respiratory outcomes among pediatric patients with OSA who underwent AT and received intraoperative ketamine versus matched patients who received alternative intraoperative analgesic medications.

Methods: This study is a retrospective chart review of pediatric patients with documented OSA who underwent tonsillectomy with or without adenoidectomy between 2020 and 2025 at the Johns Hopkins Hospital. Patients who received intraoperative intravenous ketamine were identified through the electronic medical record (Epic). An age-, weight-, and disease severity-matched comparison group who did not receive intraoperative ketamine was selected. Extracted variables included postoperative pain scores, administration of rescue analgesic medications, and respiratory events (desaturations or airway interventions), all as documented in the Post-Anesthesia Care Unit. Descriptive analyses will summarize demographic and clinical characteristics. Comparative analyses will be performed using appropriate statistical tests for continuous variables and chi-square or Fisher's exact tests for categorical variables.

Results: Data collection is in progress and will be completed prior to the 27th Annual ACCM Research Day. We anticipate that patients who received intraoperative ketamine will demonstrate postoperative pain scores and rescue analgesic use comparable to those receiving other analgesics, with a potential reduction in adverse respiratory events.

Conclusion: This study will provide preliminary evidence regarding the role of intraoperative ketamine in pediatric patients with OSA undergoing AT. Findings may inform anesthetic practice and guide future studies aimed at optimizing perioperative care for this high-risk population.

CR 3.8: Chin

Suprazygomatic maxillary nerve blocks and opioid reduction in primary palatoplasty

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[1]Johns Hopkins Department of Anesthesiology and Critical Care Medicine; [2]Luminis Health; [3]Biostatistics, Epidemiology, and Data Management (BEAD) Core, Johns Hopkins University School of Medicine; [4]Department of Medicine, Johns Hopkins University School of Medicine

Introduction: Perioperative analgesic management for pediatric populations undergoing primary palatoplasty can be challenging due to the severe pain of the procedure and goal of minimizing opioids for enhanced recovery of these patients. Effective multimodal pain strategies are crucial. In January 2024, suprazygomatic maxillary nerve block (SMNB) was introduced into the multimodal anesthesia regimen at Johns Hopkins Children's Center. This study aims to evaluate the impact of this adjunct by comparing outcomes including opioid consumption, hypoxemia, and anesthesia provider duration in patients receiving SMNB versus those not receiving SMNB.

Methods: This retrospective cohort study utilized the Multicenter Perioperative Outcomes Group (MPOG) database to identify all Johns Hopkins Children's Center patients under four years old who underwent primary palatoplasty between January 2021 and December 2025. Patients who underwent revision or secondary palatoplasty and those with multiple surgical procedures were excluded. Primary outcome measures included perioperative and postoperative opioid consumption. Secondary outcome measures included duration of anesthesia provider time and hypoxemia incidence. Opioid doses were normalized using MPOG oral morphine equivalent algorithm. Descriptive statistics were performed to analyze between-group differences.

Preliminary Results: There were 95 patients in the study; 22 received SMNB and 73 did not. There were no significant between-group differences in age, gender, or body mass index (Table 1). There were significant differences in opioid consumption, with the SMNB group receiving lower total opioid doses in the intraoperative, intraoperative-and-PACU, and first 24 hours postoperative periods (Table 2). There were no significant differences in duration of anesthesia provider time or hypoxemia incidence.

Table 1. Baseline Characteristics	SMNB (n=22)	No SMNB (n=73)	p-value	
Sex			0.349	†
Female	14 (63.6%)	36 (49.3%)		
Male	8 (36.4%)	37 (50.7%)		
Age (Years)	0.8 [0.8, 1.0]	0.8 [0.8, 0.9]	0.776	¶
Body Mass Index	18.2 (3.0)	17.5 (2.5)	0.355	§

† Chi-square test [n (%)] ¶ Wilcoxon test (Median [IQR])
§ t-test (Mean ± SD) ‡ Fisher's exact test [n (%)]

Table 2. Outcomes	SMNB (n=22)	No SMNB (n=73)	p-value	
Opioid Consumption				
Intraop OME (mg/kg)	0.7 [0.5, 0.8]	0.9 [0.7, 1.2]	0.016	¶
Intraop + PACU (mg/kg)	3.0 [1.5, 5.1]	6.0 [4.5, 9.0]	0.000	¶
Postop (0 - 24 hrs) (mg/kg)	2.0 [1.5, 2.7]	1.4 [0.0, 2.4]	0.017	¶
OME/length-of-stay (mg/kg/day)	0.7 (0.4)	0.8 (0.4)	0.116	§
Anesthesia Duration (min)	163.2 (35.4)	157.2 (37.4)	0.497	§
Hypoxemia			1.000	‡
No Hypoxemia	18 (90%)	63 (91.3%)		
Transient Hypoxemia	2 (10%)	6 (8.7%)		
Unknown	2 (10%)	4 (5.5%)		

Discussion: These preliminary results revealed a significant reduction in opioid consumption across perioperative and postoperative time periods for patients who received a SMN block, suggesting that SMNB may be an effective intervention for facilitating primary palatoplasty anesthesia and analgesia while minimizing opioid consumption. The lack of significant differences in hypoxemia incidence and anesthesia duration also suggests that safety and efficiency are not compromised with the introduction of this adjunct. These findings imply SMNB may spare patients from opioid-related side effects and promote improved recovery leading to better functional outcomes (earlier post-operative feeding) and reduced LOS.

CLINICAL RESEARCH

CR 2.5: Feng

Impact of Left Ventricular Venting on Acute Brain Injury in Patients with Cardiogenic Shock: An Extracorporeal Life Support Organization Registry Analysis

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[1]The Johns Hopkins University School of Medicine, Baltimore, MD, [2]Sidney Kimmel Medical College, Thomas Jefferson University, Philadelphia, PA, [3]Department of Anesthesiology, University of Virginia, Charlottesville, VA, [4]Department of Anesthesiology, Perioperative, and Pain Medicine, Stanford, CA. [5]Department of Surgery and Perioperative Care, Dell Medical School, Austin, TX.

Purpose: While left ventricular (LV) venting reduces LV distension in cardiogenic shock patients on venoarterial extracorporeal membrane oxygenation (VA-ECMO), it may also amplify risk of acute brain injury (ABI). We investigated the hypothesis that LV venting is associated with increased risk of ABI. We also compared ABI risk of the two most common LV venting strategies, percutaneous microaxial flow pump (mAFP) and intra-aortic balloon pump (IABP).

Methods: The Extracorporeal Life Support Organization registry was queried for patients on peripheral VA-ECMO for cardiogenic shock (2013-2024). Our primary outcome ABI was defined as hypoxic-ischemic brain injury, ischemic stroke, or intracranial hemorrhage. Secondary outcome was hospital mortality. We compared no LV venting with 1) LV venting, 2) mAFP, and 3) IABP using multivariable logistic regression. To compare ABI risk of mAFP vs. IABP, propensity score matching was performed.

Results: Of 13,276 patients (median age=58.2, 69.9% male), 1,456 (11.0%) received LV venting (65.5% mAFP and 29.9% IABP), and 525 (4.0%) had ABI. After multivariable regression, LV-vented patients had increased odds of ABI (adjusted odds ratio (aOR)=1.76, 95% CI=1.29, 2.37, p<0.001) but no difference in mortality (aOR=1.08, 95% CI=0.91-1.28, p=0.39) compared to non-LV-vented patients. In the propensity-matched cohort of IABP (n=231) vs. mAFP (n=231) patients, there was no significant difference in odds of ABI (aOR=1.35, 95%CI=0.69-2.71, p=0.39) or mortality (aOR=0.88, 95%CI=0.58-1.31, p=0.52).

Conclusions: LV venting was associated with increased odds of ABI but not mortality in patients receiving peripheral VA-ECMO for cardiogenic shock. There was no difference in odds of ABI or mortality for IABP vs. mAFP patients.

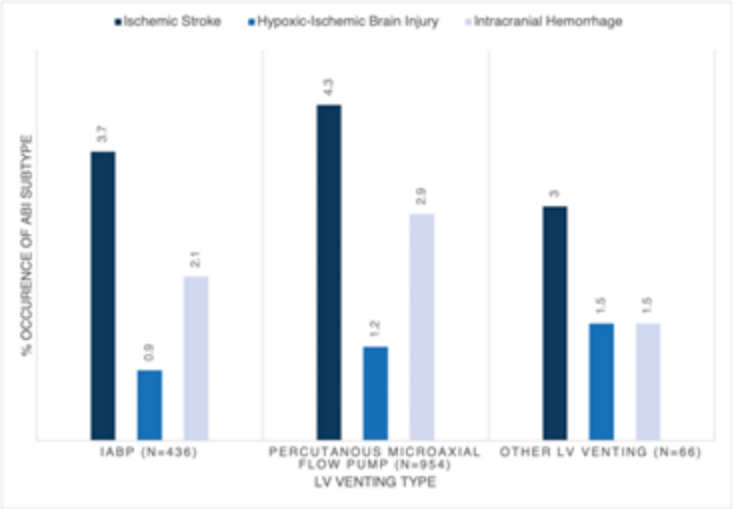

FIGURE. Distribution of ABI for LV Venting Patients Stratified by Procedure Type; IABP, intra-aortic balloon pump; LV, left ventricular

CR 3.3: Forsman

Noninvasive multimodal monitoring links hypoperfusion to early microcirculatory dysfunction after aneurysmal subarachnoid hemorrhage (aSAH)

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Objective: Impaired cerebral autoregulation (CA) and microcirculatory dysfunction during the early brain injury (EBI) phase may predispose aSAH patients to delayed cerebral ischemia (DCI). We sought to use multimodal neuromonitoring to identify factors associated with impaired CA during EBI and to determine whether divergence from optimal MAP (MAP_{Opt}) during EBI is associated with DCI.

Methods: We conducted a pilot prospective observational study of aSAH patients with continuous bifrontal NIRS-based regional cerebral oximetry ($rScO_2$) monitoring initiated within ≤72h from admission. Cerebral oximetry autoregulation index (COx, ranging −1 to +1) was computed from slow-wave MAP–$rScO_2$ correlations. MAP_{Opt} was the observed-MAP corresponding to lowest COx value. NIRS-based metrics were compared to ICP, CPP and TCD velocities. WFNS-adjusted regression models assessed factors associated with higher (worse) COx and DCI.

Results: Twenty-nine aSAH patients (median age 64y; WFNS-grade 4) were monitored for a median of 3-days from hospital Day-1. Median average COx=0.05; peak COx=0.32; MAP_{Obs} =88mmHg; MAP_{Opt}=86.7mmHg. Impaired CA defined by peak COx was associated with cerebral hypoperfusion (any CPP<60mmHg) (0.41 vs 0.17; p=0.01), but not with intracranial hypertension episodes. Average COx had inverse correlation with anterior circulation TCD velocities (Spearman ρ=−0.46;*p*=0.02). In WFNS-adjusted models, higher age (β per 10y increase=0.03[0.01–0.05];*p*=0.008), chronic hypertension (0.08[0.03–0.13];*p*=0.003), lower observed-MAP (β per 10mmHg increase=−0.02[−0.04-−0.003];*p*=0.024), and lower ACA and MCA velocities (β per 10cm/s increase=−0.01[−0.02-−0.003];*p*=0.005) were associated with worsening COx. Overall, DCI occurred in 10/29 (34.5%) patients at median of day-4. Spending >20% of monitoring time below MAP_{Opt}+/-5mmHg during the EBI phase was independently associated with DCI (aOR, 12.3[1.26–119.7];*p*=0.03).

Conclusion: Lower observed-MAP, lower proximal flow velocities and any CPP<60mmHg were associated with worsening CA during the EBI phase, underscoring the significance of early hypoperfusion in propagating EBI. Prolonged relative hypotension below MAP_{Opt} during EBI was independently associated with DCI, suggesting a role for early individualized hemodynamic optimization in aSAH patients.

Outpatient pediatric hypoxemia prevalence and pulse oximetry implementation in Malawi

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Introduction: Pneumonia remains a leading cause of under-five-year-old death globally, with hypoxemia a major mortality risk factor. The World Health Organization Integrated Management of Childhood Illness (IMCI) guidelines recommend screening for hypoxemia among outpatients with pneumonia in low- and middle-income countries like Malawi; however, implementation is limited. To address evidence gaps on the burden of outpatient hypoxemia and practicalities of pulse oximetry implementation, we sought to determine the prevalence of hypoxemia among children presenting to an outpatient clinic in Malawi. We also evaluated the measurement burden and diagnostic yield of various pulse oximeter implementation strategies within the IMCI framework.

Methods: We conducted a cross-sectional study of children aged 1–59 months in the outpatient clinic of Salima District Hospital, Malawi. Study staff trained in pulse oximetry enrolled every fifth patient over five consecutive days a month, over 12 months from 2024-2025. They collected participant demographic and clinical data and measured room air capillary oxyhemoglobin saturation (SpO_2) using a Masimo RadG device. Fast breathing was defined as respiratory rate $\geq$60 breaths per minute (bpm) in 1-month-olds, ≥50 bpm in 2–11-month-olds, and $\geq$40 bpm in 12–59-month-olds. IMCI pneumonia was defined as cough or difficulty breathing with fast breathing.

Results: An average of 125 children daily (range 56–247) attended the outpatient department clinic. Of 1,134 enrolled children, 12 (1.1%) had a SpO_2<94%, including 3 (0.3%) with a SpO_2<90%. IMCI pneumonia was present in 218 (19.2%) children and achieved a 67% (8/12) sensitivity and 81% specificity for identifying a SpO_2<94% (100% sensitivity for a SpO_2<90%). Cough and/or difficulty breathing was reported in 431 (38.0%) children; screening this group detected all SpO_2<94% cases (100% sensitivity) but required nearly double the oximeter assessments than in IMCI pneumonia cases.

Conclusions: Hypoxemia prevalence was low, despite a high burden of respiratory illness. In this outpatient Malawian setting health worker pulse oximeter measurement of children identified with cough and/or difficulty breathing had the highest sensitivity for identifying hypoxemia but could exceed existing healthcare worker testing capacity.

CR 1.6: Lam

Platelet Transfusion Practice Variability

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Introduction: Platelets are the second most commonly transfused blood product in the United States, with over two million units used annually. Despite guidelines, transfusion thresholds vary widely, creating opportunities to reduce unnecessary use. As the most expensive blood product with the shortest shelf life and frequent shortages, optimizing platelet use is essential to improve clinical outcomes and reduce costs. This study hypothesizes substantial variability in transfusion practices across services and providers, leading to avoidable transfusions without added clinical benefit. The primary objective is to characterize variability in platelet transfusion triggers (defined as the last count before transfusion) by provider, surgical service, and hospital. Secondary objectives include examining post-transfusion platelet targets, assessing pre-transfusion measurement practices, and evaluating differences in blood product ratios among patients with platelet transfusions.

Methods: This retrospective observational study will examine surgical cases from January 2015 to April 2025 using the Multicenter Perioperative Outcomes Group (MPOG) database. Eligible patients meet MPOG intraoperative research standards, have ASA status 1 to 5, and underwent a range of inpatient surgical procedures. Ambulatory cases are excluded, as are non-transfused patients in analyses focused on post-transfusion outcomes. As of June 2025, the cohort includes 153,263 patients who received platelet transfusions and 13,004,006 who did not. The primary outcome is the last platelet count prior to transfusion, analyzed both continuously and as "restrictive" (<50,000/μL) versus "liberal" (>50,000/μL). Secondary outcomes include the final intraoperative platelet count after transfusion and whether a platelet level was measured beforehand. Key exposures include surgical service, hospital, provider, and health system, with covariates such as demographics, antiplatelet therapy, blood product use, estimated blood loss, and hemostatic treatments. Analyses will use mixed-effects models to account for clustering by provider and institution, with logistic regression, ANOVA, or linear regression applied as appropriate. Sensitivity and subgroup analyses by surgical service, hospital type, race, and gender will further explore variability. Missing or implausible data will be handled through exclusion, correction, or multiple imputation, and potential confounders such as institutional practices and antiplatelet therapy will be addressed in modeling.

Results: Analyses are ongoing to characterize variability in platelet transfusion practices across providers, surgical services, and hospitals. Outcomes will include the distribution of transfusion triggers, post-transfusion platelet targets, and the prevalence of pre-transfusion platelet measurements. Variation by provider, procedure type, patient demographics, and hospital characteristics will be examined using mixed-effects modeling and descriptive statistics. Sensitivity and subgroup analyses will further explore factors contributing to observed differences.

Discussion: This study will provide a comprehensive assessment of variability in platelet transfusion practices, highlighting potential areas for optimization. Findings are expected to inform evidence-based strategies to reduce unnecessary transfusions, improve resource utilization, and enhance patient care across diverse surgical settings.

CR 3.4: Lam

The Effect Modification Between Kidney Function and Peri-Operative Opioid Dosing in Relationship to Post-Operative Delirium Onset

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Background: Post-operative delirium (POD) in older patients prolongs hospitalization and worsens outcomes. There is evidence that opioid dosing can influence the onset of POD. This issue is especially complex in older adults, as aging and changes in kidney function can impact how opioids are metabolized. Our prior work in older hip fracture patients identified an association between impaired baseline kidney function, peri-operative opioid dosing, and POD. In this study, we determined the association between baseline renal function and peri-operative opioid exposure in precipitating POD in a more generalized older surgical population.

Methods: Following IRB approval, a retrospective study was conducted using electronic medical records (EMR) of surgical patients at Johns Hopkins Bayview Medical Center (12/01/2018-03/01/2020). Eligible patients were ≥65 years old, admitted overnight, underwent delirium screening with the 4 A's Test and/or Confusion Assessment Method for the Intensive Care Unit, and had baseline creatinine. Baseline estimated glomerular filtration rate (eGFR) was calculated using the CKD-EPI Creatinine Equation (2021) and renal function was categorized as ≥60, 45-59, or <45 mL/min/1.73m². Opioid dose was calculated in morphine equivalents (mg) per body weight (kg) (MME).

Results: Preliminary analysis prior to completion of data scrubbing showed that 745 patients had at least one delirium assessment conducted on post-operative day 1 or 2. The post-operative delirium rate was 12.6%. Multi-variate regression showed that delirium was predicted by several important factors. Each additional year of age was associated with an 8% increase in the odds of delirium (OR [95% CI] = 1.08 [1.04-1.11]). Patients classified as ASA IV or higher had nearly a 30-fold greater odds of POD compared with ASA I patients (OR [95% CI] = 29.75 [10.85-81.59]). Patients with an eGFR ≥ 60 mL/min/1.73m² had a 57% reduction in the odds of developing POD compared with those with eGFR < 45 mL/min/1.73m² (OR [95% CI] = 0.43[0.24-0.78]). A 1mg/kg increase in intra-operative MME was associated with a 3.3-fold increase in POD incidence (OR [95% CI] = 3.32[1.07-10.28]). No association was found between opioid administered post-operative day of surgery and delirium on post-operative day 1 and day 2.

Conclusion: Our preliminary analysis found that increased intra-operative opioid exposure, but not post-operative day of surgery opioid exposure was associated with a greater likelihood of POD on day 1 or day 2. In addition, age, ASA, and poor kidney function were also associated with the development of POD. These results are similar to our previous study in hip fracture patients and suggest that an incremental increase in intra-operative opioid dosing and poor renal function increased the odds of day 1 and day 2 delirium in a generalized older surgical population.

Temporal variability in Near-Infrared Spectroscopy asymmetry is associated with Acute Brain Injury in Venoarterial ECMO

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Introduction: Venoarterial extracorporeal membrane oxygenation (VA-ECMO) provides temporary cardiac and respiratory support for critically ill patients. However, acute brain injury (ABI) remains a significant complication. Despite this risk, reliable predictors of ABI in VA-ECMO patients are not well established. In this study, we investigate whether cerebral oxygenation asymmetry measured by near-infrared spectroscopy (NIRS) can predict ABI, with the goal of identifying an early, noninvasive, and continuous bedside monitoring tool that can guide timely clinical intervention.

Methods: We performed a retrospective analysis of 163 adult VA-ECMO patients receiving NIRS monitoring at a tertiary center between November 2017 and March 2024. Cerebral oximetry data were obtained using bifrontal sensors capturing right and left rSO_2 values every hour during VA-ECMO support. ABI was defined as evidence of ischemic stroke, hypoxic-ischemic brain injury, intracranial hemorrhage, or seizure. rSO_2 asymmetry was defined as the absolute difference between left and right rSO_2 at each NIRS measurement. For each patient, mean and standard deviation (SD) of rSO_2 asymmetry were calculated. Associations between mean and SD of rSO_2 asymmetry and ABI were evaluated using multivariable logistic regression models, with age, sex, BMI, race as standard demographic covariates and log normalized number of NIRS measurements, log normalized hours on ECMO, and cannulation site as additional covariates. These latter two parameters were normalized due to highly variable durations on ECMO/NIRS measurements. Cannulation site was included given that peripheral (retrograde) and central (anterograde) flows differ in their effects on cerebral oxygenation.

Results: 163 VA-ECMO patients (median age 57 years, 69% male) underwent NIRS monitoring, with evidence of ABI in 23 (14%). Total median ECMO duration was 129.10 hours, with longer ECMO runs among ABI patients than those without ABI (186.62 hours vs. 123.44 hours, p=0.047). On adjusted multivariable analyses, a mean rSO_2 asymmetry exceeding a threshold of 8% was significantly associated with ABI (adjusted OR=5.166; 95% CI: 1.64-16.29; p=0.005). Increased SD of rSO_2 asymmetry was also independently associated with higher odds of ABI (adjusted OR = 1.08; 95% CI: 1.02-1.14; p=0.005). Neither total hours nor longest consecutive duration of NIRS asymmetry greater than 8% were significantly associated with ABI.

Conclusion: A mean rSO_2 asymmetry greater than 8% was associated with ABI and is further supported by our findings. High variability in cerebral rSO_2 asymmetry throughout VA-ECMO support was significantly associated with the presence of ABI. This was evidenced by a statistically significant SD of NIRS asymmetry and fluctuating ABI incidence at NIRS threshold values (4%, 6%, 8%, 10%, 12%, 14%, 16%). Variability in cerebral rSO_2 asymmetry may reflect more acute, uncompensated fluctuations to cerebral perfusion with higher risk of ABI.
This potentially could indicate compromised cerebral autoregulation, abrupt reperfusion injuries, endothelial damage, or neuronal stress. Trend-based NIRS monitoring integrating magnitude and variability of asymmetry may therefore aid in the detection of ABI for VA-ECMO patients.

CR 3.6: Mansfield

The Predictive Value of Psychosocial Determinants for Change in Functional Outcomes 1-Month After Cardiac Surgery

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Introduction: Understanding the relationship between baseline psychosocial characteristics and changes in postoperative physical function can provide valuable insight for identifying patients at risk for functional decline after cardiac surgery. Prior studies have suggested self-efficacy predicts adverse events and mortality, but they do not look in depth at functional outcomes. This observational, prospective cohort study investigated whether baseline resilience, depression, and self-efficacy scores are associated with changes in physical function from pre-surgery (baseline) to one month after cardiac surgery. We hypothesized that low baseline scores in the domains of resilience, depression, and self-efficacy would be associated with worse outcomes in both self-reported and performance-based measures of physical function at 1 month after surgery.

Methods: This study includes 155 patients aged ≥55 years undergoing cardiac surgery. The Brief Resilience Scale (BRS), PROMIS Depression (PRDEP), and PROMIS Self-Efficacy (PRSE) tests were administered prior to surgery. The PROMIS Physical Function (PRFXN) test and the Timed Up and Go (TUG) time and Gait Speed tests were administered at baseline and 1-month follow-up. Patients were stratified into groups based on baseline psychosocial scores according to validated cutpoints. Statistical analyses with t-tests and Wilcoxon rank-sum tests evaluated differences in the change in physical function scores, focusing on whether baseline scores were associated with change in one-month functional outcomes.

Results:155 patients were included in this analysis. 25% of patients had BRS scores in the low range. 16% had below average PRDEP scores. 53% had low self-efficacy based on PRSE scores. Changes in physical function (PRFXN, TUG, and Gait Speed) were analyzed relative to categories of baseline resilience, depression, and self-efficacy scores. Changes in PRFXN T-scores were significantly associated with PRSE scores, with patients with good PRSE scores showing greater improvement (change in PRFXN -4.24 points (SD 11.17) compared to those with low PRSE scores (change in PRFXN -1.01 points (SD 9.38), $p = 0.04285$). No associations were found between baseline PRSE categories and changes in TUG or Gait Speed. Baseline depression scores are significantly associated with changes in PRFXN T-score, with patients with higher scores showing significantly greater improvement (change in PRFXN -3.77 points (SD 10.34) compared to those with low scores (change in PRFXN 4.14 points (SD 7.74), $p = 0.001202$). However, no differences were observed for TUG and Gait Speed. Baseline resilience was not associated with change in PRFXN T-score changes, but greater baseline resilience was significantly associated with better performance on TUG ($p = 0.0084$) and Gait Speed test ($p = 0.0034$).

Conclusion: Low self-efficacy and depression were associated with decreases in self-reported physical function over one month following cardiac surgery. Low resilience was associated with worse objective measures of mobility. Taken together, these baseline measures may help identify patients at the highest risk for functional decline after cardiac surgery and target prevention strategies.

CR 1.2: Motz

What flavor can I get you - the effect of pre-oxygenation mask scent on anxiolysis and patient satisfaction in adults and adolescents undergoing anesthesia

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Preoperative anxiety in patients is a common phenomenon that anesthesiologists must mitigate prior to inducing general anesthesia. One of the most common approaches to anxiolysis is the use of short acting benzodiazepines like midazolam or other sedating agents. Pharmacologic anxiolysis, however, may not be feasible or advantageous for certain patient populations or procedures. The use of non-pharmacologic agents is largely provider dependent and not well established in the literature, with examples such as thorough/extended patient counseling, having the patient hold their own mask for preoxygentation, or music in the operating room prior to induction of general anesthesia.

The use of mask scents is well established in pediatric anesthesia as a tool to mitigate anxiety and promote smoother inductions in young children. The hippocampus and amygdala process olfactory senses, which are tied to both emotion and memory. By providing pediatric patients the option to choose a comforting or pleasant mask scent, they are both retaining an element of control in their environment and mitigating anxiety with a scent associated with positive emotions or memories.

There is little to no evidence surrounding the use of mask scents for adolescents and adults to facilitate anxiolysis and improved patient satisfaction with the preoperative induction process for general anesthesia. We hypothesize that, similar to younger pediatric patients, mask scent will reduce preoperative anxiety, improve patient satisfaction, and potentially reduce the need for pharmacologic agents and reduce the time needed to effectively pre-oxygenate

CR 1.8: Nadkarni

Characteristics, Management, and Outcomes of Pediatric Perioperative Cardiac Arrest: A Scoping Review

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Introduction
Pediatric perioperative cardiac arrest (CA) continues to occur and represents a critical point of failure with potentially fatal consequences. The goal of this scoping review was to create a comprehensive synthesis of the characteristics, management, and outcomes of perioperative CA events in children undergoing noncardiac surgery.

Methods
We conducted electronic searches of PubMed, Embase and Scopus in February 2024, with an update in June 2025. We included studies in children (<18 years) undergoing noncardiac surgery, experiencing perioperative CA (while under the care of anesthesia personnel or in immediate postoperative phases), with at least one pre-defined survival, neurofunctional, quality of life, or healthcare utilization outcome ascertained. Two authors reviewed citations independently with a third author solving conflicts.

Results
Of 801 unique citations, 18 studies met inclusion/exclusion criteria. There were 17 retrospective cohorts, 1 cross sectional study, and no interventional studies. Median number of CA events per study was 21 (interquartile range, 13-27). Survival to hospital discharge ranged from 30-91% overall, with a range of 46-68% in U.S.-based studies. Younger age, higher American Society of Anesthesiologists score, and emergent procedures were associated with higher CA rates. CA events designated as anesthesia-related had a trend towards higher hospital survival compared to overall perioperative CA events. One study noted an association between CA duration and mortality after CA. No study reported data on CA management, including quality of resuscitation, medication use, or defibrillation. No studies obtained neurofunctional outcomes using standardized measures. No studies addressed long-term survival, neurofunctional, healthcare utilization, or quality of life outcomes after hospital discharge.

Conclusion
Studies of pediatric perioperative CA are heterogenous, with modest sample sizes, and variability in definitions and outcome reporting. A large knowledge gap remains in CA management, neurologic consequences, and long-term outcomes. Further research is essential to establish a more comprehensive understanding of and potential interventions to improve outcomes of perioperative CA in children undergoing noncardiac surgery.

CR 2.7: Nadkarni

Pediatric Intraoperative Cardiac Arrest: Data from the American Heart Association Get With The Guidelines-Resuscitation Registry

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Introduction: Intraoperative cardiac arrest (CA) is a rare but high-risk event in the pediatric operating room. The aim of this study was to determine characteristics of children who experience CA during non-cardiac surgery and examine risk factors for mortality after these events.

Methods: We conducted a retrospective multicenter cohort study using the American Heart Association Get With the Guidelines-Resuscitation registry to identify children (<18 years) who experienced CA in the operating room during non-cardiac surgery between 2000 and 2023. Descriptive statistics were used to characterize the data. Univariate analysis is reported with odds ratios (ORs) and 95% confidence intervals (CIs).

Results: A total of 804 intraoperative CA events were included, of which 321 (40%) resulted in in-hospital mortality. The median age was 24 months (interquartile range, 6 months-11 years). In univariate logistic regression analysis of age categories and mortality, neonates (<1 month), infants (1 month to <1 year), and children (1-12 years) had significantly lower odds of mortality compared to adolescents (>12 years): OR 0.53 (95% CI 0.29-0.97), OR 0.17 (95% CI 0.11-0.27), OR 0.37 (95% CI 0.25-0.53), respectively. Among illness categories, trauma was associated with significantly increased odds of mortality compared to other noncardiac surgical patients (OR 10.82, 95% CI 6.81-17.84). Those who were pulseless on initiation of cardiopulmonary resuscitation or who started with a pulse but progressed to pulselessness had significantly increased odds of mortality compared to those who were never pulseless (OR 7.68, 95% CI 5.32-11.29 and OR 4.92, 95% CI 2.96-8.23, respectively). Use of extracorporeal cardiopulmonary resuscitation was not significantly associated with mortality (OR 1.57, 95% CI 0.76-3.32). Each subsequent year included in the analysis was associated with a 4% reduction in odds of mortality (OR 0.96, 95% CI 0.93-0.98).

Conclusion: In-hospital mortality following pediatric intraoperative CA in this registry study was 40%, lower than general in-hospital CA in children. Younger age was associated with decreased odds of in-hospital mortality, while trauma and pulselessness were associated with higher odds of mortality. Further analysis is needed to better understand potential contributors to these findings.

CR 3.1: Nino-Medina

Intraoperative Renal Venous Doppler by TEE During CPB in CABG: Feasibility and Preliminary Association With Postoperative AKI

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Background: Cardiac surgery–associated acute kidney injury (AKI) is a common complication linked to increased mortality and chronic kidney disease. Intraoperative hemodynamic perturbations, including venous congestion, are implicated in its pathogenesis. Ultrasound-based assessment of renal venous flow has emerged as a feasible way to estimate renal hemodynamics and the risk of AKI. We evaluated intraoperative renal venous blood flow velocity using transesophageal echocardiography (TEE) during cardiopulmonary bypass (CPB) and its relationship to postoperative AKI.

Methods: In this observational study, 20 patients were enrolled preoperatively. Inclusion criteria were age ≥55 years, ability to provide informed consent, English-speaking, and undergoing coronary artery bypass grafting (CABG). After induction of anesthesia, a TEE probe was placed per standard protocol. Renal venous blood flow velocity was assessed during CPB by a board-certified attending with advanced TEE certification. All TEE images were recorded every 15 minutes throughout CPB, and peak venous flow velocities were measured using FujiFilm Synapse (version 7.4.100). The primary outcome was AKI within 48 hours after surgery, defined by KDIGO criteria as an increase in serum creatinine ≥0.3 mg/dL from baseline. Descriptive statistics were reported as mean ± SD. Group comparisons were performed using Mann–Whitney U test, p value was significant < 0.05. Statistical analyses were performed using GraphPad Prism (version 10.3.1).

Results: Among 20 enrolled patients undergoing CABG with CPB, 5 (25%) developed AKI within 48 hours by KDIGO criteria. Intraoperative TEE-based renal venous Doppler measurements were successfully obtained in all patients. During CPB, the AKI group had a lower mean renal venous blood flow velocity than the No AKI group (mean 9.64 ± 3.36 vs 11.08 ± 4.20 cm/s), though the difference between groups was not statistically significant (Mann–Whitney U p≈0.96). The No AKI group showed wider range of values and a higher maximum (21.16 vs 14.27 cm/s). Normality diagnostics indicated the No AKI group deviated from normality (Shapiro–Wilk p=0.0058; Kolmogorov–Smirnov p=0.0016), whereas the AKI group showed no evidence against normality (Shapiro–Wilk p=0.969; Kolmogorov–Smirnov p>0.10). Overall, these data suggest a directional trend toward lower intraoperative renal venous velocities in patients who developed AKI, but with considerable overlap between groups.

Discussion: Patients who developed AKI had slightly lower velocities, but the difference was small and the ranges overlapped, so this measure did not clearly separate the groups in this small sample. The first 20 patients show the method is feasible and provide early estimates for a power calculation to decide how many patients are needed to test the association between intraoperative renal venous Doppler and postoperative AKI. Larger, adequately powered studies that adjust for key confounders (such as CPB time, perfusion pressures, venous congestion, and fluid balance, and baseline kidney function) are needed to confirm any independent association and to define useful thresholds for risk stratification and hemodynamic guidance.

CR 2.3: O'Neil

Chocolate or Sevoflurane? Facilitating More Pleasant Inhalational Inductions

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Introduction: Approximately 65% of children experience perioperative anxiety, which increases rates of emergence delirium, postoperative pain, and potential negative behaviors such as night terrors and enuresis that can extend beyond discharge from the hospital. Inhalational induction is a routine but unique aspect of pediatric anesthesia which can itself introduce anxiety and stress for the child. Fukumoto et al. demonstrated that an anesthesiologist can induce a "better" smell for a child during inhalational induction leading to more cooperative face mask acceptance. This concept arises from understanding that olfactory senses are processed via the olfactory bulb neural pathways that run along the hippocampus and amygdala, areas where we process emotion and memory. Despite the simplicity of this approach, no studies have validated this potentially powerful tool to optimize anesthetic induction for pediatric patients. Thus, we aimed to demonstrate the feasibility of evoking pleasant memories to alter the perception of smell of sevoflurane to decrease perioperative anxiety for our pediatric patients in a pilot randomized trial.

Methods: Inclusion criteria were children ages 5-11 years old undergoing outpatient surgery with American Society of Anesthesiologists (ASA) physical status of I and II. A total of 50 participants were randomized 1:1 using REDCap randomization into either the control group or experimental group. The experimental group was told that their favorite smell will be put into their mask via the machine. We proceeded to ask the experimental patient to take a deep breath thinking about that smell and then introduced 4% sevoflurane. The experimental group was asked if they began to smell the chosen flavor via the mask after two breaths and their response was recorded. Sevoflurane was then increased to 8%. The control group was asked to breathe into the mask with sevoflurane 4% but no mention of the smell was given prior to or after introduction of the sevoflurane and after 2 breaths sevoflurane increased to 8%. Each patient was evaluated by with the Modified Yale Preoperative Anxiety Scale (mYPAS) in the 1) preoperative area: 2) during induction process; and 3) one hour after arrival to the post-anesthesia care unit (PACU).

Results: There was no statistical significance noted when comparing preoperative and postoperative anxiety scale scores between the experimental and control groups ($p=0.26$) However, there was a statistically significant decrease in anxiety in the experimental group intraoperatively ($p=0.04$). 23 out of 25 experimental patients also noted that they smelled the flavor they chose in their mask, the other 2 did not respond. There was no difference noted between anti-emetic use in both groups and opioid use could not be compared due to the minimal use of opioid in the PACU overall.

Discussion: Through our pilot study, we were able to demonstrate a simple technique of introducing a pleasant, memory evoked odor association with the smell of sevoflurane leading to decreased anxiety at the time of the inhalational inductions. This technique can be used in any resource setting making it a powerful intervention to help our pediatric patients tolerate the perioperative setting. An added benefit to this technique is cutting out the use of nitrous oxide during inductions. There are minimal barriers to implementing this strategy as it is easy to use. Larger studies may allow us to further explore if decreased anxiety intraoperatively leads to decrease in opioids, antiemetics, emergence delirium, or long-term consequences of perioperative anxiety such as night terrors and enuresis.

CR 3.11: Ramezan

Preoperative Joint Physical-Cognitive Phenotypes and Post-CABG Recovery Trajectories

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Introduction: Reduced Cognitive Function (COG) and low Physical Function (PF) are common after major cardiac surgery in older patients, especially coronary artery bypass grafting (CABG) in older adults. Prior studies typically examine these domains separately, leaving limited evidence on how baseline function affects COG outcomes and how baseline COG affects PF outcomes. We used data from an ongoing observational cohort study to examine this question.

Methods: Prospective cohort of adults ≥55 years undergoing CABG. Patient-reported PF and COG were measured with highly validated PROMIS short forms (PRFXN, PRCOG), reported as T-scores (mean 50, SD 10; typical range 20-80) at baseline, 1, 3, 6, 9, and 12 months. We excluded visits missing either PRFXN or PRCOG. Participants were stratified at baseline as Low (≤45) vs High (>45) for PF and for COG. Primary outcomes were changes from baseline (follow-up − baseline) in PRFXN and PRCOG; we compared changes between Low vs High strata in the other domain at each time point using t-tests.

Results: At baseline (n=251) the cohort had a mean age of 68.7 years and was 79.3% male. Self-reported race was 80.1% White, 12.0% Black/African American, 2.4% Asian, 0.8% American Indian/Alaska Native, and 4.8% Other/Unknown; 94.8% identified as non-Hispanic/Latino and 3.6% as Hispanic/Latino. The mean bypass time was 126.9 minutes, and mean hospital length of stay was 10.6 days. PRFXN and PRCOG t-scores at baseline averaged 46.84 and 51.94, respectively, with 45% high baseline PF and 55% low PF, and 23% low COG and 77% high COG. PRFXN change by baseline cognition: At 1 month, patients with low baseline COG had a mean change in PF of −4.21 (SD 11.7), while patients with high COG had −3.51 (SD 10.2) ($p > 0.05$). At 3 months, low COG had +2.66 (SD 9.48) while high COG had +2.66 (SD 9.29) ($p > 0.05$). At 6 months, low COG had +5.25 (SD 9.19) while high COG had +4.32 (SD 9.11) ($p > 0.05$). At 9 months, low COG had +2.89 (SD 9.42) while high COG had +4.22 (SD 9.82) ($p = 0.51$). At 12 months, low COG had +3.10 (SD 7.09) while high COG had +3.04 (SD 8.92) ($p > 0.05$). PRCOG changes by baseline physical function: At 1 month, patients with low baseline PF had a mean change in COG of +0.65 (SD 9.32), while patients with high baseline PF had +0.93 (SD 9.17) ($p = 0.817$). At 3 months, low PF had +5.31 (SD 8.66) while high PF had +3.25 (SD 7.25) ($p = 0.115$). At 6 months, low PF had +6.47 (SD 8.41) while high PF had +7.05 (SD 8.62) ($p = 0.158$). At 9 months, low PF had +7.01 (SD 8.65) while high PF had +5.07 (SD 7.74) ($p = 0.203$). At 12 months, low PF had +2.07 (SD 7.40) while high PF had +2.46 (SD 7.77) ($p = 0.796$).

Conclusion: We did not find evidence that either baseline COG groups affected trajectory of PF or vice versa. These findings suggest limited cross-domain influence; further studies are needed to delineate the cognitive and physical function outcomes after cardiac surgery.

CLINICAL RESEARCH

CR 1.1: Sasannia

Blood-Brain Barrier Permeability and Plasma Volume Patterns in White Matter Lesion Penumbra

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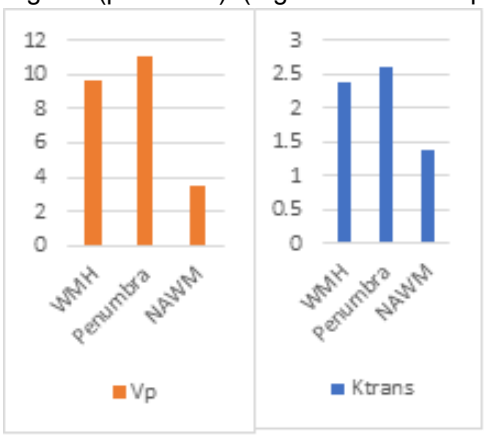
Introduction: Prior research has identified increased blood-brain barrier (BBB) permeability within white matter hyperintensities (WMHs) and their surrounding penumbra. We expanded on these findings by analyzing a larger dataset (n=337) from the GeneSTAR study which includes participants from our previous study supplemented with additional subjects, to characterize the distributions and relationships of BBB permeability-weighted estimation (K^{trans}) and plasma volume (v_p) measurements across WMHs, penumbra, and normal-appearing white matter (NAWM).

Methods: 337 volunteers (61.3% female, mean age 63.1±9.8 years) from the GeneSTAR study underwent 3T MRI scanning with dynamic contrast-enhanced (DCE) imaging analyzed with Nordic-ICE™. Regional perfusion maps were superimposed on segmented lesion maps to quantify K^{trans} and vp in WMHs, penumbra (4 voxels from WMH edge), and the remaining NAWM. Statistical analysis included regional comparisons and Spearman correlation analysis between regions and parameters.

Results: K^{trans} ($\times 10^{-4}$ min^{-1}) was highest in penumbra (2.60 ± 0.26), followed by WMH (2.37 ± 0.25) and NAWM (1.36 ± 0.24), with very high inter-regional correlations ($r > 0.88$, $p < 0.0001$). V_p (%) showed a similar pattern: penumbra (11.11 ± 2.07), WMH (9.59 ± 1.68), and NAWM (3.48 ± 0.73), with moderate inter-regional correlations ($r = 0.70–0.77$, $p < 0.0001$). K^{trans} and v_p were significantly correlated in all regions ($p < 0.001$). (Fig 1. and Bar Graph 1.)



Bar Graph 1: Summary of K^{trans} and V_p values across Different Brain Regions.

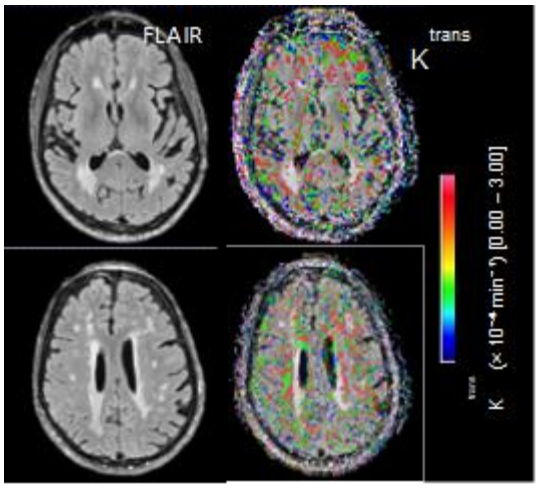


Figure 1. Overview of FLAIR and K^{trans} overlays in axial view.

Discussion: This expanded analysis confirms and extends our previous findings, demonstrating that BBB permeability and plasma volume are highest in the penumbra surrounding WMHs, suggesting this as a zone of active pathology.

CR 1.5: Sasannia

White Matter Hyperintensity and Brain Volume Changes are Associated with Cognitive Decline

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Introduction: White matter hyperintensities (WMH) are a common imaging finding in cerebral small vessel disease and can be associated with cognitive impairment. Here, we investigated this relationship between cognition and longitudinal changes in volume of total WMH, periventricular WMH (PVWMH), subcortical deep WMH (DWMH) volumes, all white matter, and the ventricles over a 13-year period. We hypothesized that progression of WMH volumes and brain structural changes would be associated with declining cognitive and motor performance in individuals with a family history of cardiovascular disease.

Methods: We studied 313 GeneSTAR participants (62% female, mean age 49.47 ± 9.71 years) with brain MRI and cognitive testing at two timepoints 13.48 ± 0.96 years apart. Brain measures included ventricular volume, white matter volume, and total WMH volume (DWMH and PVWMH). Cognitive assessments included MMSE at both timepoints, MoCA and Trail B at T2, and GPT at both timepoints. Linear mixed-effects models examined relationships between brain volumes and cognitive outcomes, adjusting for age, sex, race, education, and systolic blood pressure.

Results: PVWMH progression predicted MMSE decline (β = -0.195, p = 0.001) and GPT worsening (β = 2.812, p < 0.001). White matter volume loss predicted worse GPT performance (β = -0.408, p = 0.044). At T2, total WMH volume was negatively associated with MoCA (β = -0.105, p < 0.001) and positively with Trail B (β = 1.833, p < 0.001).

Discussion: PWMH progression shows the strongest relationship with cognitive decline and pegboard performance. Brain structural changes, increases in particularly periventricular lesion and ventricle volumes may help identify individuals at risk for cognitive and motor decline in families with a genetic predisposition to cardiovascular disease.

Brain Measure	Cognitive Outcome	β	SE	p-value
PVWMH	MMSE	-0.195	0.060	0.001
	GPT time	2.812	0.822	<0.001
WMH	GPT time	-0.408	0.202	0.044
WMH (TP2)	MoCA	-0.105	0.021	<0.001
	Trail B	1.833	0.486	<0.001

Table 1. Adjusted associations between WMH progression, brain structural changes, and cognitive outcomes.

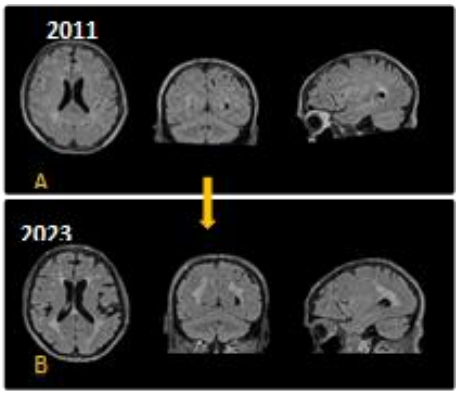

Figure 1. Longitudinal progression of WMH.

CR 1.10: Sasannia

Ten Year Increases in White Matter Hyperintensity Volume Correlates with the Severity of Ongoing Blood Brain Barrier Permeability when Measured with Dynamic Susceptibility Contrast MRI

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Introduction: Blood-brain barrier (BBB) dysfunction is a key factor in cerebral small vessel disease (cSVD). Brain MRI findings of cSVD include white matter hyperintensities (WMH), classified by location as periventricular WMH (PVWMH, adjacent to ventricles) or deep WMH (DWMH, subcortical). This study investigated the relationship between BBB permeability measured by Dynamic Susceptibility Contrast (DSC) MRI and changes in total WMH, PVWMH, and DWMH volumes over 10-13 years in asymptomatic individuals with vascular risk factors. Hypothesis: Higher K2 measurements (reflecting BBB permeability/contrast leakage) from the second MRI will correlate with increases in WMH, DWMH, and PVWMH volumes over the previous decade.

Methods: We studied 100 GeneSTAR volunteers (family-based study enriched for vascular risk factors): age 63.3±9.5 years, 60% female, 63% hypertensive, 22% African American. Two 3T MRIs were obtained 10-13 years apart. Total WMH, PVWMH, and DWMH volumes were determined using automated software with consistent co-registration. K2 was measured at the second visit by averaging the highest 100 voxels (hotspots) within lesion regions using gadolinium-based DSC-MRI. Linear regression analyzed relationships between K2 and volume changes, adjusting for age, systolic blood pressure, race, sex, and education.

Results: Positive correlations between K2 at time point two and changes in volume were statistically significant for total WMH (R-squared = 0.497, p = 0.006), PVWMH (R-squared = 0.461, p = 0.0085), but did not reach significance for DWMH (R-squared = 0.394, p = 0.08) (Table 1).

Predictor	Overall WMH	PVWMH	DWMH
K2 (BBB Leakage)	R^2 = 0.497, Table 1 Summary of the results for K2 and across WMH, PVWMH, DWMH cha **p = 0.006**	R^2 = 0.461, **p = 0.0085**	R^2 = 0.394, p = 0.08

Table 1: Summary of the results for K2 and across WMH, PVWMH,DWMH changes

Discussion: The robust correlation between K2 and overall WMH volume change underscores the potential of K2 as a biomarker for monitoring ongoing disease activity for subclinical cerebrovascular changes in at-risk populations.

CR 2.4: Sasannia

Blood Brain Barrier Permeability and Mean Transit Time are Higher in the Penumbra of Ischemic White Matter Lesions

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Introduction: Ischemic white matter Hyperintensities (WMHs) and their penumbra are associated with vascular changes and increased Blood Brain Barrier permeability (BBB). We investigated BBB permeability (K^{trans}), and Mean Transit Time (MTT) within WMHs, the penumbra, and normal-appearing white matter (NAWM) using dynamic contrast-enhanced (DCE) and dynamic susceptibility contrast (DSC) MRI imaging.

Methods: 188 volunteers were recruited from the family-based GeneSTAR study, age 63.70 ± 9.86 years, with 59.57 % females. All imaged in a 3T scanner with DSC and DCE (Nordic-ICE (™)). We superimposed regional perfusion on segmented lesion maps using in house software. Regions included were: WMHs, penumbra (the area within 4 voxels of the edge of the WMH), and NAWM. Linear mixed effects modeling was used controlling for within-subject correlations, region as a fixed effect, and subject as a random effect.

Results: Table 1 shows K^{trans} was highest in the penumbra (3.16) and WMHs (2.92) compared to NAWM (1.36; P < .0001). MTT was prolonged in both WMHs (12.14 seconds) and penumbra (12.12 seconds) compared to NAWM (8.17 seconds; P < .0001).

ROI	K^{trans} ($\times 10^{-4}$ min^{-1})	MTT (s)
WMH	2.92	12.14
Penumbra	3.16	12.12
NAWM	1.36	8.17

Table 1. Quantitative Analysis of Blood-Brain Barrier Permeability (K^{trans}), and Mean Transit Time (MTT) in Regions of Interest Related to White Matter Hyperintensities.

Discussion: BBB permeability (K^{trans}) is highest in the penumbra compared to WMH and NAWM. Higher K^{trans} is associated with prolonged MTT. These changes reflect ongoing ischemia and lesion progression within the penumbra of WMH.

CR 2.9: Sasannia

Microscopic diffusion anisotropy as a predictor of cognitive decline in asymptomatic adults

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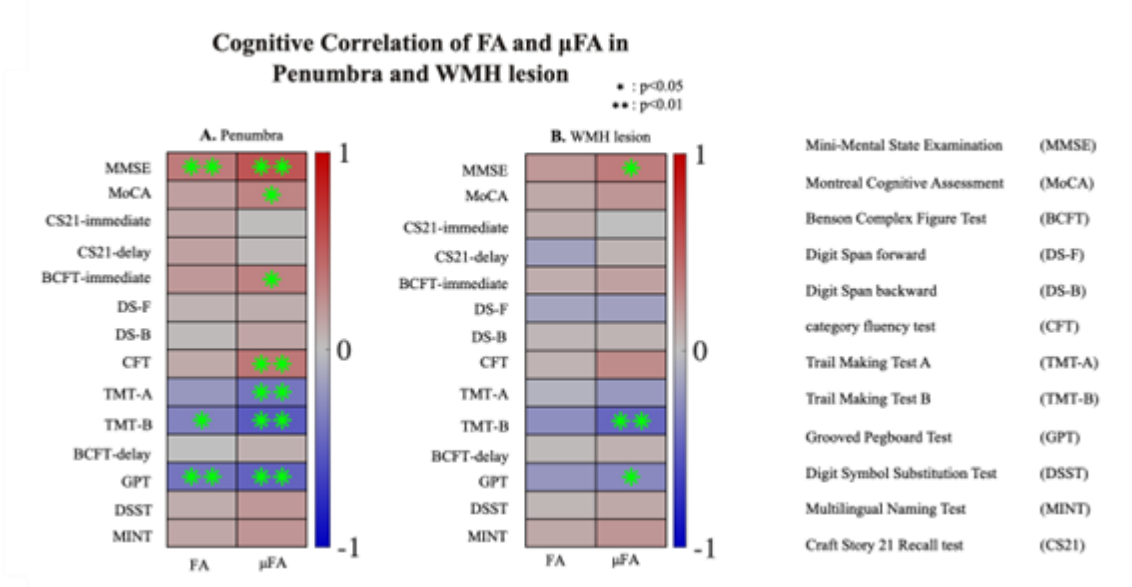
Introduction: Cognitive decline can precede clinical detection, making early identification crucial. White matter hyperintensities (WMH) on MRI indicate cerebrovascular small-vessel disease (cSVD) associated with cognitive decline. Microscopic FA (μFA), a newer diffusion MRI measure, captures microscale white matter integrity independent of fiber orientation, unlike conventional FA. We hypothesized μFA would show superior sensitivity to white matter degeneration and cognitive decline compared to FA.

Methods: 54 participants (age 61.2±9.8 years, 39 female) underwent 3T brain MRI including FLAIR for WMH assessment and tensor-valued diffusion MRI for μFA estimation. Fourteen neuropsychological tests assessed cognitive function. WMH lesions, surrounding penumbra, and normal-appearing white matter (NAWM) were segmented. Pearson partial correlations assessed relationships between FA/μFA values and cognitive outcomes, adjusting for age and sex.

Results: Both FA and μFA significantly differentiated WMH from penumbra and NAWM ($p<0.01$) and decreased with age. However, μFA in WMH showed superior clinical sensitivity for detecting cognitive decline, correlating with multiple cognitive domains ($p<0.05$) more strongly than FA (Figure 1).



Discussion: μFA provides more sensitive characterization of cognitive outcomes than conventional FA, suggesting it may be a valuable predictor of future cognitive decline before symptoms appear, enabling earlier interventions.

CR 2.1: Surma

Effect of RBC transfusion on cerebral metabolic rate of oxygen after congenital cardiac surgery.

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Jennifer M. Lynch, MD, PhD; Nicolina Rainieri, PhD[2]
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Background: The decision of which patients will benefit from RBC transfusion is a component of pediatric cardiac critical care that needs more data. NIRS is a form of diffuse optical spectroscopy which uses light absorption in the near-infrared range to quantify oxygenated and deoxygenated Hb in cerebral tissue and derive cerebral oxygenation (crSO2). Diffuse correlation spectroscopy (DCS) can be used to detect scattering from RBCs over time (the motion of RBCs) and calculate the blood flow index which reflects cerebral blood flow (CBF). A novel technique, functional NIRS/DCS (fDCS) combines these data to measure the cerebral metabolic rate of oxygen (CMRO2), which is theoretically a more precise measure of cerebral oxygen utilization than standard NIRS alone. This study will determine how CMRO2 changes with RBC transfusion in neonates after congenital cardiac surgery. We hypothesize that key clinical factors impact the degree of CMRO2 change post- vs pre-RBC transfusion, and that lower pre-transfusion Hb and higher pre-transfusion CMRO2 will be associated with greater change in CMRO2. We further hypothesize that cyanotic and single ventricle defects will be associated with a greater change in CMRO2 following transfusion compared to biventricular defects.

Study Cohort: We will use de-identified data shared by collaborators at the Children's Hospital of Philadelphia, n=49. For the CHOP prospective study, patients requiring congenital heart surgery are included if they are less than 30 days old, born at full term, and are medically stable for 24 hours prior. During surgery, continuous NIRS/DCS data is collected, followed by every two hours for 12 hours, and then daily. CMRO2 is calculated from optics data using Fick's law and assumed compartmentalized model of the microvasculature (percentage of blood in the venous compartment). Postoperative decision-making, including RBC transfusion, is dictated by the medical team, which is blinded to the NIRS/DCS research measurements. Vital sign and transfusion data from the anesthesia and ICU records will be de-identified and shared for analysis with CMRO2.

Methods: Longitudinal measures of CMRO2 will be characterized before and after RBC transfusion, and thus, anchoring the analysis by RBC transfusions is a crucial feature of this design. Duration (in hours) before and after RBC transfusion will be first summarized by linear regression models fit to each patient with CMRO2 as the dependent variable (in the log scale). Extended analyses will compare CMRO2 levels (in the log scale) and changes before and after the time of transfusion using a linear mixed model with random intercepts and slopes to account for within-individual repeated measures. The fixed effects will be time in hours before transfusion (i.e., pre-infusion slope), at the time of transfusion (i.e., intercept), and the time in hours after transfusion (i.e., post-infusion slope). We plan to explore enriched models with polynomials for time to account for non-linear relationships, as well as a spline term at the time of infusion if the change in CMRO2 is abrupt. Our study team has experience in longitudinal data analyses which will be appropriate for this aim. We will then interact Hb, CMRO2 and diagnosis with the intercept and slope terms in separate models. Using linear mixed effects models, a model fitting approach using Aikaike's Information Criterion (AIC) as a metric of error rate will identify the most parsimonious model to yield inference about potential effect modification.

CR 2.8: Surma

Difference in proteomic profiles of pediatric cardiac ECMO patients with versus without acute brain injury.

Victoria J. Surma, MD, MS; Derek Ng, PhD; Jennifer Roem, PhD; Melania M. Bembea, MD, PhD[1]
1. Johns Hopkins University School of Medicine, Baltimore, MD

Background: Mechanisms of acute brain injury (ABI) on ECMO include thromboembolism, hemorrhage, and hypoxic-ischemic injury. Higher plasma levels of biomarkers of brain injury have been associated with in-hospital mortality and neurofunctional decline at hospital discharge. While individual proteins have been studied, proteomic profiles of patients with incident ABI on ECMO have yet to be. We hypothesize that proteomic profiles will differ between patients with versus without ABI. We also hypothesize that proteomic profiles will reveal pathways or groups of proteins associated with cerebral oximetry below previously-described critical levels (crSO2<50%) and with unfavorable neurobehavioral outcomes in survivors to 18 months post-cardiac surgery with postoperative ECMO support.

Methods: We will use data collected from the prospective "Biomarkers of Brain Injury in Critically Ill Children on ECMO" (BEAM) multicenter prospective cohort which completed enrollment in October 2023 (n=224 participants) in 11 centers across the U.S., with 18-month neurofunctional follow-up period ending in April 2025, which has already received IRB approval (IRB00109290) for secondary use of data and biospecimens. A total of 200 participants enrolled in the BEAM study have biobanked samples consented for future use. There were 105 surgical cardiac patients, of which one third (n=35) developed new ABI during the ECMO course, documented by neuroimaging.

In this pilot study, we will only include BEAM study participants who underwent surgical repair of CHD and were cannulated onto ECMO postoperatively. We will match 20 participants with incident ABI confirmed by neuroimaging during the ECMO course with 20 participants without ABI confirmed by *normal* neuroimaging. Matching will be done by age, ECMO indication, and cyanotic vs non-cyanotic CHD. Specific CHD type and complexity as well as daily recordings of crSO2, RBC transfusion, and ECMO support parameters were also collected.

Plasma samples from the parent BEAM study have been biobanked in temperature-controlled freezers at -80C. For the ABI group, we will select aliquots obtained on the ECMO day of ABI diagnosis, and same ECMO day aliquots will be selected for the matched non-ABI group. We will use the SomaScan Assay for sample analysis. All assays will be done at SomaLogic (Boulder, CO), with agreements and procurement order already approved. Data analysis will be conducted at Johns Hopkins and will include descriptive statistics, data normalization, and univariate analysis using t-tests with multiple comparisons adjustments using Holm's method with a family-wise error rate (FWER) of 10%. We will then conduct multivariate analysis (PCA, PLS-DA), along with machine learning classifiers (Random Forest, Support Vector Machine), to identify discriminative features between the ABI vs non-ABI groups. Finally, we will perform pathway enrichment analysis to uncover significant biological pathways associated with ABI. We will compare proteomic profiles for dichotomous outcomes (i.e., impaired cerebral O2 delivery using accepted crSO2 cutoffs). We will also perform correlation and regression analysis to evaluate the relationship between proteomic profiles and the additional physiologic metrics affecting cerebral oxygenation as continuous variables (e.g., cerebral perfusion pressure, mixed venous saturation, hemoglobin, ECMO parameters).

CR 3.7: Thompson

Sedation Practices in the Care of Severe Pediatric Traumatic Brain Injury

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Introduction: From the most recent guidelines on the management of pediatric traumatic brain injury (TBI) patients, there is no consensus for recommendation of sedative selection or sedation practices for increased intracranial pressure management. In addition to the management of cerebral perfusion and intracranial hypertension, a primary objective in the treatment of these patients is to mitigate secondary neurological injury. Pre-clinical studies have demonstrated neurotoxicity from benzodiazepines in the healthy developing brain following prolonged exposure. Given evolving sedation practices and introduction of new agents, we developed a survey to identify the most currently used agents in the management of pediatric TBI.

Methods: This study aims to investigate the practices regarding long-term sedation and pain management of mechanically ventilated children following moderate to severe traumatic brain injury in the Pediatric Intensive Care Unit (PICU). Our objective is to assess sedation practices among clinicians involved in managing pediatric TBI patients in the PICU, including intensivists, neurologists, and other healthcare providers involved in sedative choice. The content of the survey was reviewed by experts in pediatric critical care and traumatic brain injury through collaboration with the Pediatric Neurocritical Care Research Group (PNCRG). We administered a web-based survey and distributed via the Pediatric Neurocritical Care Research Group, and the World Federation of Pediatric Intensive and Critical Care Society, with pending distribution from the Pediatric Acute Lung and Sepsis Investigator (PALISI) group.

Results: Survey response collection is ongoing, and preliminary results will be available at the time of presentation.

Conclusions: Previous pre-clinical research has demonstrated long-term neurological changes following prolonged midazolam sedation in a juvenile traumatic brain injury model. The results of this survey will inform future investigations into the neurotoxic or neuroprotective effects of various sedative agents. Additionally, these findings may assist in identifying optimal sedative and analgesic regimens in the management of pediatric TBI patients, informing future research and clinical guidelines.

CR 3.9: Wayson

The Effects of Perceived Self-Efficacy Level on Postoperative Mobility After Coronary Artery Bypass Graft Surgery

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Introduction: Early mobility after cardiac surgery has been shown to reduce postoperative morbidity and ICU length of stay. Identifying baseline factors which are associated with lower postoperative mobility may be important to target mobility-improvement strategies. One important baseline factor may be psychosocial characteristics. General self-efficacy is confidence in oneself to perform tasks successfully, and high self-efficacy levels have been shown to improve quality of life and recovery in certain surgical populations. Previous studies regarding the impact of patients' self-efficacy levels have been conducted in the outpatient cardiac rehabilitation setting for postsurgical patients, but few studies have considered the impact of self-efficacy on early mobility levels after surgery. The objective of this analysis is to determine whether patients' perceived self-efficacy levels would affect their impatient mobility level progression after coronary artery bypass graft surgery.

Methods: Patients enrolled in the CAPS study are included in this analysis, all of which are age 55 and over. Patients excluded from this analysis include those who remained intubated beyond twenty-four hours, those who had CABG surgery without use of the cardiopulmonary bypass machine, and those whose perceived self-efficacy was not assessed preoperatively. To assess perceived self-efficacy levels, the PROMIS® (Patient-Reported Outcomes Measurement Information System) General Self-Efficacy 4a form (PRSE), was administered preoperatively. The mobility outcome was assessed during postoperative days 1-4 using the Johns Hopkins Highest Level of Mobility (JH-HLM) scale, which ranges from 1 to 8 points. Highest level of mobility on postoperative day 0 was excluded due to high probability of intubation and sedation. Outcomes were compared using rank sum tests.

Results: A total of 217 patients were included in the analysis and were grouped together based on having either "average to low" or "high" perceived self-efficacy. Of the 217 patients, 114 patients had average to low perceived self-efficacy (T-scores between 37.5 and 58.9) compared to 103 patients scoring "high" perceived self-efficacy (T-score of 64.7). On each postoperative day, the highest level of mobility was not statistically different between those with average to low perceived self-efficacy and high perceived self-efficacy. For example, on postoperative day 2, HLM scores were not different between the average to low self-efficacy group (7 [IQR 6-8] and the high self-efficacy group (7 [IQR 6-8], p=0.068).

Discussion: The results of this analysis demonstrate that high baseline perceived self-efficacy was not associated with better postoperative mobility levels in patients undergoing coronary artery bypass graft surgery. Further investigation into the impact of other psychosocial characteristics, such as preoperative depression levels and resilience, on early postoperative mobility are worth exploring.

CR 1.9: Xian

Epigenetic biomarkers of brain injury in critically ill children on extracorporeal membrane oxygenation (ECMO)

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[1] Johns Hopkins University School of Medicine, [2] UT Southwestern Medical Center, [3] UCLA Medical Center, [4] Children's Hospital of Philadelphia, [5] Children's Hospital Los Angeles USC, [6] Boston Children's Hospital, [7] Texas Children's Hospital, [8] Indiana University Health Hospital, [9] Washington University in St. Louis School of Medicine, [10] The University of Tennessee Health Science Center, [11] Seattle Children's Hospital

Introduction: The use of ECMO in critically ill children with severe cardiopulmonary failure is associated with increased risk of acute brain injury (ABI) and mortality. The role of the epigenome in neuroinflammatory pathways remains unexplored.

Methods: We analyzed differences in methylation signatures from peripheral blood mononuclear cells across 38 pediatric patients enrolled in the BEAM study, a multicenter, prospective, observational study in children supported on ECMO. Methylation sequencing was performed with the Infinium EPICv2 microarray. Patients were stratified into two cohorts: pediatric patients with (n=18) vs without (n=20) ABI on ECMO. Individuals were matched based on age (<1 year of age) and ECMO indication. We analyzed differentially methylated probes (DMPs) and gene-set enrichment (GSEA) between children on ECMO with and without ABI and corrected for multiple testing with false discovery rate <0.05.

Results: The final study included methylation sequencing data of 867,448 probes across the 38 pediatric patient samples. Primary ECMO indication included cardiac (n=22), ECPR (n=12), and pulmonary (n=4). After correction for multiple testing, there were no significant methylation differences between the ECMO groups with vs without ABI, likely due to a small sample size and possible effect of the ECMO course overshadowing any methylation signatures from brain injury specifically. However, GSEA on the 100 most nominally significant DMPs showed perturbation of immune response pathways (p=0.02), implicating genes including *VSTM1*, *NPLOC4*, *WRNIP1*, *NR4A3*, *ZBP1*, *VAMP8*. Of note, 7 nominally significant probes mapped to recognized transcription start site (TSS) regions and 5UTR/Exon 1 of *VSTM1* and 6 to *ZBP1*, immune regulatory genes highly expressed in whole blood. Lower levels of methylation were universally found across these probes in the ECMO group with ABI compared to no ABI, suggesting an upregulation of an inflammatory process. We were not able to identify any specific signatures indicative of neuroinflammation.

Discussion: ECMO support involves an altered inflammatory response that corresponds to changes in the epigenome. Methylation biomarkers of inflammation in these patients provide insight into the underlying biological pathways and risk-stratification for children requiring ECMO.

CR 1.7: Zhu

Improve STS Risk Score Prediction for Postoperative Length of Stay after Major Cardiac Surgery with Liver and Metabolic Disease Parameters

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Introduction: Risk assessment models for cardiac surgery do not distinguish between degrees of liver dysfunction. We previously reported that elevated liver stiffness measurement (LSM) is associated with a prolonged hospital length of stay after cardiac surgery, effectively ruling out a short length of stay following isolated coronary artery bypass grafting procedure (CABG). We hypothesized that an elevated LSM would improve the predictive ability of the Society of Thoracic Surgeons (STS) operative risk score of short hospital length of stay following CABG in adult patients.

Methods: This is a prospective observational study of 243 adult patients undergoing non-emergent CABG at a single university hospital center. The exposure of interest was liver stiffness measured by ultrasound elastography, which was categorized at two cut points to describe patients with low to moderate LSM (< 8.1 kPa and <9.5 kPa) versus high LSM (>= 8.1 kPa and >=9.5 kPa). Multivariate logistic regression modeling was used to create receiver operator characteristics (ROC) evaluating the addition of LSM to the STS operative risk score for short hospital length of stay.

Results: When compared to those with low-moderate liver stiffness, patients with elevated liver stiffness were more likely to experience a hospital length of stay greater than or equal to 6 days. The addition of LSM did not improve the predictive ability of the STS operative risk score for short hospital length of stay.

Conclusion: Patients with an elevated liver stiffness measurement are less likely to experience an early discharge from the hospital. The addition of liver stiffness to the STS operative risk for short length of stay did not improve its ability to predict a short length of stay after CABG.

CR 3.5: Zhu

Impact of ECMO Initiation Timing on Acute Brain Injury and In-Hospital Mortality in VA ECMO Patients

Tianyue Zhu, BS[1]; Leon Fan, BS[1]; Ernesto Marin, BS[1]; Glenn J.R. Whitman, MD[1]; Sung-Min Cho, DO, MHS[1,2] on behalf of the HERALD team

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Background: Acute brain injury (ABI) is a major complication of venoarterial extracorporeal membrane oxygenation (VA ECMO). The timing of ECMO initiation may affect both the incidence and type of neurologic injury. Early initiation could mitigate hypoperfusion injury, whereas delayed support may increase reperfusion or embolic risk. This study examined the association between the ICU-to-ECMO interval (time from ICU admission to ECMO initiation) and subsequent ABI risk and in-hospital mortality.

Methods: We retrospectively analyzed 89 VA ECMO patients at Johns Hopkins Hospital (2016–2024) whose ECMO support was not initiated for a surgical indication. ABI was defined as ischemic stroke, hypoxic-ischemic brain injury (HIBI), or intracranial hemorrhage. Associations between ICU-to-ECMO interval and 1) ABI risk or 2) in-hospital mortality, defined as death before discharge, were assessed using multivariable logistic regression. A shallow CART (Classification and Regression Tree) analysis identified an ICU-to-ECMO interval threshold, which was then used to classify patients into low- and high-interval groups. Subsequent chi-square tests compared ABI risk and in-hospital mortality between these groups.

Results: Among 89 VA ECMO patients (median age 58 years; 58% male), 11 (12%) developed ABI and 51 (57%) died during hospitalization. The median ECMO duration was 119 hours. ECMO duration did not differ significantly between patients grouped by ABI status or by in-hospital mortality. In multivariable logistic regression analysis adjusting for age, BMI, and ECMO duration, the ICU-to-ECMO interval was not significantly associated with ABI or in-hospital mortality. CART analysis identified a 4-hour ICU-to-ECMO threshold. Patients initiated on ECMO within 4 hours of ICU admission had a significantly higher risk of ABI than those with longer ICU-to-ECMO intervals (p=0.01). Among patients who developed ABI, those initiated on ECMO within 4 hours of ICU admission tended to have a higher incidence of HIBI, though this difference was not statistically significant. In-hospital mortality did not differ between groups.

Conclusion: Patients initiated on ECMO within 4 hours of ICU admission had a higher risk of ABI, particularly HIBI, suggesting that rapid ECMO initiation reflects a higher-risk population who may benefit from closer monitoring and preventive strategies. These findings underscore the importance of considering baseline illness severity when evaluating ECMO timing and whether early initiation directly contributes to ABI or reflects patient acuity.

Abstracts: Critical Care

CC 1.7: Arar

Framing the Conversation: Patterns of Nudging Language in Neurocritical Care Goals of Care Discussions

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Objective: To determine the frequency and patterns of nudging language during goals of care discussions in the neurocritical care unit (NCCU).

Background: Nudging language refers to subtle phrases, cues, or framing that influences how choices are perceived by listeners. In the NCCU, clinician-led goals of care and prognostic discussions guide patient surrogates in navigating complex treatment decisions. The use of nudging language in these discussions may shape whether and how surrogates decide to initiate, continue, or discontinue life-sustaining treatments. The examination of nudging language in NCCU goals of care remains unexplored.

Methods: We qualitatively analyzed fifty-three de-identified transcripts from audio-recorded clinician-family meetings at two different centers, from an ongoing multi-center, observational study. First, two coders identified unique decision points within each transcript and recorded the number of unique decision points discussed per transcript (e.g., placement of a tracheostomy, feeding tube, or withdrawal of life-sustaining therapy). Next, transcripts were parallel-coded for instances of nudging language using a previously-published framework. Nudges were classified into eleven types: salience, framing (further sub-typed as positive, negative, or mixed), options, default, endowment, commission, omission, recommendation, expert opinion, certainty, and social norms. Any discrepancies in coding were resolved through discussion.

Results: Across fifty-three clinician-family meetings, we identified nudging language in 74% (39/53) of the transcripts. The total number of unique nudges was 202, with a median of 3.5 [3.0-5.0] nudges per transcript. The most common types of nudges were Negative Framing (present in 26/53 family meetings; 49%) e.g. "A nursing home... is not a great place to go because most people who go to the nursing home don't survive long there"; Options (26/53 family meetings; 49%) e.g., "But what does that decision look like? Well, we have two pathways"; Recommend (15/53 family meetings; 28%) e.g., "We will do whatever you want, but we would recommend not to code him"; and Certainty (9/53 family meetings; 17%) e.g., "And it's the feeling of the team that we would prefer not to [shock him and do chest compressions because] he will code within 24-48 hours."

Conclusion: Preliminary findings suggest that nudging language is very commonly used in NCCU goals of care discussions. Ongoing analysis will examine over 70 additional transcripts to further explore communication patterns and the potential implications for surrogate decision-making.

CC1.4: Bostwick

Prevalence and Impact of Clinicians' Early Open-Ended Questions in Neurocritical Care Clinician-Family Prognostication Meetings

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Introduction: Clinician listening conveys respect and may be fostered by open-ended questions, which humanize ICU communication and support value-congruent care. This study examined the prevalence and types of early open-ended questions (EOEQs) in neurocritical care family meetings and their association with surrogate ratings of clinician communication quality.

Methods: We conducted a cross-sectional analysis within the ongoing multi-center INSPIRE-CINP study *(Identifying Strategies to Prognosticate and Inform Relatives in Critically Ill Neurologic/Neurosurgical Patients)*. A total of 87 audio-recorded clinician-family meetings with post-meeting questionnaires were analyzed from three U.S. neuroICUs, involving 79 patients, 133 family members, and 32 clinicians. EOEQs posed within the first third of the transcript were qualitatively coded by three independent raters, achieving high inter-rater reliability ($\kappa > 0.9$). To account for variability in meeting length and frequency, we calculated standardized proportions of EOEQ subtypes. Associations between EOEQs and communication outcomes were examined using both overall perceived quality of communication ratings (assessed with a single global question) and validated instruments (Quality of Communication [QOC] and modified Patient-Perceived Patient-Centeredness [PPPC]). Analyses employed mixed-effects models adjusted for clustering by clinician, patient, and surrogate, with covariates retained if $p > 0.15$ in univariate testing.

Results: Across 87 meetings, 209 EOEQs were identified (median 2 per meeting, IQR 1–3): 66% addressed family understanding, 13% the patient as a person, 13% patient wishes, and 8% family needs. In multivariable models adjusted for day of meeting after admission, patient and surrogate age, surrogate health literacy, and clustering, a higher number of EOEQs was associated with lower overall perceived communication quality (–0.4, 95% CI –0.7 to –0.15; $p=0.003$). No associations were observed with QOC or PPPC. Analyses of EOEQ subtypes were underpowered.

Discussion: Examining EOEQs offers a novel lens on communication in neuroICUs. Paradoxically, more EOEQs were linked to lower surrogate ratings of overall communication quality, with no associations for QOC or PPPC. This may reflect surrogates' preference for information early in meetings, though residual confounding and measurement differences are possible. Larger studies should confirm these findings and explore the impact of EOEQ content.

CC 1.5: Devlin

Establishing Practice Guidelines for Delivery of Music Therapy in Neurocritical Care Settings

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Introduction: Music therapy (MT) utilizes music to achieve therapeutic outcomes, including reduced anxiety and stabilized physiological parameters. While MT is well studied in neurorehabilitation, its role in neurocritical care for patients with acute brain injury (ABI) and disorders of consciousness (DoC) remains underexplored. Our team piloted MT in a neurocritical care unit (NCCU) for one year to establish guidelines for safe, early integration.

Methods: We conducted a narrative review using PubMed, CINAHL, and PsycINFO for English-language studies on music therapy in ABI/DoC and critical care, supplemented by backward searching of reference lists and two non-systematic Google Scholar searches (February 2025; May 2025) to ensure currency of the evidence base. Our review identified MT guidelines for chronic DoC in neurorehabilitation and general critical care, but none in neurocritical care. A retrospective chart review of 129 NCCU MT sessions assessed safety, patient responses, and feasibility. Literature findings, patient data, and expert consensus informed the development of five implementation guidelines, illustrated through a case example of a 47-year-old woman with severe right intracerebral hemorrhage and inclusion of a family impact statement.

Results: We propose the **TEMPO framework** for MT in neurocritical care.

1. **Timing and Environmental Considerations:** Initiate MT within 48–72 hours of stabilization, minimizing distractions and optimizing session frequency. *MT-BC confirms medical clearance, closes the door, and dims the lights.*
2. **Engagement Through Patient-Centered Customization:** Tailor MT to clinical status, goals, and patient/family preferences. *MT-BC plays live music in the style of 80s rock.*
3. **Music Selection and Implementation:** Begin with simple, unfamiliar music to gauge responsiveness, then integrate meaningful music as stability improves. *MT-BC plays "Faithfully" (Journey) synchronized to the tempo of the patient's respiration.*
4. **Psychosocial Support and Family Involvement:** Engage families in music selection and attune to their needs. *While the patient is in coma, MT-BC collaborates with her husband to identify songs and foster emotional connection and expression.*
5. **Ongoing Monitoring and Adjustments:** Continuously assess physiological and behavioral responses, noting positive (e.g., improved vitals) and negative (e.g., tachycardia) indicators. *MT-BC modifies music (tempo, dynamics) in response to patient.*

Discussion: The TEMPO framework offers structured, evidence-informed guidance for safe and effective MT integration in acute neurocritical care. These recommendations emphasize individualization, family involvement, and continuous response monitoring. Future studies should evaluate early MT's impact on neurological recovery, physiological stability, and long-term outcomes in patients with ABI, coma, and DoC.

CC 1.12: Eckert

An evaluation of pediatric critical care fellows' clinical skills and knowledge at a multicenter senior fellow bootcamp.

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The Sadie Abell Senior Fellow Bootcamp seeks to enhance the educational experience for senior pediatric critical care medicine fellows by holding annual regional bootcamps to bolster the clinical, technical, and communication skills expected of pediatric intensivists. The bootcamp hosts trainees from a variety of fellowship programs in that geographic area over multiple days with multimodal educational approach including discussion of clinical cases, high-fidelity simulation, task trainers, and small group discussion. This study seeks to measure the effectiveness of the educational curriculum through pre- and post-tests, needs assessments, and direct observations during clinical simulations. The information gained from this study will help identify opportunities for growth within the curriculum and will provide insight for expansion of the curriculum. While the Sadie Abell Bootcamp draws fellows from a variety of fellowship programs (each with their own unique extracorporeal support patient volume and technological capabilities), this study aims to evaluate critical skills that PCCM fellows should have knowledge of at the end of their training.

Our team will study Pediatric Critical Care Medicine fellows participating in the Sadie Abell Senior Fellow Bootcamp. Although participation in different geographic locations may vary, we anticipate 10-40 fellows per bootcamp session, with three bootcamps offered each academic year around the country. We plan to use a mixed-methods approach in data collection and analysis, using quantitative and qualitative feedback from knowledge assessments, direct observations, and needs assessments filled out by fellow participants.

This study will provide insights into the effectiveness of the educational curriculum for PCCM fellows and help tailor future training sessions to meet the identified needs and improve competencies in ECMO management.

CC 2.3: Fan

Hospital Risk Frailty Score as a Predictor of Key Clinical Outcomes in ECMO Patients

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Background: Frailty is increasingly recognized as a key determinant of outcomes in critically ill patients, yet its utility among patients receiving extracorporeal membrane oxygenation (ECMO) remains poorly defined. The Hospital Frailty Risk Score (HFRS) has emerged as a tool for quantifying frailty using data from ICD-10 code documentation. This study aims to evaluate the predictive performance of HFRS for key ECMO outcomes, and compare HFRS with established risk frailty indices including the Charlson Comorbidity Index (CCI) and 5-factor Modified Frailty Index (mFI-5).

Methods: We conducted a retrospective analysis of ECMO patients at Johns Hopkins Hospital from 2016 to 2024. HFRS was derived from ICD-10 codes. Primary outcomes included prolonged length of stay (LOS > 7 days), in-hospital mortality, successful weaning (survival greater than 24 hours following decannulation without recannulation or mortality) and discharge disposition among survivors (home vs non-home). The predictive performance of HFRS compared to CCI and mFI-5 were assessed using receiver operating characteristics (ROC curves and corresponding area under the curve (AUC) metrics.

Results: A total of 278 patients receiving ECMO were included (median age: 54 years, 40.3% female). Median BMI for patients was 29.6 kg/m^2 (IQR: 24.1 - 35.7) and patients had a median duration of ECMO of 126 hours. HFRS demonstrated strong predictive ability for prolonged length of stay (AUC = 0.78), non-home discharge (AUC = 0.70), and successful ECMO weaning (AUC = 0.66), but showed poor performance for in-hospital mortality (AUC = 0.44). In contrast, CCI and mFI-5 demonstrated modest predictive performance across all outcomes, with AUCs ranging from 0.45 to 0.62 (CCI: 0.48-0.61; mFI-5: 0.45-0.62).

Conclusion: HFRS effectively identifies ECMO patients at risk for prolonged hospitalization, non-home discharge, and successful ECMO weaning, supporting its use for risk stratification and ECMO care planning over the use of established frailty metrics such as CCI and mFI-5. Its poor performance for in-hospital mortality likely reflects acute physiological factors not captured by ICD-10 based frailty codes, highlighting the need for complementary metrics such as ELSO's SAVE score for mortality risk assessment.

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Early Hemodynamic Signatures and Acute Brain Injury in VA ECMO: The Role of Systolic Blood Pressure

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Background: Acute brain injury (ABI) is a major complication of venoarterial extracorporeal membrane oxygenation (VA ECMO), but the impact of early hemodynamic status on ABI risk is poorly understood. This study investigates how systolic blood pressure (SBP), a marker of hemodynamic status, influences the risk of ABI during the first 48 hours after ECMO cannulation.

Methods: We retrospectively analyzed 290 VA ECMO patients at Johns Hopkins Hospital (2016-2024). ABI was defined as ischemic stroke, hypoxic-ischemic brain injury, intracranial hemorrhage, or seizures. Temporal hemodynamic data were extracted and captured as mean, minimum, maximum, variability, rate of change, and AUC. Univariate and multivariable logistic regression assessed the association between SBP and ABI. A shallow CART (Classification and Regression Tree) analysis identified an optimal SBP threshold for risk stratification, and an odds ratio compared patients below and above the identified threshold.

Results: We analyzed 38,424 blood pressure measurements from 290 VA ECMO patients (median age=58, 62% male), of whom 38 (13.1%) developed ABI. The median ECMO duration was 122.9 hours, with patients with ABI experiencing longer runs compared to those without ABI (163.8 vs 117.7 hrs, p=0.043). Minimum SBP in the first 0-6 hours was significantly associated with ABI in univariate (p=0.004) and multivariable analyses adjusting for age, BMI, LV venting, ECMO duration, and central versus peripheral cannulation (p=0.039). Minimum diastolic blood pressure and pulse pressure during the first 6 hours were not significant. CART analysis identified an optimal threshold of 77.5 mmHg. Patients with a minimum SBP below this threshold within the first 6 hours of ECMO cannulation had a 5.5-fold increased odds of ABI (95% CI: 1.87-16.17, p<0.001).

Conclusion: Early (0-6 hours) low minimum systolic blood pressure (<77.5 mmHg) is significantly associated with ABI in VA ECMO patients. Notably, the earliest period of ECMO support appears to be the most critical for ABI risk, with later windows showing weaker associations. Unlike prior studies that focused on mean hemodynamic values, our findings highlight the minimum SBP as a more sensitive and clinically actionable marker, with clinicians able to respond in real time to mitigate adverse neurological events.

CC 1.2: Hoffman

Continuous Physiological Monitoring Reveals Poor PRN Sedation Efficacy in Pediatric Critical Care

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Introduction: Analgosedation-decision making is subjective, contributing to suboptimal outcomes in over 42% of pediatric critical care cases. Pro re nata (PRN) sedation doses are administered by nurses to address a patient's immediate analgosedation needs and increase the efficiency of bedside patient care; however, they often lack an objective clinical basis. We hypothesize that continuous monitoring of patient vital signs can be automatically assessed to improve PRN decision making for critical care teams.

Methods: Nine mechanically ventilated, continuously sedated, critically ill children were recruited for this pilot study between 2023 and 2025. Patient electronic health record (EHR), continuous waveform vital sign data, and video recordings were obtained. PRN doses were assessed using physiological parameters surrounding PRN administration, incorporating known drug kinetics and patient vitals waveform response patterns compared to baseline (6-hour preceding waveform mean).

Results: We analyzed 358 total PRN administrations of sedation medications (dexmedetomidine, hydromorphone, morphine, fentanyl, and diazepam) and quantified physiological changes from baseline levels in the 30 minutes following the PRN to account for variations in drug onset time. Contrary to expected sedation effects, heart rate increased by 0.77 ± 11.53 bpm following PRN administration ($p<0.3022$, Wilcoxon p-value). Respiratory rate showed -0.79 ± 5.31 breaths/min increase in variability post-medication ($p<0.0004$, Wilcoxon p-value). Our findings of increased physiological waveform signal following PRN administration were further validated by movement descriptions annotated in patient video recordings by the clinical team.

Conclusions: Current PRN administration demonstrates poor correlation with physiological waveform data, often resulting in paradoxical increases in agitation markers. Continuous monitoring can provide objective PRN effectiveness data to clinical teams during daily rounds, enabling evidence-based titration of continuous analgosedation infusions. Data-driven PRN assessment tools and heuristics are needed to ensure informed analgosedation decision-making in pediatric critical care.

CC 1.8 Huang

Patterns of multiple organ dysfunction in children on extracorporeal membrane oxygenation support

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Introduction: In this retrospective cohort study of children on extracorporeal membrane oxygenation (ECMO) support, we characterized patterns of multiple organ dysfunction and their associations with in-hospital mortality.

Methods: Electronic health records data were extracted for all consecutive children <18 years on ECMO at a single U.S. academic center between 2011 and 2024. Organ dysfunction (OD) was assessed using Pediatric Organ Dysfunction Information Update Mandate (PODIUM) criteria, as well as Pediatric Sequential Organ Failure Assessment (pSOFA) and Pediatric Logistic Organ Dysfunction-2 (PELOD-2) scores. These metrics were evaluated in 24-hour intervals from 14 days prior to cannulation through 28 days after cannulation.

Results: A total of 317 patients with a median age of 3.9 months were supported on ECMO with primary pulmonary (43%), cardiac (28%), or extracorporeal cardiopulmonary resuscitation (29%) ECMO indications. Cumulative incidence of in-hospital mortality was 46% and median time-to-death was 9 days [IQR 1-34]. Prior to cannulation, the median number of concurrent PODIUM OD was the same between survivors to hospital discharge (3 organs [IQR 1.5-4]) and non-survivors (2 organs [IQR 1-4], p=0.22). Accumulation of more OD among non-survivors vs survivors began shortly after cannulation. On ECMO day 0, a median of 7 organs [IQR 6-8] for non-survivors vs 6 [IQR 5-7] for survivors (p<0.01) were observed in dysfunction. These differences persisted while on ECMO, with a median of 6 organs [IQR 5-7] for non-survivors vs 5 [IQR 4.5-6] for survivors (p<0.01), and widened after decannulation, with a median of 4 organs [IQR 3-5] for non-survivors vs 1 [IQR 0-2.25] for survivors (p<0.01). pSOFA and PELOD-2 scores followed the same pattern and were statistically significant. Maximum PELOD-2 score by day 14 while on ECMO showed the best prognostic performance for in-hospital mortality (AUC 0.71).

Conclusions: Differences in the number of concurrent OD, as measured by PODIUM criteria, pSOFA and PELOD-2 scores, between survivors and non-survivors only began to emerge shortly after cannulation, suggesting that identifying intervenable risk factors pre- and on-ECMO could affect mortality.

CC 1.3: Hwang

Patterns of NAT Recognition in Young Children: A Single-Center Report

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Introduction: Nonaccidental trauma (NAT) is a leading cause of trauma mortality in infants and toddlers. Available data indicate delayed recognition may affect nearly 20% of NAT cases. We hypothesize that unlike critically ill children initially evaluated at a tertiary pediatric center, those requiring secondary transfer may be at higher risk for delayed recognition. We aim to assess patterns of NAT recognition and report patients' characteristics at our Level 1 Pediatric Trauma Center.

Methods: We retrospectively reviewed the charts of children ≤2 years old admitted to our institution's PICU between 7/1/2016 and 6/30/2023 who had a discharge diagnosis of NAT. We compared characteristics of patients who initially presented to our ED vs transferred from a referring facility. Data pertaining to initial presentation, transport, and hospital course were compared using Mann-Whitney U test post hoc and one-way ANOVA.

Results: 83 patients were included: 54 (65.1%) transferred (TX group) vs 29 (34.9%) presented to our ED (ED group). Initial presentation and hospital course did not differ between groups. Compared to the TX group, the ED group included a lower proportion of white ($p=0.007$) and a higher proportion of African American patients ($p<0.002$). Among the ED group, NAT was suspected for 89.7% (26/29) and not suspected for 10.3% (3/29) of patients during their ED evaluation. In contrast, among the TX group, 37% (20/54) had a pretransfer diagnosis of NAT and another 37% (20/54) had documented suspicion in the transfer records, whereas 25.9% (14/54) had no NAT concern pretransfer. Within the TX group, patients without NAT concern pretransfer had higher Pediatric Transport Triage Tool (PT3) scores (median: 6 vs 1 vs 2, $p=0.03$) and higher rates of pretransfer intubation (50% vs 20% vs 15%, $p=0.05$) compared to those diagnosed with or suspected of NAT.

Conclusion: Among critically ill children with NAT at a Level 1 Pediatric Trauma Center, transferred patients may have had higher rates of delayed recognition compared to those initially evaluated in our ED, despite no difference in severity of illness. Transferred patients without initial NAT concern presented with higher acuity than those where NAT was suspected, questioning whether urgency of medical stabilization may have contributed to delays in recognition.

CC 1.9: Hwang

Association of Hemolysis with Major Adverse Kidney Events in Children on ECMO

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Introduction: Intravascular hemolysis is a known complication of pediatric extracorporeal membrane oxygenation (ECMO) and an independent predictor of mortality. Resulting elevation in plasma free hemoglobin (PFH) has been associated with increased risk for acute kidney injury.

Methods: We measured PFH in plasma from pediatric ECMO patients enrolled in the Biomarkers of Brain Injury in Critically-Ill Children on ECMO (BEAM) multicenter prospective observational study. Samples were collected daily for the first 5 days of ECMO support, and every third day thereafter, with a last sample at the time of decannulation. The primary outcome for this analysis was major kidney adverse events (MAKE) at hospital discharge (composite of death, dialysis dependence or persistent kidney dysfunction).

Results: PFH was measured in 1037 samples in 218 study participants of which 51% were < 1 year and 53% were male. Primary ECMO indications included respiratory failure (28%), cardiac failure (54%), and ECPR (18%). In the first sample on ECMO (within the first 48h from cannulation), PFH levels were significantly higher in those with cardiac failure vs primary respiratory failure or ECPR as primary indications for ECMO. Likely related to longer ECMO duration, peak PFH levels throughout the ECMO course were highest in the primary pulmonary indication group (median 150 mg/dL), with lower levels in the primary cardiac and ECPR indication groups (median 120 mg/dL and 101 mg/dL, respectively, p=0.028). Those with vs without MAKE at hospital discharge had significantly higher PFH levels in the first sample on ECMO, median 86 mg/dL vs 63 mg/dL, p=0.016, peaking at a median of 146 mg/dL vs 106 mg/dL, p<0.001, during the ECMO course. In a Cox proportional hazards model, a PFH >100 mg/dL at any time point during the ECMO course was associated with 2.04 times higher hazard of MAKE at hospital discharge (95% CI: 1.30, 3.01), after adjusting for age and primary ECMO indication.

Conclusion: In this prospective study with standardized collection of blood samples, elevated PFH levels were associated with increased risk of MAKE at hospital discharge in pediatric patients on ECMO support. Methods to mitigate or reduce hemolysis may lead to improved outcomes in this high-risk patient population.

CC 2.1: Lehrer

Empathy from Clinicians in the Neurocritical Care Unit: Using Vr-CoDES to Investigate Family Decision-making Meetings

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Objective: To examine clinician expressed empathy during neurocritical care family meetings and how different types of empathetic statements influence surrogate decision-making.

Background: When neurocritical care patients are unable to speak for themselves, empathy fosters a clinician-family relationship grounded in trust and respect. Although family meetings provide opportunities to discuss patient values and preferences, communication priorities often diverge. Understanding clinicians' responses to family distress may identify communication strategies to support shared decision-making.

Methods: We qualitatively analyzed 30 de-identified audio-recorded family meeting transcripts of an ongoing multi-center cross-sectional study using the internationally validated Verona Coding Definitions of Emotional Sequences (Vr-CoDES). Family and clinician utterances were coded using two complementary systems: (1) c*onsensus definition of cues and concerns expressed by patients in medical consultations* and (2) c*oding of health provider talk related to cues and concerns*. Empathic statements initiated by clinicians without a preceding family cue/concern were coded and classified by their target (family or patient).

Results: Across 30 meetings, we identified a total of 178 total empathic statements, 150 clinician responses, and 58 clinician-prompted empathic statements. Family cues/concerns were present in 93.3% of meetings, 66.7% of which were family initiated. 26.7% of family cues involved explicit expressions of negative emotion, and 34% were indirect verbal hints to hidden concerns. 47.3% of clinician responses reduced emotional space for continued discussion, and 33.3% were non-explicit acknowledgement. The most frequent clinician response type was information/advice giving (38%); affective exploration or switching occurred the least often (1.3%).

Discussions: Empathetic communication occurred in most NCCU family meetings, predominantly in response to family cues/concerns. However, many clinician responses reduced space for continued discussion of emotions by ignoring or by defaulting to informational explanations. These findings highlight opportunities to improve empathetic communication by promoting response styles that validate emotion and foster trust. Strengthening targeted empathic responses may improve both surrogate decision-making and family satisfaction.

CC 2.4: Ma

Global Patterns of Neonatal Sepsis Disability-Adjusted Life Years Across Socio-demographic Index Levels Reflect Gaps in Critical Care Equity

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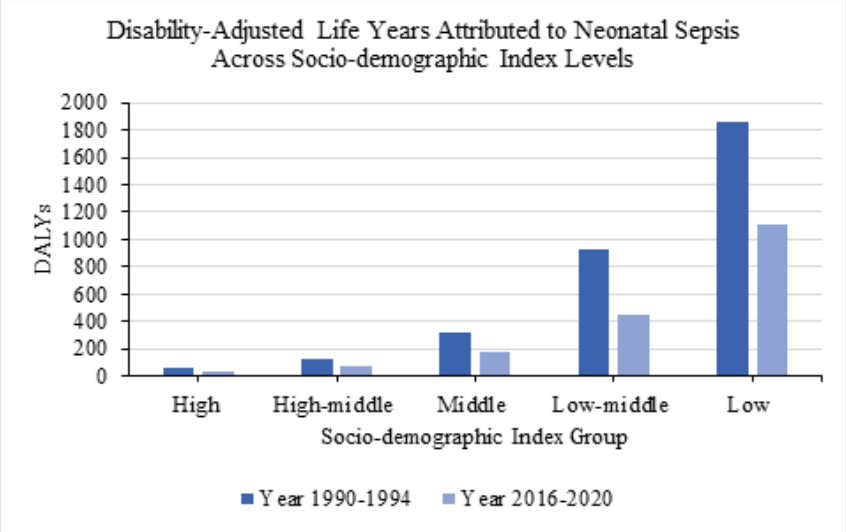
Introduction: Neonatal sepsis remains a major determinant of newborn survival, particularly where access to critical care is limited. Examining sepsis-related Disability-Adjusted Life Years (DALYs) across Socio-demographic Index (SDI) groups reveal persistent inequities in neonatal care capacity and resource distribution. This analysis highlights disparities in outcomes and system preparedness that mirror broader challenges in achieving global critical care equity to help inform strategies for prevention, early recognition, and equitable resource allocation.

Methods: DALYs attributable to neonatal sepsis were analyzed using estimates from the Global Burden of Disease study. Data were examined across five Socio-demographic Index (SDI) quintiles (high, high-middle, middle, low-middle, and low) representing gradients of income and education. Mean DALYs per 100,000 population were compared between two time periods (1990–1994 and 2016–2020) to assess temporal trends across differing demographic and economic contexts.

Results: All SDI quintiles experienced reductions in DALYs from 1990–1994 to 2016–2020 (Figure 1). High-SDI regions showed the lowest burden, decreasing from 63.81 to 35.26 per 100,000 followed by high-middle (130.89 to 66.87), middle (318.06 to 175.12), low-middle (926.04 to 447.90), and low-SDI regions (1,860.87 to 1,107.25). While absolute DALYs declined across all groups, the steep SDI gradient persisted, with low-SDI regions retaining nearly a 30-fold higher burden than high-SDI regions, underscoring continued inequities in neonatal critical care access and outcomes.



Discussion & Conclusion: Although global DALYs from neonatal sepsis have declined over three decades, persistently high rates in low-SDI regions highlight an ongoing equity challenge in critical care. Addressing this gap requires sustained investment in neonatal intensive care capacity, workforce development, and infection prevention to ensure all newborns have access to lifesaving sepsis management and reduce preventable mortality worldwide.

CC 2.9: Maimie

Use of $ETCO_2$ – Directed Cardiopulmonary Resuscitation in a Pediatric Swine Model of Ventricular Fibrillation Cardiac Arrest

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Introduction: Conventional cardiopulmonary resuscitation (CPR) guidelines do not account for individual variability in physiologic response, which may limit resuscitation effectiveness. End tidal carbon dioxide ($ETCO_2$) is a noninvasive surrogate for cardiac output and may allow real – time physiologic titration of resuscitative efforts. Our prior work demonstrated that $ETCO_2$ guided CPR improved intra – arrest hemodynamics in a prolonged asphyxial cardiac arrest model. In this study, we investigated whether $ETCO_2$ guided CPR improves intra-arrest hemodynamics and outcomes in a pediatric ventricular fibrillation (VF) swine model.

Methods: In this prospective, randomized study, 3.5–4.5 kg swine underwent 7.5 minutes of untreated VF followed by 10 minutes of CPR. Animals were randomized to receive either standard CPR or $ETCO_2$-guided CPR. The standard CPR group followed AHA guidelines (compression rate of 100/min, depth 1/3 the anteroposterior diameter, and epinephrine administration every 4 minutes). In the $ETCO_2$-guided group, the compression rate was increased by 10 compressions/minute for every minute that the $ETCO_2$ remained < 30 mmHg and the epinephrine administration interval was increased to as frequent as every 2 minutes to maintain $ETCO_2$ ≥30 mmHg. The primary outcomes were mean intra–arrest $ETCO_2$, diastolic blood pressure (DBP), and myocardial perfusion pressure (MPP). Secondary outcomes were the rate of return of spontaneous circulation, 3-day survival, and time-to-ROSC.

Results: Mean $ETCO_2$ during the first 10 min of resuscitation was similar between groups (25.6±0.6 vs. 25.5±0.6, p=0.99). The $ETCO_2$ – guided group had a significantly higher mean compression rate (124±1.5 vs. 101±0.5, p<0.0001) and received more epinephrine doses (4.2±0.3 vs. 3.0±0.0; p=0.003). There were no differences between the DBP or MPP between the two groups. ROSC was achieved in 10/10 (100%) of the $ETCO_2$-guided CPR group vs. 9/11 (82%) of the standard CPR group (p=0.476). Time-to-ROSC and three-day survival were similar between the two groups.

Discussion: $ETCO_2$ – guided CPR resulted in comparable intra – arrest $ETCO_2$, DBP and MPP to standard CPR in this pediatric VF model. Despite higher compression rates and more frequent epinephrine dosing, no adverse effects were observed with $ETCO_2$-directed CPR.

CC 1.11: O'Neil

Barriers and Facilitators to Implementing an Intensivist-led Pediatric Sedation Service

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Introduction: Pediatric procedural sedations (PPS) continue to expand beyond the operating room, with pediatric intensivists emerging as key leaders in delivering safe, high-quality care. Given the national shortage of pediatric anesthesiologists, pediatric intensivists are already performing 55% of sedations and are well-suited to fill this need. However, little is known about how these clinicians perceive the implementation of structured sedation services. This study explores barriers and facilitators to establishing a dedicated pediatric sedation service at a quaternary Children's Hospital. We hypothesize that several modifiable barriers will be elucidated that can inform tailored implementation strategies.

Methods: We performed a qualitative study focusing on current pediatric intensivist faculty in our center. Transcripts from a semi-structured interview were inductively coded using grounded theory to create an initial codebook, aided by qualitative software. Thematic analysis was then undertaken. The checklist for consolidated criteria for reporting qualitative research (COREQ) was used.

Results: Fourteen interviews have been completed to date. Eighty-five percent of the pediatric Intensivists identified as women with a median experience of 10 years (IQR: 4-20 years). The global theme of PPS service implementation revealed three sub themes relating to 1) perceived physical and institutional barriers; 2) personal interest; and 3) perceived competence. Safety concerns related to a new practice area and sedative-hypnotic medication best practices and standardization of practices. Modifiable factors included standardizing monitoring and safety equipment checklists and creating a training curriculum to address patient selection, pharmacology, and emergency response plans.

Conclusions: Thematic categorization of faculty perceptions prior to implementation of a PPS service allows for identification of facilitators and modifiable barriers. A priori knowledge is valuable during the implementation phase, informing training and curricular development. Furthermore, this study may serve as a roadmap at other institutions seeking to implement a pediatric procedural sedation service.

CC 2.6: O'Neil

Targeted Pediatric Procedural Sedation Curriculum for Pediatric Intensivists

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Introduction: Pediatric procedural sedation (PPS) is increasingly performed by non-anesthesiologists, including pediatric intensivists. A gap exists in standardized training despite the publication of consensus-based entrustable professional activities (EPAs) utilizing a competency-based medical educational framework. This curriculum aims to equip pediatric intensivists with the necessary competencies for safe and effective PPS within a newly developing service in the Johns Hopkins Children's Center.

Methods: We developed a targeted curriculum aligned with Kern's six-step approach, integrating simulation-based training, didactic lectures, and communication workshops to facilitate competency in consensus-based entrustable professional activities (EPAs). Learner needs were assessed using both qualitative and quantitative measures. The curriculum addresses pre-sedation evaluation, procedure appropriateness, sedation strategies, shared decision-making, anxiety management, continuous monitoring interpretation, medication pharmacology, adverse event management, and psychological safety. Learning objectives are assessed through quizzes, simulation evaluations, and direct observation.

Results: The curriculum is designed to improve intensivist proficiency in PPS, as measured by demonstration of skills in simulation and clinical settings. Outcomes will be evaluated using checklists, rubrics, and standardized patient feedback, with plans for ongoing process improvement and integration of peer feedback. The training will include incorporation of parental, family, or caregiver presence for children, highly anxious patients, and patients with special needs or psychiatric conditions

Discussion: This structured curriculum, integrating simulation and EPAs, offers a framework to standardize PPS training for pediatric intensivists. It will improve patient safety, provider confidence, and access to care. We anticipate this approach to serve as a model for other institutions. This model is anticipated to be transferable to target pediatrician sedationists from other backgrounds including pediatric emergency medicine and pediatric hospitalist medicine.

CC 1.10: Panagopoulos

Differences in Communication Between Clinicians and Families in Neurocritical Care Family Meetings

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Introduction: In the neurocritical care unit (NCCU), critically ill patients cannot speak for themselves, making family meetings essential for guiding care. We examined differences in clinician-family communication categories and whether clinician statements about patient identity/values/preferences (PIVP) were associated with family ratings of patient-centeredness (PPPC).

Methods: We conducted a cross-sectional mixed-methods analysis of 87 de-identified transcripts of audio-recorded clinician-family meetings from the ongoing multi-center INSPIRE-CINP study *(Identifying Strategies to Prognosticate and Inform Relatives in Critically Ill Neurologic/Neurosurgical Patients)*. A "statement" was defined as a sentence expressing complete thought, categorized by clinician or family member. Statements were qualitatively coded into one of 7 categories: neurodiagnostics/medical course, treatment options, patient identity/values/preferences, prognostication, trust building, support from others, or other. For each meeting, we quantified total and subtype frequencies, then calculated standardized proportions to account for differences in meeting length. Clinician-family differences in standardized proportions were compared with paired t-tests (Bonferroni-adjusted $p<0.05$). Univariate and multivariable mixed-effects models to adjust for clustering by clinician and patient were applied. We hypothesized that more clinician statements about patient identity, values, and preferences are associated with improved patient-centeredness of care as graded by the surrogates after the family meetings.

Results: Across 87 transcripts with 32 clinicians and 133 family members, we identified 40,909 statements, of which 26,619 (65%) were made by clinicians and 14,311 (35%) by families. With the exception of "treatment options" and "support by others," all subtypes differed significantly between clinicians and families. Contrary to our hypothesis, univariate and mixed-effects models showed no statistically significant association between the proportion of clinician PVP statements and higher PPPC scores.

Conclusion: Clinicians and families demonstrate distinct differences in the categorical breakdown of communication. However, greater clinician focus on patient identity, values, and preferences was not associated with higher family ratings of patient-centered care, potentially reflecting residual confounding or measurement limitations.
ROSC nor 3-day survival. This cardiac arrest model produces neuronal injury in the basal ganglia and preliminary results show a similar percentage of viable neurons in the standard CPR and algorithm CPR groups.

CC 1.1: Raghavan

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Introduction: Only 58% of critically ill children in the United States are optimally sedated, with sedation-associated adverse events occurring in up to 70% of cases. Sedation-agitation assessment is conducted using validated qualitative scales such as the State Behavioral Scale (SBS) and Richmond Agitation Sedation Scale (RASS) but are subject to significant variability and infrequent measurement. The objective of this study is to evaluate the State Behavioral Scale in assessing patient state and making critical sedation decisions.

Methods: Nine mechanically ventilated, critically ill children were recruited for this pilot study between 2023 and 2025. Patient electronic health record (EHR), continuous waveform vital sign data, and video recordings were obtained. EHR data included nurse-documented SBS scores and all continuous and intermittent analgosedation administered. SBS scores were retrospectively determined using video footage from the patient's bedside in conjunction with their heart rate and respiratory rate waveforms. Scoring was performed by a pair of research assistants (M.D., O.M.) trained by a pediatric critical care nurse and physician and validated by a pediatric critical care physician. Retrospective SBS scores were assessed in 30-minute windows, during any patient stimulation, and at time of intermittent analgosedation administration.

Results: In total, 855 hours of video were analyzed, with a mean of 95 hours and 191 retrospective SBS scores per patient. Retrospective SBS scores from patient video (Interrater reliability: Cohen's kappa 0.775 and 0.873) showed poor agreement with nurse-documented SBS scores: MAE 1.10, RMSE 1.44, Pearson r=0.12, Cohen's Kappa 0.05. Even in extreme nurse-documented agitation (SBS +2), 100% of retrospective assessments were SBS < +2. Vital signs showed weak correlations with retrospective SBS (Retro: HR: r=0.095, RR: r=0.324). Intermittent analgosedation PRN medication administration was commonly issued when not recommended based on retrospective SBS scores (Spearman rho =-0.021).

Conclusions: The SBS scale demonstrates poor correlation with video sedation assessments, analgosedation medication decisions, and physiological parameters. Objective, data-driven assessment tools are critically needed to validate pediatric sedation decision-making and improve patient care.

CC 2.10: Smith

Optimizing Oxygen Administration in the Pediatric ICU Through a Collaborative Quality Improvement Initiative

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Introduction: National data suggests poor adherence to prescribed oxygen ranges. Local preliminary data showed patients receiving oxygen spend 43% of monitored time outside the prescribed SpO_2 range, with all deviations being above 96%. Excessive oxygen exposure is linked to worse outcomes in critically ill children, including increased morbidity and mortality. Supported by evidence from adult and pediatric studies, including Oxy-ICU and PALICC-2, conservative oxygen targets improve patient outcomes. Despite an established oxygen titration policy at Johns Hopkins Hospital (JHH), adherence remains suboptimal. This project aims to implement an interprofessional quality improvement (QI) program to enhance guideline compliance, reduce hyperoxia, and improve patient outcomes.

Primary Aims: Our initial objectives for this quality improvement project are to:

- Enhance provider awareness and understanding of the JHH oxygen titration policy and promote consistent application and adherence to the prescribed SpO_2 target ranges.
- Improve adherence to prescribed oxygen target ranges by 10% from baseline data without increasing escalation of respiratory support or prolonging use of non-invasive or invasive positive pressure ventilation.

Methods: We assembled an interprofessional team including pediatric critical care medicine (PCCM) fellows, nurse practitioners, a clinical nurse specialist, respiratory therapist, and PCCM faculty. Using the Institute for Healthcare Improvement's Model for Improvement, we conducted a key stakeholder analysis, notified essential stakeholders, completed process mapping of the current system, and created a cause-and-effect diagram. We then generated an effort-benefit chart to determine initial Plan-Do-Study-Act (PDSA) cycles. We plan to implement the following PDSA cycles:

1. Multicomponent education: didactics, a bedside teaching tool, and interactive modules—to reinforce guidelines and emphasize risks of hyperoxia. (Implemented 10/20/2025)
2. Standardize oxygen therapy orders and incorporate SpO2 goals into rounding scripts.
3. Provider report cards: individualized SpO_2 histograms benchmarked against targets and peer data to provide direct feedback to providers and motivate accountability.

Data will be collected via the electronic health record focusing on the percentage of within-target range (WTR) SpO_2, duration of all oxygen therapy, ICU and hospital length of stay, safety outcomes, and demographic data. Process control charts for all primary and secondary outcomes will be generated, including 1 year pre-intervention, the 6-month intervention period, and 6-months post intervention to monitor progress. Pre-, during-, and post-intervention assessments of staff knowledge and adherence will inform iterative improvements. Pre-intervention survey was deployed on 10/6/2025.

Expected Impact: We hypothesize that using quality improvement methodology and combining targeted education with real-time feedback will significantly improve guideline adherence, decrease hyperoxia, and improve patient outcomes, serving as a scalable model for conservative oxygen therapy across pediatric critical care. Sustained stakeholder engagement and culture change are key to long-term implementation.

CC 2.5 Soule

Energy Expenditure in the ECMO Patient: Validation of Bedside Capnometry and Fick-Based Methods for Individualized Nutrition Assessment

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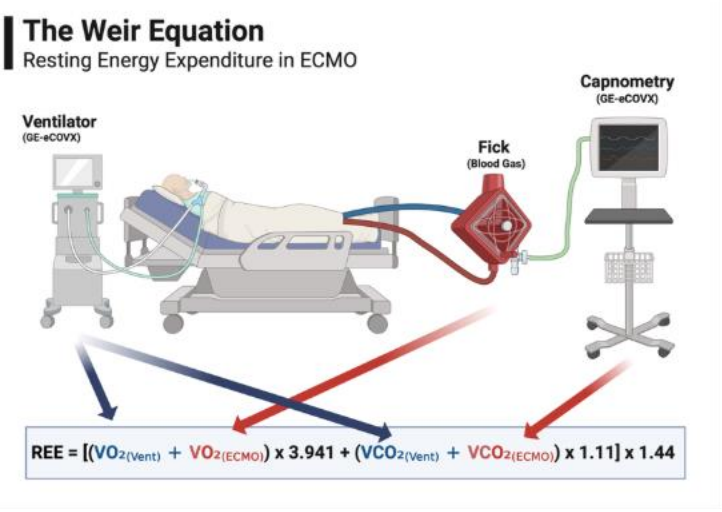

Introduction: Accurate assessment of energy expenditure (EE) in extracorporeal membrane oxygenation (ECMO) patients remains an unsolved clinical challenge. Current ASPEN guidelines (12–25 kcal/kg) rely on predictive equations that may under- or overestimate true caloric needs. Indirect calorimetry (IC), the gold standard for metabolic assessment, is not feasible during ECMO because O_2 uptake and CO_2 elimination occur across two parallel circuits. This study aims to validate novel bedside methods for individualized EE measurement using oxygenator-side gas analysis and the Fick principle.

Methods: Two complementary techniques were evaluated: (1) Cap-EE_{ECMO}, which calculates CO_2 elimination (VCO_2) from oxygenator exhaust pCO_2 and sweep gas flow; and (2) Fick-VO_2, which computes O_2 uptake (VO_2) from ECMO flow, hemoglobin concentration, and pre- and post-oxygenator blood gases. Energy expenditure was determined using the modified Weir equation. VO_2 and VCO_2 were compared with values from IC and ASPEN guideline predictions.

Results: To date, 7 ECMO patients (19 VCO_2 and 25 VO_2 measurements) have been analyzed. VCO_2 ranged from 24–274 cc/min and VO_2 from 25–281 mL/min. Measured EE was significantly greater than ASPEN-Low predictions (p=0.008) but not different from ASPEN-High (p=0.46), averaging 138% and 14% higher than the respective guideline estimates. These findings highlight substantial inter-patient variability and underscore the need to further validate individualized EE measurement in this population.

Discussion: ASPEN's lower guideline underfeeds most ECMO patients, while the upper limit roughly captures mean needs but not inter-patient variability. Capnometry and Fick-based oxygen uptake provide accurate, low-cost, bedside measurement of EE in ECMO patients, overcoming the limitations of conventional IC. This individualized approach may enhance nutritional precision, reduce risks of under- or overfeeding, and provide clinicians with real-time, continuous assessment of metabolic demand.

CC 1.6: Taylor

Perspectives from the PICU: Interprofessional Views on Screening for Health-Related Social Needs

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Introduction: Health-related social needs (HRSN), including food insecurity, housing instability, and transportation barriers, contribute to pediatric health disparities. Screening can identify needs and connect families to resources, but without provider engagement, sufficient resources, and institutional support, it falls short. In the Pediatric Intensive Care Unit (PICU), where critical illness intersects with social risk, these challenges are amplified. Addressing HRSN during hospitalization may improve outcomes for vulnerable children. While one study examined caregiver perspectives, no prior research has focused on clinician views on HRSN screening in the PICU. This study explores interprofessional perspectives on HRSN screening in this setting.

Objectives: To assess interprofessional attitudes, beliefs, and perceived barriers related to health-related social needs (HRSN) screening within two, distinct Pediatric Intensive Care Unit (PICU) via a brief, anonymous survey.

Methods: We conducted a cross-sectional study by distributing a survey among interprofessional providers at two geographically diverse, academic pediatric referral centers' PICU. Guided by the Health Beliefs Model, the survey assessed interprofessional team members' attitudes, behaviors, benefits, and perceived barriers to HRSN screening using Likert-scale questions. Descriptive and non-parametric comparative analyses were used to examine differences by site and role.

Results: Of 585 invited participants, 180 completed the survey (response rate: 31%), representing 16 unique clinical roles. Most respondents (95%) agreed that HRSN screening is important, though only 46% had previously conducted such screening. A large majority (85%) agreed or strongly agreed that screening would improve patient care. The most frequently endorsed barriers included perceptions that patients and/or caregivers may feel vulnerable when completing a social needs screening (93%), concerns about confidentiality (83%), and the belief that another staff role is better suited to complete screening (84%).

Conclusions: PICU staff globally value HRSN screening but face interprofessional and structural barriers. To address disparities for hospitalized children and enable PICU interprofessionals to perform HSRN assessments, potential solutions may include incorporating provider perspectives and enhancing training, workflows, and resource access. Inclusion of PICU interprofessional perspectives adds important considerations to efforts focused on expanded USN screening in health care settings.

CC 2.7: Yi

Seizures in Adult Patients on Venovenous Extracorporeal Membrane Oxygenation Support: Analysis of the Extracorporeal Life Support Organization Registry

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Introduction: Seizure epidemiology in adults supported with venovenous extracorporeal membrane oxygenation (VV-ECMO) remains poorly defined due to limited electroencephalography (EEG) monitoring and diagnostic challenges in critically ill patients. While acute brain injury (ABI) is known to worsen outcomes, data on seizure incidence, risk factors, and mortality impact in this population are limited. Using the ELSO Registry (2018–2025), this study aimed to determine seizure incidence, detection methods, and associated risk factors, and to evaluate their relationship with mortality and ABI subtypes, including ischemic stroke, hypoxic-ischemic brain injury, intracranial hemorrhage, and brain death.

Methods: A retrospective cohort study was conducted using data from 25,353 adult VV-ECMO patients (median age: 47.3 years; 64.5% male) from 2018-2025. Seizures were identified through either EEG or clinical determination. Patients were stratified by seizure status, and comparative analyses were performed across demographics, pre-/on-ECMO physiological parameters, and neurologic outcomes. Mortality and survival distributions were evaluated accordingly.

Results: Of the 25,353 patients, 195 (0.8%) experienced seizures, with 71 (36.4%) detected by EEG, 142 (72.8%) by clinical signs, and 18.5% detected by both modalities. Patients with seizures were younger (median age: 44.2 vs. 47.4 years, p = 0.001), had lower BMI (29.2 vs. 30.6 kg/m², p = 0.004), and presented with more severe acidemia (pre-ECMO pH: 7.25 vs. 7.27, p = 0.008) and higher lactate levels (2.50 vs. 1.80 mmol/L, p = 0.001). On-ECMO, seizure patients showed higher systolic blood pressure (120 vs. 116 mmHg, p = 0.025), altered gas exchange (higher PaO_2 and lower $PaCO_2$), and elevated lactate levels ($p < 0.05$ for all).

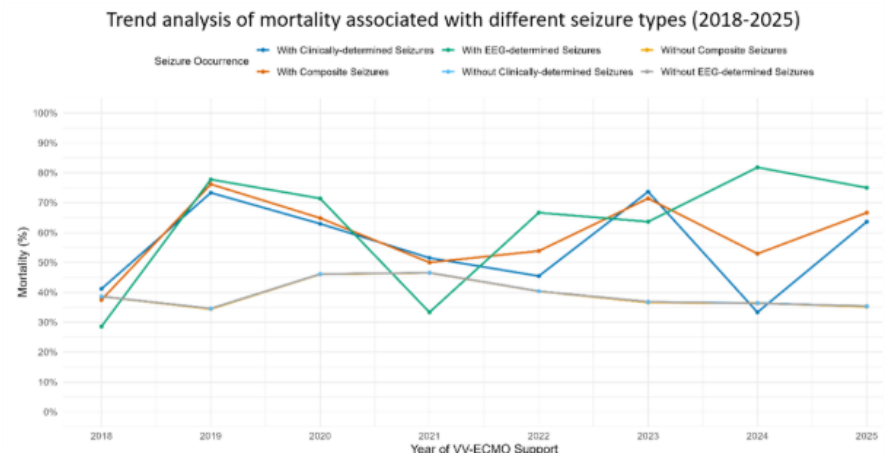

Figure 1. Yearly trend in mortality among adult VV-ECMO patients, stratified by seizure occurrence and detection method (2018–2025).

Discussion: Seizures following VV-ECMO were uncommon (0.8%) but associated with physiologic instability and markedly worse neurologic outcomes, including higher rates of ABI and mortality. EEG monitoring remains underutilized but critical in detection. The strong association with ABI subtypes suggests a shared pathophysiologic mechanism linking hypoxemia, CO_2 retention, and metabolic instability to seizure occurrence. These findings emphasize the need for standardized neuromonitoring protocols and early EEG surveillance to improve detection and optimize management in adult VV-ECMO patients.

CC 2.11: Yi

CO2 and pH changes and their impact on acute brain injury in VV-ECMO: Analysis of the Extracorporeal Life Support Organization Registry

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Introduction: Rapid normalization of severe hypercapnia and acidemia is routine during venovenous ECMO (VV-ECMO), yet such abrupt shifts may precipitate acute brain injury (ABI), including intracranial hemorrhage. Prior studies link large $PaCO_2$ reductions to ABI, but $PaCO_2$ does not fully represent cerebral acid–base stress, especially when metabolic acidosis coexists. Because intra- and extracellular pH directly modulate ion channels, cerebral blood flow, and neuronal viability, we hypothesize that pH change better predicts ABI in adult VV-ECMO than PaCO2 change.

Methods: Using the international Extracorporeal Life Support Organization (ELSO) Registry, we retrospectively identified all adults (≥18 yr) cannulated for VV-ECMO between 2018 and 2025 for acute respiratory failure or ARDS (ICD-10 J96.0x, J80). Pre-cannulation and 24-hour laboratory values ($PaCO_2$, pH, HCO_3^-), hemodynamics, and organ-support variables were abstracted. The primary outcome was composite ABI as defined by ELSO (brain death, ischemic or hemorrhagic stroke, diffuse hypoxic-ischemic injury).

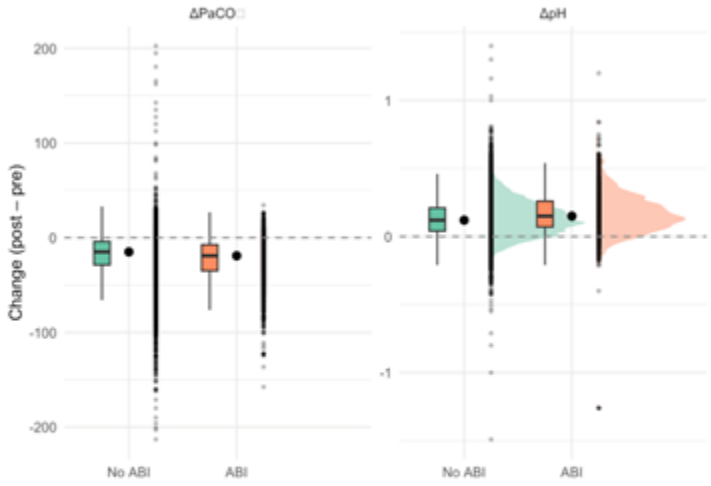

Figure 1. Rain-cloud plots of ΔpH and $\Delta PaCO_2$ by ABI status show that patients who developed acute brain injury experienced larger 24-hour pH rises and greater $PaCO_2$ reductions than those without ABI.

Results: We analyzed 27 125 adult VV-ECMO runs; 2 559 (9.4%) were complicated by acute brain injury (ABI). Baseline demographics were comparable across groups, yet patients who developed ABI displayed higher body-mass index (33 ± 11 vs 32 ± 11 kg m^{-2}, p<0.001), higher $PaCO_2$ (68 ± 24 vs 63 ± 23 mm Hg, p<0.001), and lower pH (7.22 ± 0.14 vs 7.26 ± 0.13, p<0.001). Over the first 24h post-cannulation, median $PaCO_2$ declined from 59 [48–74] to 43 [38–49] mmHg (Δ –15 [–29 to –4]; p<0.001) while pH rose from 7.30 [7.24–7.33] to 7.40 [7.37–7.42] (Δ +0.10 [0.0–0.20]; p<0.001). Both gas-exchange shifts were significantly larger among ABI cases ($\Delta PaCO_2$ and ΔpH, $p=1.7\times10^{-22}$ and 9.7×10^{-24}). Multivariable logistic regression identified lower baseline pH (OR 0.91 per 0.1-unit increase, 95% CI 0.83–0.98) and higher pre-cannulation lactate (OR 1.05 per mmol L^{-1}, 95% CI 1.04–1.07) as independent predictors of ABI.

Discussion: Neurologic sequelae after VV-ECMO appear to stem more from the patient's pre-cannulation physiologic milieu than from the subsequent speed of gas correction. Baseline markers of global metabolic stress—profound acidemia and hyperlactatemia—were the strongest correlates of acute brain injury, whereas the absolute or relative changes in $PaCO_2$ and pH lost independent influence once these factors were considered. Hence, pronounced gas shifts may primarily signal, rather than cause, cerebral vulnerability. Although limited by its retrospective nature and potential under-recognition of subclinical events, our large, registry-based analysis supports refocusing preventive efforts on optimizing perfusion and cautiously reversing acidemia in future prospective studies.

Global Disparities in Neonatal Sepsis Mortality Across Socio-Demographic Index Levels

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Introduction: Neonatal sepsis remains a significant cause of preventable neonatal mortality worldwide, disproportionately affecting infants born in low-resource settings. Understanding mortality trends through the lens of the socio-demographic index (SDI) provides insight into progress achieved and persistent inequities in neonatal care.

Methods: Mortality rates attributable to neonatal sepsis were extracted from the Global Burden of Disease (GBD) study and examined across five SDI quintiles (high, high-middle, middle, low-middle, and low SDI) from two time periods: 1990-1994 and 2016-2020. Trends were compared to assess absolute and relative improvements across global developmental strata.

Results: Neonatal sepsis mortality rates declined across all SDI categories between 1990-1994 and 2016-2020, reflecting global advances in infection prevention, perinatal care, and antimicrobial access (Figure 1). In high-SDI regions, deaths fell from 0.453 to 0.158, while in low-SDI regions mortality rates decreased from 20.568 to 11.905. Despite these gains, the relative mortality in low-SDI in countries remained over 70-fold higher than in high-SDI countries. Likewise, low-middle SDI countries saw rates decline from 10.095 to 4.566, while still maintaining elevated mortality rates relative to higher SDI settings.

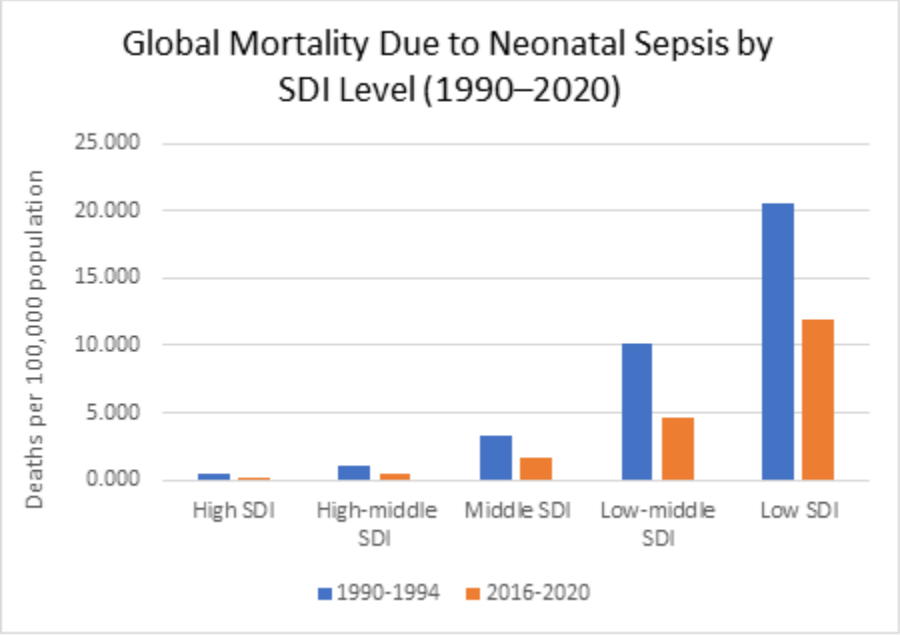


Figure 1. Trends in global mortality due to neonatal sepsis among five SDI quintiles

Discussion: Global reductions in neonatal sepsis mortality mortality signify progress in infection control, obstetric care, and neonatal intensive care capacity. However, the enduring mortality gap between SDI groups highlights the moral and public health imperative to strengthen neonatal care systems, ensure equitable antibiotic distribution, and enhance surveillance and maternal education in low-income countries. Addressing these disparities is essential to achieving the sustainable development goals for neonatal survival and health equity.

Abstracts: Informatics, AI, Engineering, & Technology

AIT 1.8: Acha

Tubular Biosensors for Critical Medicine

Chris Acha BS[1], Samantha Ho[2], David H. Gracias PhD[1,3,4,5,6,7], Lewis H. Romer MD[2,8,9,10,11]

Department of [1]Chemical and Biomolecular Engineering, [2]Department of Biomedical Engineering, [3]Center for MicroPhysiological Systems (MPS), [4]Department of Oncology, [5]Sidney Kimmel Comprehensive Cancer Center (SKCCC), [6]Department of Materials Science and Engineering, [7]Department of Chemistry, [8]Department of Anesthesiology and Critical Care Medicine, [9]Department of Cell Biology, [10]Department of Pediatrics, and the [11]Center for Cell Dynamics, Johns Hopkins University, Baltimore, MD, USA.

Introduction: The human body incorporates millions of miles of tubular tissues, including vascular, urinary, mammary, gastrointestinal, and respiratory tissues. The complex micromorphology of these cell-laden tubes presents challenges to the creation of in vitro models for drug discovery due to limitations in patterning and assembling anatomically accurate, curved and cell-layered structures. To address these challenges, we are utilizing an interdisciplinary approach that combines novel self-folding of tubular sensors within multiple cellular layers.

Methods: We pattern wires and electrodes using photolithography within strain-engineered self-rolling SU8 bilayers. We use Au electrodes and conductive polymer matrix Poly(3,4-ethylenedioxythiophene) polystyrene sulfonate (PEDOT: PSS) contact pads. We will first validate the sensors with electrochemical impedance spectroscopy (ECIS) on hydrogels loaded with chemicals (e.g., nitrates, dopamine) to demonstrate biosensor sensitivity, then validate barrier function as measured by ECIS monitoring using cell layers from the vascular wall (endothelial cells with and without smooth muscle cells).

Results:

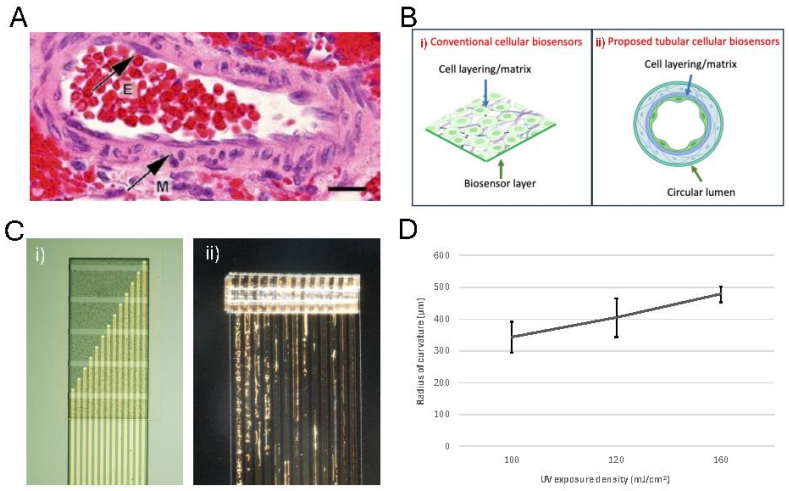


Fig. 1 Prior results and schematics of self-rolling tubular cell laden biosensors with accurate layering, functional electrical biosensors and tunability radius of curvature.

Discussion: Self-rolling is an innovative, bioinspired process reminiscent of the natural self-assembly observed in tissue formation during morphogenesis and embryogenesis. It incorporates high precision and micropatterning capabilities from the semiconductor chip industry. Our approach involves employing ECIS to meticulously monitor the barrier integrity of biomimetic vascular walls, which are composed of precisely layered components. We will explore both flat (without roll-up control) and curved (with roll-up control) configurations. This study will rigorously assess the effects of various factors, including diameter, extracellular matrix constituents, and cytokine exposure, on barrier integrity. By doing so, we aim to enhance our understanding of cellular behavior in curved environments, thus contributing significantly to the field of tissue engineering and regenerative medicine.

AIT 2.5: Ahmed

Identification of Apolipoprotein-Related Coagulation & Complement Pathway Genes Linked to VA-ECMO Outcomes

Yaman B. Ahmed M.D.[1], Mingfeng Cao PhD[2], Glenn Whitman M.D.[1], Sung-Min Cho DO, MHS[1]
[1]Johns Hopkins Hospital, [2]Johns Hopkins University Biomedical Engineering

Introduction: Coagulopathy and complement activation contribute to Veno-Arterial extracorporeal membrane oxygenation (V-A ECMO) failure, yet molecular predictors remain poorly defined.

Methods: We analyzed two transcriptomic datasets (GSE93101 and GSE182600) from the Gene Expression Omnibus comprising 33 V-A ECMO patients. ECMO failure was defined as death or inability to wean off ECMO within 30 days, while success denoted survival with successful decannulation **(Figure 1)**. Differentially expressed genes (DEGs) were identified at ECMO initiation and 2 hours post-initiation using GEO2R ($|\log_2 FC| \geq 1.2$, $p<0.05$). Coagulation and complement pathway (CCP)-related genes were curated from the Molecular Signatures Database. DEGs were intersected with CCP-related genes, and key features were selected using three machine learning models: LASSO regression, Random Forest, and Support Vector Machine. Co-expression networks and pathway enrichment were assessed using STRING and clusterProfiler.

Results: Of 33 patients (mean age 50.0±14.3 years, 69.7% male), 16 experienced ECMO failure. The most common diagnoses were myocardial infarction (42%) and dilated cardiomyopathy (18%). Among 22 significant DEGs, APOC1and APOC3 were consistently identified across all models. At 0 h, median normalized expression levels of APOC3 were 4.25 vs 1.98 (p=0.003), and APOC1 were 1.23 vs 0.73 (p=0.012). At 2 h, APOC3 remained elevated (p=0.004), as did APOC1 (p=0.020). Enrichment analysis revealed networks involving lipid metabolism, cholesterol transport, PPAR signaling, and lipoprotein remodeling.

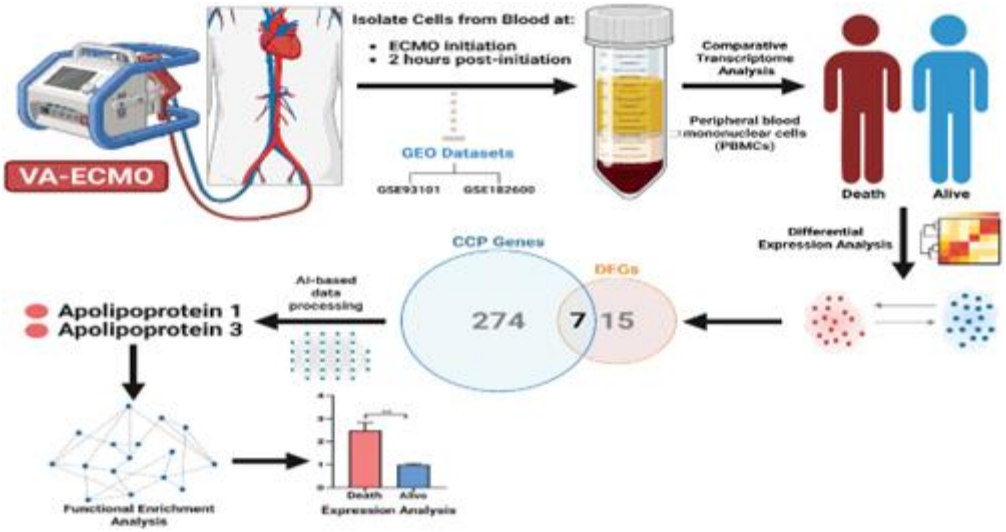


Figure 1. Workflow for identifying apolipoprotein-related coagulation and complement pathway genes associated with VA-ECMO outcomes. PBMC transcriptomes at ECMO initiation and 2 h were analyzed; DEGs intersected with CCP genes, followed by machine-learning selection and enrichment analysis.

Discussion: APOC1 and APOC3 are early biomarkers of ECMO failure and are implicated in lipid-mediated complement/coagulation dysregulation. These findings offer novel mechanistic insight and may support future precision medicine strategies for ECMO patient risk stratification.

AIT 2.2: Ascani Orsini

Binaural beats as Bedside Arousal Probe for Conscious Perception Across Hemispheres

Alessandro Ascani Orsini BS,[1] Siyu Wang MS,[2,3] Chang Liu BS,[2] Beichen Shen BS,[2] Nitish Thakor BS,[1,2] Sung-Min Cho D.O., M.H.S. [2,3]

[1]Johns Hopkins University Whiting School of Engineering, [2]Johns Hopkins University School of Medicine, [3]Johns Hopkins Hospital

Background: Disorders of consciousness (DOC), including coma and minimally conscious states, present critical challenges in intensive care due to the scarcity of reliable neurophysiological markers of arousal and awareness. Traditional evoked potential measures, such as the auditory steady-state response (ASSR), provide valuable insights into cortical synchrony but require cumbersome EEG setups and lack adaptive, bedside applicability.

Methods: Binaural beats are an auditory phenomenon perceived when two slightly different pure tones are presented separately to each ear which produce an illusory “beat” at the frequency difference, capable of inducing cortical entrainment. Unlike conventional amplitude-modulated tones that primarily assess cortical reactivity, binaural beats engage bilateral and subcortical auditory pathways, requiring neural integration across hemispheres and the brainstem. This cross-network processing makes them uniquely sensitive to the integrity of the arousal and perceptual systems that support consciousness. We introduce a novel bedside approach combining binaural beat stimulation with Cortico-Temporal Auricular Activity (CTAA) recording, a near-ear electrophysiological signal that captures auditory cortical reactivity. The system delivers controlled binaural beat stimulation (20–40 Hz in 5 Hz intervals) while recording CTAA and peripheral physiological signals to assess real-time brain responsiveness and quantify residual auditory entrainment in DOC patients through phase-locking and power modulation metrics.

Results: Preliminary validation in healthy participants (n = 3) demonstrated robust phase coherence at the beat frequency, consistent with cortical entrainment patterns observed in conventional 40 Hz ASSR. Pilot ICU recordings will assess the feasibility of stable CTAA acquisition in high-noise clinical environments and explore spectral differences between sedated and awakening states. Early observations indicate transient re-emergence of 40 Hz synchronization coinciding with behavioral recovery, suggesting binaural-beat–evoked CTAA as a potential early biomarker of arousal.

Discussions: These findings support the feasibility of using binaural beats as a passive arousal probe in critical care. The integration of near-ear cortical monitoring with adaptive auditory stimulation may provide a scalable, non-invasive tool to detect covert consciousness and track neural recovery trajectories in patients with disordered states of awareness.

AIT1.1: Collins

Processed electroencephalograms for sedation monitoring in the pediatric intensive care unit: a scoping review

Candace Collins MD[1], Divya Manikandan BS[2], Katie Lobner MLS[3], Jim Fackler MD[1], Sue Hong MD[1], Jessica LaRosa MD[1]

[1]Department of Anesthesiology and Critical Care Medicine, Johns Hopkins Children's Center [2]Johns Hopkins School of Medicine [3]Johns Hopkins School of Medicine Welch Medical Library Informationist Services

Introduction: Processed electroencephalograms (pEEGs) monitors in the form of commercially available depth of anesthesia monitors may offer an objective method to monitor sedation for critically ill children in the pediatric intensive care unit (PICU). These tools were initially designed about three decades ago for monitoring depth of anesthesia in the operating room, but have since expanded their use to intensive care settings, including the pediatric intensive care unit, where patients often require prolonged periods of sedation. We seek to understand the current landscape of pEEG use for sedation monitoring in the pediatric intensive care unit through this scoping review.

Methods: Searches on PubMed, Embase, SCOPUS, and CINAHL, were conducted on August 14, 2025. Studies were included if they (1) evaluated the use of processed EEGs for sedation monitoring, (2) focused only on the intensive care unit setting, (3) were based in a neonatal or pediatric population, and (4) were written in English. Studies that used processed EEG for seizure monitoring were excluded. Search terms included "depth of anesthesia monitors" with specifications for "EEGs," including processed EEGs and amplitude integrated EEGs, in critically ill children. Names of commercial EEG-based sedation monitors were also included, such as bispectral index (BIS), Masimo SedLine, Entropy, Narcotrend, SNAP, and Neurosense. Two reviewers conducted title and abstract screening (CC and DM) and any discrepancies were resolved by a third review (JML). Full text review and data extraction will be performed by the same reviewers with anticipated completion by December 2025.

Results: Our search on August 14th, 2025 yielded 675 studies from 1984 to 2025 of which 97 met criteria on title and abstract screening. These are currently under full text review. Full results of the screening process should be completed within the next few weeks.

Discussion: Despite the continued development and study of EEG-based depth of anesthesia monitors in pediatric intensive care settings for about 20 years, the literature lacks an updated, comprehensive scoping or systematic review. The previous review article was completed in 2012 and only included studies that evaluated BIS monitors. We anticipate that this scoping review will provide an overview of current practices in pEEG use for sedation monitoring in PICUs and will identify gaps in the literature that highlight areas of future investigation.

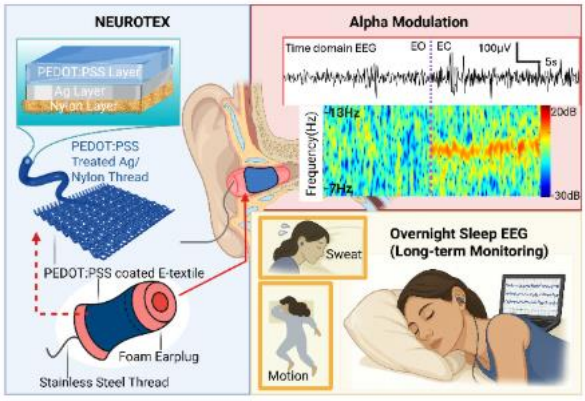
AIT 1.2: Liu

NeuroTex: Functionalized Hybrid Polymer-Metal Textile for Soft, Robust, and Dry Auricular Neural Interfaces

Chang Liu[1], Alessandro Ascani Orsini[2], Pierce L. Perkins[1], Haoyu Xu[1,2], Sung-Min Cho[3], and Nitish V. Thakor[1,2]

[1]Department of Biomedica Engineering, Johns Hopkins University, [2]Departement of Electrical and Computer Engineering, Johns Hopkins University, [3]Department of Anesthesiology and Critical Care Medicine, Johns Hopkins Hospital

Background: Wearable bioelectronic interfaces must maintain high conductivity, low electrode–skin impedance, and reliable electrode–electronics coupling under sweat, motion, and prolonged use. Metallic textiles offer good conductivity and stable connections but are hydrophobic, prone to cracking and oxidation, and dependent on conductive gels to achieve the low impedance required for low-amplitude electrophysiological signals. Gel dependence also introduces additional limitations, including slow application and dehydration over time, reducing practicality for long-term wear.



Methods: Here, we introduce NeuroTex, a PEDOT:PSS-functionalized silver nanowire textile that engineers the electrode–skin–electronics interfaces to overcome these challenges. The PEDOT:PSS coating reduced resistance by almost 50% (0.27 vs. 0.47 Ω·cm²), suppressed oxidation in phosphate-buffered saline, and lowered contact impedance by more than 85% compared to metallic textiles without gel(89.3 vs. 639 kΩ at 15 Hz). Mechanical evaluations under torsion, stretching, bending, and low-force fatigue confirmed preserved fiber integrity, stable resistance, and robust electrode–lead connections enabled by the customized sewing pattern.

Results: Wettability and breathability measurements showed enhanced hydrophilicity without moisture accumulation, supporting conformal skin interfacing. Integrated into an in-ear platform, NeuroTex enabled multimodal biosignal recordings of in-ear electroencephalography (ieEEG), electrooculography (EOG), electromyography (EMG), and electrocardiography (ECG). Reliable acquisition of the technically demanding ieEEG signal was achieved, demonstrating alpha-modulation responses consistent with gel-based electrodes. Overnight ieEEG recordings capturing distinct sleep patterns further confirmed stable performance during natural sleep.

Discussion: These results establish NeuroTex as a gel-free, mechanically resilient, and electrochemically stable interface suitable for long-term ieEEG monitoring.

AIT 2.7: O'Conor

Big Data Driving Better Care: JHM ACCM and the MPOG Consortium

Katie J. O'Conor MD MBA, Tracey Stierer MD, and the MPOG Steering Committee*
Johns Hopkins University School of Medicine,
Department of Anesthesiology and Critical Care Medicine

Introduction: The Multicenter Perioperative Outcomes Group (MPOG) is a collaborative research and quality improvement consortium that integrates electronic health record (EHR) data from academic and community hospitals around the world. MPOG harmonizes detailed perioperative data from healthcare institutions to enable large-scale research, benchmarking, and evidence-based improvement in anesthetic and surgical care. By leveraging a robust, standardized data infrastructure, MPOG facilitates multicenter studies, supports performance improvement initiatives, and promotes best practices in perioperative care.

Methods: Johns Hopkins Medicine (JHM) Department of Anesthesiology and Critical Care Medicine (ACCM) contributes EHR data to the MPOG platform via extraction from Epic, post-processing, quality control, and transfer. Data available include minute-to-minute perioperative physiologic data, medication administration records, case events and timestamps, laboratory values for one year pre/post case, national quality measures, and standardized outcome data. There are multiple mechanisms available for ACCM and JHM colleagues to utilize MPOG data, by working with the MPOG team (and the ACCM Clinical Research Core (CRC) when needed):

- Multicenter prospective trials
- Multicenter retrospective research projects
- Singlecenter (JHM) research projects
- Singlecenter (JHM) quality improvement and clinical operations projects
- Individual practice insights via monthly provider feedback emails

Results: The JHM MPOG dataset contains over 400,000 cases from contributing sites Johns Hopkins Hospital, Bayview Medical Center, Howard County Medical Center, and All Children's Hospital from September 2020 to present. Over 61 project inquiries have been initiated since the launch of JHM MPOG in 2024, including representation from all ACCM anesthesiology divisions and participation by faculty, fellows, CRNAs, residents, and administrators.

New Project Inquiries by Quarter	23-24Q3	23-24Q4	24-25Q1	24-25Q2	24-25Q3	24-25Q4	25-26Q1	Total
Multicenter Prospective Trials - Invitations from Lead Sites	0	0	1	0	2	1	0	4
Multicenter Retrospective- Invitations from Lead Sites	0	0	0	0	0	4	1	5
Multicenter Retrospective Studies - Originated by JHM	1	0	2	4	1	0	2	10
Singlecenter JHM Research Studies	4	1	3	6	6	1	2	23
Singlecenter JHM Quality Improvement & Clin Ops Projects	1	3	3	3	3	2	4	19
All Project Inquiries	6	4	9	13	12	8	9	61

Projects by Status	Completed	Active Analysis	Project Prep, IRB or Grant Pending	On Hold by PI	Not Feasible	Total
Multicenter Prospective Trials - Invitations from Lead Sites	0	0	3	0	1	4
Multicenter Retrospective- Invitations from Lead Sites	0	0	5	0	0	5
Multicenter Retrospective Studies - Originated by JHM	0	1	7	2	0	10
Singlecenter JHM Research Studies	1	5	10	4	3	23
Singlecenter JHM Quality Improvement & Clin Ops Projects	3	9	5	2	0	19
All Projects	4	15	30	8	4	61

Discussion: The MPOG platform provides numerous avenues for advancing clinical care and science through research, quality improvement, and clinical operations analysis. Please reach out to Dr. O'Conor or the CRC to explore project possibilities.

**MPOG Steering Committee: Katie O'Conor, Tracey Stierer, Jake Abernathy, Nadia Hensley, Rahul Koka, Paige McMurtrie, Robert Stevens, Nick Dalesio, Neeraj Kumar, Athir Morad, Simer Bains, Shivani Patel, Anjana Sekaran, Ric Rivers, Colleen Mennie, Josh Rudnicki, Mela Bembea, Mo Rehman; collaborators: Nauder Faraday, Jim Fackler*

AIT 2.6: Sailesh

A Robust AI Pipeline for Analysis of Various Animal Behavioral Tests through DeepLabCut Computer Vision

Shreyas F Sailesh,[1] Theresa Aguilar,[1] Varsha Arun,[2] Javier Allende Labastida, MD, MPH, PhD,[3] Spencer Shumway, MSE, BS,[4] Sujatha Kannan, MD[3]

[1]Krieger School of Arts and Sciences, Johns Hopkins University, [2]Bloomberg School of Public Health, Johns Hopkins University, [3]Anesthesiology and Critical Care Medicine, Johns Hopkins School of Medicine, [4]Center for Nanomedicine, Johns Hopkins School of Medicine

Background: Animal behavior is a fundamental component of neuroscience research and is instrumental in the functional assessment of disease and treatment effects. However, the analysis and interpretation rely on the experience of the observer, which is time consuming and adds a level of subjectivity. Automated behavioral analysis greatly reduced subjectivity and the requirement for independent observers. The current market solutions for automated behavioral analysis, like ANY-maze, are limited by their high cost, inflexibility, and tracking inaccuracies. We are optimizing an AI pipeline for rat behavioral analysis in various environments that integrates the open-source python library DeepLabCut with advanced post-processing algorithms.

Methods: To address the tracking inaccuracies, we used a k-means clustering algorithm to identify the most common positions of the rat from video data and labeled key body parts across hundreds of frames to train a 50-layer convolutional neural network. Successive rounds of hyperparameter optimization were conducted to improve tracking. When the algorithm was tested on video recordings of the Elevated Plus Maze test (EPM), the resulting model returned a root mean square error of 3.04% on a separate set of videos, demonstrating the model's reliability in body part tracking.

Results: A major bottleneck in single animal experiments is interpreting tracking data to derive model-specific behavioral measures. Our post-processing algorithms automatically record these metrics for a variety of mazes. For EPM, we used the collected positional data to track the amount of time the rat spent in user-defined zones of the maze. This basic pipeline extends to other single-animal mazes like the Y-maze spontaneous alternation, Barnes Maze, or Morris Water Maze due to the high transferability of DeepLabCut models.

Discussions: The scope of this research goes beyond single-animal positional analysis, as DeepLabCut models recognize multiple animals in a single environment. We are training a new model to track and identify multiple animals within social interaction tests to record social interaction duration. Besides locational analysis, we are additionally creating models for behavior identification for complex experiments like the forced swim test, tail suspension test, and open field test by implementing a clustering algorithm on tracked position data to find common motion primitives in a test video. From these motion primitives, we can define which combinations correspond to specific animal behaviors. These behavior tracking algorithms also extend to 3D representations. For open field analysis, we are optimizing the use of two cameras to record the 3D position of each body part and derive motion primitives for behavior tracking.

We are currently testing these models against an existing computer vision tool, ANY-maze, as well as against manual human analysis. These DeepLabCut models have proven to surpass ANY-maze in tracking reliability and approach human-level accuracies in a fraction of the time.

AIT 2.3 Schramm

Machine learning predicts post-operative necrotizing enterocolitis in neonates with congenital heart disease

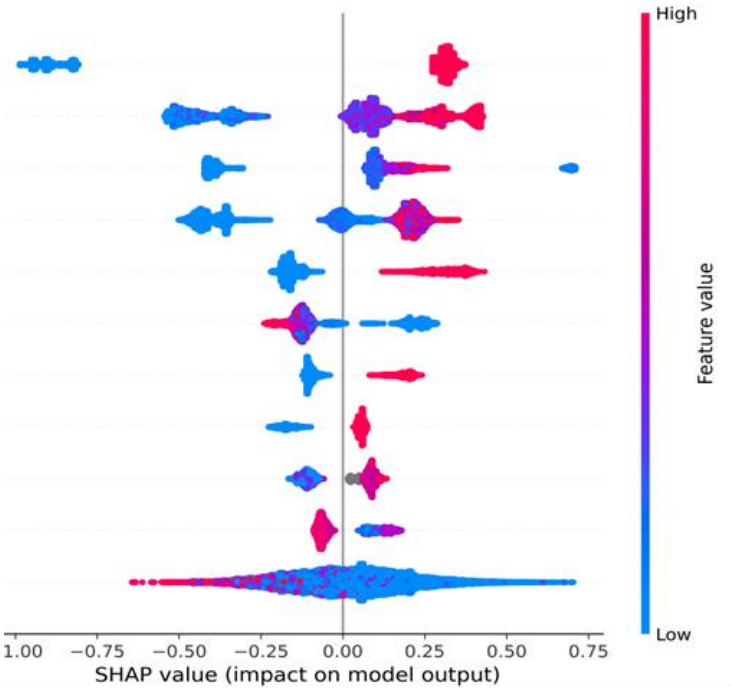
Jennifer E. Schramm, MD[1]; Bhargava Chinni, MS; Garrett Reichle, MS[2] ;Kurt Schumacher, MD, MS[2] ;Cedric Manlhiot, PhD[3]; Renee Willet, MD[4] ;Anita Krishnan, MD[5]; Guillermo Torres-Viera, MD[1] ;Justin Yeh, MD[6]; Ashley Moellinger, PNP-AC[7]; Jennifer B. Fundora, MD, MHS[1]; Hayden Zaccagni, MD[8]; Andrew Smith, MD, MSCI, MMHC, MS[9]; Julie Nogee, MD[10]; Betsy Kannen, PNP-AC[1]; Eric Graham, MD[11]; Darren Klugman, MD[12]; Sarah Tabbutt, MD, PhD[13]; Melania Bembea, MD, PhD, MPH[1*]; Allen D. Everett, MD[1*]

[1]Johns Hopkins University School of Medicine; [2]University of Michigan; [3]Department of Pediatrics at SickKids Toronto; [4]Children's Hospital of Philadelphia; [5]Children's National Medical Center; [6]Children's Hospital of Orange County; [7]Children's Hospital of Alabama; [8]UT Southwestern Medical Center; [9]Monroe Carell Jr Children's Hospital; [10]Greaer Baltimore Medical Center; [11]Medical University of South Carolina Children's Hospital; [12]CalmWave; [13]Benioff Children's Hospital; *Co-senior authors

Background: Necrotizing enterocolitis (NEC) is a complication of care in neonates with congenital heart disease (CHD) associated with high mortality, prolonged hospitalization, and significant resource utilization. Due to its rarity and complex pathophysiology, robust risk prediction has been challenging. Leveraging a large, multicenter registry, the Pediatric Cardiac Critical Care Consortium (PC4), we applied machine learning to comprehensively describe risk factors for post-operative NEC in neonates.

Methods: We retrospectively analyzed data from the PC4 registry across 70 centers, focusing on neonates who underwent index surgical intervention at less than 30 days of life and developed NEC within the first 31 days postoperatively. Neonates with gastrointestinal anomalies were excluded. The analytic group included 356 cases of NEC with 1,039 unmatched controls. The group was then randomly split into a training cohort (80%) and a test cohort (20%). The data was cleaned, time constructed, and parsed into 72-hour windows. We utilized Extreme Gradient Boosting (XGBoost) to review all 437 features available using Shapley Additive Explanations (SHAP) values.

Results: The model achieved strong overall performance, with an AUC of 0.79 for the test cohort and an observed-to-expected ratio of 1.03 to 1, indicative of excellent discrimination and calibration. The most influential predictor was the surgical procedures performed after the index operation, closely followed by the Society for Thoracic Surgeons (STAT) category. Features suggesting more critical illness pre- and post-operatively were also highly influential (i.e., duration of open chest, longer mechanical ventilation times, use of a peripheral arterial line).



Conclusion: This study demonstrates the utility of an XGBoost-based machine learning approach to predict NEC risk in neonates after cardiac surgery. Importantly, the model identified both fixed and potentially modifiable factors that contribute to NEC risk and identifies features descriptive of our most critically ill and vulnerable neonates. These findings may inform future interventional strategies aimed at NEC prevention and support the development of a prospective, real-time clinical risk prediction tool tailored to the neonatal cardiac intensive care population.

AIT 1.6: Shen

Quantitative EEG Assessment for ABI Detection in ECMO Patients

Beichen Shen, BS,[1] Mingfeng Cao, MS,[1] Jeffery Wang, MD[2], Xiaoyan Zhu, MD[3], Sungmin Cho, DO[2]

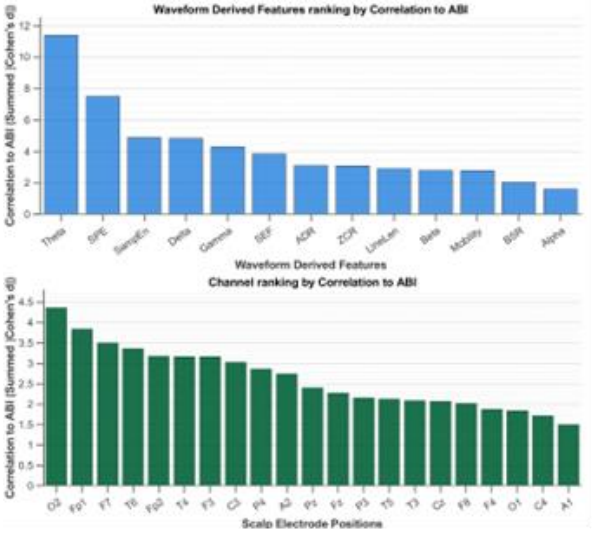
[1]Department of Biomedical Engineering, Johns Hopkins University, Baltimore, USA

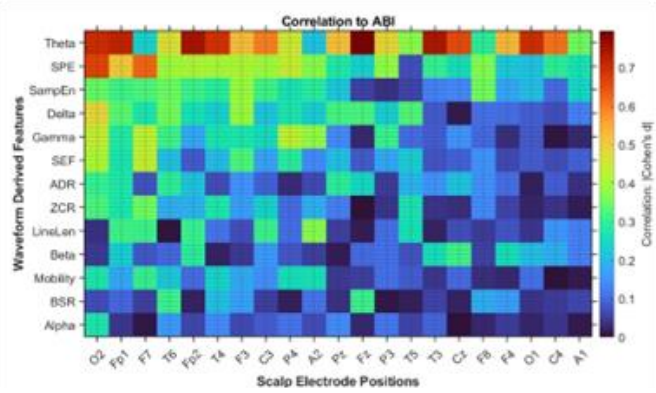
[2]Johns Hopkins University School of Medicine, Baltimore, USA

[3]Affiliated Hospital of Qingdao University, Qingdao, China

Introduction: Acute Brain Injury (ABI) affects about one-third of ECMO patients and is linked to high mortality and long-term neurological deficits. Conventional imaging such as CT or MRI is limited by cost, radiation, and lack of real-time capability. In contrast, EEG provides continuous, real-time monitoring of brain activity, enabling early detection of cortical dysfunction and evolving injury, making it a promising tool for ABI assessment in ECMO patients.

Methods: We retrospectively analyzed EEG recordings from 57 ECMO patients (VA and VV), including 21 with neuroimaging-confirmed acute brain injury (ABI). Standard scalp EEG leads covering frontal, central, parietal, and temporal regions were examined. Quantitative features were extracted to capture diverse aspects of brain dynamics, including five sub-band relative powers (δ, θ, α, β, γ), alpha/delta ratio (ADR), spectral entropy (SPE), spectral edge frequency (SEF), line length, zero-crossing rate (ZCR), sample entropy, burst suppression ratio (BSR), and Hjorth mobility.





Results: EEG feature analysis revealed that theta-band power, spectral entropy (SPE), and sample entropy (SampEn) showed the strongest correlations with ABI, followed by delta and gamma power. Occipital (O2) and frontal (Fp1, F7) electrodes exhibited the highest discriminative values, indicating region-specific sensitivity. Overall, ABI patients showed increased low-frequency power and reduced EEG complexity across channels.

Discussion: These results suggest that ABI during ECMO is marked by cortical slowing and decreased signal complexity. Spectral and entropy-based features effectively captured these abnormalities, highlighting their value for detecting global brain dysfunction. The strong performance of frontal and occipital leads further suggests potential for simplified EEG setups in real-time ABI monitoring.

AIT 2.1: Tandri

Towards modular ultrasound and photoacoustic based monitoring in critical care: feasibility studies

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Introduction: Wearable devices are at the forefront of healthcare technology; such devices are becoming increasingly essential in various fields due to their ability to enable early diagnosis and personalized treatment through continuous provision of data. As structural and functional imaging is key to disease diagnosis and critical care condition monitoring, ultrasound (US) and photoacoustic (PA) imaging have emerged as key players for longitudinal imaging, despite the reliance on trained operators for image acquisition. Flexible ultrasound arrays have been developed to tackle this issue, but they are limited due to small aperture size and the unsolved issue of array geometry mapping. Through the development of a modular form-factor for US and PA that relies on optically tracked geometry registration, we aim to address many of the shortcomings in probe and flexible-array based imaging and increase the use cases of acoustic imaging in a manner tailored to wearable longitudinal monitoring.

Methods: This study seeks to demonstrate the feasibility of optically tracked array geometry registration for imaging. A custom US module (Fig. 1a) was designed using a 1.2 MHz PVDF element for receive with 2-mm diameter, and a 1.35MHz ceramic piezoelectric element for transmit. Urethane-based material was used for low acoustic impedance potting of the elements. The inverse side of the module contained 4 850nm light emitting diodes (LEDs) that were position-registered by the Atracsys fusiontrak 500 optical tracking system, to determine the location of the module relative to a reference marker. This module was used for US imaging of a 0.7mm graphite lead in a synthetic gel hemispherical phantom.

Results and Discussion: The optical tracking provided stable spatial registration of the A-line data, enabling consistent target localization similar to use of ground-truth position (Fig 1b-1c) and supporting the feasibility of tracked single-element imaging for phantom-based validation. The mean absolute error in element spacing for optically tracked positions was 0.028 ± 0.019 mm. This study illustrates the feasibility of optically tracked disjoint modules for US imaging. Limitations include the decrease in contrast resolution with increased element spacing, given reduced element field of views (Fig 1d). Future work includes the application of machine learning-based methods for element interpolation to mitigate this limitation, and further phantom and animal model testing of critical care monitoring circumstances.

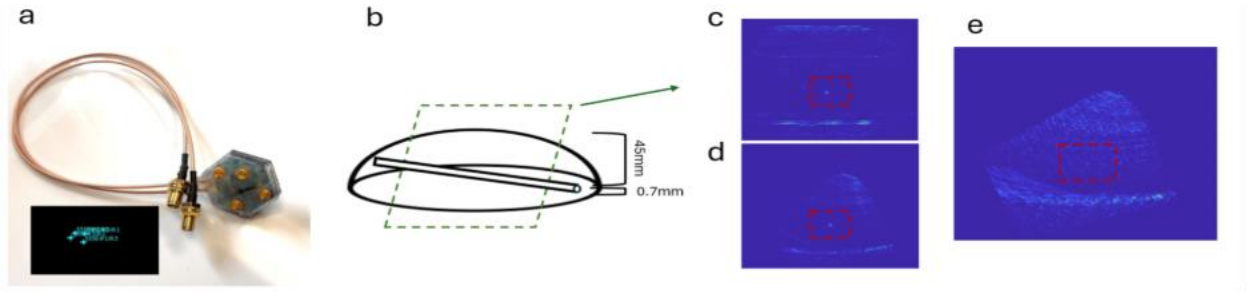

Figure 1 a) Custom module with transmit/receive elements, IR LEDs for optical tracking. Inset: Optical tracking of the module. b) Schematic of imaging phantom with graphite rod. c) Reconstruction with 0.5mm module spacing and ground truth positions. d) Optically tracked reconstruction with 5mm module spacing.

AIT 1.4: Wang

Digital Holographic Imaging as a Noninvasive Alternative to Arterial Lines: Comparative Validation Over Intact Skin and Exposed Arteries

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Introduction: Current gold-standard methods of cardiovascular (CV) monitoring rely on invasive arterial catheterization, which limits broader clinical use. Noninvasive approaches such as point-of-care ultrasound provide valuable but intermittent and operator-dependent measures. To create an optical non-invasive continuous monitoring solution, we assessed tissue motion measured at high spatiotemporal resolutions with a digital holographic imaging (DHI) system that was able to accurately characterize cardiac physiology. In this study we compared optical recorded tissue motion to continuously recorded arterial line recordings. Our study includes two complementary conditions: DHI imaging of an exposed formal artery to establish direct physiological correlation, and transcutaneous DHI imaging over intact skin to assess noninvasive feasibility. We aim to determine the translational potential of this technology.

Methods: Two recording conditions were studied across four rodents: transcutaneous (n = 16) and exposed artery (n = 15). All animals received a femoral arterial line to provide ground-truth arterial blood pressure (ABP). For exposed recordings, the DHI system targeted the contralateral exposed femoral artery; for transcutaneous recordings, it was positioned over intact skin proximal to the same site (**Fig. 1A**). DHI-derived ABP was estimated from vertical tissue displacement, and heart rate (HR) from its temporal derivatives. Optical signals were band-pass filtered (3–55 Hz) to remove signal drift, and ABP waveforms were calibrated to mean arterial pressure from the arterial line. Stroke volume (SV) was obtained from the systolic area of the ABP waveform, and cardiac output (CO) as CO = SV × HR. DHI-derived ABP and CO were compared to arterial-line values using coherence, correlation, and root mean square error (RMSE). Differences between exposed and transcutaneous recordings were evaluated using unpaired t-tests on these metrics.

Results: DHI imaging through intact skin achieved comparable accuracy to exposed-artery imaging for arterial blood pressure (ABP) estimation (coherence: 0.967 ± 0.010 vs 0.970 ± 0.008; correlation: 0.901 ± 0.080 vs 0.937 ± 0.045; RMSE: 5.780 ± 1.942 vs 5.169 ± 1.866 mmHg; $p > 0.14$ for all; **Fig. 1B**). In contrast, cardiac output (CO) estimation showed reduced performance through intact skin (coherence: 0.991 ± 0.011 vs 0.996 ± 0.011; correlation: 0.430 ± 0.380 vs 0.860 ± 0.146; RMSE: 8.018 ± 6.971 vs 3.157 ± 2.344 mL/min; $p = 0.0006$ and 0.0195 for correlation and RMSE; **Fig. 1C**).

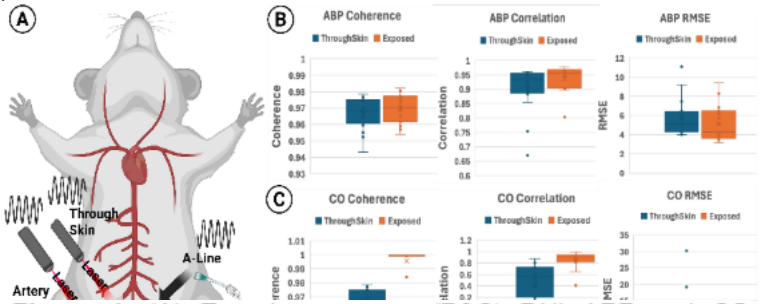

Figure 1. (A) Experiment setup (B&C) DHI ABP and CO waveform agreement with arterial line measurement

Discussion: Our DHI system accurately estimated clinically relevant cardiac physiology derived from both exposed and transcutaneous conditions. The strong agreement with arterial-line waveforms indicates that pressure-related tissue displacement can be captured through intact skin. In contrast, CO accuracy was reduced in the transcutaneous group, primarily due to HR error rather than stroke volume estimation. Because HR was derived from derivative of the displacement, attenuation of the velocity signal through skin likely dampened waveform peaks and impaired detection. Nonetheless, the mean correlation of 0.43 between transcutaneous DHI and arterial-line CO suggests initial feasibility and a clear path for optimization.

AIT 1.7: Wang

Auricular-Cardiogram: A Novel Strategy for Unobstructive Cardiac Monitoring

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Introduction: Continuous cardiac monitoring is essential in critical care, but standard electrocardiography (ECG) systems rely on adhesive chest leads that can interfere with procedures and patient management. Wearable photoplethysmography (PPG) devices avoid chest contact but cannot capture cardiac electrical activity and are limited to heart rate monitoring. To address these constraints, we propose the Auricular-Cardiogram (ACG), an ear-canal–based approach for unobstructive acquisition of electrocardiac signals. This study presents feasibility data from one intensive care unit patient, comparing ACG to gold-standard chest ECG.

Methods: One adult patient undergoing continuous electroencephalography monitoring in the Neuroscience Critical Care Unit was enrolled under IRB protocol IRB00448563. An in-ear electrode was placed in the left ear canal, and a reference electrode, also serving as the ground, was positioned on the left side of the neck (**Fig. 1A**). Recordings were conducted for three hours. ACG signals were acquired and analyzed in comparison with simultaneously recorded chest ECG, including assessments of waveform morphology and heart rate estimation.

Results: Distinct P and QRS waveforms were identifiable in the ACG and showed strong morphological correspondence with simultaneously recorded chest ECG (**Fig. 1B**). Averaged ACG traces (over 120 seconds segment of recordings) demonstrated R-peak amplitudes of approximately 513 μV, compared to 360 μV from the chest ECG. RR intervals derived from ACG closely match those from ECG (**Fig. 1C**), enabling accurate heart rate estimation, with a correlation of 0.941 and a root mean square error (RMSE) of 3.11 beats per minute (bpm) (**Fig. 1D**).

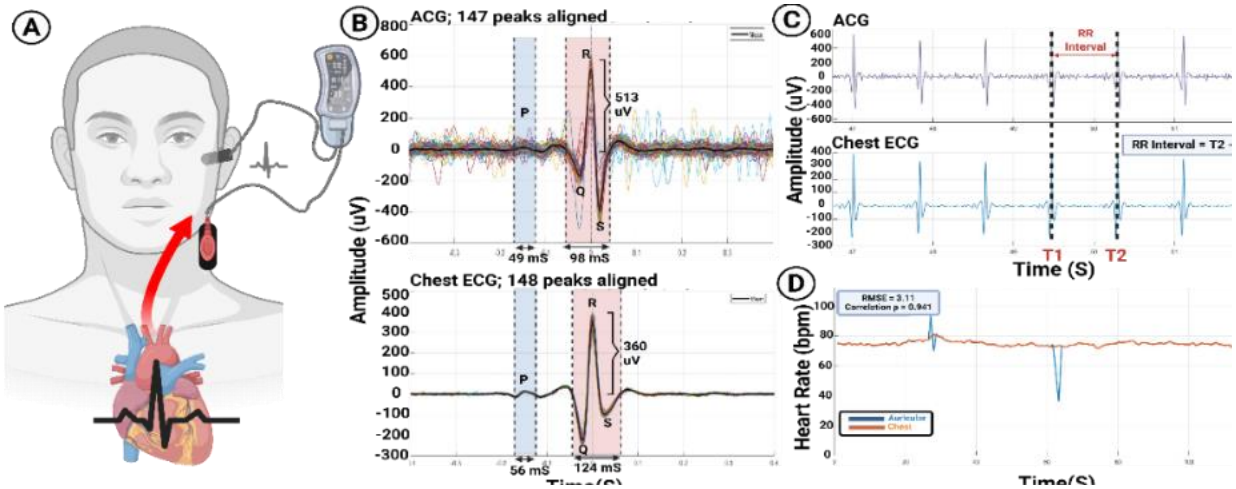

Figure 1. (A) Anatomical placement of the in-ear electrode relative to the heart. (B) Averaged ACG and chest ECG waveforms from a 120-second segment showing clear P and QRS complexes with preserved morphology. (C) RR intervals derived from ACG closely match those from chest ECG. (D) Heart rate comparison demonstrates strong correlation and low RMSE between auricular and chest recordings.

Discussion: These preliminary findings demonstrate that ACG can be reliably captured from the ear canal with waveform morphology and heart rate metrics comparable to chest ECG. The strong agreement between RR intervals and visible P–QRS complexes highlights the feasibility of ACG as an unobstructive alternative to traditional monitoring. This proof of concept supports further validation of the ear canal as a clinically viable site for cardiac electrophysiology acquisition.

AIT 2.4: Wensel

Enrichment of Mucosa-Associated *Sutterella spp.* Characterizes Biofilm-Positive Colorectal Cancer

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Background. Colonic biofilms (BF) are invasive bacterial aggregates that promote colorectal cancer (CRC), a leading cause of cancer death globally. Importantly, BF may also predate or co-evolve with CRC precursor lesions such as polyps. Therefore, determining whether an individual is BF+ may help identify those at increased risk for CRC and inform strategies to prevent disease onset and progression. BF are currently identified using fluorescent *in situ* hybridization (FISH); but this method is time-intensive, qualitative, and requires invasive tissue sampling. Additionally, FISH does not allow for broad genus and species-level characterization. Thus, in this study, we examined the bacterial composition and predicted functions of BF in CRC human cohorts using next-generation sequencing.

Methods. Samples included colon tumor and paired normal tissues (n = 83 total) from people with CRC undergoing colectomy at the Universiti Malaya in Malaysia (n = 25 people) and at the Johns Hopkins Hospital (n = 19 people). Samples were collected before the routine use of oral antibiotics prior to CRC resection; therefore, only two participants received oral antibiotics before surgery. Half of the samples were BF positive (BF+). Groups were matched on all available clinical and demographic data. 16S rRNA gene amplicon sequencing was performed ($\geq$ 100,000 raw read pairs per sample). Reads were trimmed, denoised, merged, chimeras removed, and taxonomy assigned using QIIME2, DADA2, and BLAST+. The data were rarefied, and differential analysis was performed. Random forest (RF) models, built with caret, were trained and tested (80:20 split) with five-fold cross-validation. PICRUSt2 was used for predictive functional analysis. RNA-seq was performed on the same samples to validate and expand upon the 16S rRNA gene amplicon sequencing findings.

Results. *Sutterella* relative abundance and percent positivity was higher in BF+ than BF negative (BF-) tissues (FDR p = 7.28e-4, p = 1.52e-6 respectively). *Sutterella* did not differ between tumor and paired normal samples. *Sutterella* had the highest importance score in RF models and, alone, had an AUC of 0.75. A model with *Fusobacterium*, *Bacteroides*, and *Escherichia*, all associated with CRC and BF, only had an AUC of 0.67. A model that included bacteria with the 25 highest importance scores and tumor location had an AUC of 0.92. In predictive functional analysis, the formaldehyde assimilation II pathway was upregulated in BF+ samples and samples in which *Sutterella* was present (FDR $p < 0.01$, log fold-change > 2).

Conclusions. *Sutterella* was higher in BF+ than BF- tissues and, alone, was predictive of BF, suggesting that *Sutterella* is related to BF formation and/or maintenance. Research suggests that Sutterella may degrade IgA, thereby disrupting the colonic mucosal barrier, a process important for biofilm formation. Further, *Sutterella* and BF+ tissues share predicted pathways like formaldehyde metabolism. Formate, a derivative of formaldehyde, can be produced by gut bacteria, promotes CRC development, and increased utilization relates to BF formation. Thus, Sutterella may be biomarker for CRC BF and formate may contribute to CRC BF formation.

AIT 1.5, Xu

Continuous intrapartum fetal monitoring using a wearable ultrasound and photoacoustic device

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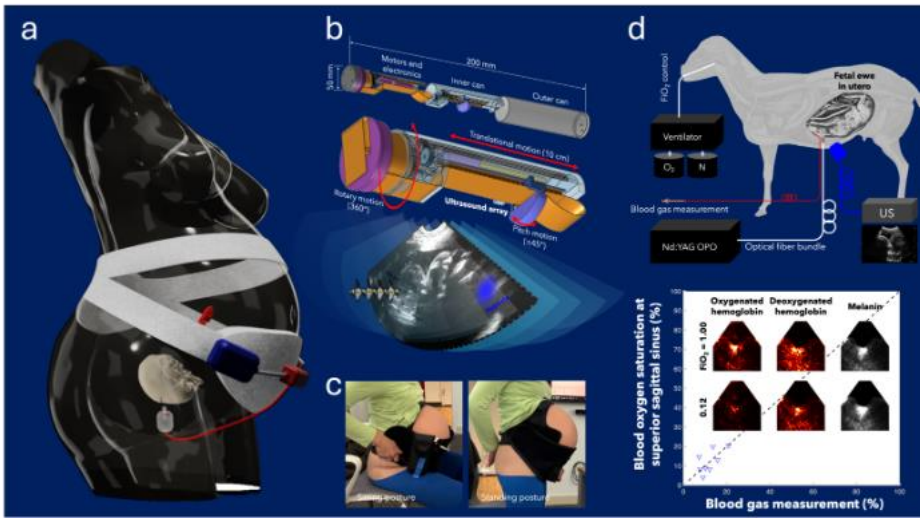
Introduction: Peripartum brain injury results in lifelong disabilities with substantial economic and societal burdens. However, the current clinical standard, electronic fetal heart rate monitoring, lacks accuracy in predicting neurologic injury and is an unreliable predictor of C-section need. We aim to remedy this gap via a novel wearable device for longitudinal monitoring of fetus using ultrasound and photoacoustic contrast.

Methods: We designed a mobile ultrasound platform that monitors fetal superior sagittal sinus (SSS) HbO_2 saturation, brain blood perfusion, fetal heart function, and cervical dilation during labor (Figure a). It is comprised of a mechatronic scanner (Figure b), a photoacoustic (PA) transcervical light delivery system, and a control/processing unit integrated into a wearable form factor worn by the mother (Figure c). The scanner employs a compact, liquid-filled cylindrical enclosure ergonomically fit and acoustically coupled to the maternal abdominal surface above the pubic symphysis via a hydrogel pad. It performs automated B-mode and photoacoustic imaging by tracking the region of interest with its 3 degrees-of-freedom actuated convex transducer. We validated PA sensing of fetal SSS HbO_2 saturation with a pregnant sheep model. To mimic the intended transcervical light delivery in the breech-position ewe, light was delivered directly through an optical fiber bundle to the fetal scalp surface. Fractional inspired oxygen (FiO_2) was changed to model fetal hypoxia and PA-derived O_2 saturation was compared to a ground truth blood gas measurement direct from the SSS.

Results: The estimated fetal SSS venous HbO 2saturation was well correlated with ground-truth blood gas measurements, with an absolute error of 3.45 ± 2.66 % within the 0-100% FiO 2 range (Figure d). Additionally, we sought to determine the minimum required laser energy to obtain PA contrast in the fetal brain through intact scalp and skull layers. This value was determined to be approx. 0.8-2.2 mJ/cm^2, dependent on wavelength, and thus dictates energy requirements for the wearable PA sub-system.



Discussion: The results of this study highlight the feasibility and utility of in utero PA brain monitoring and with the wearable scanner device represents a key milestone to improve fetal care and accessibility.

AIT 1.3: You

Deep learning-based rapid mechatronic ultrasound scanning for longitudinal monitoring of fetal health and labor progress during labor

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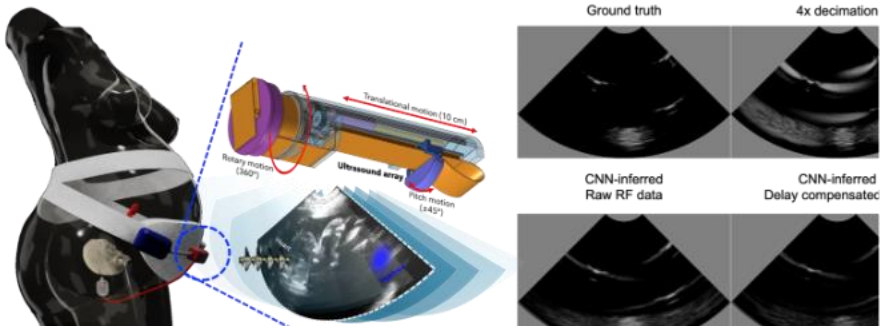
Introduction: Mechatronic ultrasound (US) has high potential to enable autonomous scanning for longitudinal fetal monitoring during labor for 6-10 hours without the need for a sonographer. Fast and energy-efficient US imaging is essential for its portable and wearable form factors. These systems require sustained, real-time imaging without image quality degradation, while operating under strict power and form-factor constraints. We have proposed a wearable US fetal monitoring device to address this clinical need, where a mechatronic US scanner resemble a manual scan by a human operator with three degrees of freedom (DOF: translation, pitch, roll), located at right above the pubic symphysis. Target regions of interest include the fetal brain and heart and cervical dilation width, reflecting fetal health and labor progress. However, a complete scan of the volume demands extensive transmit and receive events with long scanning time and excessive data to transfer, which will lower clinical efficacy of the wearable device with motion artifacts and short battery life.

Methods: To address this challenge, we focus on reducing the total number of scanning events, which will proportionally lower scanning time and power consumption. We propose a deep learning (DL)–based channel interpolation framework by producing full-aperture radio-frequency (RF) data from sparsely sampled channels. As a proof of concept, a 128-element linear array transducer was modeled in Field II to rotate radially for volumetric imaging. A total of 288 steered plane-wave transmissions were simulated from –45° to 45° in 0.3128° steps, with 2 – 6 points and 1 – 4 hypoechoic mass targets randomly placed in the field-of-view (FOV). We adopted an encoder–decoder convolutional neural network (CNN) with skip connections. The input data were delay-compensated to align echoes across channels, improving spatial coherence. A coherence factor (CF)–attention map adaptively weighted feature responses, further guiding the network toward physically consistent reconstructions.

Results: To assess the effectiveness of physics-guided training, we compared 4× decimated beamformed images reconstructed under different training objectives, reflecting a case that commits only 25% of the original scanning duration. Models trained with delay compensation and CF attention yielded better structural consistency and image quality (SSIM = 0.85 ± 0.03) compared to the network trained by raw RF data (SSIM = 0.83 ± 0.04) and original decimated data (SSIM = 0.76 ± 0.07).

Discussion: Our results confirms that our DL-based channel interpolation framework will help improving image quality during rapid scanning, which will secure higher clinical efficacy. This innovation is a critical step towards automated fetal and labor monitoring as it promotes decreased hardware and data complexity. The DL approach represents a key milestone in US physics-informed non-linear interpolation for artifact reduction and holds the potential to improve the implementation of novel sparse US form factors.



Abstracts: Pain & Regional Anesthesiology

PRA 1: Agordekpe

Access to Epidural Analgesia in Ghana: A Patient-Centered Pilot Study

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Background: Epidural analgesia is the most effective method of labor pain relief yet remains underutilized in Ghana. Despite its benefits, evidence regarding patient awareness, preferences, and access is limited. This pilot study examined patient knowledge, experiences, and decision-making factors surrounding epidural analgesia during childbirth at Kwame Nkrumah University of Science and Technology (KNUST) Hospital in Kumasi, Ghana.

Methods: We conducted a cross-sectional pilot study at KNUST Hospital, Ghana, involving postpartum women aged 19-48 years. Participants were consecutively recruited and completed structured questionnaires capturing awareness, exposure, interest in epidural analgesia, and perceived barriers. Descriptive statistics with 95% confidence intervals were calculated for key outcomes. Categorical associations were analyzed using Fisher's exact test, and non-parametric tests were applied for skewed continuous variables. Decision-making factors were assessed using a 5-point Likert scale (1 = not important at all, 5 = extremely important).

Results: Among 125 women analyzed (median age 30 years, IQR 27-34), epidural awareness was low at 37.9% (95% CI: 29.4-46.4%). Only 11/125 (8.8%) were offered epidural analgesia during labor; among the 10 participants with available data, 9 (90.0%) accepted (95% CI: 55.5-99.7%). Notably, 78.2% (95% CI: 69.5-86.8%) indicated they would consider epidural analgesia if cost barriers were removed. Education level was significantly associated with epidural awareness (Fisher's exact test, p=0.003), with tertiary-educated women showing 54.9% awareness compared to 20-27% in other education groups. Key decision-making factors including pain tolerance concerns, fear of side effects, and cost considerations were rated with moderate importance (median 3/5, IQR 2-4). Participants rated overall pain management as highly important (median 4/5, IQR 4-5).

Conclusions: This study reveals a substantial gap between patient willingness to use epidural analgesia and current service provision in Ghana. While awareness remains low, high acceptance rates among informed patients and strong interest when cost barriers are addressed indicate significant unmet need. The association between education and awareness highlights opportunities for targeted educational initiatives. These findings provide a foundation for larger, multi-site studies and support patient-centered strategies to improve maternal pain management in low-resource settings. Our findings support developing culturally sensitive patient education programs, targeted provider training, and cost-reduction policies to increase equitable access to labor analgesia. High acceptance rates among informed patients justify investments in expanding epidural services to improve patient satisfaction and maternal care outcomes.

Keywords: Labor epidural, maternal health, Ghana, pain management, patient-centered care, health equity, resource-limited settings.

PRA 7: Lee

Effect of a novel Adalimumab-conjugated PAMAM hydroxyl dendrimer on the gait of humanized mice with symptoms of Rheumatoid arthritis.

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Introduction: Rheumatoid arthritis (RA) is a chronic inflammatory pathology that causes pain, swelling and distortion of the joints. One of the main therapeutic strategies involves the inhibition of Tumor Necrosis Factor alpha (TNF-α), with Adalimumab (ADA) being the reference drug. In patients with RA, as well as in pre-clinical models of RA, gait abnormalities are one of the key visible features observed. Based on the numerous advantages of dendrimer-based nanotherapies in terms of selective targeting abilities and safety, this study evaluates the effect of a novel Adalimumab (ADA)-conjugated PAMAM hydroxyl dendrimer (HD-ADA) in the gait of B6.Cg-Tg(TNF)#Xen mice, a humanized mice model of RA, using CatWalk XT gait analysis.

Methods: Symptomatic mice were randomly assigned to four groups: Wt/Wt – Saline (SAL), Tg/Wt SAL, Tg/Wt ADA, and Tg/Wt D-ADA. Animals were treated biweekly at doses of 1 and 5 mg/Kg SQ. We recorded changes in gait performance using CatWalk XT analysis. Every week, starting with the week before treatment started and up to the 8th week following treatment started. 3 – 5 compliant runs were collected in each trial to be analyzed.

Results and conclusions: Interestingly, HD-ADA showed a superior potential for halting disease progression, evidenced by its ability to slow down the abnormalities observed in locomotion and coordination patterns. One of the greatest deviations was the regularity index (RI, %). RI quantifies the proportion of normal step sequences relative to total paw placements. A high RI indicates well-coordinated interlimb gait, while a low RI suggests disrupted locomotor performance. While RI stayed stable, around 95%, in the healthy control animals (Wt/Wt SAL), HD-ADA was more efficacious than ADA in preventing the deterioration of locomotion and coordination observed in untreated transgenic animals. Further analysis will be conducted to detect abnormalities not only in gait patterns but also in paw prints to determine changes in toe positioning characteristic of this condition.

PRA 5: Li

Opioid-Escalated Chronic Postsurgical Pain: Role of DNA Methylation in Developing Brain Pain Circuitry

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Department of Anesthesiology and Critical Care Medicine, Johns Hopkins School of Medicine

Introduction: Chronic post-surgical pain (CPSP) is a frequently reported chronic pain condition. It usually develops from an acute state with surgery-associated nerve and tissue damage to chronic. After surgery, patients traditionally receive opioid analgesics to relieve pain. However, such opioid regimens frequently cause adverse effects including opioid-induced hyperalgesia (OIH). OIH is a paradoxical response to opioid medications, where patients take opioid for pain relief but actually become more sensitive to pain over time. So far, the mechanism for opioid-caused chronic pain remains elusive. In this study, we use cellular and molecular biological techniques to test the hypothesis that consistent opioid usage consumes opioid receptors in neurons in anterior cingulate cortex (ACC) and insular cortex (IC), which are two key brain areas for pain perceptions, via elevated DNA methylation and consequently aggravates CPSP. Inhibition of DNA methylation might reduce susceptibility to chronic pain. If this hypothesis is substantiated it will lay the groundwork for future CPSP studies, which would be of great translational relevance plans to lower the risk of subsequent chronic pain disorders.

Methods: Mice, except naïve group, received juvenile spared nerve injury (SNI; left side) at P18 to provoke CPSP. It was followed by 3-week daily morphine (MPH) or vehicle (VEH) injection (10 mg/kg) and another 3-week injection of 0.5 mg/kg 5-aza-deoxycitidine (DAC; DNA methylation inhibitor) or PBS. Starting from baseline, pain behavior tests (von Frey and Hargreaves) were weekly performed. Assessment for pain sensitivity will be determined with behavior results in all time points. Six weeks after SNI, right ACC and IC were harvested for immunohistochemistry (IHC), Western blotting (WB), and quantitative real time PCR (qPCR). Image analysis and statistics will be done with ImageJ and Prism 8 programs.

Results: (1). MPH reliefs acute pain in week 1 but causes OIH from week 2, which is mitigated by DAC injection. (2). SNI reduces mu opioid receptor (MOR) positive neurons in ACC/IC. MPH further decreases MOR+ cells. (3). WB and qPCR data show SNI and MPH increases, but DAC decreases level of DNA methylation molecules DNA methyltransferase 1 (DNMT1) and 5-methylcytosine (5mC). (4). SNI and MPH increases, but DAC decreases c-fos (activity marker) and pS6 (mTOR marker) immunolabeled neurons in ACC/IC. (5) In SNI caused CPSP model, phospho-extracellular signal-regulated kinase (p-ERK), GluN2B, and PSD95 molecules are upregulated by MPH injection and reduced by DAC application.

Discussion: DNA methylation is an important epigenetic modification which represses gene transcription. Moreover, specific gene/locus DNA methylation alterations have been correlated with pain hypersensitivity, neuronal hyperexcitability, and inflammatory responses. Pathological DNA methylation patterns, observed in conditions such as cancer, neurological disorders, and CNS dysregulation, can lead to aberrant gene expression, thereby affecting pathogenesis. Recent findings indicate that DNA methylation modulates the expression of pro-nociceptive and antinociceptive genes in the nociceptive pathways. Patients with chronic pain syndromes including CPSP display altered global DNA methylation profiles compared to healthy individuals. DNA methylation is catalyzed primarily by the members of DNMT family. Blocking nerve injury-induced increase of DNMTs rescues the expression of MOR and kappa opioid receptor (KOR) and relief neuropathic pain. DAC, a DNMTs inhibitor, has been extensively used in clinic and preclinic studies for cancer therapy, but has not been reported in chronic pain. Our study shows that in SNI caused CPSP, DAC rescues OIH, restores opioid-escalated neuronal hyperactivity and aberrant increase of mTOR, and decreases excitatory receptors in ACC and IC. This will open a new direction to investigate the cellular and molecular mechanisms of opioid induced CPSP and to discover possible mitigation strategies.

PRA 2: Pham

Survey of Pain Assessment and Management Practices in Pediatric Intensive Care Units Across the US

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Introduction: Pain is a universal concern for critically ill children admitted to Pediatric Intensive Care Units (PICUs), yet assessment and management remain understudied. Historical misconceptions, challenges in evaluating non-verbal patients, and variability in institutional practices have contributed to undertreatment. International surveys demonstrate considerable heterogeneity in monitoring tools and analgesia strategies, but no nationwide data exist to describe U.S. practice patterns. Standardized, evidence-based guidelines require a clear understanding of current practice and barriers to implementation.

Methods: A cross-sectional survey was developed targeting pediatric intensivists at approximately 115 large U.S. children's hospitals. One pediatric critical care physician from each site was invited to participate or nominate a colleague with expertise in pain management. Eligibility required completion of critical care training and self-identified knowledge of both pain assessment and management strategies. The REDCap-based survey collects data on institutional monitoring approaches, pharmacologic and non-pharmacologic interventions, presence of institutional pain or sedation related protocols, and the presence of specialized pain services.

Results: A total of 15 PICU respondents completed the survey to date, with more expected responses after a 4 week reminder. A dedicated pediatric acute pain service was available in 67% of hospitals. The service was very involved in PICU care in 70% of sites. Common indications for consultation include postoperative pain, chronic or difficult-to-manage pain, epidural management and opioid or sedative weaning. FLACC scale was the most frequently used assessment for pain. RASS was the most frequent sedation tools, while the Withdrawal Assessment Tool-1 (WAT-1) was used universally for withdrawal assessment. Multimodal analgesia was the standard across respondents, with near-universal use of acetaminophen and NSAIDs and frequent use of dexmedetomidine and ketamine as adjuncts. Most PICUs reported using regional anesthesia at least monthly, though only 13% used it daily. Regional catheter placement outside the immediate perioperative period represented a limited number.

Discussion: Findings demonstrate substantial variability in pain and sedation practices across U.S. PICUs. While validated scales for assessment are widely used, fewer than half of responding units employ standardized analgesia or sedation protocols. The broad adoption of opioid-sparing, multimodal regimens reflects growing efforts to reduce opioid exposure. However, inconsistent use of formal protocols and variable integration of pediatric pain services highlight opportunities for guideline development to promote equitable, evidence-based pain control in critically ill children.

PRA 4: Sckaff

Dorsal penile vs. caudal nerve blocks in pediatric circumcision: a meta-analysis of pain and recovery outcomes

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Introduction: The dorsal penile nerve block (DPNB) and the caudal epidural block (CB) are commonly used for analgesia in pediatric circumcisions, however, their comparative effectiveness in post-operative outcomes remains unclear.

Study aim: We present an updated meta-analysis comparing the post-operative outcomes of DPNB and CB in pediatric circumcisions.

Methods: We performed a systematic review and meta-analysis of randomized and non-randomized clinical trials comparing DPNB to CB for analgesia as part of the anesthetic approach in pediatric circumcision. Our primary outcomes included: (1) post-operative pain, (2) incidence of post-operative non-opioid analgesic need, (3) incidence of nausea and vomiting, (4) first analgesic demand time reported in the post-anesthesia care unit, and (5) time to first void.

Results: Nineteen studies comprising 1,550 pediatric patients undergoing circumcision were included: 807 patients (52%) received CB, and 743 patients (48%) received DPNB. Post-operative pain scores were significantly higher in patients who received DPNB compared to CB (Std mean difference 0.57; 95% CI [0.06, 1.09]; p = 0.03). However, time to first void was significantly shorter with patients who received DPNB compared to CB (mean difference -1.42 hours; 95% CI [-2.46, -0.38]; p = 0.02). There were no significant differences between DPNB and CB for the primary outcomes of incidence of post-operative analgesic need, incidence of nausea and vomiting, and first analgesic demand time. In a subgroup analysis, the first analgesic demand time was shorter for patients who received DPNB when outcomes reported by parents were included (mean difference -44.06 minutes; 95% CI [-85.51, -2.61]; p = 0.04).

Conclusion: In pediatric patients undergoing circumcisions, this meta-analysis demonstrates that the use of DPNB is associated with higher post-operative pain scores and shorter times to first void compared to CB. Choice of CB vs. DPNB should be guided by both pain management and recovery priorities.

Regional Analgesia Use in the Pediatric Intensive Care Unit Outside of the Peri-Operative Period: A Scoping Review

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Introduction: The use of regional analgesia (RA) in pediatric surgical patients has rapidly expanded in recent decades as evidence of its safety and efficacy has grown. However, evidence for use of RA techniques in pediatric critical care outside of continuation of RA initiated in the operating room has been limited. Pediatric patients with pain related to trauma, burns, vaso-occlusive crises, oncologic processes, or other sources may benefit from improved pain control with RA. Expansion of RA use in pediatric critical care may improve site-specific pain control while reducing side effects (sedation, constipation, tolerance) of systemic opioids. The objective of this scoping review is to identify and map existing evidence for RA techniques to improve pain control in pediatric critical care outside of the immediate postoperative period.

Methods: A comprehensive search of 4 databases was conducted with the assistance of a medical librarian in August 2024. The search strategy included the following terms and their synonyms: pediatric, critical care, and regional analgesia. English-language studies involving pediatric patients (≤18 years), admitted to the pediatric ICU (PICU), who received regional analgesia outside of the immediate perioperative period were included in this study. Search results were imported into the Covidence systematic review software and deduplicated. Study titles and abstracts were screened by 2 independent investigators (KS, TL), with a third reviewer (TV) resolving any disagreement. For studies that passed title and abstract review, the full text was analyzed to ensure inclusion criteria were met.

Results: We screened 2839 studies, 40 of which were selected for full-text review. 9 studies met inclusion criteria, including 1 case series (India, 6 patients) and 8 case reports (US, Italy, UK, Oman; 1-4 patients each). Indications for RA included vaso-occlusive crises (1 case series), traumatic rib fractures (3 case reports), femur fracture in TBI patients requiring neuromonitoring (1 case report), traumatic foot amputation with RA placed in PICU after inadequate pain control (2 case reports), and prolonged respiratory failure following thoracotomy (2 case reports). The following techniques were used: epidurals (9), continuous peripheral nerve blocks (10), and continuous fascial plane blocks (4). There were no adverse effects highlighted in the included studies, and each reported improved pain control (measured by variable metrics including reduced requirement for sedation and systemic analgesia, nurse-reported pain control, FLACC scores, and VAS scores).

Discussion: While studies highlight the feasibility of utilizing regional analgesia in the PICU and improvement in pain control, there is significant heterogeneity in clinical context and a paucity of randomized control trials to support significant improvement in pain control. Our results highlight the need for larger studies, including randomized control trials, to fully evaluate the efficacy of regional analgesia and its impact on pain control in the PICU.

PRA 3: Uniyal

Targeting Tmem100-Mediated TRPA1 Regulation at Central Terminals of DRG Neurons for Neuropathic Pain Relief

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Background: Neuropathic pain remains a major clinical challenge, as current pharmacotherapies often provide insufficient relief and cause substantial side effects. Transient receptor potential (TRP) channels, particularly TRPA1 in dorsal root ganglion (DRG) neurons, play a crucial role as key mediators of pain signaling. Previously, Tmem100 was identified as a key regulator that enhances TRPA1 activity at the peripheral terminals of DRG neurons in a TRPV1-dependent manner. In contrast, the Tmem100-3Q mutant selectively inhibits TRPA1 activity within the TRPA1/V1 complex.

Methods: Building on this mechanism, we developed a cell-permeable peptide, P2-Mut, to mimic the context-dependent action of the Tmem100-3Q mutant. However, periphery local injection of P2-Mut only attenuated mechanical pain hypersensitivity. Intriguingly, TRPA1 activation at central nerve terminals enhances spinal synaptic transmission of noxious inputs, increases excitability of dorsal horn neurons, and thus may amplify multiple sensory modalities, including not only mechanical but also heat and cold. In this study, we evaluated whether P2-Mut can selectively block TRPA1 activity at the central terminals of nociceptive DRG neurons co-expressing TRPA1 and TRPV1, thereby offering a targeted and safer therapy for managing symptom clusters associated with neuropathic pain.

Results: The immunostaining analysis revealed high Tmem100 expression (~80%) in rodent DRG neurons that co-express TRPA1. The co-immunoprecipitation test confirmed Tmem100 association with TRPA1 and TRPV1 in the mouse spinal cord. Intrathecal (i.th.) administration of P2-mut significantly inhibited endogenous TRPA1 agonist-induced pain and sensitization, and importantly, attenuated both mechanical and cold hypersensitivity in nerve-injured animals, indicating a broader inhibition of different pain modalities by attenuating TRPA1 activity at central terminals. P2-Mut also produced conditioned place preference in nerve-injured but not sham-operated animals, suggesting relief of ongoing pain without reinforcing (drug liking) properties. Mechanistically, *in vivo* calcium imaging of DRG neurons in Pirt-GCaMP6s mice post-nerve injury revealed that P2-Mut, but not scrambled peptide, inhibits the mechanical stimulus-induced activation of small-diameter DRG neurons. Importantly, pretreatment with P2-Mut reduced TRPA1 agonist-evoked spontaneous excitatory post-synaptic currents in lamina I neurokinin 1 receptor-positive neurons.

Discussions: Collectively, these findings demonstrate that targeting Tmem100-mediated regulation of TRPA1 activity at central terminals of DRG neurons represents a promising strategy for neuropathic pain relief.

Abstracts: Quality Improvement & Health Systems/Services

QH 2.3: Agyemang

Improving Pediatric Anesthesia Outcomes in The Gambia through Equipment Modernization and Outcome Monitoring

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The Edward Francis Small Teaching Hospital (EFSTH) pediatric surgery unit relies on an aging anesthesia machine with frequent malfunctions, posing severe safety risks for children requiring anesthesia. Notably, the existing anesthesia machine cannot provide the low tidal volumes required for safe ventilation in young children under 22kg, posing a serious risk to patient safety. As of 2022, the hospital also lacked a stable oxygen supply, leading to frequent interruptions in surgical care due to oxygen shortages and the high cost of oxygen cylinders. Recognizing these limitations, the Society of Critical Care Medicine (SCCM), in partnership with Johns Hopkins Global Alliance of Perioperative Professionals (JHU-GAPP), implemented a hospital-wide oxygen delivery system between 2022 and 2025, with piped oxygen now reaching every clinical area.

While oxygen supply has been introduced, the anesthesia delivery platform remains unreliable. Replacement of this device presents an opportunity to systematically document the risks of obsolete anesthesia equipment and the benefits of installing a modern, pediatric- appropriate machine. Current literature on anesthesia equipment upgrades in low-resource settings is limited, particularly regarding measurable patient outcomes and provider experience. Through a mixed method study including quantitative measurements of patient post-operative vitals and complications; pre and post-acquisition the anesthesia machine, as well as a failure mode and effects analysis (FMEA) including anonymous surveys of perioperative providers enquiring user experiences, we aim for the following outcomes:

Primary Objective:

- To address the severe safety concerns associated with an outdated anesthesia machine for pediatric ventilation and to assess the change in equipment-related anesthesia safety incidents before and after replacement of the pediatric anesthesia machine.

Secondary Objectives:

- To describe provider-reported challenges and perceptions of safety before and after

machine replacement elucidating sub-ideal standards of care in this institution.

- To quantify changes in perioperative adverse events in pediatric anesthesia cases.
- To evaluate the implementation process, training outcomes, and equipment reliability

QH 1.8: Bennett

Firearm Safety Counseling with and without Providing a Safe Storage Device: A Systematic Review

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Introduction: Firearm injury is a leading cause of morbidity and mortality in the United States, especially among youth and marginalized populations. Safe firearm storage is a proven strategy to reduce firearm-related harms from suicide, homicide, and unintentional injuries. A comprehensive assessment of the literature examining safe storage programs is needed to optimize clinical practice in this area. We conducted a systematic review to characterize the state of the evidence for safe storage interventions and their effectiveness at improving safe storage behaviors.

Methods: Using PRISMA guidelines, we conducted a systematic review of randomized and quasi-experimental controlled studies from May 27, 2015, to March 21, 2025. Eight databases were searched with a specified strategy, aligning with a prior systematic review from 2016. Eligible studies evaluated interventions promoting safe firearm storage, with or without provision of storage devices. Two reviewers independently screened titles, abstracts, and full texts, with adjudication by a senior investigator.

Results: Eleven studies met inclusion criteria and were grouped into: studies examining (1) education, counseling, or outreach; (2) counseling with and without device provision; and (3) comparing free and reduced-cost devices. Of seven randomized controlled trials (RCTs) focused on education or outreach, two showed that web-based interventions significantly improved safe storage; five showed no effect. One stepped-wedge trial demonstrated that lethal means counseling doubled the odds of safe storage. Of two RCTs involving device provision, one found cable lock distribution improved both storage device use and firearm locking, and the other showed within-group improvement from baseline but no between-group difference. Finally, one cost-focused study found free device distribution increased acceptance and pledging but did not improve actual storage behavior.

Conclusion: Interventions that include direct provision of safe storage devices are more likely to improve firearm storage behaviors than interventions of education alone. For critical care providers, integrating device distribution into lethal means counseling may enhance injury prevention efforts in vulnerable populations.

QH 1.2: Bertolino

Knowledge Acquisition and Retention Following a Multi-Modal Educational Curriculum for Pediatric Critical Care Medicine Senior Fellows: A Pilot Study

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Introduction: Simulation-augmented educational curricula are implemented along the continuum of medical training; however, there is a dearth of studies evaluating curricular efficacy for such simulation-augmented curricula for subspecialty fellow physicians nearing graduation. This pilot study is a focused and preliminary assessment of curricular efficacy for a multimodal simulation-augmented "bootcamp" in a population of senior pediatric critical care medicine (PCCM) fellows, assessing knowledge acquisition, knowledge retention, and real-life clinical application.

Background: Simulation-based learning activities offer a low-risk learning environment for learners to practice high-risk, low-frequency clinical events. This experiential learning modality has shown efficacy in developing psychomotor and team-based skills. Our primary goals for this pilot study were to assess one objective measure of curricular efficacy via baseline knowledge, knowledge acquisition, retention and decay following a multi-modal "bootcamp" curriculum. Real-life clinical applicability will be assessed using subjective questions.

Methods: Prospective, repeated measures pre-post assessments were administered electronically at multiple time-points immediately prior to and at the conclusion of bootcamp and at 1- and 6-month intervals. The investigator requesting participation, distributing assessments and collecting data does not perform learner supervision or evaluation. Data was collected in the years 2023, 2024, and 2025. Test questions reflect current ABP PCCM Board content specifications, evidence-based practice recommendations, and were developed and vetted via a modified Delphi method with content experts in pediatric critical care medicine clinical focus areas. Knowledge acquisition, retention and decay were assessed by percent correct answers on the post-tests compared to the baseline pre-test. Curriculum real-life clinical applicability will be assessed electronically at the 6-month time-point by the frequency with which each topic is encountered in graduates' first attending physician position.

Results: Preliminary data are mixed. Mean test scores were evaluated by linear regression. There was no significant difference in pre-/post-test scores at any point in 2023.The 2024 and 2025 test series both showed overall mean score increases over time and at each time point interval; the increase from the first posttest to the one-month post testing in 2025 was statistically significant ($p=0.002$).

Discussion: This pilot study describes three years of data collection. Data demonstrating knowledge acquisition and retention are mixed. This is not surprising; evaluations were administered to individuals expected to have sophisticated baseline knowledge. Further, much of bootcamp curricula focuses on psychomotor skill performance and behavioral change, which represent higher-level learning. Analysis also suggests additional question refinement is needed— substantial variation in single question performance likely reflects question quality more than the learners' responses. Limitations of this project include small participant sample size and low number of test questions, as well as lack of control for response biases. This pre-post-test tool continues to be revised and will be one component of a collaborative multi-site, mixed-methods assessment of curricular efficacy and clinical application of three such regional "bootcamps" with 60 total participants over the next year.

QH 2.2: Booth

Exploring Unmet Healthcare Needs of Children in the U.S. Before and After COVID-19: A Cross-sectional Study of the National Survey of Children's Health

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Introduction: Improving access to preventive care remains a national priority, especially for children, who depend on adults to make care decisions and can benefit most from early interventions that prevent chronic disease. Although access to care for children had been steadily improving, the COVID-19 pandemic disrupted this progress. It remains unclear whether this access has fully recovered or if longstanding disparities have persisted. Here, we examine trends in well-child checks (WCC), a key form of preventive care and a foundation for quality metrics, using nationally representative data from 2016–2019 and 2021–2023. We assess how WCC rates changed before and after the pandemic, identify predictors of having a WCC, and evaluate whether disparities widened or narrowed over time.

Methods: We used repeated cross-sectional study data from the annual National Survey of Children's Health with survey weights for nationally representative estimates. The analytic sample included survey participants who reported that the child had either 0 or ≥ 1 WCC visit within the past year. The key variable was time, divided into pre-pandemic (2016-2019) and post-pandemic (2021-2023). We adjusted for demographics, need for special care, insurance, and metropolitan statistical area (MSA) status. We used a generalized estimating equation model with a binomial family, a logit link, and an unstructured correlation structure to estimate the average population effect of not having a WCC. Model selection was guided by theory and quasi-likelihood under the independence model criterion.

Results: Before the COVID-19 pandemic, 3.9% of children did not have an annual WCC, compared to 4.3% afterward. Our sample was 48.9% female, mostly identified as white only (71%), non-Hispanic or non-Latino (73.9%), with private insurance (56.8%), living in MSAs (79.1%), with a poverty level over 400% above the poverty line (34.2%), and without special care needs (78.7%). By age categories, the proportion was: birth to 5 years (34.2%), school-aged (38.8%), and teenagers (27%). After adjusting for covariates, children were 0.89 percentage points (95% CI: 0.52–1.26) less likely to have received a WCC in the post-pandemic period compared with the pre-pandemic period, which was statistically significant. Age was a strong predictor: school-aged children (6-12 years) and adolescents (13-17 years) were 2.7 percentage points (95% CI: 2.33–3.15) and 3.3 percentage points (95% CI: 2.86-3.74) less likely, respectively, to have received a WCC than the youngest group (birth to 5 years). The predicted probability of not having a WCC for the youngest age group (birth to 5 years) was 0.021 before COVID and 0.027 after COVID, which was statistically significant. This pattern also appeared among school-aged children pre-COVID, with a predicted probability of not having a WCC of 0.047 (95% CI: 0.043-0.051) before COVID and 0.0576 (95% CI: 0.053-0.062) after COVID, which was again statistically significant. Teenagers had a 0.0517 predicted probability (95% CI: 0.048-0.056) of not having a WCC before COVID and 0.0639 (95% CI: 0.059-0.069) after COVID, which reached statistical significance.

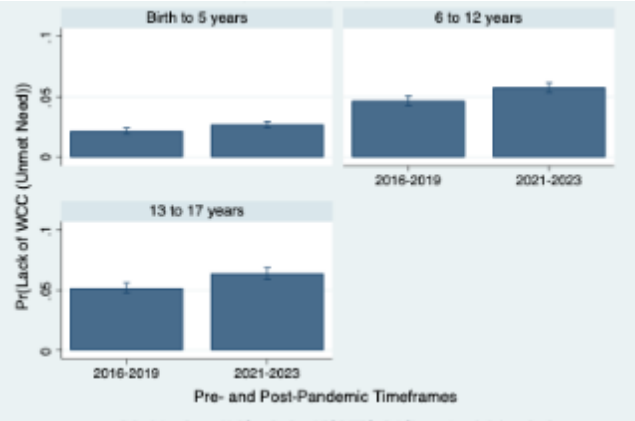

Figure 1. GEE adjusted average population predicted probability of not having a WCC by age categories, 2016-2019 and 2021-2023, from the NSCH

Conclusions: The COVID-19 pandemic disrupted healthcare and worsened pre-existing unmet needs, most notably in school-aged and teenage children, as compared to the youngest children ≤ 5 years for annual well-child checks.

QH 2.6: Booth

Content Analysis of Communications to Front-line Staff from a Novel Adverse Event Voluntary Reporting Program

Lauren D. Booth, MSN[1], David C. Stockwell, MD, MBA[1], Katy Duke, DNP[3], Stephanie Morgenstern, MSN[2], Kate Brant, MBA[2], LeAnn McNamara, PharmD[2], Cynthia Canale, MSN[2], Jessica M LaRosa, MD[1], Amanda B. Levin, MD[1]

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Introduction: Healthcare is high-risk and depends on adverse event detection to inform operations and improve processes to prevent errors and patient harm. To improve the work system, methods, and patient outcomes, there must be a means to report, trend, and communicate Adverse Events (AEs). As such, voluntary AE repoIntroduction: Healthcare is high-risk and depends on adverse event detection to inform operations and improve processes to prevent errors and patient harm. To improve the work system, methods, and patient outcomes, there must be a means to report, trend, and communicate Adverse Events (AEs). As such, voluntary AE report programs are integral to the healthcare system, allowing for frontline staff to report near-miss and AEs that reach patients. While the Institute of Medicine and the World Health Organization provide general guidance for AE program implementation—such as being non-punitive, confidential, independent, expert-led, timely, system-oriented, and responsive—they do not specify *what* to communicate to frontline staff. Therefore, we aim to close this gap by conducting a content analysis of our new AE review program communications to staff.

Methods: We are conducting a content analysis of AE communications from the PICU AE program to frontline staff from April 2019 to December 2023 at Johns Hopkins Hospital, a 28-bed PICU at a large, academic, urban facility in Baltimore, MD, USA. During this period, 55 monthly presentations were delivered to nursing staff, physicians, advanced practice nurses, respiratory therapists, and leadership staff members in a standing quality and safety meeting. These communications were iteratively, inductively coded, and thematic saturation was reached.

Results: We identified 28 unique codes from 1014 unique communications over the 55 months. During the inaugural program year (April 2019-December 2019), there were 70 communications. For the subsequent full calendar years, there were 189 (2020), 206 (2021), 298 (2022), and 251 (2023) communications. The current top five codes for all years are related to: medication practices (n=115), broken or lack of supplies (n=115), communication and bed flow challenges (n=85), lack of standard operating procedures for lines, drains, and access points (n = 81), and issues related to electronic medical record errors (n=67).

Conclusions: Themes from AEs can be identified and tracked over time. Our future directions will include axial coding to develop themes that emerge from the data.

QH 2.11: Booth

Bridging a Gap in Microbiological Testing Overuse: Perceptions and Values of Caregivers of Chronically, Critically Ill Children

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Introduction: There is an increasing number of children admitted to the pediatric intensive care unit (PICU) who have chronic or long-term critical illnesses, which increases their risk for healthcare-associated infections. Due to this elevated risk, clinicians tend to have a low threshold to evaluate these patients and may not immediately recognize the potential harms of over-testing. We have previously implemented quality improvement initiatives to reduce over-testing for infections among patients without supporting signs or symptoms of the infection in the PICU. However, these initiatives have not involved caregivers in understanding their role in the decisions to obtain microbiology testing. There is currently limited understanding of values and expectations regarding diagnostic testing among caregivers of chronically ill children, who make up the majority of PICU admissions. Increasingly, we recognize that a critical interaction occurs between the patient/caregiver and the medical team during diagnostic decision-making. Therefore, this study aims to address a crucial gap in our knowledge of how to improve testing practices effectively in this setting.

Methods: This is a qualitative study conducting semi-structured interviews of caregivers of children in the PICU that is currently enrolling participants. Eligible participants include English-speaking caregivers of children with chronic illnesses admitted to the PICU or PCICU for more than 72 hours. Caregivers are approached to participate voluntarily and receive an incentive for enrollment. The interview guide is based on the Shared Decision-Making Model. The interview (LDB) performs reflexivity exercises throughout the process and writes interview memos during the interviews. Interviews are recorded, transcribed, and will be analyzed using inductive and deductive coding. Interviews will be conducted until thematic saturation is achieved, with a maximum of 20 participants.

Results: So far, we have conducted three semi-structured interviews. A few themes are emerging from these interviews: a tension between caregivers and clinicians to obtain tests, understanding the risks and benefits of testing, and examining whether test results are seen as valuable or not, including the downstream effects of these results. An excerpt from a transcript:

> *So in terms of like-- when we think about it for us as caregivers, for him,* ***knowing that just about any test has some level of risk to it****, I mean, just anything we do during the course of a day has potential risks for it. But when we think about if we were going to have to do a urinalysis, if we had to do a catheter, right, that comes with the risk of potential infection, infectious agents, those types of things that we're then choosing to introduce.* ***When we think about the benefits, though, there are times where we need to know the information, and so we have to outweigh the risks and the benefits when we're making those decisions. And other risks too come with decision-making*** *we've had to make in the past when we've done genetic testing for him, for example.* ***It might give you answers that you're not prepared for.*** *And so in some cases, we have to also be aware of what might this tell us, and sometimes it's going to give us information that is sort of an incidental finding. And this has happened for us a lot of times on MRIs, for example,* ***and other tests that we've done that we're like, "Okay, but this information doesn't match with his clinical presentation." So then it's the risk of like, "Do we need to explore this further? Is this what is baseline for him?"*** *Those types of things. But back to the original question, I suppose the real risk is whether it will cause him pain. And if it is, how can we work through that?* ***Is it going to give us information that is valuable as well as is this information we need to plan for his care?***

Conclusions: Forthcoming, pending future interviews with iterative deductive and inductive coding.

QH 1.10: Cohen

Optimizing Non-Emergent NICU-to-PICU Transfers: Perspectives of Pediatric Intensivists

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Introduction: Previous studies have demonstrated that there is a considerable population of NICU-to-PICU transfers with complex medical needs and high relative mortality. From these long-stay admissions, research suggests caregivers are at increased risk of post-intensive care syndrome and providers are at increased risk for burnout. Despite evidence that patient harm can be induced by transfer, no guidance for best practices exists to optimize these transitions for patients, families, and clinicians. Using a qualitative approach, we aimed to characterize facilitators and barriers of effective NICU-to-PICU transfers among pediatric intensivists.

Methods: Semi-structured interviews were conducted with pediatric intensivists recruited from a previous national survey. Interviews were recorded, transcribed, and qualitatively analyzed using an iterative process to elicit themes. Interviews will continue until thematic saturation is reached.

Results: Ten interviews have been conducted to date, with a median duration of 38 minutes (range 29-46 minutes). Intensivists interviewed represented unique PICUs ranging from 16-40 beds at academic medical centers.
Notable themes emerged in the pre-transfer, transfer, and post-transfer phases. Pre-transfer themes included (1) prioritizing patient needs, which was facilitated by routine NICU-PICU joint meetings and hindered by bed capacity challenges and (2) expectation setting with families, which was subject to the ability to have PICU personnel meet with family pre-transfer. Peri-transfer, facilitators included (3) multidisciplinary communication beyond the physician teams and (4) care overlap (e.g. joint rounding or NICU consult shortly after transfer) Post-transfer, differences in (5) medical care as well as (6) unit culture were identified as having the potential to both improve the therapeutic alliance with families or slow patient progress toward discharge.

Conclusions: In this qualitative study, pediatric intensivists have begun to identify aspects of non-emergent NICU-to-PICU transfer that make such transfers either more effective or more challenging. Components of care that optimize effectiveness rely on advanced planning, multidisciplinary input, and directly addressing differences in NICU and PICU care with families.

QH 1.7: Devlin

Live interactive music therapy across the perioperative continuum: A scoping review

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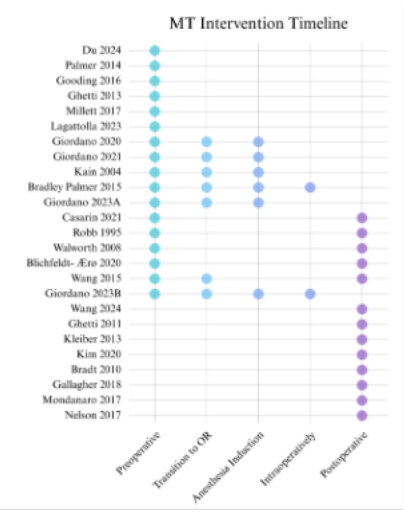
Introduction: Music therapy (MT) is often integrated as an adjunct to analgesia in hospitals, but its role across the perioperative continuum remains undefined. This review aimed to characterize and synthesize available evidence on live interactive MT delivered by music therapists for patients of any age, procedure, or outcome across the perioperative continuum.

Methods: This scoping review followed PRISMA-ScR guidelines. Eligible studies in English examined live interactive music therapy (MT) delivered by a certified music therapist to pediatric and adult patients across the perioperative continuum (24 hours before; 72 hours after surgery). MT was defined as the interactive use of music by a music therapist, differentiated from passive listening experiences administered by other healthcare professionals (e.g., nurses). Searches were conducted in PubMed, CINAHL, PsycINFO, Music Index, ProQuest Dissertations and Theses, and Embase (October 2024), with supplemental Google Scholar searches pre-extraction (April-June 2025). Six reviewers screened 2,095 titles and abstracts; four completed full-text review of 1,049 articles and extracted data from 25 eligible studies.

Results: 25 studies included 1,821 participants across pediatric, adult, and mixed surgical contexts, most commonly oncologic or orthopedic procedures. Live interactive music therapy (MT) delivered by certified therapists varied in timing (see MT Intervention Timeline Figure), duration (5 minutes to 4 hours), and format (live, recorded, or mixed), and was generally compared with standard care controls. MT consistently reduced anxiety and stress and often improved pain, mood, and sleep, though physiological and functional outcomes were mixed. Intervention type, session length, and therapist factors influenced some outcomes, highlighting the individualized nature of MT.



Discussion: Findings demonstrate live interactive MT is a feasible perioperative intervention, particularly for anxiety and stress. Variability in physiological and functional outcomes suggests MT delivery method, duration, and therapist expertise may affect efficacy. Results support integrating MT into perioperative care and underscore the need for further research to refine intervention protocols, explore therapist effects (including relationship impact), and identify best practices across diverse patient populations and surgical contexts.

QH 2.12: Edwards

Implementation of universal quantitative neuromuscular blockade monitoring in an academic pediatric center

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Introduction: In 2023, the American Society of Anesthesiologists (ASA) recommended that quantitative train-of-four (TOF) monitoring be employed whenever neuromuscular blockade (NMB) is administered. In 2024, we embarked on a multi-phase quality improvement initiative to improve the use of NMB monitoring in our institution's pediatric center by using the Lean Six Sigma methodology to clearly define and address barriers to universal implementation. Preliminary data was collected to determine the scope of the problem. We used TOF documentation as a surrogate metric for neuromuscular blockade monitor use. Overall, appropriate documentation of TOF prior to reversal was only 52%. Those 0 to 2 years of age had documentation in only 37% of cases while all other age groups were greater than 50 percent. With this data, we launched significant educational efforts and addressed the most common barrier, device availability. Prior to implementation of universal quantitative NMB monitoring in mid-September 2025, we examined the current practice patterns surrounding NMB monitoring, administration, and reversal to determine targets for improvement in practice.

Methods: 459 patients were identified and met the criteria for inclusion in this analysis using data collected from the Multicenter Perioperative Outcomes Group (MPOG) dataset for Johns Hopkins. Patients were grouped by age into the following categories: Term neonates (less than 28 days), infants (28 days to 12 months), toddlers (13 to 23 months), children (2 to 5 years), children (6 to 11 years), and adolescents (12 to 18 years).

Results: We found that overall appropriate documentation of TOF increased from 52% in July to August 2024 to 73% in July to August 2025. However, there is still a huge disparity in monitoring in term neonates, infants, and toddlers with only 12%, 49%, and 60% of patients receiving monitoring respectively. In terms of NMB dosing, in term neonates, infants, toddlers and children, 42% of patients received greater than the suggested initial dosing recommended per kilogram of body weight. Reversal of NMB was given in only 92% of cases across all age groups. Amongst patients receiving NMB, General Surgery was the most common surgical service, followed by Orthopedics and Neurosurgery respectively.

Conclusion: The lowest documentation rate continues to be the youngest, most vulnerable patients undergoing anesthesia with NMB which is particularly concerning as this group is also more likely to receive higher than recommended doses of NMB. Reversal was not administered in 8% of cases without objective evidence of complete reversal. We expect that with objective data from quantitative NMB monitoring this may increase provider confidence in forgoing reversal.

QH 1.5: Flaster

Implementation of a new Maryland prehospital protocol for cardiac arrest secondary to refractory ventricular fibrillation and tachycardia

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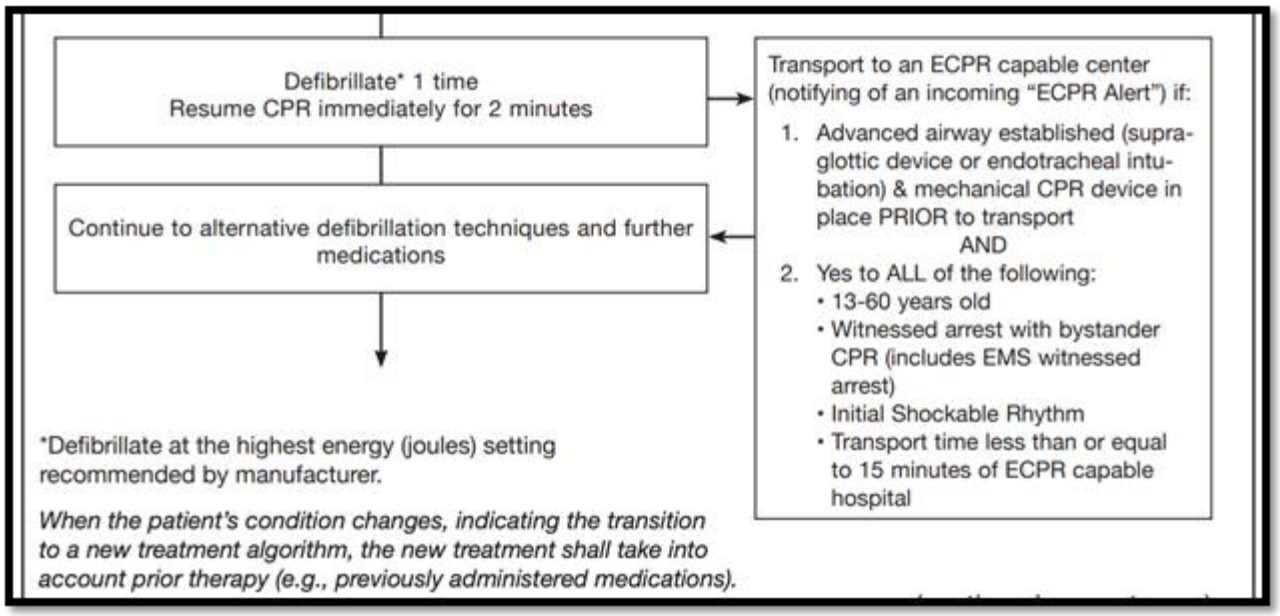
Introduction: Refractory ventricular fibrillation (VF) and pulseless ventricular tachycardia (pVT) out of hospital cardiac arrest (OHCA) are associated with low survival rates and poor neurologic outcomes. Furthermore, patients in pVT or VF may be candidates for extracorporeal CPR (ECPR) if they are quickly transported to an ECPR capable hospital, further adding pressure on prehospital providers to decide whether to continue treatment on scene or expedite transport to hospital within the critical time window.

Methods: The Center for Transport and Resuscitative Medicine at Johns Hopkins, recognizing the potential survival advantage of fast transport to ECPR centers for patients with refractory VF or pVT, introduced a new prehospital protocol prioritizing transport to ECPR capable centers after two shocks in the field. This protocol was approved by the Maryland Institute for Emergency Medical Services (MIEMSS) and is in force for the State of Maryland as of July 1st 2024.

Results: MIEMSS has approved the new protocol, of which a section is included below. Please note, that this portion of the protocol references patients who have already had one defibrillation attempt.



Discussion: The optimal number of defibrillation attempts after which transport should occur has never been investigated. Future research includes a retrospective analysis of MIEMSS data for pVT or Vfib OHCA between 2020-2025. The primary outcome is sustained prehospital ROSC (ROSC>20min). Multivariable logistic regression analysis will then be used to examine whether the number of defibrillations was independently associated with the outcomes.

QH 1.13: Flaster

ECPR vs CPR at JHH: Single Institution Retrospective Review

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Introduction: Extracorporeal Cardiopulmonary Resuscitation (ECPR) is an emerging and increasingly well-established adjunct to conventional CPR. ECPR is defined as the use of Veno-Arterial Extracorporeal Membrane Oxygenation (VA ECMO) in patients where conventional CPR measures are unsuccessful in achieving a sustained return of spontaneous circulation (ROSC). By providing organ perfusion, ECPR allows time for the delivery of interventions necessary to regain native circulation. As a part of a QA/QI project, we compared survival to discharge between all patients receiving CPR only vs ECPR at The Johns Hospital between 1/27/2017 and 12/19/2022. Our hypothesis was that ECPR would be associated with a higher rate of survival to discharge.

Methods: We performed a retrospective review of all cardiac arrest patients at JHH between 1/27/2017 and 12/19/2022. Inclusion criteria were adult patients (age > 18) presenting with in-hospital cardiac arrest (IHCA) and outside hospital cardiac arrest (OHCA) presenting to our emergency department. We received IRB approval for this project (IRB00373646). A total of 2050 cardiac arrest patients were identified. Of these patients, 46 met the Extracorporeal Life Support Organization (ELSO) criteria for IHCA ECPR. All patients were IHCA as we did not attempt ECPR on any OHCA patients during the study time period.

Results: We found that for the CPR only group, the average survival to discharge was 29%, while the average survival to discharge in the ECPR group was 15%. This was found to be statistically significant with a p-value of 0.04.

	CPR	ECPR	Total
Survivors	582	7	589
Non-survivors	1422	39	1461
Total	2004	46	2050

Discussion: At JHH, we found that ECPR was associated with a lower likelihood of survival to discharge than conventional CPR. Our ECPR survival rate of 15.2% is well below the ELSO average of 30%. This study was not designed to answer the question as to why our outcomes are different from the ELSO average. However, possibilities include low-volume and patient selection. We will conduct a propensity-matched study of this cohort to better understand patient selection and outcomes at JHH.

QH 1.4: Getchell

Evaluation of a cardiology-focused simulation curriculum to augment pediatric resident education in the face of new curricular requirements

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Introduction: Nationally, pediatric resident exposure to caring for patients with cardiac disease is becoming increasingly limited. Patients with cardiac disease are being cared for in specialized centers and within units where residents do not routinely rotate. Additionally, 2025 ACGME-mandated curriculum changes required pediatric residency programs to shift significant amounts of inpatient training experiences to more outpatient, clinic-based experiences. Yet, the American Board of Pediatrics continues to identify acute pathologies common to pediatric patients with cardiac disease as vital knowledge and experience for all pediatric residents to gain during training. The aim of this study is to design and implement a cardiology-focused simulation curriculum for pediatric residents to determine if it improves resident performance and confidence in caring for pediatric patients with cardiac disease, a population at particularly high risk for rapid decompensation.

Methods & Results: We will determine if a standardized simulation curriculum implemented during the pediatric residents' required cardiology rotation improves their performance and confidence in caring for patients with cardiac disease utilizing a pre-post interventional study of approximately 60-70 pediatric residents. The educational strategy will include access to an asynchronous, video-based curriculum of recommended peer-reviewed videos from the OPENPediatrics (openpediatrics.org) website to help build foundational knowledge throughout the rotation plus a dedicated simulation day. Simulation scenarios will cover high-yield pediatric cardiac pathologies, with an educational debrief following each. Evaluation of simulation performance will occur pre- and post- the educational debrief using a checklist developed to highlight critical action items in patient management for each scenario. Residents will also complete a confidence assessment survey pre- and post-curriculum. Individual simulation performance and survey response will be compared using paired t-tests. Data collection is starting October 2025 with a plan to continue for the next 15-18 months.

Discussion: Simulation has been well documented as an effective educational tool in many medical disciplines, though its use in pediatric sub-specialty care is limited. We hypothesize that we will demonstrate the value of simulation as an educational tool to improve resident performance and confidence in managing acute problems among pediatric patients with cardiac disease, which may help bridge current gaps in experiential learning on the wards.

QH 1.6: Hales

Intravenous Methergine and Periprocedural Blood Pressures during Cesarean Section

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Introduction: Postpartum hemorrhage is the leading cause of maternal morbidity and mortality in the world. Uterine atony is the leading cause of postpartum hemorrhage, accounting for around 75% of postpartum hemorrhage cases. Methylergonovine ("methergine") is a common second line treatment for uterine atony which causes sustained contraction of the uterus. Methergine is commonly delivered by intramuscular injection; intravenous (IV) use is approved but limited due to concern for hypertension secondary to vasoconstriction. Our overall interest is to explore whether IV administration with fractionated dosing may provide adequate uterine tone while minimizing side effects related to hypertension.

Methods: We conducted a descriptive case series of cases performed at our institution. Cases were identified using the Multicenter Perioperative Outcomes Group (MPOG) registry. The search parameters were patients who had a cesarean section at Johns Hopkins Hospital or Bayview Medical Center between 2020 and 2025 who received intraoperative doses of methergine, where individual doses were less than 200mcg each. To tolerate potential medical record errors, we considered any sub-200mcg doses to be IV doses. We assessed mean arterial pressure (MAP) means during three periods: perioperative prior to first methergine dose, between first and final dose of intraoperative methergine, and for one hour following final methergine dose.

Results:

Six cases met our criteria.

Patient ID	Intraop IV doses of methergine	Periop MAP prior to methergine	Intraop MAP during methergine dosing	Periop MAP during 1 hour post-methergine
Patient 1	4 x 20mcg	78	71	70
Patient 2	5 x 40mcg	77	84	89
Patient 3	4 x 20mcg	87	86	75
Patient 4	3 x 20mcg	96	95	107
Patient 5	8 x 20mcg	85	69	79
Patient 6	4 x 20mcg	77	71	71

Discussion: The purpose of this study is to evaluate a series of cases to understand the relationship between intravenous methergine and periprocedural blood pressures. The MAPs described in these cases suggest that a fractionated IV methergine approach during a postpartum hemorrhage may preserve hemodynamic stability, but further research is required. Given that methergine is a quick-acting and potent uterotonic, fractionated IV methergine has the potential to decrease morbidity and mortality of patients with uterine atony as well as decrease medication administration and blood transfusions.

QH 2.1: Houshmand

Designing a Web-Based Firearm Safety Curriculum for Clinicians: Insights from a Diverse Focus Group

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Background: Clinicians play a critical role in firearm safety counseling, yet most receive little formal training. As part of broader work on a firearm safety toolkit for trauma centers, we sought to gather insights from a diverse group of experts with lived experience in firearm ownership, military service, law enforcement, and clinical counseling.

Methods: We aimed to identify key firearm safety principles that clinicians should understand to effectively counsel gun-owning patients and families on firearm injury prevention. A half-day, in-person focus group was convened with 11 experts in firearm safety. Participants included physician and nurse clinicians, local and federal law enforcement officials, and military veterans. Participants were identified through organizational leadership based on subject matter expertise with the goal of centering the voices of gun-owning professionals. Facilitated discussions explored clinician education priorities, teaching strategies, and respectful approaches to counseling. Breakout sessions addressed specific clinical contexts: (1) special populations (young children, adolescents, adults with dementia), (2) suicide prevention and veterans, and (3) interpersonal violence.

Results: Audio recordings were transcribed and thematically analyzed. Key themes included the need for clinical integration amidst time and resource constraints; the value of scenario-based training to enhance communication and technical knowledge; and the importance of using nonjudgmental language to build trust. Participants emphasized increasing clinician comfort when discussing firearms, even among those without personal firearm experience, and identified basic firearm knowledge as essential for effective counseling.

Discussion: Findings highlighted key areas for enhancing clinician firearm safety education and identified best practices for effective curriculum design. These insights have guided the development of a web-based training module, co-created with a certified firearms instructor, covering firearm types and safe storage methods. Our findings demonstrate how diverse expert perspectives can shape clinician education to be more credible and effective in supporting firearm injury prevention efforts.

QH 1.9: Manikandan

Uncertain Steps: Gaps in Documentation and Adherence in a Pediatric ICU Early Mobility Program

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Objectives: Early mobility in Pediatric Intensive Care Units (PICU) is associated with improved outcomes, however, electronic health record (EHR) documentation of mobility by nurses remains limited. This study evaluates discrepancies between expected mobility, nursing-report and EHR documentation in a PICU with an early mobility program.

Methods: We conducted secondary analysis of a quality improvement project to increase nurse-led mobility among 101 patients admitted to the PICU for ≥3 days. Mobility level (1 = most restrictive to 3 = most liberal), highest level of mobility achieved (HLM), and number of mobilizations were collected from EHR documentation and end-of-shift interview with nurses (RN-report). We retrospectively assigned expected mobility level, HLM, and mobilization count based on protocol.

Results: Median mobilizations per shift were 1 (IQR 2) by EHR vs. 6 (IQR 2) by RN-report, compared to an expected 6. Mobility level varied by data source. EHR data showed 13% of patients at Level 1, 26% Level 2, 48% Level 3, 14% undocumented. RN-report data showed 9% Level 1, 23% Level 2, 50% Level 3, 28% unknown. Expected levels were 24% Level 1, 23% Level 2, 53% Level 3. Agreement between expected mobility level and EHR was 56.4% (κ=0.34, $p<0.001$) and 53.5% (κ=0.32, $p<0.001$) for RN-report. HLM also varied by source and from the expected. By EHR data, HLM was 13% bedrest, 41% passive range of motion (ROM), 39% out-of-bed activity. By RN-report, HLM was 1% on bedrest, 33% passive ROM, and 53% out-of-bed activity. Expected HLM was 0% bedrest, 29% passive ROM, 54% out-of-bed. The agreement of expected HLM was 38% (κ=0.17, $p<0.001$) with the EHR and 39% (κ=0.18, $p< 0.001$) with RN-report. A higher Pediatric Cerebral Performance Category Score (OR=2.07, p=0.007), sedation infusions (OR=4.25, p=0.042), and feeding tubes (OR=7.7, p=0.074) increased the odds of uncertain mobility level. Feeding tubes also increased the odds of level 3 patients being moved less than expected (OR=0.019, p=0.018).

Conclusions: Discrepancies between nurse-report, EHR data, and protocol expectations are common. Baseline function, sedation infusions, and feeding tubes are associated with mobilization discordance and uncertainty in PICUs. Future research should target education and human factors to improve documentation and protocol adherence.

QH 2.7: Manikandan

Tethered in Place: Equipment-Related Barriers to Early Mobility in PICUs

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Background: Early mobilization of patients in the pediatric intensive care unit (PICU) is safe, feasible, and associated with improved patient outcomes. Yet, patients in PICUs nationwide continue to be poorly mobilized. Indwelling medical equipment is a commonly cited barrier to mobilization despite the rarity of safety events and a low risk of dislodgement. This study identifies clinical characteristics associated with reduced out-of-bed mobility for critically ill patients in the PICU, with a focus on indwelling medical equipment.

Methods: We conducted a secondary analysis of the *PICU Up!* multicenter stepped wedge randomized controlled trial. On each study day, out-of-bed (OOB) activities were documented for patients with a PICU stay ≥ 72 hours at seven U.S. PICU sites. Mixed effects regression was used to estimate odds ratios (OR) with a 95% confidence interval (CI) and patients were nested within study sites. Covariates included age, gender, ethnicity, race, admission reason, Pediatric Risk of Mortality Score (PRISM), baseline functional status, quantity and types of medical equipment, respiratory support, delirium screening results, and family presence.

Results: 2,572 patients and 24,206 study days were included. On average, patients had 1.97 (±1.71) pieces of medical equipment per study day. Having 1 to 2 pieces of medical equipment decreased the odds of OOB mobility by 22% ($p<0.001$) and having greater than 2 pieces of equipment decreased the odds by 38% ($p<0.001$). Specifically, the presence of a central line, arterial line, Foley catheter, chest tube, surgical drain, extracorporeal membrane oxygenation, and intracranial pressure monitor were associated with lower OOB mobility ($P<0.001$). The presence of any sedation also lowered the odds of mobilization (OR = 0.08, 95% CI 0.07-0.09, $p<0.001$), and compared to patients on no respiratory support, patients receiving CPAP/BiPAP (OR = 0.77, 95% CI 0.65-0.91, $p=0.002$), ventilation through a endotracheal tube (OR = 0.05, 95% CI 0.04-0.054, $p<0.001$), or tracheostomy (OR = 0.24, 95% CI 0.19-0.30, $p<0.001$) were also less likely to be moved. Patients with a positive delirium score (OR = 0.40, 95% CI 0.36.-0.45, $p <0.001$) and those who were not screened (OR = 0.84, 95% CI 0.77- 0.92, $p<0.001$) had lower odds of mobilization than patients without delirium. Compared to surgical candidates, patients admitted to the PICU due to trauma were moved less (OR = 0.42, 95% CI 0.29-0.62, $p <0.001$). Meanwhile, patients on nasal cannula (OR = 1.26, 95% CI 1.07-1.48, $p=0.006$) and those with a PICC line were more likely to mobilized (OR = 1.75, 95% CI 1.5-2.0, $p<0.001$). Adjusted odds ratios largely supported these findings. Additionally, the presence of family was a positive predictor for OOB mobility (aOR = 1.59, 95% CI 1.06- 2.38, $p=0.025$). As was the presence of any central venous line (aOR = 1.57, 95% CI 1.23-2.01, $p<0.001$) and a ventricular assist device (aOR = 3.49, 95% CI 1.00 - 12.14, $p=0.049$).

Conclusion: Indwelling medical equipment, sedation, mechanical ventilation, and delirium significantly decrease the odds of out-of-bed mobility for patients in the PICU, whereas the presence of family at the bedside increases the odds. Existing literature strongly supports the fact that medical equipment does not preclude safe mobilization, thus increased education of PICU staff and family-involved treatment plans may help overcome the culture of immobilization and decrease risks of long-term morbidity in critically ill pediatric patients.

QH 2.4: Nadkarni

Weaning High Flow Nasal Cannula in Pediatric Bronchiolitis: A PICU Quality Improvement Project

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Introduction: High flow nasal cannula (HFNC) has been increasingly used in children with bronchiolitis requiring care in the pediatric intensive care unit (PICU). However, children may stay on HFNC longer than medically necessary when concerted efforts are not made to wean. We implemented a fellow-championed, respiratory therapist (RT)-driven weaning protocol for HFNC in the PICU for children with bronchiolitis using a quality improvement framework.

Methods: On September 1, 2024, we implemented a respiratory scoring system and an RT-driven decision support tool for children < 2 years of age with bronchiolitis in the PICU of a single academic children's hospital. Patients with baseline respiratory support prior to admission, infants < 6 months born at < 34 weeks gestational age, and children with chronic lung disease or congenital heart disease were excluded. We retrospectively extracted data for 12 months pre- and 10 months post-intervention to compare outcomes and balancing metrics.

Results: A total of 242 bronchiolitis admissions in 236 unique children were included in the analysis: 120 (50%) admissions during the 12 months pre-intervention and 122 (50%) admissions during the 10 months post-intervention. Median age was 8.0 months (interquartile range 2.7-15.0). The median hospital length of stay (LOS) was significantly reduced post-intervention compared to pre-intervention (46.2h vs 70.7h, $p < 0.001$). The median HFNC length of therapy (LOT) was also significantly reduced after intervention (13.5h post-intervention vs 29.9h pre-intervention, $p < 0.001$). Prior to intervention, 19 bronchiolitis admissions (16%) required escalation to positive pressure ventilation (PPV), compared to 15 admissions (12%) post-intervention. Escalation to intubation occurred in 9 admissions (8%) pre-intervention and 3 admissions (2%) post-intervention. There were no deaths in either group. Further analyses of balancing measures are underway.

Conclusion: Implementation of a standardized HFNC weaning pathway was associated with decreases in hospital LOS and HFNC LOT, without worsening escalation to PPV, escalation to intubation, or death. An RT-driven pathway is a safe and feasible way to ensure continued weaning of HFNC when it becomes medically unnecessary, improving outcomes and optimizing healthcare resource utilization.

QH 2.10: O'Conor

Multicenter Perioperative Outcomes Group (MPOG) Health Equity Initiative Phase I

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Introduction: Health equity entails that every patient receives the highest standard of care, regardless of background, identity, or circumstances – an ethical and medicolegal imperative that requires examining systems and practice patterns. The Multicenter Perioperative Outcomes Group (MPOG) data platform offers a powerful foundation to evaluate health equity in perioperative care by aligning local performance with MPOG's national evidence-based quality measures and incorporating detailed demographic data to identify disparities in care delivery across race, ethnicity, gender, and other attributes. At Johns Hopkins Hospital (JHH), we launched a multi-phase health equity initiative (HEI) powered by MPOG, with Phase I focused on identifying division-specific measures and characterizing health equity status.
Methods: The MPOG platform and HEI were introduced at divisional quality meetings over the course of academic year 2024-2025 (AY25) on a staggered schedule. Meetings were also held with division chiefs, quality improvement (QI) leads, and/or MPOG leads. For each division, one to three measures were selected by these leaders for health equity analysis based on relevance to the division's practice focus. Baseline data assessed JHH performance compared to national benchmarks, grouped by race/ethnicity and gender, over the 12 months prior to selection. Performance was deemed equitable if subgroup performance either (1) demonstrated crossover of monthly trend lines during the 12-month period (indicating no consistent disparity between groups), or (2) showed a stable absolute difference of <1% across all months. Division-specific reports were generated monthly and emailed to division chiefs, QI leads, and MPOG leads through the end of AY25. Semiannual reports were presented at the JHH Quality leadership meeting. Analysis of MPOG data is IRB acknowledged for quality improvement purposes.
Results: Participating divisions in Phase I included Cardiac, Pediatric, Obstetric, Adult Multispecialty, Neuro, and Ambulatory. Initially, 13 of 20 measures (65%) had equitable and target-meeting performance, which increased to 18 of 20 (90%) by the end of the initial phase.

		2023-2024		2024-2025	
Division	**Measure**	**Race/Ethnicity**	**Gender**	**Race/Ethnicity**	**Gender**
Cardiac	Acute Kidney Injury in Cardiac Cases (AKI-02-C)				
	Hyperglycemia Treatment (GLU-08-C)				
Obstetric	Antibiotic Timing for Cesarean Delivery (ABX-01-OB)		N/A		N/A
	Hypotension SBP<90 in Cesarean Delivery (BP-04-OB)		N/A		N/A
Pediatric	Pain: Multimodal Analgesia (PAIN-04-Peds)				
	Overtransfusion (TRAN-04-Peds)				
Adult Multi	Thermoregulation- Active Warming or T≥36°C (TEMP-01)				
	Transfusion Vigilance (TRAN-01)				
	Overtransfusion (TRAN-02)				
Ambulatory	PONV Prophylaxis (PONV-05)				
Neuro	Pain: Multimodal Analgesia in Spine Surgery (PAIN-02)				

Key:
Equitable & met national target | Met national target, but with inequity | Performance below target, no inequity | Performance below target, no inequity

Discussion: Divisional performance on MPOG measures was moderately equitable and target-meeting at baseline and improved over the observation period. Phase I of the health equity initiative was designed to use a minimally burdensome approach to characterize performance and empower divisions with equity data relevant to their practice needs. Using the MPOG platform can empower leaders to examine evidence-based measures for patterns in processes and outcomes, uncover gaps, and drive targeted, data-informed improvements aimed at promoting equitable care for all patient populations, which we look forward to in Phase II.

QH 2.8: Ojukwu

PICU Up! rounds: An ICU liberation quality improvement initiative

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Background: Early and progressive mobilization is a feasible and safe intervention in the pediatric intensive care unit (PICU) setting. Designed to mitigate preventable PICU-acquired morbidities, early mobility has been associated with improved clinical outcomes. The Johns Hopkins Children's Center developed the first multifaceted early and progressive mobilization program for children, PICU Up!, carried out by an interprofessional clinical team. However, ten years into implementation of PICU Up!, new barriers to its delivery have been identified, including a lack of appropriate use of delirium assessment tools and inadequate documentation of PICU Up! bundle elements. The aim of this project is to increase proportional adherence to the early mobilization practice targets outlined by the PICU Up! program.

Methods & Results: We developed and implemented "PICU Up! rounds" wherein members of the interprofessional PICU Up! team round on a panel of five selected PICU patients each week. For each patient, the team systematically reviews documentation and orders to determine proportional adherence to PICU Up! bundle elements. Proportional adherence is the proportion of eligible elements executed accurately divided by the number of eligible elements. Adherence indicators include accuracy of sedation goals and orders, daily sedation doses administered, screening for spontaneous breathing trial eligibility, delirium screening, delirium management, accuracy of mobility level determinations and activity orders, and family engagement.
PICU Up! rounds began in April 2025 and occur weekly from 13:30-15:00 every Thursday. Eligible patients are those with a PICU stay ≥ 24 hours without planned transfer, brain death testing, or withdrawal of life-sustaining medical equipment. Five patients are randomly selected by 11:00 on the day of rounding. Over 27 weeks, we have conducted rounds on 135 patients, providing direct education and feedback to each patient's interprofessional care team on bundle adherence. The most common feedback has focused on improving documentation and orders, optimizing rehabilitation plans, and educating teams about delirium screening and prevention. The PICU Up! rounds have been well received by the care team. Future iterations of Plan-Do-Study-Act cycles will include developing a high-risk patient checklist, asking care teams to identify high-risk patients proactively, and distributing formal email feedback with suggestions for improvement to the entire team.
We will conduct a pre-post intervention evaluation. Data comparisons from the one-year period preceding the intervention and six months after the intervention has concluded will be used to ascertain intervention impact and sustainability, respectively. Demographic data will be compared using descriptive statistics.

Conclusions: Weekly PICU Up! rounds conducted by an interprofessional team to ensure adherence to the PICU Up! program are feasible and sustainable. We hypothesize that implementation of PICU Up! rounds will improve proportional adherence to the PICU Up! intervention program and facilitate improved evidence-based care for critically ill children.

QH 2.5: Pickle

What's in a Name: A Comparative Analysis of Pediatric Palliative Program Naming Conventions

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Introduction: Pediatric palliative care divisions use diverse naming conventions, which may influence perceptions of the service. The goal of this study is to systematically review the naming practices of palliative care services at children's hospitals and analyze them through the lenses of framing and health communication.

Methods: Public-facing websites, informatics and brochures for top 50 international children's hospitals were reviewed, as defined by *Newsweek* publication's "specialized hospital rankings". Program names and descriptions were extracted with "key terms" identified within their titles, including whether or not they included "palliative" explicitly. Service names were categorized into groups by themes that included "direct medical", "neutral", "supportive" and "family or values oriented". Additional information was extracted including resources provided by the services and if the program sources included "child or family friending branding".

Results: Preliminary review indicates increasing adoption of more varied naming styles for Pediatric Palliative programs and services. While direct medical terms ("Palliative", "Hospice") are still used frequently (69.4%), an increasing number of programs are implementing neutral ("Advanced Care", "Life Long Care"), supportive ("Supportive Care", "Quality of Life") and values oriented ("Comfort Care") terms when naming or renaming their services.

Figure: Table 1

Table 1. Demographics of Pediatric Palliative Programs

		Number	%
International			
	Yes	24	48%
	No	26	52%
Institution Type			
	Children's Hospital	36	72%
	Children's Center within System	14	28%
Naming Theme			
	Direct Medical	41	69.4%
	Neutral	9	15.3%
	Supportive	6	10.2%
	Family or Values Oriented	3	5.1%
Palliative Explicit			
	Yes	41	82%
	No	9	18%
Family Friendly Branding			
	Yes	17	34%
	No	33	66%

Discussion: Naming conventions for Pediatric Palliative services vary widely and, while many still use direct "palliative" terminology, others are utilizing differing themes along with these more traditional medical phrases. These trends align with efforts to reduce stigma and improve referral uptake. Findings may guide institutions in selecting non-stigmatizing, family-centered program names without misrepresenting service scope.

QH 1.1: Thompson

Meeting the Need: Feasibility of Implementing a Pediatric Sedation Service

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Statement of Need: The Pediatric Sedation Service is a novel entity at the Johns Hopkins Children's Center, extending moderate and deep sedation services beyond the ORs, PICU, and Pediatric ER. This new service aims to optimize the skillsets of multiple subspecialists, leveraging the experience of pediatric critical care medicine physicians in natural airway sedation and facilitating availability of pediatric anesthesiologists for operating room and general anesthesia cases. Born out of a partnership between the Departments of Anesthesiology-Critical Care Medicine and Pediatrics, it consists of a phased rollout with Phase I consisting of inpatient cases and outpatient oncology cases. Phase 1 aims to 1) improve efficiency of patient care for diagnostic and therapeutic procedures and 2) maximize the utilization of pediatric ORs. We present here markers of feasibility (e.g., case mix and service utilization) and safety (adverse events).

Program Description: The service is staffed by a pediatric intensivist as sedationist and PACU nurse as sedation RN, with Phase I live as of July 9, 2025. Its current home is PACU Bay 33, with patients coming through pre-op prep and recovering post-procedure in the PACU. The service currently operates 3 days a week for bedside procedures that are to be performed by proceduralists (residents, APPs, Attendings, etc.) working within their routine scope of practice.

Preliminary Outcomes: Through approximately 2 months, 93 cases have been performed, with a median of 4 daily cases over the most recent 3 weeks (overall median 3 cases/day) with 40 inpatient consults. Procedures have been performed by nine subspecialties spanning the medical and surgical fields: Oncology, General Pediatric Surgery, Urology, Radiology, VAT-PICC Team, Dermatology, Neurology, Plastic Surgery, and Nephrology. Residents, APPs, and attendings have all served as proceduralists, and all procedures have been completed successfully. No major patient safety events have occurred from a cardiorespiratory standpoint. Challenges have emerged in the domains of 1) resources (limited physical space, service dates, and staffing for proceduralist) and 2) workflows (e.g., appropriate billing and obtaining IV access). Evidence of fidelity to the established goals includes: 1) performing same-day procedures for new oncologic diagnoses, 2) removing a central line to allow same-day discharge when no OR slots were available, and 3) providing moderate sedation for a skin biopsy when anxiolysis was insufficient.

Next Steps: While ongoing work is needed to streamline workflows, these early results demonstrate feasibility of the Pediatric Sedation Service and suggest that it is achieving its major goals safely and effectively. With improved resources (space and service days), the service is well-positioned to transition to Phase II and begin scheduling outpatients. Next steps should focus on obtaining formal feedback from proceduralists and families in addition to the creation of a data dashboard for continued safety and efficacy monitoring

QH 1.3: Wang

The Pediatricians Providing Perioperative Care Project (P4): What are the educational needs of pediatric residents to optimize perioperative care of children?

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Introduction: Pediatricians are vital in the preoperative evaluation and postoperative management of children. However, pediatricians have little exposure to the operative environment and have no required competencies or tested knowledge surrounding pediatric perioperative management by the ACGME or ABP. Further, no prior work has been done to understand the training needs of pediatricians in these domains. Our objective was to carry out a needs assessment of perceived perioperative care training needs through the lens of pediatrics trainees and pediatric anesthesiologists to inform educational objectives.

Methods: Cross-sectional surveys were distributed to pediatrics trainees and anesthesiologists (attendings/fellows) across four tertiary care children's centers. Descriptive and comparative statistics were performed and thematic analysis was performed for open-ended responses. Combined pediatrics/anesthesiology trainees were excluded from analysis.

Results: The survey was deployed to 503 potential pediatric resident and 169 potential pediatric anesthesiologist respondents. Among pediatric residents, 23% (115/503) completed the survey along with a 43% response rate (73/169) for anesthesiologists. Both groups rated the importance of pediatric training in perioperative care similarly with median ratings out of 10 for pediatrics trainees (7, IQR 6-8) was similar to ratings of pediatric anesthesiologists being (7, IQR 5-8) [$p = 0.18$]. However, out of 10, trainees reported feeling significantly more comfortable with perioperative management (5, IQR 3-6) than their perceived adequacy of training by anesthesiologists (3, IQR 2-4) [$p < 0.001$]. 59% of surveyed trainees rated their current perioperative training as inadequate. Responses were not significantly different between centers. Thematic analysis of pediatrics residents demonstrated a need for more training in preoperative assessment and risk stratification, and management of postoperative pain and complications. Trainees also emphasized communication difficulties and inadequate handoff with anesthetic and surgical teams as a key concern. Anesthesiologists highlighted preoperative optimization and management (NPO timing, medication management, indications for preoperative testing), accurate assessment of perioperative risk, and an understanding of differences in anesthetic approaches as knowledge gaps for pediatrics trainees.

Discussion: This study is the first to explore pediatric trainee and anesthesiologist perspectives on pediatrician perioperative care training. Both groups agree that current training is inadequate in preparing pediatricians to effectively deliver this care. Next steps include using identified knowledge gaps to inform new medical education curriculum for pediatricians.

Conclusions: Pediatricians are integral to the perioperative care of children but receive inadequate training to feel confident and competent in this role.

QH 1.12: Wang

WikiAnesthesia: An Open-Source Mobile App for Point of Care Clinical Decision Support and Emergency Management

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Introduction: WikiAnesthesia is a crowd-sourced online resource designed to provide concise, practical, and evidence-based information for anesthesia clinicians, with over 2500 members contributing to over 600 articles. However, there is a need for affordable point of care solutions optimized for perioperative environments with time-sensitive clinical decision-making. Towards this end, we have developed the WikiAnesthesia Mobile Application, an open-source, freely available app intended to provide a “one stop shop” for accessing anesthesia knowledge in real-time in the OR.

Methods: Our app is built on Flutter, an open-source framework for developing applications for multiple platforms including web, iOS and Android. Key design priorities included offline access to emergency resources, user-friendly search functions, and streamlined integration of high-yield topics such as drug dosing, subspecialty information, and resources for trainees. Through WikiAnesthesia’s “Practice Group” feature, users can access institution-specific details, such as surgeon and ERAS preferences, phone numbers, door codes, and rotation guides in a searchable, easy-to-read format.

Results: At time of submission, a closed alpha is available for Hopkins residents, with an open beta release in the coming weeks. Features include access to all articles on WikiAnesthesia, a mobile-optimized version of the Stanford Emergency Manual, perioperative checklists, drug dosing calculators, and pediatric equipment sizing.

Conclusion: By addressing accessibility and usability gaps with other resources, WikiAnesthesia represents a step forward for disseminating point of care anesthesia knowledge in the fast-paced perioperative setting. Future directions include broader dissemination and formal evaluation of the app’s impact on education and clinical practice.

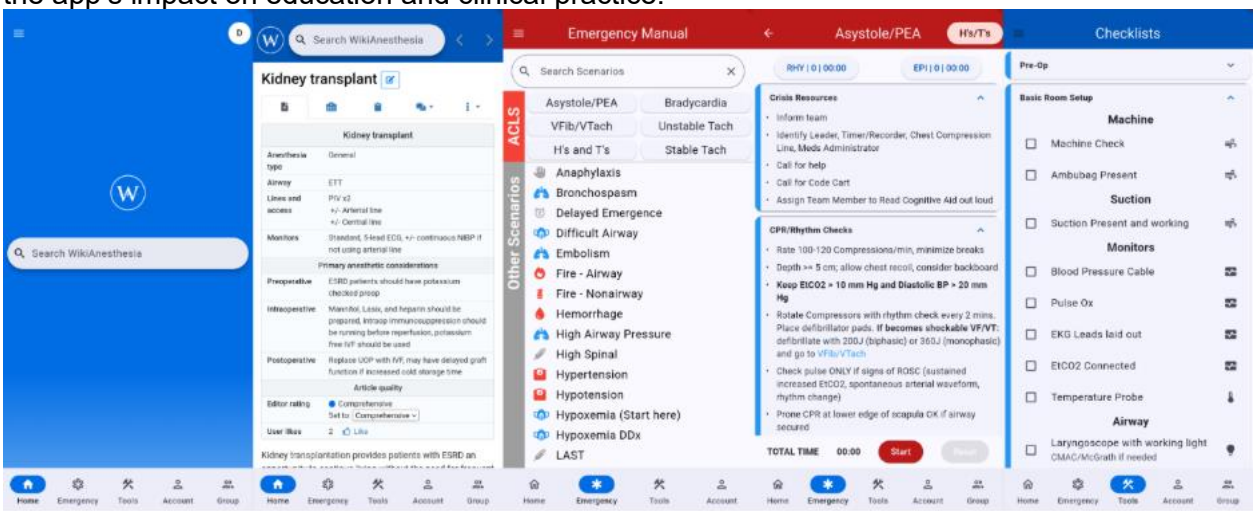

Figure 1: Screenshots from the WikiAnesthesia Mobile App

QH 2.9: Yi

Complication as a Determinant of Hospital Mortality in Adult ECMO Support

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Introduction: Extracorporeal membrane oxygenation (ECMO) rescues adults with refractory cardiac or respiratory failure, yet hospital mortality remains >40%. Outcomes depend not just on initial illness but on accumulating complications. We quantified how death risk rises with each extra complication and pinpointed the most lethal two-event combinations in a modern adult ECMO cohort.

Methods: Using the Johns Hopkins ECMO registry, we retrospectively examined all adult runs from January 2017 through September 2025. Only the first run per hospitalisation was included. Eleven major complications were abstracted and independently validated: renal-replacement therapy (RRT), acute brain injury, sepsis, severe hyperbilirubinaemia, major cannula or surgical bleeding, gastrointestinal haemorrhage, cardiac tamponade, limb fasciotomy/amputation, cardiopulmonary resuscitation (CPR) while on ECMO, and seizures. The primary outcome was in-hospital mortality. Descriptive statistics were calculated, mortality was tabulated across strata of cumulative complication count (0, 1, ≥2). Two-complication dyads were displayed in a heat map and evaluated for synergistic lethality.

Results: The study comprised 428 runs in 408 adults (median age 55 years, 61% male; 30.9 BMI, 71% VA mode). Median support duration was 6 days. 40% of patients were free of major complications, 29% had one, 18% two, and 13% three or more. Overall mortality was 51%. Death rose with each added event: VA climbed from 34% (zero) to 100% (five), while VV stayed between 50–75% once any complication occurred(Figure 1A). Time on support increased step-wise with complication load: patients with no complications averaged 8.8±12.4 days, those with a single event 10.5±15.7 days, and those with multiple events 19.6±24.4 days—more than double the “no-event” duration ($p<0.001$). CPR on ECMO (81% mortality), hyperbilirubinaemia (81%), and seizures (75%) were the most lethal single events. Among 55 possible dyads, five demonstrated crude mortalities ≥80% (Figure 1B).

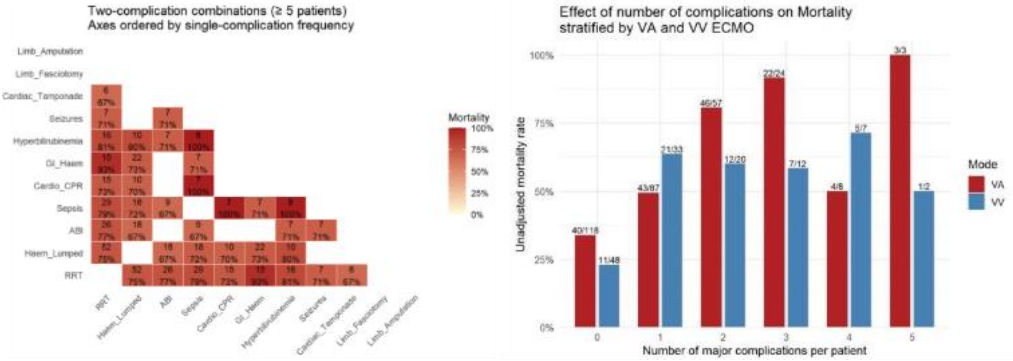

Figure 1. (A) Bar chart showing how increasing numbers of major complications raise hospital mortality, displayed separately for VA (red) and VV (blue) ECMO modes. (B) Heat-map shows renal-replacement therapy appears in the most frequent, especially lethal when coupled with gastrointestinal haemorrhage. Sepsis reaches highest mortality when combined with hyperbilirubinaemia or on-ECMO CPR.

Discussion: Our findings reveal a graded relationship between complication count and death, with renal failure acting as a “common accelerator” that magnifies harm when paired with other insults. Limitations include the retrospective single-centre design, potential misclassification of complications, and lack of granular physiologic scores, underscoring the need for external validation. Nevertheless, integrating complication thresholds and high-risk pairs into bedside algorithms may improve prognostication and support data-informed decisions about continuing or discontinuing ECMO.

QH 1.1: Yu

Development of A Novel Ophthalmic Anesthesia Curriculum for an Ophthalmology Residency Program

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Introduction: Ophthalmic anesthesia (OA) is essential for patient safety and surgical outcomes, yet many residents begin training with little anesthesiology exposure. Despite being an ACGME milestone, OA education remains inconsistent across residencies, with few offering structured curricula. This gap can leave interns underprepared for perioperative decision-making and limit interdepartmental collaboration. To address this, we developed a competency-based OA curriculum integrating multidisciplinary and multimodal learning for ophthalmology interns.

Methods: A multidisciplinary team of ophthalmology and anesthesiology faculty and residents at a single academic institution developed a 4-week hybrid OA curriculum using Kern's six-step approach. Interns gained in-person experience by assisting anesthesiology attendings in perioperative care and attending lectures, Grand Rounds, and simulation workshops. The virtual component followed a "Watch, Listen, Read, Test, Teach" format, incorporating asynchronous materials such as video tutorials, podcasts, readings, assessments, and a capstone presentation. Pre- and post-rotation surveys evaluated self-reported knowledge, perceived relevance, confidence, and comfort with OA delivery. Descriptive statistics analyzed changes in these outcomes.

Results: Nine ophthalmology interns reported two or fewer weeks of prior anesthesiology experience. Respondents' self-assessed OA knowledge rose from a pre-session mean of 2.63 to a post-session mean of 3.43 on a five-point Likert-type scale. Perceived clinical importance of OA rose from a pre-session mean of 5.57 to a post-session mean of 6.18 on a seven-point Likert-type scale. Confidence and comfort in providing OA rose from a pre-session mean of 2.30 and 1.94 to a post-session mean of 4.50 and 4.18, respectively, on a five-point Likert-type scale.

Discussion: A step-wise, multidisciplinary OA curriculum was feasible to implement and associated with measurable gains in trainees' knowledge, attitudes, confidence, and comfort in delivering OA. While limited by small sample size, single-institution design, and reliance on self-reported outcomes, this pilot highlights the potential for broader adoption and standardization across ophthalmology residency programs, addressing a critical educational gap in early surgical training. Future studies should evaluate long-term retention and clinical performance outcomes.