Department of Pediatrics
UNIVERSITY OF WISCONSIN
SCHOOL OF MEDICINE AND PUBLIC HEALTH

RESEARCH WEEK

Abstract Booklet

Virtual Lectures & Poster Presentations
May 23-27, 2022

Department of Pediatrics
UNIVERSITY OF WISCONSIN
SCHOOL OF MEDICINE AND PUBLIC HEALTH

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Schedule of Events

Monday, May 23
8-9 a.m., Morning Report: Quality Improvement and Scholarly Work
12-1p.m., MOC Part 4 Overview

Tuesday, May 24
8-9 a.m., Morning Report – Mentor and Mentee Relationships
1:30-5 p.m., Fellow Capstone Research Presentations

Wednesday, May 25
8-9a.m., WARF Presentation
12-1:00 p.m., Regulatory, Compliance and Recruitment Strategies

Thursday, May 26
7:30-8:30 a.m., Odell Lecture (Pediatric Grand Rounds)
8:30-9:00 a.m., Odell Award Recipient and Presentation
9:00-9:30 a.m., Wald Award Recipient and Presentation
9:40-12:30 p.m., Wald Faculty Research Forum

Friday, May 27
1-1:30 p.m., Research Week Keynote Presentation
1:30-3 p.m., Platform Presentations
3-3:30 p.m., Opportunity to view online posters and abstracts
3:30-5 p.m., Virtual Poster Presentations

Platform Presentations

1:30-3:00 p.m.

Time	Presenter	Title
1:30-1:45	Hannah Schumacher, MD Tyler Sternhagen, MD	Reducing time to enteral feeding during HFNC use for bronchiolitis
1:45-2:00	Aisha Ansar, MBBS	Sharp Rise in New-Onset Pediatric Diabetes During the Covid-19 Pandemic
2:00-2:15	Narmin Mukhtarova, MD	Atopic phenotype is influenced by biological sex and iron deficiency at birth
2:15-2:30	Diane Brown, MD	Improvements in post-operative cardiac surgery arrhythmia identification using the Atriamp signals
2:30-2:45	April Hall, PhD, MS, CGC	Improved Insurance Coverage of Exome Sequencing in an Outpatient Medical Genetics Clinic Leads to Increases in Diagnoses and Positively Impacts Clinical Management
2:45-3:00	Elizabeth Mann, MD	Delivering Advancements in the Lives of Youth with Type 2 Diabetes (DAILY T2D): a quality improvement initiative to address disparities and provide quality, individualized care

Platform Presentations

1:30-3:00 p.m.

1. **Reducing time to enteral feeding during HFNC use for bronchiolitis**
   Schumacher H, Sternhagen T, Koffarnus K, McCormick N, O'Connor K, Shadman K

2. **Sharp rise in new-onset pediatric diabetes during the COVID-19 pandemic**
   Ansar A, Livett T, Beaton W, Carrel A, Bekx T

3. **Atopic phenotype is influenced by biological sex and iron deficiency at birth**
   Mukhtarova N, Babu A, Coe C, Kling P

4. **Improvements in post-operative cardiac surgery arrhythmia identification using the atriamp signals**
   Brown D, Al-Subu A, Zhang X, VonBergen N

5. **Improved insurance coverage of exome sequencing in an outpatient medical genetics clinic leads to increases in diagnoses and positively impacts clinical management**
   Hall A, Garcia K, Smid C, Meder A, Perrera L, Scott Schwoerer J

6. **Delivering advancements in the lives of youth with type 2 diabetes (daily T2D): A quality improvement initiative to address disparities and provide quality, individualized care**
   Mann E, Rehm J, Roe E, Beaton W, Shadman

Reducing time to enteral feeding during HFNC use for bronchiolitis

Schumacher H, Sternhagen T, Koffarnus K, McCormick N, O'Connor K, and Shadman K

Background: Enteral feeding in children receiving high flow nasal cannula (HFNC) for viral bronchiolitis is often delayed due to perceived concerns of ventilation-swallowing dysfunction, peri-intubation aspiration risk, or aspiration-related respiratory failure (ARRF), despite recent evidence suggesting that early enteral nutrition during HFNC use is safe, well tolerated, and associated with vital sign improvement and earlier discharge. Our aim is to analyze local feeding practices in these patients to develop a standardized feeding workflow with a goal of reducing the average time to enteral feeding by 50% by April 2023.

Design/Methods: An interdisciplinary stakeholder group met to understand the variation in feeding children with bronchiolitis treated with HFNC. Retrospective chart review was performed on patients admitted to the American Family Children's Hospital with bronchiolitis treated with HFNC during the respiratory seasons of 2019-2022. Patients were excluded if they were less than 32 weeks gestational age, had a concurrent diagnosis of pneumonia on admission, or underlying history of hypotonia or dysphagia. Practice variation was analyzed via fishbone diagram to identify common root causes, change ideas, and measures for future improvement cycles. The primary outcome measure was time between HFNC initiation and first enteral feeding. Flow rates at time of first feed and route of feed were also collected. Documented concern for feeding related aspiration pneumonia was collected as a balancing measure. Time to first feeding was analyzed using an Individual statistical process control chart.

Results: The group identified a lack of shared vision, local culture of feeding practices, and non-standardization as common causes for practice variation. Of the 55 patients reviewed, average time from initiation of HFNC to first feeding was 12.6 hours with a range from 15 minutes up to 49 hours. Average flow rate on HFNC at time of first feed was 1.2 L/kg. Only 2 patients were fed via nasogastric tube for their first feed on HFNC. None of the included patients developed documented pneumonia requiring treatment with antibiotics following re-initiation of feeds while on HFNC.

Conclusions: The large variation in nil per os time suggests a lack of a shared interdisciplinary mental model of feeding children with bronchiolitis on HFNC. Next steps include development of a standardized feeding guideline for this specific patient population and ongoing tracking of measures.

*** Sharp rise in new-onset pediatric diabetes during the COVID-19 pandemic**

Ansar A, Livett T, Beaton W, Carrel A, Bekx T

Background: Recent studies report a significant impact of the COVID-19 pandemic on the incidence and severity of diabetes. Our study aims to determine the incidence of new onset pediatric diabetes pre-pandemic vs during the pandemic. A second aim was to analyze the presentation based on age, severity, HbA1c, BMI, and Covid testing.

Design/Methods: This retrospective cohort study includes pediatric patients with newly diagnosed diabetes (Type 1 and 2) admitted to the American Family Children's Hospital (Madison, WI) from 2018 to 2021. Data includes age at diagnosis, body mass index, hemoglobin A1c % and pH at presentation, presence of autoimmune pancreatic antibodies, and Covid-19 PCR results at admission in pre-pandemic (Jan 2018-March 2020) versus pandemic periods (March 2020 - through 2021. Diabetes was diagnosed as Type 1 when 1 or more pancreatic antibodies were positive, Type 2 when all 4 antibodies were negative and BMI >85th percentile. Statistical analysis was performed using SAS software with the incidence rates analyzed using univariate and multivariate Poisson regression analyses.

Results: During the pandemic, the incidence of both T1DM and T2DM increased (67% and 257% respectively), and a higher percent of T1DM patients presented in DKA(diabetic ketoacidosis), i.e., pH <7.3 (62% vs 54% pre-pandemic). Rates of severe DKA (pH <7.1) increased from 19% in 2018-2019 to 26% in 2020, and almost 30% in 2021. T1DM patients with a BMI >95th percentile increased from fewer than 10% to above 15%. There were no significant differences observed in HbA1c between the two periods. Almost all patients were Covid-19 PCR negative at the time of diagnosis (97% in 2020 and 93% in 2021).

Conclusions: We and others have shown an increased number and severity of newly diagnosed pediatric diabetes cases with the pandemic. The increase in the incidence of pediatric diabetes at our center was not explained by factors such as changes in referral patterns or insurance coverage. Societal factors such as changes in the functionality and accessibility of the healthcare system and parental fears over contracting Covid may have contributed to increased severity at time of presentation. A possible direct diabetogenic effect of Covid-19 remains unknown.

*Accepted at Pediatric Endocrine Society 2022

*** Atopic phenotype is influenced by biological sex and iron deficiency at birth**

Mukhtarova N, Babu A, Coe C, Kling P

Background: Sex differences are already evident in some innate and adaptive immune responses at delivery, which may reflect sex-related differences in growth rates and iron utilization. Low levels of storage iron in neonates have been associated with risk for eczema and wheezing in infants/toddlers. A skewed cytokine responses by mononuclear cells (MNC) in the neonate may be indicative of an atopic phenotype. However, the interaction between neonatal sex, iron deficiency (ID), and the cytokine profile of MNC from cord blood (CB) is unknown. The objective of this study was to determine sex-specific effects of ID on CB MNC cytokine responses at delivery.

Design/Methods: CB was collected from healthy term newborns after elective cesarean delivery. Samples were categorized by biological sex and neonatal iron status. Maternal and infant sociodemographic factors were considered as covariates. ID was defined as CB transferrin saturation ≤25%. Th1 and Th2 cytokines were obtained. MNC were stimulated in culture for 24 hr with the mitogen phytohemagglutinin to induce cytokine responses. To delineate the direct impact of iron on MNC cytokine response, iron was chelated with deferoxamine (DFX). Thiazolyl blue (MTT) dye confirmed cell viability. Statistical tests included chi-square, ANOVA, Shapiro-Wilk normality test, and either Wilcoxon rank-sum test or t test.

Results: Eighty-five CB samples were analyzed. Male infants were less likely than females to show an eosinophilia at birth ($p=0.02$). Male infants had higher CB MNC IL-6 release ($p=0.03$). ID was associated with lower levels of CB plasma TNF-α ($p=0.02$), but elevated MNC TNFα release ($p=0.01$). DFX did not lessen the significant difference in MNC TNFα release between ID and iron sufficient states; however, the reversed direction of association was observed. Based on MTT results, cell viability did not differ. When stratified by sex, male & female MNC TNFα, female MNC IL-8 release was higher (all $p<0.05$) and female CB plasma IL-6 ($p=0.003$) and TNFα ($p=0.02$) were lower with ID.

Conclusions: Our study indicated that Th1/Th2 cytokine balance may differ in females and males at delivery. Further, ID at birth influenced MNC cytokine release in culture and the release of MNC TNFα in the ID group was susceptible to iron chelation, lowering the response. The linkage between immune processes, iron status, and sex is important for clinicians to appreciate.

*Accepted at Pediatric Academic Societies

*** Improvements in post-operative cardiac surgery arrhythmia identification using the atriamp signals**

Brown D, Al-Subu A, Zhang X, VonBergen N

Background: Following cardiac surgery, as many as 50% - 60% of patients will experience an arrhythmia. These arrhythmias are associated with increased morbidity and occasional mortality. Therefore, rapid and accurate identification is paramount to the improvement of patient outcome.

Design/Methods: An IRB approved prospective observational study of children less than or equal to 18 years of age admitted to the PICU with atrial pacing wires following congenital heart surgery. The AtriAmp was connected to atrial pacing wires and an AEG was displayed along with a surface ECG on GE monitors. Nine different types of arrhythmias were collected over the course of the first five months of the study. A 12-question online survey was given to critical care and cardiology providers at ten different programs across the country as well as being posted to the AAP SOCC fall newsletter. Six questions displayed signals from only the surface leads, while the other six showed the same arrhythmias with an AEG also displayed. Answers were then evaluated for confidence and accuracy. A paired t-test along with mixed method modeling was used to assess the data.

Results: 88 providers, MDs and NPs completed the survey. The study showed that a provider's overall accuracy in diagnosis significantly increased ($p=0.08$) as well did their confidence in their diagnosis ($p<0.001$). When looking at correctness for individual arrhythmias, junctional ectopic tachycardia (JET), sinus tachycardia, and complete heart block showed that providers had a significant increase in their ability to accurately diagnose the arrhythmia when using the AtriAmp signal ($p<0.001$, $p=0.002$, $p=0.010$ respectively).

Conclusions: Use of the AtriAmp increased provider ability to accurately diagnosis post-operative arrhythmias when compared to the same arrhythmias seen on surface electrograms. It also increased a provider's confidence in their diagnosis.

*Accepted Midwest PCCM Meeting

*** Improved insurance coverage of exome sequencing in an outpatient medical genetics clinic leads to increases in diagnoses and positively impacts clinical management**

Hall A, Garcia K, Smid C, Meder A, Perrera L, Scott Schwoerer J

Background: Exome sequencing (ES) is a cost-effective and powerful tool to diagnose patients suspected of having a Mendelian disorder. ES can also impact care and inform prognosis, surveillance, treatments, recurrence risks, support, and research opportunities in patients both receiving a diagnosis and those with negative test results. However, insurance coverage of this testing is often lacking with the testing being denied as experimental or lacking medical necessity. To address this gap, we established collaborations with several local insurers to better understand their needs in providing coverage for exome sequencing.

Design/Methods: Data on all ES prior authorization requests and tests ordered from 2016-2021, in an outpatient medical genetics clinic at UW Health was analyzed. Demographics, phenotype, insurance, testing ordered, results of testing, and clinical outcomes (active clinical management, monitoring and long-term clinical management, family focused outcomes, and reproductive -focused outcomes) was collected.

Results: ES approval rates have significantly improved across all payors (private and public) since 2017 (7 approvals in 2017 (44% approved) and 156 approvals (89% of requests approved) in 2021. Most exomes ordered were proband testing with targeted, confirmation variant testing in parents and/or other family members due to lack of insurance coverage of trio or familial testing. Common indications for ES were multiple congenital anomalies, global developmental delay/intellectual disability, neurodevelopmental disorders, and/or dysmorphic features. Pathogenic variants were detected in 96 individuals (38%, n=255), 154 individuals had one or more variants of unclear significance (60%), and 41 had a negative exome (16%). 29% of individuals received a diagnosis related to their presenting symptoms. ES impacted medical management in 60% of cases overall and often impacted medical management in 2 or more categories. In more than 90% of patients receiving a diagnosis and in 46% of cases not receiving a diagnosis, ES impacted their medical management.

Conclusions: ES has a high diagnostic yield and impacts medical management in an outpatient setting. This data supports the continued and expanded insurance coverage of ES as a first-tier test for underserved populations, adults, and those presenting with features other than multiple congenital anomalies, developmental delays or dysmorphic features.

*Accepted at American College of Medical Genetics

*** Delivering advancements in the lives of youth with type 2 diabetes (daily T2D): A quality improvement initiative to address disparities and provide quality, individualized care**

Mann E, Rehm J, Roe E, Beaton W, Shadman K

Background: Pediatric Type 2 diabetes (T2D) management includes non-insulin medications, nutrition, and exercise therapy. Youth with T2D at this academic center were previously seen across multiple clinics with intermittent access to specialized T2D care. Consolidating T2D visits to diabetes clinic increases access to multi-D care with providers trained in T2D management. The specific aim of this initiative was to increase the percentage of pediatric T2D visits scheduled in multi-D diabetes clinic from 57% to 90% in 6 months.

Design/Methods: A stakeholder team identified key drivers to improve T2D care, including multi-D care at every visit with nutrition, nursing and social work, case management services, consistent provider expertise of novel T2D therapeutics, comorbidity monitoring and treatment, and patient-centered new onset education. Using PDSA cycles, T2D care was consolidated from 5 endocrinology clinics to a specialized multi-D clinic beginning October 2020. Interventions included E-mail and meeting announcements, updating EMR documentation, RN training and protocol tools, provider education rounds, and increasing staffing with a diabetes educator and a care coordinator assistant. Monthly reports were generated and reviewed using run charts or percentage (p) statistical process control (SPC) charts and centerlines were adjusted for special cause using established run and SPC rules. Outcome measure was percentage of all T2D vists scheduled in diabetes clinic. Process measures included T2D visits in diabetes clinic with nutrition services scheduled and total T2D visits in diabetes clinic each month. Balancing measures included qualitative surveys and feedback from providers and care team members.

Results: A total of 691 visits were scheduled for 113 distinct youth with T2D across 5 endocrinology clinics between January 2020 and February 2022. P SPC chart showed special cause was achieved in Oct 2020 and Apr 2021, with an increasing percent of T2D visits scheduled in multi-D diabetes clinic from baseline of 57.2% to 75.6% and 89.6%, respectively.

Conclusions: In the first 6 months, we achieved consolidation of ambulatory pediatric T2D care to a specialized multi-D diabetes clinic. Sustainability will be achieved when rates remain >80% for more than 12 months. Subsequent efforts will focus on screening and managing comorbidities, with an initial focus on diabetes nephropathy.

*Accepted at Academic Pediatric Association Quality Improvement Conference

Group 1: Basic & Neuroscience

Moderator: Jim Gern, MD

3:30-5:00 p.m.

Time	Presenter	Title
3:30-3:35	Jim Gern, MD	Welcome
3:35-3:45	Doug Dean, PhD	Cord Blood DNA Methylation Levels in Genes regulating Hematopoietic and Mesenchymal Cells are Associated with Infant White Matter Microstructure
3:45-3:55	Marissa DiPiero	Increased Inflammatory Indices at Birth Are Associated with Brain Structure at 1-Month
3:55-4:05	Katie Beverley	LCA16 Disease Mutation Shows that Inner Pore Size is Critical for Kir7.1 Channel Function
4:05-4:15	Rachel Spanton	Longitudinal hearing outcomes in infant macaques exposed prenatally to Zika virus
4:15-4:25	Marissa Galli	Multi-modal Longitudinal Assessment of Infant Brain Organization in Perinatal Brain Injury
4:25-4:35	Anthony Babu	Short- and long-term effects of congenital iron deficiency on hematopoietic cell lineages.
4:35-4:45	Marissa DiPiero	Investigating Early Brain Development and Executive Function in Young Children
4:45-4:55	Doug Dean, PhD	Mapping Brain Development in Infants and Young Children Using MPnRAGE T1 Relaxometry
4:55-5:00	Jim Gern, MD	Closing Words and Thank You

Group 2: Basic, Clinical and Quality Improvement

Moderator: Ellen Wald, MD

3:30-5:00 p.m.

Time	Presenter	Title
3:30-3:35	Ellen Wald, MD	Welcome
3:35-3:45	Paige Condit, MD	Investigating the association between renal tissue oxygenation and development of AKI in preterm neonates
3:45-3:55	Nicholas Hess, PhD	Analysis of T cell specific predictive biomarkers of graft-vs-host disease and relapse following post transplant cyclophosphamide prophylaxis
3:55-4:05	Lorenzo Miller	Volumetric Capnography as an Indirect Assessment of Cardiac Output in an Acute Respiratory Distress Syndrome Swine Model
4:05-4:15	Regina Golding	IFN-γ and IL-6 response decreases at onset of acute respiratory distress syndrome in the oleic acid pediatric swine model
4:15-4:25	Kent MacLaughlin	Stem Cell Mobilization by Nominal Hyperbaria
4:25-4:35	Allie Hurst, MD *Tyler Sternhagen will be presenting on behalf of Allie Hurst	Project HIFLO: A Local Quality Initiative to Reduce High-Flow Nasal Cannula in Bronchiolitis
4:35-4:45	Julia Blue, DO	Improving Rate of Asthma Action Plan Completion in Primary Care Pediatric Clinics
4:45-4:55	Danielle Rodgers, MD	Effect of antenatal steroids on T cell receptor excision circle copy number in preterm infants
4:55-5:00	Ellen Wald, MD	Closing Words and Thank You

Group 3: Clinical Innovations & Education

Moderator: Emily Ruedinger, MD, MED

3:30-5:00 p.m.

Time	Presenter	Title
3:30-3:35	Emily Ruedinger, MD, MED	Welcome
3:35-3:45	Jacob Faultersack	Follow-up of infants diagnosed with PFO, secundum ASD, muscular VSD, or PDA during their newborn hospitalization
3:45-3:55	Connor Brown, MD	Accuracy of Prehospital Weight Estimate in Children
3:55-4:05	Hannah Sherfinski	Partnering with PATCH: Integrating Trauma-Informed Care and Resilience into a Youth-Led Program
4:05-4:15	Jayse Weaver	Automated Motion Artifact Detection on Pediatric Diffusion MRI Using a Convolutional Neural Network
4:15-4:25	Colin Korlesky	Making Electroretinography Accessible to All
4:25-4:35	Samantha Williams Al-Kharusy, MD	Resident education on food insecurity: partnering with the community to improve resident comfort, screening, and referrals
4:35-4:45	Ellen Bryant, MD & Laura Dos Reis, MD	A Guide to Telemedicine Use in Adolescent Primary Care
4:45-5:00	Emily Ruedinger, MD, MED	Closing Words and Thank You

Group 4: Practice Patterns and Patient Experiences

Moderator: Ryan Coller, MD. MPH

3:30-5:00 p.m.

Time	Presenter	Title
3:30-3:35	Ryan Coller, MD, MPH	Welcome
3:35-3:45	Samantha Cordum, MD	Children with Surgically Corrected Congenital Heart Disease Who Are Long-Stay Intensive Care Patients: An Analysis of Post-Discharge Burden of Care
3:45-3:55	Anna Uhing, MD	Rare Presentation of Precocious Puberty Secondary to LH-Secreting Adenoma
3:55-4:05	Caleb Kitcho, MD & David Bergstrand, MD	Impact of Enteral and/or Parenteral Nutrition on Outcomes after Autologous Stem Cell Transplant for High-risk Neuroblastoma
4:05-4:15	Christiana Ekezie, MBBS	Hemosuccus Pancreaticus Following Acute Pancreatitis in a 12-Years-old Boy Secondary to Pancreatic Pseudoaneurysm Treated with Endovascular Coil Embolization.
4:15-4:25	Hareem Rauf	A Survey on the Management of Anomalous Aortic Origins of the Coronary Arteries
4:25-4:35	Rachel Engen, MD	Impact of multiorgan and kidney-pancreas allocation policies on pediatric kidney-alone transplant candidates in the United States
4:35-4:45	Madeline Kieren	The Process of Safety Reporting by Parents of Hospitalized Children with Medical Complexity: A Qualitative Analysis
4:45-4:55	Ryan Coller, MD, MPH	Closing Words and Thank You

Group 1: Basic & Neuroscience

Moderator: Jim Gern, MD

3:30-5:00 p.m.

1. **Cord blood DNA methylation levels in genes regulating hematopoietic and mesenchymal cells are associated with infant white matter microstructure**
   Dean III D, Dipiero M, Planalp E, Madrid A, Papale L, McAdams R, Coe C, Alisch R, Kling P

2. **Increased inflammatory indices at birth are associated with brain structure at 1-month**
   DiPiero M, Weix K, Planalp E, Coe C, McAdams R , Alisch R , Kling P, Dean D

3. **LCA16 disease mutation shows that inner pore size is critical for Kir7.1 channel function**
   Beverley K, Shahi P, Pattnaik B

4. **Longitudinal hearing outcomes in infant macaques exposed prenatally to Zika virus**
   Spanton R, Krabbe N, Razo E, Rozycki L, Schotzko M, O'Connor D, Golos T, Hartman A, Ausderau K, Mohr E

5. **Multi-modal longitudinal assessment of infant brain organization in perinatal brain injury**
   Sutter E, Saiote C, Mak V, Dean D, McAdams R, Rao R, Georgieff M, Peyton C, Gillick B, Christopher P, Galli M, Piette C, Schiller J

6. **Short- and long-term effects of congenital iron deficiency on hematopoietic cell lineages**
   Babu A, Mukhtarova N, Smith Z, Kling P

7. **Investigating early brain development and executive function in young children**
   DiPiero M, Pletcher C, Heinrich L, Alexander A, Kecskemeti S, Planalp E, Dean D

8. **Mapping brain development in infants and young children using MPnRAGE T1 relaxometry**
   Dean III D, Shah L, DiPiero M, Pletcher C, Heinrich L, Planalp E, Alexander A, Kecskemeti S

***Cord blood DNA methylation levels in genes regulating hematopoietic and mesenchymal cells are associated with infant white matter microstructure**

Dean III D, Dipiero M, Planalp E, Madrid A, Papale L, McAdams R, Coe C, Alisch R, Kling P

Background: Maternal health and environmental stressors may initiate epigenetic modifications in genes regulating brain networks and architecture. Because hematopoietic and mesenchymal progenitor cells present in cord blood (CB) are under study to improve neonatal encephalopathy, we investigated DNA methylation levels in genes regulating hematopoietic and mesenchymal networks. Our objective was to determine if CB DNA methylation levels in genes regulating hematopoietic and mesenchymal networks are related to infant brain microstructure previously found to be associated with maternal depression and anxiety symptoms.

Design/Methods: 55 mother-infant dyads with CB collected at delivery and diffusion MRI of the infant at 1 month of age were evaluated. Neurite density index (V-IC) was measured using the neurite orientation dispersion and density imaging (NODDI) model from bilateral prefrontal cortex regions that included the frontal gyrus and corona radiata. These regions were previously shown to be influenced by maternal depression and anxiety symptoms during pregnancy. DNA methylation levels were determined using the Infinium HumanMethylationEPIC array. To assess the associations between DNA methylation and V-IC, linear regressions were performed, controlling for CB cell numbers, sex of the infant, gestation corrected age at delivery, Hollingshead socioeconomic status, and motion during MRI acquisition. Genes exhibiting differential methylation were subjected to gene ontological analysis.

Results: 351 differentially methylated genomic positions (DMPs) in CB were with associated with infant MRI neurite density (V-IC) ($p<0.05$, FDR-corrected). Gene ontological annotation of these V-IC-associated DMPs revealed that 50% of the top 24 significant pathways were involved in hematopoietic and mesodermal stem cell development and function, including genes such as TAL1, JAK3, SMAD1, HOXA11, and FOXC1.

Conclusions: Although preliminary, these findings suggest that the impact of maternal depression and anxiety on fetal development of bilateral prefrontal white matter microstructure may act by modifying gene expression patterns of hematopoietic and mesenchymal cells in the circulation. Understanding these processes in early microstructural maturation helps to inform genetics and epigenetic contributions guiding early brain development.

*Accepted at Pediatric Academic Societies

Increased inflammatory indices at birth are associated with brain structure at 1-month

DiPiero M, Weix K, Planalp E, Coe C, McAdams R , Alisch R , Kling P, Dean D

Background: The developing fetal brain is sensitive to maternal health and wellbeing. Inflammatory processes in the placenta and fetal compartment influence early brain maturation and may contribute to the underlying pathophysiology of neurobehavioral disorders during childhood. However, relative vulnerability of different neural processes and brain regions is not known. Thus, it is critical to examine the brain during the perinatal period to better understand the relative vulnerability of different neural processes and brain regions that may contribute to future differential developmental outcomes.

Design/Methods: This analysis included 45 full-term healthy infants with cord blood (CB) collected at delivery and MRI (diffusion and structural) data collected at 1-month of age. Diffusion tensor imaging (DTI) and neurite orientation dispersion and density imaging (NODDI) were used to characterize white matter (WM) microstructure of the posterior limb of the internal capsule (PLIC) and cerebellar hemispheres (CH). Volumetric measures of the hippocampus and amygdala were derived from structural images. Pro-inflammatory cytokines, including IL-6 and TNF-α, were assayed from CB. Linear models were used to assess the association between CB cytokine levels and brain structure at 1-month, controlling for gestation corrected age and sex. Volumetric analyses also considered the influence of total brain volume.

Results: TNF-α significantly predicted axial diffusivity (AD) in the left PLIC. IL-6 was positively related to AD, mean and radial diffusivity, and negatively related to neurite dispersion in the WM of the left CH. Further, TNF-α was positively associated with right hippocampal volume.

Conclusions: Our preliminary data suggest inflammatory activity, i.e. CB cytokines at delivery, is associated with brain development. Associations were found with the PLIC, cerebellum, and hippocampus at 1-month. Left lateralized WM microstructural associations were observed in the left PLIC and left CH, whereas hippocampal volumetric differences were evident on the right. The findings may highlight differential effects of prenatal immune activation on early WM microstructural and volumetric organization. Using NODDI to understand these relationships will inform perinatal influences on neurodevelopment

LCA16 disease mutation shows that inner pore size is critical for Kir7.1 channel function

Beverley K, Shahi P, Pattnaik B

Background: Inwardly rectifying potassium (K+) channels (Kir) maintain membrane potential and K+ homeostasis across many tissues. Mutations in the KCNJ13 gene encoding for Kir7.1 protein, in the retinal pigmented epithelium (RPE), cause pediatric blindness. One-point mutation in the KCNJ13 gene c.458C>T Threonine (T) to Isoleucine (I) at amino acid position 153 lines the inner pore of the tetrameric protein. We sought to elucidate the effect of inner pore size on channel conductance.

Design/Methods: Molecular modeling was performed using Protean3D to determine the inner pore size of T153I, T153G, T153A, T153L, T153C, or T153S. Whole-cell patch-clamp electrophysiology with either extracellular Ringer's or Rb+ was performed on cell's expressing GFP tagged wildtype (WT) Kir7.1 or T153 mutants to determine channel function. Extracellular K+-gradient was used to determine chord conductance. Data analyzed using the Clampfit and ANOVA.

Results: The rank order for inner pore radius was Gly>Ala>Cys>Ser>WT>Ile>Leu. The IV plot for the Kir7.1 WT showed inward current measured at -150 mV with a mean amplitude of -863.67 ± 142.44 pA (n = 8) compared to Ile -68.54 ± 10.49 pA (n = 9, P <0.0001). Extracellular K+ dependent chord conductance confirmed that T153I is nonfunctional. The K+ current amplitude rank order was Cys>WT>Ser>Gly>Ile>Ala>Leu. Chord conductance confirmed the current amplitude data for T153C, T153S, and T153A. Zero-current potential was -57.75 ± 3.23 mV (n = 8) for the WT and -5.46 ± 6.01 mV (n = 9, P <0.0001) for T153I with a rank order of Cys>WT>Ser>Leu>Gly>Ile>Ala. Rb+ ion, selectively permeates through Kir7.1 channel with a fold-change of 7.28 ± 1.63 (n = 8) for WT and 6.48 ± 2.78 (n = 9, P=0.1717) for T153I with a rank order of Leu>Ser>WT>Ile>Cys>Gly>Ala.

Conclusions: T153I was non-functional as determined by K+ ion permeability. Because T153I exhibits Rb+ permeability, it is actually dysfunctional. Based on rank order, inner pore size is critical for Kir7.1 ion conductance. Kir7.1 channels without a narrow inner pore are non-functional. Channels with an inner pore similar to WT exhibit normal function. Channels with inner pore constriction are dysfunctional. Kir7.1 permeability is based on both ion size and inner pore size. The narrow inner pore of Kir7.1 is required for normal channel function.

Longitudinal hearing outcomes in infant macaques exposed prenatally to zika virus

Spanton R, Krabbe N, Razo E, Rozycki L, Schotzko M O'Connor D, Golos T, Hartman A, Ausderau K, Mohr E

Background: Zika virus (ZIKV), a mosquito-borne virus in the family Flaviviridae, causes a spectrum of disease outcomes and neurodevelopmental consequences in infants who are exposed prenatally, including structural anomalies, visual and auditory deficits, and other neurological delays. Sensorineural hearing loss occurs in 6% of human infants with microcephaly who have congenital Zika syndrome. It is unknown how maternal ZIKV infection conditions, such as the timing of infection during pregnancy, virus isolate, or maternal history of dengue virus infection impact the rate and trajectory of hearing deficits.

Design/Methods: Here, we utilized a translational macaque model to elucidate the impact of multiple maternal ZIKV infection conditions on hearing outcomes. We tested auditory brainstem responses (ABR) in infants at 1, 3, 6, and 12 months of age who were born to dams with the following gestational ZIKV infection conditions: a Puerto Rican ZIKV isolate (ZIKV-PR) early (gd30, n=7) and later (gd45, n=7) in pregnancy, history of dengue virus infection prior to infection with ZIKV-PR (gd45, n=7), and an African ZIKV isolate (gd45, n=4). We defined hearing in infants born to dam inoculated with saline as controls (n=8). We monitored changes in ABR (wave IV latency) to click and tone burst (1000hz) stimuli at intensity levels ranging from 20-80 decibels.

Results: In our macaque model, we found no apparent differences in hearing between the control group and all maternal ZIKV infection conditions. We observed expected hearing developmental outcomes in all of our groups (control and ZIKV groups): wave IV latency increased with decreased intensity within a testing session, and also decreased with increasing age.

Conclusions: These findings suggest that hearing deficits are not observed in this macaque model of prenatal ZIKV exposure where microcephaly does not commonly occur at a rate that is measurable with our sample size. We will continue to evaluate whether these ZIKV-exposed infant macaques have late onset hearing loss through early childhood. Studying macaque development where ZIKV-associated hearing loss occurs more frequently is necessary for modeling long-term outcomes associated with prenatal ZIKV infection. Even though hearing loss during the first year of life does not occur in these ZIKV-exposed infants, we continue to monitor neurodevelopment, visual function, and brain structure longitudinally because of the possibility of new deficits in early childhood.

***Multi-modal longitudinal assessment of infant brain organization in perinatal brain injury**

Sutter E, Saiote C, Mak V, Dean D, McAdams R, Rao R, Georgieff M, Peyton C, Gillick B, Christopher P, Galli M, Piette C, Schiller J

Background: Perinatal brain injury, including stroke or hemorrhage, is a common cause of cerebral palsy. 50-75% of infants with a perinatal brain injury will develop lifelong motor, sensory and/or cognitive impairments. The first two years of life are a key time of brain and corticospinal tract (CST) development. The CST is the primary pathway by which the cerebral cortex controls movement, and its organization impacts motor function. However, the interaction between recovery after perinatal brain injury, CST organization, and infant motor outcome is poorly understood. Given consensus that earlier diagnosis has the potential to improve outcomes, it is important to understand the mechanisms of brain development following perinatal brain injury. This study aims to longitudinally assess brain development and motor function in infants with early brain injury to identify bioindicators that can be used to develop future early diagnosis and intervention paradigms.

Design/Methods: We present a multi-modal longitudinal assessment of infants with perinatal brain injury. The protocol incorporates assessments at five ages (corrected for prematurity): 0-2, 3-6, 12, 18, and 24 months. We will use transcranial magnetic stimulation (TMS) and magnetic resonance imaging (MRI) to measure CST integrity and development of motor pathway circuitry. We will also assess the association of cortical excitability, integrity and motor function using the General Movements Assessment, the Hammersmith Infant Neurological Examination, and the Bayley Scales of Infant and Toddler Development. The study is funded by the National Institute of Child Health and Human Development.

Results: This study will examine the association of CST integrity and excitability with motor outcomes and cerebral palsy diagnosis. Circuitry will be assessed based on presence of motor evoked potentials and motor threshold in each hemisphere, obtained with single-pulse TMS. CST structural integrity will be assessed with diffusion MRI tractography.

Conclusions: This multimodal early assessment protocol will lead to identification of bioindicators related to motor outcome and neuroplasticity for infants with perinatal brain injury. It will inform future early detection, diagnosis, and intervention to improve understanding of brain development after early injury.

*Accepted at the American Academies of Cerebral Palsy and Developmental Medicine

*Accepted at the American Society of Neurorehabilitation

Short and long-term effects of congenital iron deficiency on hematopoietic cell lineages

Babu A, Mukhtarova N, Smith Z, Kling P

Background: Iron deficiency (ID) is the most common micronutrient deficiency in the world, with the highest rates in childhood and pregnancy. Gestational ID can contribute to fetal ID. Severe ID impairs red blood cell (RBC) function. Little is known about how ID impacts the RBC and other hematopoietic cell lineages in fetal and neonatal life. Leveraging an established rat ID model can improve a better understanding of hematopoietic cell lineages. The objective was to examine the impact of gestational ID on offspring hematopoietic lineages.

Design/Methods: Gestational ID model was created by an ID rat diet from postnatal day (P) 2 of pregnancy until P7 and was compared to controls fed a normal nutrient sufficient diet. After P7, ID dams were switched to an iron-sufficient diet. All pups were weaned to a normal nutrient diet. Pup blood was collected starting at P2, and ending at P45 to measure iron parameters and complete blood cells (CBCs) with differentials. T-tests compared data or log-converted data.

Results: Compared to controls at P2-3, ID hemoglobin levels were 30% lower, platelet counts were 25% lower, ZnPP/H ratios were 350% higher (all $p<0.004$), and WBC was lower (28%, $p=0.015$). At P45, 38 days post-normal nutrient diet, the formerly gestational ID rats exhibited a 5% lower hemoglobin ($p<0.02$) and 14% lower platelet count ($p<0.006$), despite the normal iron index measure zinc protoporphyrin. The total white count did not differ between groups at P45.

Conclusion: At birth, we found abnormalities in RBC, WBC, and platelet lineages; at P45, equivalent to adolescence, abnormalities presented in RBC and platelets despite having normalizing iron status. As a result, short-term and long-term changes in hematopoietic cell lineages may be clinically relevant.

***Investigating early brain development and executive function in young children**

DiPiero M, Pletcher C, Heinrich L, Alexander A, Kecskemeti S, Planalp E, Dean D

Background: Executive Function (EF) is a set of higher-order processes involved in the conscious control of thoughts and actions, particularly goal-directed behavior. The emergence of EF in children is an important developmental process that impacts later cognitive and behavioral outcomes; however, much remains unknown about the neural processes underlying the development of EF. In this study, we quantified volumetric measures from structural MRI to investigate associations between EF and brain structure in children aged 3 to 10 years old.

Design/Methods: 26 children (15 males) between the ages of 3-and-10 years old completed an MRI scan and the NIH Toolbox-Cognition Battery (NIHTB). We examined associations between EF and brain measures of brain volume, cortical thickness, and surface area from regions in the frontal lobes, parietal lobes, and subcortical structures. Within our linear model framework, we corrected for age and sex when examining surface area and cortical thickness, while corrections for age, sex, and estimated total intracranial volume were used for cortical and subcortical volumes.

Results: EF scores correlated with neuroimaging measures across the brain. Specifically, EF scores correlated with the following: the cortical volumes of the left inferior parietal and right lateral orbitofrontal cortices, the subcortical volumes of the left accumbens and left cerebellum cortex, the surface areas of the left rostral anterior cingulate cortex, left inferior parietal cortex, left frontal pole, right rostral anterior cingulate cortex, and right medial orbitofrontal cortex, and the cortical thickness of the right medial orbitofrontal cortex.

Conclusions: We report multiple significant relations between brain measurements and EF. Volumetric and surface area measurements were related to higher EF. Conversely, measures of thickness were negatively related to EF, indicating improved EF with decreasing cortical thickness. Interestingly, we observed these associations in the right hemisphere, which may indicate development of hemispheric specialization in this age range. Clarifying the neural mechanisms underpinning the development of EF in typically developing children will contribute to our understanding of the sensitive period of EF development and could provide a framework for studying EF in children with neurodevelopmental disorders.

*Accepted at the International Society for Magnetic Resonance in Medicine

***Mapping brain development in infants and young children using MPnRAGE T1 relaxometry**

Dean III D, Shah L, DiPiero M, Pletcher C, Heinrich L, Planalp E, Alexander A, Kecskemeti S

Background: Quantitative magnetic resonance imaging (qMRI) techniques offer unique opportunities to understand developmental patterns of brain tissue microstructure. However, many qMRI techniques are sensitive to motion, presenting significant challenges to obtaining high-quality and high-resolution data in pediatric populations. Here, we present data from a novel, motion-robust qMRI technique acquired in a cohort of infants and children across the first 10 years of life.

Design/Methods: 47 children (2 months – 9.75 years; 32 Male) were recruited and imaged. Children under 4 years of age were imaged during non-sedated sleep, while children over 4 years of age were imaged awake while watching a movie or TV show. Scan time was approximately 9 minutes for awake children and 14 minutes for sleeping infants. MPnRAGE T1w images were reconstructed with and without motion correction. Maps of quantitative T1 (qT1) were estimated. Age and study-specific templates were created1 and qT1 maps were transformed to template space. Mean qT1 values were extracted, plotted against age, and fit to a logarithmic model.

Results: MPnRAGE motion-correction algorithm is observed to be robust to intra-scan motion, while also preserving images quality with minimal motion. As expected, qualitative changes in the gray/white matter contrast are apparent in the T1w images, with images becoming more "adult-like" with increasing age. Alongside qualitative changes in T1w images, decreases of qT1 are observed across the brain, reflecting the progressive decreases in water content and brain myelination associated with the maturing brain. Age-related trajectories from the corpus callosum and internal capsules indicate that this developmental pattern follows monotonically decreasing shape. The overall spatiotemporal changes of qT1 are consistent with existing literature2, extending from deep to superficial brain regions in a posterior to anterior pattern.

Conclusions: Our results demonstrate that MPnRAGE provides high-resolution, motion-robust T1w and qT1 relaxometry in infants and young children. This technique may help advance the use of quantitative imaging in pediatric and other challenging populations. Moreover, given the sensitivity of T1 relaxation to neurodevelopmental changes in the brain, this technique may be informative for characterizing patterns of early brain development as well as assessing relationships of emerging cognition or specific risk factors of early neurodevelopment.

*Accepted at the International Society for Magnetic Resonance in Medicine

Group 2: Basic, Clinical and Quality Improvement

Moderator: Ellen Wald, MD

3:30-5:00 p.m.

1. **Investigating the association between renal tissue oxygenation and development of AKI in preterm neonates**
   Condit P, Chuck J, Lasarev M, Chock V, Harer, M

2. **Analysis of T Cell specific predictive biomarkers of graft-vs-host disease and relapse following post transplant cyclophosphamide prophylaxis**
   Hess N, Nadiminti K, Hematti P, Capitini C

3. **Volumetric capnography vs an indirect assessment of cardiac output in an acute respiratory distress syndrome swine model**
   Miller L, Golding R, Braun R, Eldridge M, Hacker T, Al-Subu A

4. **IFN-γ and IL-6 response decreases at onset of acute respiratory distress syndrome in the oleic acid pediatric swine model**
   Golding R, Braun R, Miller L, Staehler A, Lasarev M, Eldridge M, Al-Subu A

5. **Stem cell mobilization by nominal hyperbaria**
   MacLaughlin K, Lamers L, Marcou M, Braun R, Eldridge M

6. **Project HIFLO: A local quality initiative to reduce high-flow nasal cannula in bronchiolitis**
   Hurst A, Sternhagen T, Sunde K, Tsichlis J, Reamer R, Koueik J, Shadman K

7. **Improving rate of asthma action plan completion in primary care pediatric clinics**
   Blue J, Pletta K, Kerr B, Moreno, M

8. **Effect of antenatal steroids on T Cell receptor excision circle copy number in preterm infants**
   Rodgers D, Seroogy C, Lasarev M, Baker M, Kaluarachchi D

*** Investigating the association between renal tissue oxygenation and development of AKI in preterm neonates**

Condit P, Chuck J, Lasarev M, Chock V, Harer, M

Background: Neonatal acute kidney injury (AKI) is a frequent problem associated with short- and long-term consequences. Neonatal AKI is defined by elevations in serum creatinine (SCr) and decreases in urine output, yet, collecting both of these measurements in the neonatal population is fraught with challenges. Monitoring renal regional saturation of oxygen ($RrSO_2$) with near-infrared spectroscopy (NIRS) can potentially diagnose AKI noninvasively before changes in traditional markers of kidney function thereby creating a therapeutic window for intervention. The objective of this study is to evaluate the relationship between $RrSO_2$ changes and SCr during the first week of age for preterm neonates born at < 32 weeks gestational age (GA).

Design/Methods: Prospectively measured neonatal $RrSO_2$ values collected during the first week of age in neonates at < 32 weeks GA were analyzed from two sites (A & B). Variables were compared between groups (AKI vs no AKI) using rank-sum or exact unconditional tests for continuous and categorical variables, respectively. Poisson regression was used to estimate the rate of AKI events over the duration of observation (t), which varied by patient.

Results: 109 neonates (32% from A and 68% from B) were included and 560 SCr values were obtained during the first week of age (Table 1, demographics). Eight cases of AKI were observed in the cohort (all diagnosed with SCr) with a similar prevalence between the two sites (9% at A and 7% at B, p=0.767). For the 8 cases with AKI, the median [IQR] of their mean %$RrSO_2$ was 46.2 [32.8,70.5] and for the non-AKI cases it was 67.1 [58.5, 74.0] (p=0.12). A decrease of 10 percentage points in mean %$RrSO_2$ was associated with a 1.7-fold increase in AKI risk (95% CI: 1.1–2.6; p = 0.016).

Conclusions: Decreases in mean $RrSO_2$ in neonates born at < 32 weeks GA were associated with an increased risk of AKI. Further prospective studies are necessary to determine whether $RrSO_2$ changes can accurately detect AKI and correlate with urinary biomarkers of kidney injury. Future guidelines and studies should focus on early interventions and therapies that can improve renal oxygenation and whether improved renal oxygenation improves short- and long-term kidney outcomes.

*Accepted at the Pediatric Academic Societies

*** Analysis of T Cell specific predictive biomarkers of graft-vs-host disease and relapse following post transplant cyclophosphamide prophylaxis**

Hess N, Nadiminti K, Hematti P, Capitini C

Background: Despite a deeper understanding of the biology of acute graft-vs-host disease (aGVHD) and relapse following allogeneic hematopoietic stem cell transplantation (HSCT), it is currently impossible to predict which patients will relapse or develop aGVHD. It is well known that donor T cells are responsible for both aGVHD and graft-vs-leukemia (GVL) activity. Based on the results from a xenogeneic transplant study that identified several T cell-specific predictive biomarkers of aGVHD, we investigated the longitudinal functional properties of human T cells after HSCT to identify and validate a suite of T cell- specific biomarkers of both aGVHD and relapse following post-transplant cyclophosphamide (PTCy) based GVHD prophylaxis.

Design/Methods: After IRB approval, patients who received HSCT for all hematologic malignancies at the University of Wisconsin were prospectively enrolled from 2020-2021. Patient characteristics are detailed in Table 1. Blood samples were collected weekly for 98 days, starting day 7 following allogeneic HSCT. Thirty five patients were enrolled, of which 24 are included in the current interim analysis. All patient receive PTCy based GVHD prophylaxis. Blood samples were RBC lysed prior to flow cytometric staining.

Results: Higher numbers of CD3+CD45RO+ donor T cells in the first twenty days after HSCT was predictive of grade 3-4 aGVHD (p=0.03) while lower numbers were predictive of relapse (p=0.008) with an AUC of 0.78.(Fig 1A-C). Surprisingly, we also identified a CD4+CD8+ double positive T cell (DPT) population that increases in frequency 2-3 weeks prior to the development of grade 2-4 aGVHD (p=0.03)(Fig 1D). CD4 T cells primarily expressed PD-1 and CD27, CD8 T cells primarily expressed ICOS and NKG2D and DPTs primarily expressed 4-1BB and OX40 (Fig 1E).

Conclusions: This is the first study to prospectively monitor T cell subsets, including the identification of DPT, that persist after PTCy for allogeneic HSCT and correlate them with patient outcomes. The number of CD3+CD45RO+ T cells in the first 20 days may be associated with aGVHD and GVL effects. While the function of DPT is currently not known, their appearance in peripheral blood before presentation of grade 2-4 aGVHD suggest they may be used as a predictive biomarker. Validation of DPTs with grade 2-4 aGVHD will be needed in multicenter, prospective trials. Overall, the continual monitoring of DPT and activated T cell subsets after allogeneic HSCT may give clinicians insight into predicting aGVHD and relapse

*Accepted at the Transplantation and Cellular Therapy Conference.

*** Volumetric capnography vs an indirect assessment of cardiac output in an acute respiratory distress syndrome swine model**

Miller L, Golding R, Braun R, Eldridge M, Hacker T, Al-Subu A

Background: Volumetric capnography has the potential to assess cardiac output (CO) in critically ill patients, however its utility to assess CO in patients with acute respiratory distress syndrome (ARDS) has been sparsely described. The primary aim of this study was to assess the correlation between the volume of carbon dioxide (VCO_2) and end-tidal carbon dioxide ($EtCO_2$) with CO in a swine model of ARDS. The secondary aim was to assess those correlations using a fluid challenge.

Design/Methods: Juvenile pigs were sedated and mechanically ventilated. ARDS [P/F ratio <300 mmHg] was induced using continuous infusion of oleic acid at 0.05-0.6 mL/kg. Animals received a fluid challenge of 0.9% Sodium Chloride at a rate of 100 mL/min over 10 minutes once before induction of ARDS, and once in ARDS. Respiratory and hemodynamic variables were continuously monitored. Pearson's rank correlation coefficients were used to assess correlation between measurements.

Results: Sixteen 2-month-old animals weighing 23±3 kg were included in this analysis. Prior to ARDS induction, mean (SD) CO, VCO_2, $EtCO_2$, and physiological dead space to tidal volume ratio (Vd/Vt) were 4.12 (1.23) L/min, 98.37 (19.38) ml/min, 39.75 (3.46) mmHg and 0.26 (0.09) respectively. Correlation coefficients (r) between CO, VCO_2, and $EtCO_2$ were 0.41 and 0.46 (p=.001 and p=.001) respectively. After ARDS induction, mean CO, VCO_2, $EtCO_2$, and Vd/Vt were 3.42 (0.71) L/min, 112.72 (22.97) ml/min, 49.23 (9.73) mmHg and 0.43 (0.08). Correlations between CO, VCO_2, and $EtCO_2$ were 0.26 and 0.34 (p=.001 and p=.001). The correlations pre and post fluid challenge were not statistically significant before and during ARDS (p=0.11 and p=0.16).

Conclusions: Continuous measurements of $EtCO_2$ and VCO_2 can be used as moderate surrogate markers for CO in the absence of interstitial lung disease. Increased Vd/Vt may limit this. Neither VCO_2 nor $EtCO_2$ were able to detect fluid responsiveness following fluid challenge.

*Accepted at the Wisconsin Regional Pediatric Critical Care Consortium

IFN-γ and IL-6 response decreases at onset of acute respiratory distress syndrome in the oleic acid pediatric swine model

Golding R, Braun R, Miller L, Staehler A, Lasarev M, Eldridge M, Al-Subu A

Background: Acute Respiratory Distress Syndrome (ARDS) is an acute, non-cardiogenic inflammatory response in the lungs associated with capillary endothelial injury and diffuse alveolar damage. Previous studies in adults and adult animal models shows increased levels of pro-inflammatory cytokines. However, there is little data on cytokine changes within the pediatric population. With a mortality of 20-40% amongst children receiving intensive care for ARDS, it is vital to understand and model the inflammatory response in pediatric ARDS. Previous studies have shown that oleic acid is effective at inducing clinical ARDS in a swine model. Using a similar model of pediatric ARDS, we hypothesize that pro-inflammatory plasma cytokine mRNA expression will increase at ARDS when compared to baseline level.

Design/Methods: Pigs weighing 23±3kg were sedated, intubated, and ventilated. Oleic acid was continuously injected until ARDS was achieved, marked by a P/F ratio of <300. Blood samples were collected prior to oleic acid injection and when ARDS was achieved. RT-qPCR was used to analyze the mRNA expression level of interferon- (IFN-), tumor necrosis factor-α (TNF-α), interleukin (IL)-17, IL-10, IL-8, and IL-6. Wilcoxon signed-rank test was used to determine significance.

Results: Twelve swines were included in our experiment. Contrary to our hypothesis, the pro-inflammatory cytokine IFN-g was reduced by a median [IQR] factor of 0.7 [0.4, 0.9] (p=0.007) and IL-6 was lower by a median factor of 0.4 [0.2, 0.8] (p=0.034) at ARDS compared to baseline levels. These changes were not correlated to the time it took for the pig to reach ARDS nor their baseline P/F ratio.

Conclusions: In an oleic acid swine model, pediatric ARDS is characterized by acute decreased IFN-γ and IL-6 mRNA levels. This is contrary to our hypothesis and current published data and warrants futures studies to better characterize this early decrease and the effect on lung inflammation.

*** Stem cell mobilization by nominal hyperbaria**

MacLaughlin K, Lamers L, Marcou M, Braun R, Eldridge M

Background: The use of hyperbaric air as a "placebo/sham" in Hyperbaric Oxygen Therapy (HBOT) research has developed into an active debate. Hyperbaric air has not been tested as a placebo/sham. It is well understood that hyperbaric air increases the partial pressures of all the gasses in inhaled air and subsequently in the body tissue, and yet, in the face of strong assertions by some researchers that hyperbaric air is a dose treatment, findings of a placebo effect prevail. In a recent review on the use of HBOT in mild Traumatic Brain Injury (mTBI) the authors concluded: "This systematic review revealed that for patients suffering from persistent symptoms after mTBI, HBO2 therapy is no better than sham treatment, if, in fact, the "sham" treatment is a true sham, and hence not recommended as a therapy. However, the improvements in outcomes shown within groups for both HBO2 and sham treatment cannot be ignored." 1We asked the question, "Is hyperbaric air a true placebo/sham?" Because Stem Progenitor Cell (SPC) mobilization is an accepted primary end point of HBOT research 2, we tested 1.27 Atmospheres-Absolute (ATA) hyperbaric air for SPC mobilization.

Design/Methods: 10 study-participants were exposed 1.27 ATA for 90 minutes daily for 10 treatments over a 14-day period. Blood was drawn at 4 time points and SPC's were analyzed by flow cytometry before and after the first treatment, before the tenth treatment and three days after the tenth treatment.

Results: We found SPC mobilization nearly 2-fold prior to the 10th/final treatment and a 3-fold increase in SPC's mobilization 3 days post the 10th/final treatment.

Conclusions: Our findings show that hyperbaric air mobilizes SPC's in a striking semblance to HBOT. Our findings further suggest that hyperbaric air placebos should be tested prior to being used as a placebo. The use of hyperbaric air as a "placebo" in HBOT research and findings in studies using hyperbaric air as a placebo should be re-evaluated.

1. *Accepted at the Undersea Hyperbaric Medical Society

Project HIFLO: A local quality initiative to reduce high-flow nasal cannula in bronchiolitis

Hurst A, Sternhagen T, Sunde K, Tsichlis J, Reamer R, Koueik J, Shadman K

Background: High flow nasal cannula (HF) is a respiratory support modality used to treat mild to moderate bronchiolitis that has not demonstrated a significant change in clinical course, length of hospital stay, or rate of intensive care unit (ICU) admission when compared to low-flow nasal cannula (LF). The American Academic of Pediatrics Value in Inpatient Pediatrics Network Quality Improvement (QI) Collaborative instituted a national project to decrease the use of HF after smaller, local initiatives showed promise that outcomes limiting HF did not cause significant change in patient outcomes. Our primary aim is to reduce the proportion of infants with bronchiolitis treated with HF by 30%.

Design/Methods: Retrospective chart review was performed on patients aged 30 days to 23 months with a diagnosis of bronchiolitis. Exclusion criteria included patients born <32 weeks; chronic lung, cardiac, or neuromuscular disease; transfers from other hospitals; patients on positive pressure ventilation; and patients on oxygen at home. The intervention consisted of maximizing suctioning, antipyretics, hydration, and LF prior to HF initiation and documenting a High-flow Initiation Pause (HIP) if these interventions were performed. The primary outcome was the percentage of patients treated with HF after instituting the HIP. Balancing measures included ED and inpatient LOS. 2019 was used as the comparison year due to the atypical 2020-2021 respiratory viral season during the COVID-19 pandemic.

Results: There were 52 patients included in the pre-intervention period and 11 post-intervention. HF initiation averaged 56% (95% CI 49-62%) in the pre-intervention group, and post-intervention 9% (95% CI 0-30%). The HIP was documented in one patient post-intervention. The proportion of total inpatient hours spent on HF pre-intervention was 44% (95% CI 41-47%) and 1% post-intervention (95% CI 0-4%). ED LOS did not change significantly over the project. The average in-hospital LOS increased relative to the pre-intervention period (48 hours pre- vs 74 hours post-intervention), but there was a significant outlier in the post-intervention period with a 254-hour stay.

Conclusions: Our local QI initiative successfully reduced the use of HF in our hospital by 47%. Documentation of the HIP was not completed consistently, however HF use still decreased. Patient volumes were also unusually low due to the continued COVID-19 pandemic, which may have resulted in fewer patients requiring HF overall.

Improving rate of asthma action plan completion in primary care pediatric clinics

Blue J, Pletta K, Kerr B, Moreno, M

Background: The asthma action plan (AAP) is an important tool for patients with asthma to manage their medications and monitor their asthma symptoms. It should be reviewed annually in all patients with asthma. The AAP completion rate had been steadily decreasing in our system's primary care pediatric clinics over the past several years. A grant was used to identify barriers and suggestions for improvement from the pediatricians using a mixed-method study. Common responses were identified and used to guide change ideas. The goal of this QI project was to address barriers by implementing pediatrician-identified recommendations in order to improve the AAP completion rate.

Design/Methods: Specific pediatrician-identified interventions were implemented in primary care pediatric clinics including: 1) Medical staff were asked to complete asthma outreach to update AAPs and schedule well visit if due, 2) Medical staff were asked to identify well-visit patients due for AAPs and initiate an Asthma Control Test (ACT) at the start of the well-visit, 3) Printers closest to exam rooms were identified and linked to exam room computers, 4) A new EHR link was developed for faster flow. The AAP completion rate was recorded at baseline and at 12 monthly time points following implementation of the intervention. AAP completion rate changes were assessed using a statistical process control chart for proportions (p-chart).

Results: The AAP completion rate was followed for 5 primary care pediatric clinics involving 40 pediatricians. The AAP completion rate increased from 51.4% at baseline to a high of 75.6% at 8 months then decreased and stabilized near 71.5% at 12 months. A p-chart showed more than 6 consecutive increasing points suggesting special cause variation. Provider feedback obtained during the interventions noted staff outreach time as a continued barrier.

1. Conclusions: Addressing barriers by implementing pediatrician-identified interventions is an effective way to improve AAP completion rates. This may improve asthma control for children. Mixed-method studies can help develop successful quality interventions.

* Effect of antenatal steroids on T Cell receptor excision circle copy number in preterm infants

Rodgers D, Seroogy C, Lasarev M, Baker M, Kaluarachchi D

Background: Compared to full term infants, preterm infants have a disproportionately high rate of below-range T cell Receptor Excision Circle (TREC) copy number on newborn screening. Antenatal steroids are commonly administered to women who are at risk of preterm birth. Steroids are known to affect immune ontogeny and function; however, the effects of antenatal steroids on TREC levels in newborns are not known. The objective of this study was to define the relationship between antenatal steroid (ANS) exposure and TREC copy number in preterm infants. We hypothesized that antenatal steroid exposure would be associated with lower TREC copy number.

Design/Methods: All infants born <32 weeks of gestation admitted to Unity Point Health Meriter neonatal intensive care unit (NICU) from 01/01/2012 to 04/30/2018 were included in the study. Study cohort was divided into three groups: no antenatal steroids (ANS, N=37), partial ANS course (N=55), and complete ANS course (N=206). TREC copy number on the first newborn screening, completed between birth and 96 hours of life, was compared between the three groups.

Results: Infants exposed to ANS, either via full or partial courses, have statistically significantly higher TREC copy numbers compared to infants who were not exposed to ANS ($p=0.006$ for full course, $p=0.041$ for partial course). There was no significant difference in TREC copy number between infants exposed to a full course of ANS compared to those exposed to a partial course of ANS. After adjusting for additional variables with a direct relationship to TREC copy number (gestational age and single versus multiple gestation), a statistically significant difference in TREC copy number persists between infants exposed to a full course of ANS compared to those with no ANS exposure ($p=0.002$).

Conclusions: This is the first known study investigating the association between TREC copy number and antenatal steroid administration. In our cohort, we demonstrate exposure to antenatal steroids is associated with a statistically significant increase in TREC copy number. This relationship is the inverse to our original hypothesis. Based on the results of this study, antenatal steroid administration is unlikely to contribute to the observation that premature infants have a disproportionately high rate of below-range TREC copy number on newborn screens.

*Accepted at MSPR Virtual Scientific Meeting

*Accepted at Pediatric Academic Societies

Group 3: Clinical Innovations & Education

Moderator: Emily Ruedinger, MD, MED

3:30-5:00 p.m.

1. **Follow-up of infants diagnosed with PFO, secundum ASD, muscular VSD, or PDA during their newborn hospitalization**
   Faultersack J, Johnstad C, Zhang X, Hokanson J, Greco M

2. **Accuracy of prehospital weight estimate in children**
   Brown C, Hromatko C, Kim M

3. **Partnering with PATCH: Integrating trauma-informed care and resilience into a youth-led program**
   Sherfinski H, Koepsel E, Ruedinger E

4. **Automated motion artifact detection on pediatric diffusion MRI using a convolutional neural network**
   Weaver J

5. **Making electroretinography accessible to all**
   Korlesky C, Ver Hoeve J, Pattnaik B

6. **Resident education on food insecurity: Partnering with the community to improve resident comfort, screening, and referrals**
   Williams Al-Kharusy S, Rogers, K, Houser L, Mathur M

7. **A guide to telemedicine use in adolescent primary care**
   Bryant E, Dos Reis L, and Ruedinger E

Follow-up of infants diagnosed with PFO, secundum ASD, muscular VSD, or PDA during their newborn hospitalization

Faultersack J, Johnstad C, Zhang X, Hokanson J, Greco M

Background: Neonatal echocardiography is a vital tool in the early assessment of congenital heart disease; however, many newborns have echocardiographic findings that may spontaneously resolve and the need for follow-up is unclear. Objective: To describe the current management and follow-up of secundum atrial septal defect (ASD), patent foramen ovale (PFO), muscular ventricular septal defect (mVSD) and/or patent ductus arteriosus (PDA) identified during newborn hospitalization.

Design/Methods: Infants who had an echocardiogram during their birth hospitalization and at least one echocardiogram in outpatient follow-up were identified. Echocardiograms performed between 9-1-17 and 9-1-21 were reviewed. Those newborns with findings limited to an ASD, PFO, mVSD and/or PDA were included. Those neonates where surgical correction was inevitable (atrioventricular canal, double outlet right ventricle, etc.) or with other cardiac defects requiring ongoing assessment (bicuspid aortic valve, rhabdomyoma, etc.) were excluded.

Results: 1091 newborns had echocardiograms during their birth hospitalization and 143 met inclusion criteria. Of those 143, none required any surgical intervention or catheterization during the study time frame. Forty-two infants were discharged from care. The most common indications for first echocardiograms were follow up of abnormal fetal echocardiogram (55 patients) and murmur (49 patients). The mean age at last echocardiogram was 96 days for those discharged and 128 days for those who had continued follow-up. There was no significant difference in rate of discharge, number of follow-up echocardiograms, or age at last echocardiogram when compared by diagnosis at last echocardiogram at birth hospitalization. Of 21 patients who had a PFO only on their last echocardiogram during birth hospitalization, only 7 were discharged from care during the time frame studied. Only 1 of 5 patients who had a PDA only was discharged from care. For all diagnoses included in this analysis, rates of discharge from care were below 40%.

1. **Conclusions:** No infants referred for outpatient follow-up in pediatric cardiology for PFO, ASD, and mVSD and/or PDA required any intervention during the study time frame. The majority of infants have continued follow-up scheduled but may not require surgical or procedural intervention in the future. Pediatric cardiologists may be continuing to follow patients for shunts that are unlikely to be clinically significant.

Accuracy of prehospital weight estimate in children

Brown C, Hromatko C, Kim M

Background: As medication dosing in children are solely based on weight, accurate weight estimate is critical in safe emergency medication administration in the prehospital arena. Despite availability of evidence-based tools such as Broselow tape, EMS providers often use their guestimate. In Dane County, there is no prehospital best method recommendation in weight estimates for children. The objectives of this project are to assess the accuracy of current weight estimate in children and to develop an algorithm for EMS providers.

Design/Method: Data were obtained prospectively and through a chart review to measure the accuracy of EMS weight estimate compared to ED weight in convenient sample of patients < 18 years. Weight documented in the EMS run data and ED measured weight were abstracted during the study period of 8/21 to 2/22. The source of weight estimate was obtained from EMS providers upon delivery of patients to ED. Benchmark accuracy method of PW10>70% and PW20>95% were used where PW10>70% means greater than 70% of patients should have estimate weight within 10% of the measured weight. PW20>95% means greater than 95% of patients should have estimate weight of less than 20% of the measured weight. A weight estimate algorithm was developed for EMS providers to achieve the most accurate weight estimate.

Results: A total of 195 chart were identified and source of weight estimate was obtained in 135 patients. Approximate 26.2% underestimated by >10%, 61% within 10%, and 12.9% had overestimate by >10% with mean accuracy of 88.9%. Overall PW10 was 61% and PW20 was 83.6%. Weight estimate source were 11 from the clinic (mean accuracy:95.1%, PW10: 91% PW20:91%), 18 from patients (mean accuracy:93%, PW10:83%, PW20:94%), 63 from parents (mean accuracy:90%, PW10:59%, PW20:84%), 11 by Broselow tape (mean accuracy: 86%, PW10:55%, PW20: 82%), 32 by guess (mean accuracy:85%, PW10:47%, PW20: 69%), and by age-based (mean accuracy:81%, PW10:26%, PW20:63%).

Conclusions: Different methods are being used to estimate weight of children by EMS providers and they are not very accurate. Weight obtained from patients, parents or Broselow tapes were more accurate than guessing or using age-based system. Our weight estimate algorithm utilizes patient, parent and Broselow tape for most accurate weight estimates for children in the prehospital arena. We strongly discourage guessing or using the age-based system.

Partnering with PATCH: Integrating trauma-informed care and resilience into a youth-led program

Brown C, Hromatko C, Kim M

Background: Healthcare providers are well suited to recognize and respond to youth who have experienced trauma. However, many providers lack adequate training on trauma-informed care (TIC) and resilience. Likewise, many youth are not empowered to optimize their interactions with healthcare providers. A potential way to address these issues is to incorporate TIC and resilience principles into existing trainings designed to improve interactions between adolescents and healthcare systems. Providers and Teens Communicating for Health (PATCH) is one organization providing this type of training. The goals of this project are to: 1. identify best practices for TIC and resilience education directed at healthcare providers and youth, 2. evaluate PATCH provider and youth curricula for incorporation of TIC and resilience principles, and 3. identify areas of opportunity for better integration of TIC and resilience principles into PATCH.

Design/Methods: A literature review and expert interviews were conducted to gain a strong foundation in TIC and resilience. Ideal-state curricular objectives regarding TIC and resilience were crafted. Using an objectives-centered approach, PATCH training materials were evaluated for fidelity to these objectives. Interviews with PATCH stakeholders were conducted to gain insight on optimal integration of TIC and resilience principles into PATCH.

Results: PATCH curricula currently do not explicitly address most objectives related to TIC and resilience. However, many of these principles are implicitly woven into the content. In contrast, on an organizational level, PATCH demonstrated high fidelity to TIC and resilience principles in nearly all assessed domains. Key stakeholder takeaways supported these findings.

1. Conclusions: Five key recommendations were to PATCH: formalize TIC and resilience training for PATCH facilitators; incorporate TIC and resilience scenarios into provider and teen workshops; add language about TIC and resilience into PATCH's mission, vision, and values; recruit and support Teen Educators who may have experienced trauma; and bolster the PATCH for Parents toolkit. With these modifications, PATCH could continue its role as a valuable educational resource and a vital community partner, while also more explicitly promoting TIC and youth resilience.

Automated motion artifact detection on pediatric diffusion MRI using a convolutional neural network

Weaver J

Background: Diffusion MRI (dMRI) is an imaging technique that exploits the diffusion of water molecules to generate contrast in MR images. In pediatric brains, dMRI provides information relevant for brain development such as white matter microstructure. However, it is challenging for these populations to remain still, and motion artifacts can be present. Removing images with motion artifacts is a manual process, which is prone to subjective error and time-consuming due to the many imaging volumes acquired. In recent years, deep learning (DL) methods have shown great success with quality control (QC) tasks, such as classifying an image as artifactual or normal. In this work, we propose a three-dimensional convolutional neural network (3D-CNN) capable of recognizing motion artifacts in dMRI images of 1- and 24-month subjects.

Design/Methods: Raw dMRI images were obtained from a prior study where subjects were imaged at 1-month (n=95) and 24-months (n=24). Manual QC of the subjects' 4D image volumes were performed by trained lab members and 3D sub-volumes were flagged for motion artifacts. Image volumes were zero-padded or cropped to be of size 128x128x70, and pixel intensities were normalized between 0 and 1. A 50/50 class balance was achieved by selecting an equal number of artifactual and normal volumes. The labeled data were used to train a 3D-CNN consisting of five 3D convolutional layers of increasing filter size and ReLu activation. Each convolutional layer is followed by max-pooling and batch normalization. The output from the last block is flattened, passed to a dense layer with 256 neurons, and then to a dropout layer to prevent overfitting. Finally, a dense layer of 1 neuron with sigmoid activation is used to perform binary classification. The model was trained for 20 epochs and a 5-fold cross-validation method was used to evaluate sensitivity to the training data.

Results: The labeled dataset used for this work contained 2013 and 263 volumes from 1- and 24-month subjects respectively. Training and validation were performed on 5 unique data splits, resulting in a mean accuracy of 95 ± 1.2%.

Conclusions: A DL model for binary classification can be extended to motion artifact detection in diffusion MRI of pediatric subjects. A high accuracy of 95% was achieved for a dataset of images acquired at 1- and 24-months of age. Future work will expand the dataset to include a wider variety of ages and imaging protocols to create a more general and robust network.

Making electroretinography accessible to all

Korlesky C, Ver Hoeve J, Pattnaik B

Background: Electroretinography (ERG) remains an underutilized clinical diagnostic tool due to high device cost and strict facility requirements. We considered two different approaches to improving accessibility to ERG testing. First, we explored the feasibility of a wearable medical device that performs clinical ERG testing while decreasing per-procedure cost, time, and facility requirements. Secondly, we explored creating a light isolation tent to ensure an appropriate ERG testing environment no matter the testing facility.

Design/Methods: For both the ERG goggles and the light-isolation tent, we consulted with WARF, the Isthmus Project, and the Discovery to Product entrepreneurial program offered by UW-Madison to explored both technical and market feasibility.

For the ERG goggles, the housing is 3D printed polylactic acid and eyepieces are made of polyurethane foam and designed for complete light tightness. LEDs stimulate the retina and illuminate the IR camera, while light intensity is controlled via current and voltage regulators as well as pulse width modulation (PWM). Light stimulus duration is controlled via LED drivers. IR cameras dynamically measure pupil diameter and digitally adjust light intensity while a phototransistor validates the output. User interface, testing procedures, and image processing are programmed using a Raspberry Pi 4 and Python. For the ERG light isolation tent, a hydroponics grow tent was converted into a light tight ERG testing environment. Electric fans created airflow within the tent while temperature and humidity sensors actively monitored ambient conditions to ensure the comfort of both the tester and the patient.

Results: We created a functional ERG goggle prototype capable of flashing light and measuring pupil diameter. The pupil measurement software was accurate within 2.5% relative to standard controls ranging from 4-26 mm. The estimated cost of this device, not including labor or excess materials, is $450. We also created a functional ERG tent prototype capable of creating the black-out environment necessary for ERG testing while maintaining a comfortable internal environment. The estimated cost is $200.

1. **Conclusions:** The ERG goggle prototype reduces cost, time and facility burdens associated with clinical ERG testing. However, continued research would require a substantial time and financial investment. In the short term, the ERG tent creates a mobile, lighttight testing environment compatible with current ERG testing devices.

*** Resident education on food insecurity: Partnering with the community to improve resident comfort, screening, and referrals**

Williams Al-Kharusy S, Rogers, K, Houser L, Mathur M

Background: As a result of the COVID-19 pandemic, Feeding America estimates that as many as 1 in 4 US children lives in a household with insufficient food to sustain an active, healthy life. Despite this significant need, few pediatricians receive training to reduce the burden of Food Insecurity (FI). In this quality improvement initiative, we attempt to increase pediatric resident comfort addressing FI by partnering with community organizations to develop a FI educational curriculum.

Design/Methods: We created an educational curriculum using evidence-based national and local resources in partnership with local community organizations. This curriculum consisted of one-hour educational sessions over a consecutive three-day period. Sessions focused on the burden of FI in our local community and how to address FI with patients and families, including how to place a referral for social work support within the electronic medical record. Instructional materials included a "Resident Quick-Guide" tri-fold pocket brochure that we developed alongside the FI curriculum. Additionally, residents had the opportunity to participate in the Supplemental Nutrition Assistance Program (SNAP) Challenge followed by a group reflection session. Investigators measured outcomes by comparing pre-curriculum surveys to those completed 3- and 8-months' post-curriculum.

Results: Pediatric residents completed surveys prior to the FI curriculum and again at 3- and 8-months' post-curriculum (n=55). At 3 months' post-curriculum, an increased proportion of residents reported they asked about FI in a majority of clinic visits (increase from 48% to 75% of residents, p = 0.026), were comfortable placing referrals (increase from 24% to 65% of residents, p = 0.037), and placed referrals in a majority of visits after identifying a FI need (increase from 36% to 65% of residents, p = 0.049). At 8 months' post-curriculum, residents sustained increased comfort placing referrals (from 24% to 78% of residents, p = 0.013).

Conclusions: Partnering with community organizations to provide a FI curriculum resulted in increased reported screening rates, comfort placing referrals, and referral rates among pediatric residents, with a sustained increase in comfort placing referrals at 8 months' post-curriculum.

*Accepted at Pediatric Academic Societies

A guide to telemedicine use in adolescent primary care

Bryant E, Dos Reis L, and Ruedinger E

Background: Telemedicine has become an important tool in the medical care of adolescents, especially as virtual interactions became ubiquitous during the COVID-19 pandemic. Providers caring for adolescents in primary care need concise guidance on how to adapt telemedicine effectively for this population.

Design/Methods: A review of available literature was performed with PubMed, ClinicalKey, and web-based guidelines for pediatric virtual care (AAP, Bright Futures, American Telemedicine Association) for articles pertaining to virtual care for well and problem visits for teens. This also included strategies to adapt the physical exam, anticipatory guidance, and learner participation to the telehealth setting. Through this, we compiled tactics for incorporating telemedicine successfully into primary care for teens.

Results: While limited regarding physical examinations, most adolescent visit types can be fully or mostly performed effectively through telemedicine. Many studies have found high patient satisfaction with telemedicine among adolescents and their caregivers. Adaptations to ensure privacy are vital for promoting autonomy, allowing sharing of concerns, and providing effective and pertinent anticipatory guidance. It is imperative that routine immunizations and screening labs continue to be incorporated into virtual visits with the assistance of nursing visits or laboratory orders as indicated.

Conclusions: Structuring effective telemedicine virtual workflows will ensure high quality care, maximize team-based care approaches, and provide for smoother transitions to adult care. Telemedicine has the potential to increase access to care in many respects (decreasing travel time, decreasing missed work/school, and improving access to specialty care), though consideration must be taken to ensure that equitable care is provided, as access may be decreased for non-native English speakers, those with limited technology proficiency, and those in low resource settings without appropriate devices, adequate bandwidth, or secure internet connections. There remains limited research on patient health outcomes following the recent expansion of telemedicine. Future research should also include transitions of care and telehealth platform security. Given the increase in the use of telemedicine during the COVID-19 pandemic, and the potential to improve care accessibility and patient satisfaction, primary care providers must familiarize themselves with how to optimize telemedicine for adolescent care.

Group 4: Practice Patterns and Patient Experiences

Moderator: Ryan Coller, MD. MPH

3:30-5:00 p.m.

1. **Children with surgically corrected congenital heart disease who are long-stay intensive care patients: An analysis of post-discharge burden of care**
   Cordum S, Hagen S

2. **Rare presentation of precocious puberty secondary to LH-secreting adenoma**
   Uhing A, Ahmed A, Salamat S, Chen, M

3. **Impact of enteral and/or parenteral nutrition on outcomes after autologous stem cell transplant for high-risk neuroblastoma**
   Kitcho C, Bergstrand D, Mandli S, Walkiewicz-Jedrzejczak D, Capitini C

4. **Hemosuccus pancreaticus following acute pancreatitis in a 12-years-old boy secondary to pancreatic pseudoaneurysm treated with endovascular coil embolization**
   Ekezie C, Gill K, Pfau P, Johannes A, Woods M, Pinchot J, Furuya Ka, O'Connell D, Ratchford T, Sigurdsson L, Walkiewicz D, Valentyne A, St. Clair N, Ehlenbach M, Woodring T, Danko I

5. **A survey on the management of anomalous aortic origins of the coronary arteries**
   Hareem R, Smith Hokanson, J

6. **Impact of multiorgan and kidney-pancreas allocation policies on pediatric kidney-alone transplant candidates in the United States**
   Engen R, Shepherd D, Bradford M, Foutz J, Bartosh S, Smith J

7. **The process of safety reporting by parents of hospitalized children with medical complexity: A qualitative analysis**
   Kieren M, Kelly M, Garcia M, Chen T, Baird J, Haskell H, Luff D, Mercer A, Ngo T, Quiñones-Pérez B, Williams D, Khan A

Children with surgically corrected congenital heart disease who are long-stay intensive care patients: An analysis of post-discharge burden of care

Cordum S, Hagen S

Background: Children who undergo cardiac surgery for congenital heart disease (CHD) typically have ICU stays less than 2 weeks. However, some patients with surgically corrected CHD require prolonged ICU stays. Previous studies have reported that ICU long stay (LS) patients have higher mortality, lower quality of life, and use disproportionate PICU health care resources. The specific needs of long-stay patients after discharge have not been well described. We aimed to quantify the medical care that LS pediatric ICU patients require after discharge.

Design/Methods: This study was a retrospective chart review approved by the IRB at the University of Wisconsin. We reviewed patients admitted to the PICU at the American Family Children's' Hospital between 2009 and 2018 for surgical correction of congenital heart disease and had an ICU stay for longer than 28 days. Outcomes measured included three-year mortality, medications prescribed, technology dependency, sub-specialty clinic visits and re-admission to the hospital.

Results: A total of 69 patients met the inclusion criteria. Hospital and three-year mortality were 10.1% and 16%, respectively. Readmission to the hospital occurred in 74% of the survivors within the first year. Within the first year of discharge from the PICU, on average patients were prescribed 7.8 medications and followed with 5.2 subspecialists. 53.9% had home nursing, 12.9% had home respiratory support, and 66.7% had a gastrostomy tube in place.

1. Conclusions: In our single institution study, children with LS in the PICU after cardiac surgery have lower mortality than previous reports. The majority of survivors have significant chronic health care needs creating a large burden of care for families. Future studies will identify long-stay patients early in the PICU course that need support for chronic medical needs.

*** Rare presentation of precocious puberty secondary to LH-secreting adenoma**

Uhing A, Ahmed A, Salamat S, Chen, M

Background: Normal male puberty begins after 9 years of age with a concurrent rise in LH and FSH. These play distinct roles, with LH acting on Leydig cells to stimulate testosterone and secondary sex characteristics, while FSH promotes testicular growth by stimulating the maturation of seminiferous tubules.

Case: An 8-year 9-month-old male TV presented with a 1.5-year history of facial hair and 9 months of phallic growth, body odor and acne. Physical exam revealed phallic enlargement, Tanner stage I pubic hair and firm, borderline pubertal testes. Bone age was 9 years at 8 years 6 months of age. Laboratory evaluation was inconsistent with typical puberty – LH (9 mIU/mL, RR 0-0.3) and testosterone were elevated (519 ng/dL, RR 2-8) while FSH was pre-pubertal (<0.1 mIU/mL, RR 0-2.8) and androgens were only mildly elevated (androstenedione 0.363 ng/mL, RR 0.03-0.3; 17-OHP 155 RR<63). Head MRI revealed an anterior pituitary adenoma measuring 8 x 12 x 10 mm. After failing to respond to leuprolide, TV was initiated on spironolactone and anastrozole to minimize pubertal progression prior to transsphenoidal adenomectomy. Surgical pathology was positive for steroidogenic factor 1 but negative for LH, FSH and TSH immunoreactivity. However, he had post-operative reduction of LH (0.4 mIU/mL, RR 0-0.3) and testosterone (16 ng/dL, RR 2-8).

Conclusions: Normal male puberty follows a predictable sequence, beginning with testicular enlargement followed by body odor, pubic hair growth, phallic enlargement, voice change, and increased growth velocity. In TV, hypersecretion of LH led to testosterone production, causing secondary sex characteristics. However, his pre-pubertal FSH did not stimulate the testicular growth that typically heralds the onset of puberty. Digression from typical pubertal sequence and isolated high LH raised concern for a pathologic cause. Central precocious puberty is most often idiopathic in females, although more commonly associated with CNS lesions in males. Rarely, precocious puberty results from a functioning gonadotroph adenoma. Less than 1% of these are hormonally active. If active, these most often secrete FSH or co-secrete FSH and LH, and typically require surgical resection given limited success of medical therapies. This case illustrates the distinct roles of FSH and LH in pubertal development. Departures from the typical sequence of development should expand one's differential to include etiologies resulting in nonconcurrent secretion of gonadotropins.

*Accepted at Pediatric Endrocine Society

Impact of enteral and/or parenteral nutrition on outcomes after autologous stem cell transplant for high-risk neuroblastoma

Kitcho C, Bergstrand D, Mandli S, Walkiewicz-Jedrzejczak D, Capitini C

Background: Neuroblastoma is the most common extracranial solid tumor of childhood. Treatment of high-risk neuroblastoma includes autologous stem cell transplant, which involves a myeloablative conditioning regimen that can lead to malnutrition, pancytopenia, mucositis, and infections. The effects of enteral and parenteral nutrition on nutrition status, adverse events during treatment and outcomes in children with high-risk neuroblastoma after autologous stem cell transplant remain understudied.

Design/Methods: 36 patients diagnosed with high risk neuroblastoma who underwent at least one autologous stem cell transplant were selected for retrospective chart review. Nutritional parameters consisting of height, weight, BMI, BMI z-score, weight change, caloric demand, and type of feeding tube were analyzed before, during, and after autologous stem cell transplant. Clinical outcomes including days with diarrhea or vomiting, mucositis, time to neutrophil or platelet engraftment, number of transfusions, length of stay, and mortality were also analyzed before, during and after autologous stem cell transplant.

Results: Within the parenteral nutrition group, a significant increase in BMI z-score was observed from pre- to post-transplant (+0.55, p=0.0379). When comparing recipients of parenteral versus enteral nutrition, a significant increase in weight (+0.8kg, p=0.0006) and BMI z-score (p=0.0003) was observed in recipients of parenteral nutrition. A significant increase in caloric demand was observed in recipients of parenteral versus enteral nutrition from pre- to post-transplant (+24.6 vs. -37.8, p=0.0012). There were a significant decrease in days of diarrhea, vomiting, mucositis severity scores, and number of packed red blood cell transfusions observed in recipients of enteral nutrition as compared to parenteral nutrition. Time to platelet engraftment was shorter in recipients of enteral nutrition as compared to parenteral nutrition.

Conclusions: High-risk neuroblastoma patients supported with parenteral nutrition during autologous stem cell transplant appear to have less decline in their nutritional status compared to those supported with enteral nutrition. However, recipients of enteral nutrition show less complications like length of diarrhea and vomiting as well as mucositis severity while showing faster time to engraftment of platelets and less number of blood transfusions.

Hemosuccus pancreaticus following acute pancreatitis in a 12-years-old boy secondary to pancreatic pseudoaneurysm treated with endovascular coil embolization

Ekezie C, Gill K, Pfau P, Johannes A, Woods M, Pinchot J, Furuya Ka, O'Connell D, Ratchford T, Sigurdsson L, Walkiewicz D, Valentyne A, St. Clair N, Ehlenbach M, Woodring T, Danko I

Background: Hemosuccus Pancreaticus is defined as bleeding from the pancreatic or peri-pancreatic vessels into the main pancreatic duct. It is a rare but potentially life-threatening cause of upper gastrointestinal bleeding. It occurs mainly in adults and very few cases have been reported in children.

Case: A 12-year-old boy with a complex medical history including TUBA1A mutation, cerebral palsy and spastic quadriplegia who presented with hematemesis and severe anemia that developed following an episode of acute pancreatitis.

Discussion: Upper endoscopy did not reveal a bleeding source. An Endoscopic retrograde cholangiopancreatography performed for evaluation of common bile duct obstruction identified bleeding from the pancreatic duct. Subsequently the bleeding source, a pseudoaneurysm of the splenic artery, was identified by conventional angiography and occluded with coil embolization.

Conclusions: The diagnosis of hemosuccus pancreaticus may be difficult in children due to rare occurrence and the unusual anatomical site, hence a high index of suspicion is needed in a patient with a history of pancreatitis who presents with intermittent upper gastrointestinal bleeding and normal upper endoscopy.

A survey on the management of anomalous aortic origins of the coronary arteries

Hareem R, Smith Hokanson, J

Background: Anomalous aortic origins of the coronary arteries (AAOCA) can be associated with sudden cardiac death, but are most often identified incidentally on echocardiograms performed for concerns other than coronary anatomy. The management of patients with AAOCA remains controversial due to limitations in risk stratification and limited data on follow-up of surgical treatments. Consequently, providers face uncertainty when formulating treatment plans for these patients.

Design/Methods: We sent out an anonymous electronic survey to the American Academy of Pediatrics Section on Cardiology and Cardiac Surgery (AAP SOCCS) and Pediheart.net online community regarding their practice patterns in the care of patients with AAOCA. The survey was limited to anomalous origins of the right coronary from the left cusp (AAORCA) and left coronary from the right cusp (AAOLCA) with inter-arterial courses.

Results: We received 103 complete responses. There were 98 pediatric cardiologists, of which 90 routinely read echocardiograms. Of those who had completed training, the mean years of practice was 15.9 years. Respondents felt that the coronaries were adequately imaged in first-time echocardiograms at the following ages 84% (<1 year), 79% (1-4 years), 80% (5-9 years) and 72% (10-20 years). Across the age spectrum, less than ¼ of respondents recommended repeat echocardiography if the coronaries were not adequately visualized. After incidental diagnosis of AAOCA at birth, the next cardiology visit, next echocardiogram and coronary CT were recommended at 1.50 (+/- 1.59), 1.93 (+/-2.09) and 5.69 (+/-3.89) years for AAOLCA and 1.92(+/-1.94), 2.35 (+/-2.23) and 6.08 (+/-3.89) years for AAORCA. In a 16 yo with no evidence of ischemia on stress imaging, surgery was felt to be appropriate or somewhat appropriate in 1/103 and 4/103 in the case of AAORCA and 40/103 and 31/103 in AAOLCA. In a 16 yo with AAORCA with no evidence of ischemia on stress testing, respondents were more likely to recommend surgery in competitive athletes (45/103) and patients with hypertension (14/103) and less like to recommend it in patients with Down's syndrome (14/103) and pulmonary hypertension (14/103).

Conclusions: Our survey demonstrates that although the coronary arteries are generally well identified on routine echocardiography, there is a wide range in the practice management of AAOCA.

*** Impact of multiorgan and kidney-pancreas allocation policies on pediatric kidney-alone transplant candidates in the United States**

Engen R, Shepherd D, Bradford M, Foutz J, Bartosh S, Smith J

Background: United States organ allocation policies prioritize kidney-pancreas and other multiorgan candidates above pediatric kidney-alone candidates, but the effects of these policies is unclear.

Design/Methods: We used OPTN data to describe trends in multiorgan and kidney-pancreas transplantation and identify 377 next-sequential pediatric kidney-alone candidates between 4/1/2015 and 10/31/2019 for individual-level analysis.

Results: 11% of all kidneys were allocated as part of a multiorgan or kidney-pancreas transplant and 6% of pediatric kidney candidates were impacted. Pediatric next-sequential candidates accrued a median of 118 days (IQR 97-135 days) of additional wait time, and this was significantly longer for children who were Hispanic (p=0.02), blood type B or O (p=0.01), or had a cPRA ≥20% (p<0.01). Eight pediatric next-sequential candidates (2%) were removed from the waitlist due to death or 'too sick to transplant'. Sixty-three percent were transplanted with a kidney with a higher KDPI than the original multiorgan match (p<0.01). Donor service areas with higher volumes of kidney-pancreas transplants had significantly longer additional wait times for pediatric next-sequential candidates (p=0.01).

Conclusions: Current allocation policy results in longer waiting times and higher KDPI kidneys for pediatric kidney candidates. As multiorgan transplant volume is increasing, further consideration of allocation policy is necessary to maximize equality and utility.

*Accepted at the International Pediatric Transplant Association

The process of safety reporting by parents of hospitalized children with medical complexity: A qualitative analysis

Kieren M, Kelly M, Garcia M, Chen T, Baird J, Haskell H, Luff D, Mercer A, Ngo T, Quiñones-Pérez B, Williams D, Khan A

Background: Although there is evidence that parents of hospitalized children, particularly those with medical complexity (CMC), have valid safety concerns, little is known about parents' experiences with the process of reporting these concerns during their child's hospital stay.

Design/Methods: We conducted a secondary analysis of qualitative data from semi-structured interviews with 34 English- and Spanish-speaking parents of CMC at two tertiary care children's hospitals as part of a larger study on family safety reporting. Interviews lasted from 45-60 minutes and were audio-recorded, translated, transcribed, and verified for accuracy. Three researchers inductively and deductively coded the transcripts using an iteratively refined codebook with validation by a fourth researcher and a conceptual model of family safety reporting was created.

Results: Four steps emerged illustrating the process of safety concern reporting: (1) parent recognizing concern, (2) parent reporting concern, (3) staff/hospital response to concern, and (4) parent feelings of validation. Themes, definitions and illustrative quotes are shown in Table 1. Many parents endorsed that they were the first to catch a safety concern. Some parents reported their concerns were not acknowledged or addressed by the healthcare team, leading to feelings of being overlooked, disregarded, or judged. Others reported their concerns were acknowledged and addressed, resulting in parents feeling heard or seen and often a change in a clinical process or outcome.

Conclusions: Parents identify multiple steps in reporting safety concerns in the inpatient setting. Effective family safety reporting interventions must help parents recognize and report concerns and help staff effectively respond to, acknowledge, and validate parent concerns.