ABSTRACT BOOK

neoFORUM Poster Symposium

June 8th, 2023

Fiddler's Elbow Country Club

neoFORUM

Session A – Conservatory

Session B – Reagan Library

Session C – Moseley Conference Room

Group	Presenting Author	Title
A5	Renee Behme, MD	Implementation of a Golden Hour Protocol to Improve Care of Infants Born at Less than 27 Weeks Gestation
C2	Josh Daniel, DO	Improving Early Human Milk Fortification in Infants <1500g
B4	Christina Ferrucci-Da Silva, MD	Implementation of Continuous Positive Airway Pressure (CPAP) Protocol to Reduce Chronic Lung Disease (CLD) in Infants 22-29 Weeks Gestation
A1	Thomas Hays, MD	Implementation of Rapid Genome Sequencing for Critically Ill Infants with Congenital Heart Disease
B3	Bethany Hunt	Factors associated with failure of initial non-invasive respiratory support in late preterm and term infants and its impact on outcomes
B5	Tracey Koplik, RN	Nurse-Led Education Contributions Support Interprofessional Quality Improvement Initiatives in the NICU
C1	John Ladino, MD	A randomized controlled trial of oropharyngeal therapy with mother's own milk for premature infants, final report
A2	Chris Lee, PhD	Phytosterols Alter Cholesterol Regulatory Pathways and Bile Acid Transporters in Human Hepatocytes
C4	Rebekah Muthalaly, DO	Bile Acid Metabolism in Rat Pups Exposed to Phytosterols in Lipid Emulsions
A4	Matthew Ostroff, NP	Transhepatic and Subcostal Ultrasound Imaging for Catheter Location of Subcutaneously Tunneled Mid-Thigh Femoral Vein Catheters in Neonates
B1	Javier Pacheco-Quinto, MD	Exosomes as Drug Delivery Vehicles for Dexamethasone: Findings from an In Vivo Model of Bronchopulmonary Dysplasia
A3	Harsimran Panesar	Utilizing Antenatal Doppler Velocimetry as a Tool for Predicting Outcomes in Small for Gestational Age Newborns
C5	Shivani Rao	The Role of Maternal Social Factors in Perinatal Outcomes
C3	Ruth Snyder, NP	Prevention of Problematic Metabolic Acidosis in Very Low Birth Weight Infants: A Quality Improvement Initiative
B2	Lily Zheng	Do maternal adverse childhood events (ACE) scores affect rates of breastfeeding adherence and neonatal growth as well as mother's resilience?

Poster Number: A1

Implementation of Rapid Genome Sequencing for Critically Ill Infants with Congenital Heart Disease

Thomas Hays, MD, PhD, Rebecca Hernan, MS, CGC, Michele Disco, MS, CGC, Emily L. Griffin, MS, CGC, Nimrod Goldshtrom, MD, MS, Diana Vargas, MD, Ganga Krishnamurthy, MD, Miles Bomback, BA, Atteeq U. Rehman, PhD, Amanda T. Wilson, PhD, Saurav Guha, PhD, Shruti Phadke, MS, Volkan Okur, MD, Dino Robinson, MS, Vanessa Felice, BS, Avinash Abhyankar MD, PhD, Vaidehi Jobanputra, PhD, Wendy K. Chung, MD, PhD

Columbia University Irving Medical Center

Background: Rapid genome sequencing (rGS) has been shown to improve the care of critically ill infants. Congenital heart disease (CHD) is a leading cause of critical illness in infants and is often caused by genetic disorders. Genetic disorders often cause extracardiac disease, some which is preventable, and some of which can be life limiting. Use of resource-intensive rGS is challenging because it is unclear which patient characteristics are associated with genetic disorders prior to testing.

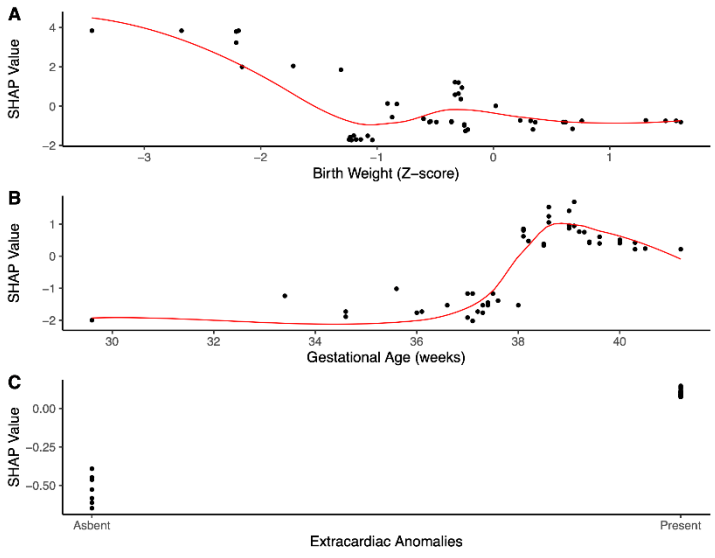
Objectives: 1) Determine the clinical impact of rGS for critically ill infants with CHD. 2) Evaluate characteristics of infants that are associated with diagnostic rGS results.

Design/Methods: This was prospective cohort study of newborns with complex CHD admitted to a regional referral ICU. We implemented a multidisciplinary approach involving genetic counsellors, neonatologists, cardiologists, and clinical and molecular geneticists. Infants in whom genetic disease was clinically suspected were enrolled for rGS. Changes in clinical management were determined. And infant characteristics were compared between those with and without diagnostic rGS results using a machine learning model.

Results: In a cohort of 48 infants with complex CHD, rGS diagnosed 14 genetic disorders in 13 individuals, including one secondary finding unrelated to CHD. All but two genetic disorders arose de novo, and therefore could not have been anticipated from family history or screening. Genetic disorders consisted of 9 single gene disorders and 4 copy number variants. Median (interquartile) time from consent to return of results was 6.5 (1.3) days.

rGS led to changes in management in 8 of 13 cases. These included 2 cases in whom diagnoses helped avert intensive, futile interventions (surgery and ECMO) that would have been inconsistent with families' goals of care, and 3 cases in whom eye disease was diagnosed and treated.

Modeling using a machine learning approach (extreme gradient boosted decision trees) indicated that extracardiac anomalies, later gestational age, and small for gestational age birth were the features most likely to be found in infants with diagnostic rGS results.



Conclusions: rGS identified the genetic disorders responsible for 13 of 48 cases of CHD and changed management in most diagnostic cases. Our model depended on close multidisciplinary coordination. Using machine learning, we preliminarily identified characteristics that may help direct this resource-intensive test. These findings highlight the important role for rGS in CHD and demonstrate the need for expanded study of how to implement rGS for a broader population of infants with CHD.

Poster Number: A2

Phytosterols Alter Cholesterol Regulatory Pathways and Bile Acid Transporters in Human Hepatocytes

Naureen Memon, M.D., Elizabeth Eckman, Ph.D., Aimee Herdt, Ph.D., and Chris Lee, Ph.D.

MidAtlantic Neonatology Associates, Biomedical Research Institute of New Jersey

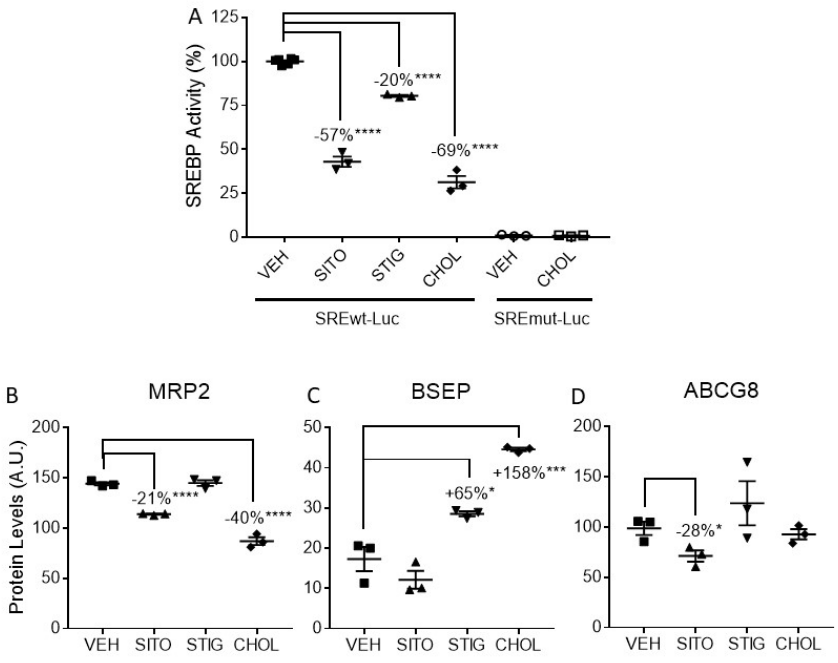
Background: Traditional lipid emulsions (LE) are derived from 100% soybean oil (SO) and contain high concentrations of toxic plant cholesterols, known as phytosterols (PS). PS containing LEs are a major contributor to PN associated liver disease (PNALD). Data on the cellular mechanisms by which hepatic PS accumulation affects cholesterol and bile acid (BA) metabolism is limited and conflicting. Additional mechanistic studies are needed to understand the pathogenesis of PS induced liver disease.

Objectives: To determine whether PS alter the activity of sterol regulatory element-binding protein (SREBP) and affect the protein expression of key BA and sterol efflux transporters in human hepatocytes.

Design/Methods: SREBP activity was quantified by luciferase-based sterol regulatory element (SRE) reporter assay. DNA constructs containing wildtype SRE or non-functional mutant SRE were transiently transfected into HEPG2 cells, followed by treatment with vehicle (0.5% w/v hydroxypropyl-□-cyclodextrin), β-sitosterol (22 □M), stigmasterol (22 □M) or cholesterol (22 □M) for 48 hours in delipidated culture medium. Luciferase activity (ONE-Glo, Promega) was measured in soluble cell lysate normalized to protein concentration. BSEP, MRP2 and ABCG8 protein levels were measured by western blot in lysates prepared from native HEPG2 cells treated with sterols for 6 days. Statistical analysis was performed using ANOVA and unpaired t-test.

Results: Cholesterol and □-sitosterol suppressed SREBP activity by 69% and 57%, respectively, whereas stigmasterol inhibited the activity by only 20% ($p<0.0001$ for each, vs. vehicle). As expected, mutant SRE reporter activity was not detectable under any condition (Fig A). MRP2 levels were reduced by□□-sitosterol (-21%, $p<0.0001$) and cholesterol (-40%, $p<0.0001$), but not by stigmasterol. BSEP levels were increased by stigmasterol (+65%, $p<0.05$) and cholesterol (+158%, $p<0.001$). ABCG8 levels were reduced only by □-sitosterol (-28%, $p<0.05$) (Fig B).

Conclusions: β-sitosterol and stigmasterol alter cholesterol homeostasis by suppressing SREBP activity and differentially alter the expression of key BA and sterol efflux transporters in human hepatocytes. These findings provide insight into various cellular mechanisms that may be implicated in the pathogenesis of PS induced liver disease.



Poster Number: A3

Utilizing Antenatal Doppler Velocimetry as a Tool for Predicting Outcomes in Small for Gestational Age Newborns

Anna Weinstein DO, MS, Soindos Abdah BS, Harsimran Panesar BS, Tara Lozy MS, Andrew Brofsky BSEd, Kim Murphy DO, Antonia Oladipo MD, MSCI, Jesus Alvarez-Perez MD, Marwa Khalil MD

Hackensack Meridian University Medical Center

Background: Fetal growth restriction (FGR) is a leading cause of perinatal morbidity. The underlying etiologies of FGR cause uteroplacental hypoperfusion leading to chronic fetal hypoxia. Antenatal ultrasound surveillance with doppler velocimetry allows perinatologists to monitor the progression of FGR. While abnormal umbilical artery doppler (UAD) studies implicate poor neonatal outcomes, their utility in predicting specific neonatal morbidity has not yet been investigated.

Objectives: To identify antenatal sonographic findings amongst FGR fetuses that can predict postnatal complications in the small-for-gestational-age (SGA) neonates.

Design/Methods: A retrospective chart review of SGA neonates was performed. Corresponding maternal antenatal sonograms were reviewed. Pregnancies affected by known chromosomal abnormality were excluded. Group comparisons were performed using student t-test for continuous variables and chi-square test for categorical variables with a significance threshold of 0.05.

Results: 82 SGA neonates were diagnosed with FGR antenatally. Maternal chart review showed heterogeneous racial distribution, with 27% of mothers being >35 years old and 83% mothers were at least overweight. 33% of SGA neonates required total parenteral nutrition (TPN) postnatally (n=26), out of which 50% had abnormal UAD on antenatal ultrasound (n=13; p <0.01). 13% of the SGA neonates had residual feeds (n=10), 60% of whom had abnormal UAD (n=6; p <0.01). 58% of SGA neonates had hyperbilirubinemia (n=46), 33% of whom had abnormal UAD (n=15; p<0.05). There was a significant correlation between the estimated fetal weight (EFW) and birthweight of fetuses at the time of FGR diagnosis from 25-30 weeks of gestation (P 0.01, r = 0.70) and >30 weeks (P <0.01, r = 0.61) (Figure 1). After adjusting for gestational age, the average length of stay for SGA neonates who had abnormal UAD was 19.5 days, whereas the average length of stay for SGA neonates without doppler abnormalities was 4 days (p<0.05).

Conclusions: Our preliminary results demonstrate that FGR with abnormal UAD is predictive of neonatal feeding intolerance, hyperbilirubinemia, and increased length of stay. It was found that EFW after 25 weeks of gestation is highly predictive of a SGA neonates' birthweight. Given this study's limited sample size, future investigation is warranted. Such research could inspire the development of antenatal sonographic markers for postnatal complications and counseling of pregnancies affected by FGR.

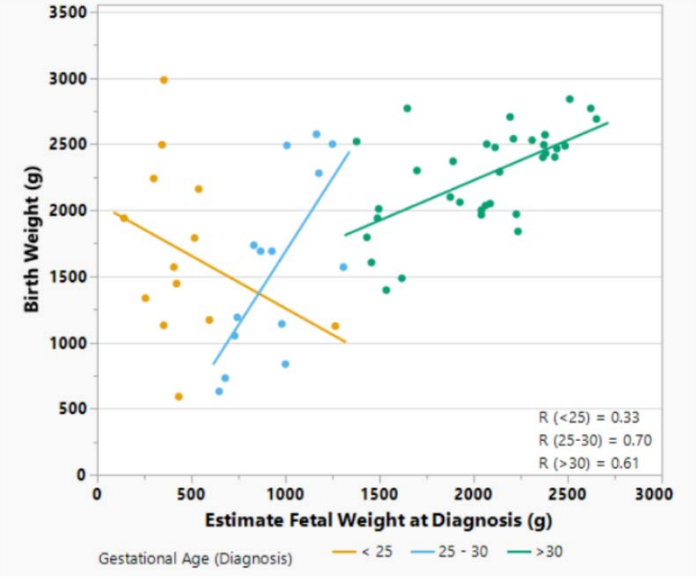


Figure 1: Scatterplot showing the relationship between EFW at FGR diagnosis and birth weight. Neonates are categorized by their gestational age at FGR diagnosis.

Poster Number: A4

Transhepatic and Subcostal Ultrasound Imaging for Catheter Location of Subcutaneously Tunneled Mid-Thigh Femoral Vein Catheters in Neonates

Matthew Ostroff, MSN, APN, Adel Zauk, MD, Subhashree Datta-Bhutada, MD, Zarah Pua, MD

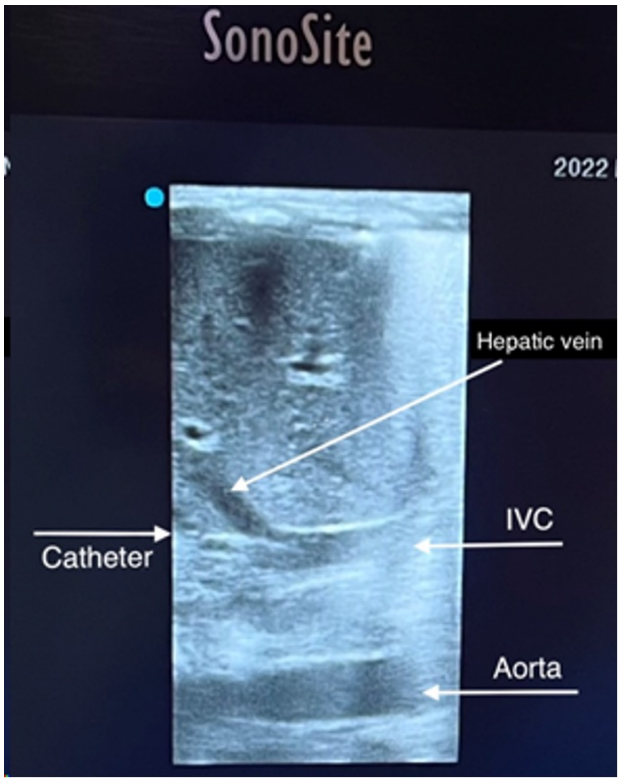
St Joseph's University Children's Hospital

Background: Our 2020 publication in the Journal of Vascular Access showed that subcutaneously tunneled femorally inserted central catheter (ST-FICC) placement is an important procedure to provide parenteral nutrition and medications to critically ill neonates while preserving their upper extremities vasculature. We currently confirm FICC position using the standard radiography.

Objectives: To improve patient care and decrease radiation exposure to the neonates, we recently adapted the use of point-of-care-ultrasound to confirm neonatal ST-FICC placement compared to standard radiograph.

Design/Methods: A quality improvement (QI) initiative was performed on fifty neonates requiring placement of a 1.4 or 1.9 French ST-FICC. The procedure was performed using a transparent drape under ultrasound guidance. Following placement, transhepatic and subcostal ultrasound views were performed identifying the catheter in the vena cava, and visualizing a saline flush to the right atrium. Two views of the chest and abdomen radiographs were then performed to verify catheter location and tip positioning.

Results: POCUS guided venous vessel confirmation was 100% (50/50) compared to radiography. In one case, POCUS was superior to x-ray in defining that FICC was in IVC due to due to neonate's abdominal distention. POCUS catheter tip in the upper one third of the IVC was 86% (43/50) accurate compared to radiograph. In 3 cases the crystals were unable to be identified and radiography interpreted the catheter tip within the RA. In 2 cases the crystals were unable to be identified (imaged) but radiography interpreted the catheter tip in proper position. In 2 cases the flush was visualized but on radiography the catheter was looped onto itself. POCUS allowed for real time verification of FICC placement.



Conclusions: POCUS is an effective and efficient way to localize central venous tip line position for ST-FICC in neonates. It is a safe, portable, ionizing radiation free alternative to standard radiography when catheter identification is confirmed in both the transhepatic and subcostal view of the IVC in addition to the visualization of a saline flush in the RA. A prospective, investigational powered study is currently ongoing to confirm validity of this QI project.

Implementation of a Golden Hour Protocol to Improve Care of Infants Born at Less than 27 Weeks Gestation

Renee Behme MD, Twyla Osei MSN-Ed, RNC-NIC, IBCLC

Capital Health

Background: The Golden Hour refers to the first hour of life in extremely premature infants during which infants are resuscitated and stabilized in the delivery room and neonatal intensive care unit (NICU). Research has shown that standardization of care, attention to detail, and adherence to evidence-based practices in the first hour of life can improve short and long term outcomes in premature infants.

Objectives: To improve admission temperature, time to initiation of intravenous fluids, and time to administration of first antibiotic in infants born at less than 27 weeks gestation

Design/Methods: In 2018, we developed a multidisciplinary Golden Hour Team, which consisted of neonatologists, nurses, respiratory therapists, a physical therapist, a lactation consultant, and unit secretaries. We reviewed the literature and our own unit practices to develop a golden hour protocol to standardize the delivery room and admission process for infants born at less than 27 weeks gestation.

Results: The Golden Hour Team reviewed the delivery room and admission process and created a protocol and clinical tools for the NICU staff. Clinical tools included a new huddle form, an “IV connections board”, and a video of the delivery room process that was created with the help of the hospital's audiovisual department. The educational plan included a slide presentation, viewing the video of the delivery room process, hands-on practice in “mini-competencies”, and a Golden Hour simulation. 100% of staff members were educated. Data and clinical processes were analyzed over two PDSA cycles. Median admission temperature improved from 97.9F before implementation of the protocol to 98.6F after implementation. The median time to administration of first antibiotic improved from 125 minutes before implementation of the protocol to 91.5 minutes after implementation. These improvements were sustained for 2 years after implementation. The feedback from the nursing staff was overwhelmingly positive.

Conclusions: Implementation of a new Golden Hour protocol led to improvement in admission temperatures and a shortened time to administration of first antibiotic in infants born at less than 27 weeks gestation. Secondarily, the new Golden Hour protocol positively influenced feelings of teamwork and communication among staff members, two important human factors that contribute to high quality care for extremely premature infants.

Poster Number: B1

Exosomes as Drug Delivery Vehicles for Dexamethasone: Findings from an In Vivo Model of Bronchopulmonary Dysplasia

Javier Pacheco-Quinto, PhD, Dana Clausen, BA, Elizabeth Eckman, PhD, Christopher Stryker, MD

Biomedical Research Institute of New Jersey

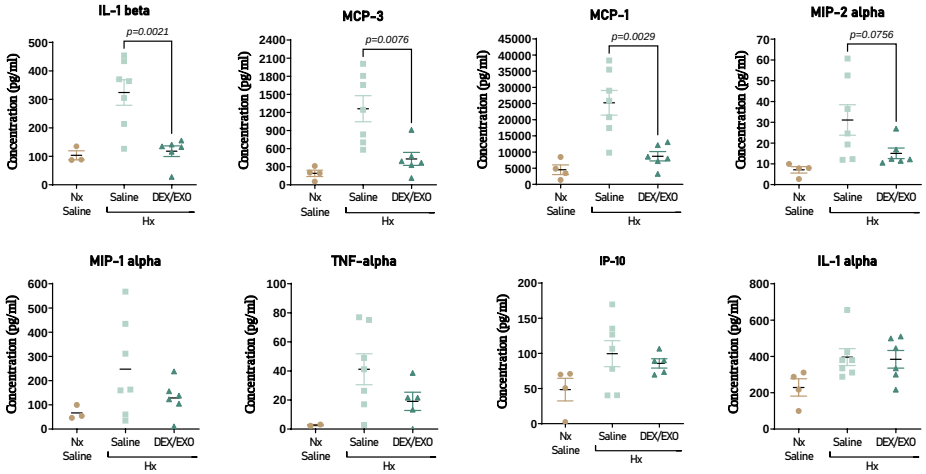
Background: Bronchopulmonary dysplasia (BPD) remains a common morbidity in preterm infants and is associated with adverse outcomes. Dexamethasone (dex) has shown therapeutic promise for BPD, but use is limited by potential adverse effects on neurodevelopment. Exosomes, small extracellular vesicles naturally secreted by many cell types, may represent ideal vehicles for drug delivery to the lung, given their low immunogenicity, stability, and tropism for specific organs based on membrane composition.

Objectives: To investigate the effects of exosomes loaded with dex on lung inflammation in a rat model of BPD.

Design/Methods: Exosomes were extracted from adult rat lungs by density gradient centrifugation, loaded with dex by sonication, washed, and resuspended in sterile saline. In a series of experiments, rat pups were exposed to hyperoxia (85% to 95% O2) from day 0 to 7. On days 0 and 4, pups were intraperitoneally injected with 25µg dex-loaded exosomes (n=7), unloaded exosomes (n=5), or saline (n=7). Controls were reared in normoxia and received either no treatment, the treatments listed above, or free dex (tapering doses days 0-3). On day 7, the lungs were extracted, weighed, homogenized, and 12 inflammatory cytokines were measured using the Luminex platform. Animal weight, length, and brain weight were also measured.

Results: Eight of the 12 cytokines were significantly elevated in the lung homogenates of the hyperoxia/saline group compared to controls. In pups treated with dex-loaded exosomes, IL-1β, MCP-1 and MCP-3 were significantly lower compared to the saline-treated group; there was a trend toward reduction of MIP-1-α, MIP-2-α and TNF-α (Figure). There were no differences between the unloaded exosome group and the saline group. Exposure to free dex was associated with decreased weight, length, and brain weight. In the dex-loaded exosome group, length, and brain weight were comparable to saline-treated controls; weight was significantly decreased in 2 of 3 experiments.

Conclusions: In this study, we demonstrate that exosomes loaded with dex protect against lung injury caused by sustained hyperoxia. The observed anti-inflammatory effects are attributable to dex, rather than the exosome vehicle. Furthermore, loading dex into exosomes may effectively target drug delivery to the lungs, while decreasing adverse systemic side effects associated with free dex. Future studies will evaluate histologic features of BPD after dex-exosome treatment and exosome tropism for the lungs.



Poster Number: B2

Do maternal adverse childhood events (ACE) scores affect rates of breastfeeding adherence and neonatal growth as well as mother's resilience?

Lily Zheng, Alla Kushnir

Cooper Medical School of Rowan University

Background: Adverse childhood experiences (ACE) have shown to have a negative impact on health outcomes. There is evidence of how negative childhood events adversely affect self-esteem in adulthood. Not only do ACEs have an impact on one's own life, but maternal ACEs have shown to have consequences on infants' development as well, indicating a negative intergenerational impact.

Objectives: To analyze the relationship between maternal ACEs on infant outcomes, breastfeeding adherence, and maternal self-perception

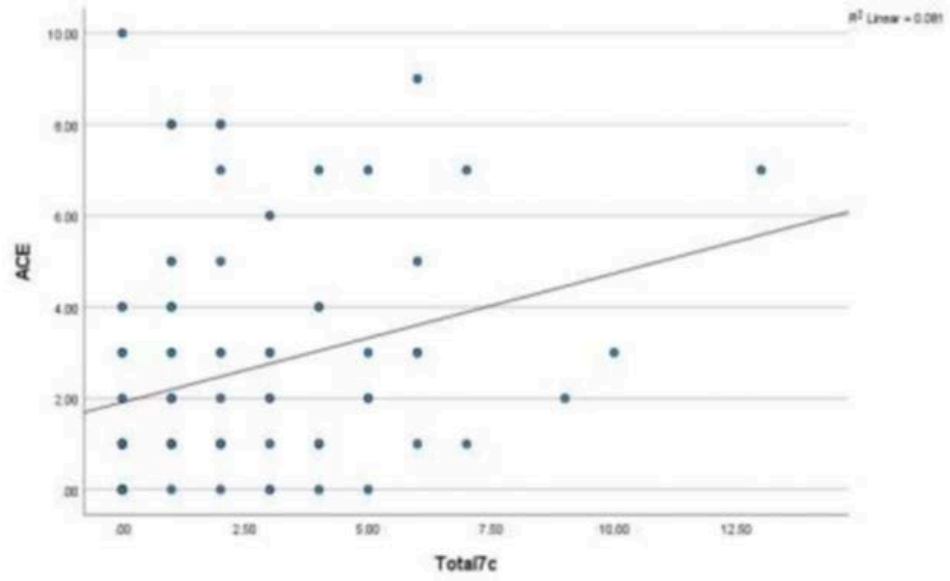
Design/Methods: Between 2020 and 2022, 100 mother-infant pairs from a New Jersey urban hospital were approached between their 2nd trimester and the 2-month newborn visit. Mothers completed the ACE Questionnaire and the 7 C's Tool survey for maternal resilience. Infant developmental milestones were collected from 2-,4-,6-, and 12-month well-visits. Chi-square, Mann Whitney U, and independent t-tests were used to examine ACEs, maternal race and resilience, breastfeeding, and infant developmental milestones.

Results: A total of 46% of mothers were categorized as having high ACE scores (2+). Higher scores from the 7 C's Tool survey reflected lower resilience. There was a significant association between maternal ACE scores and maternal resilience scores (p=0.001). The Pearson correlation coefficient was measured to be 0.370.

There was found to be no significant relationship between ACE scores, race, and breastfeeding, and infant weight and head circumference. Additionally, there was no significant relationship between resilience scores, race, breastfeeding, and infant weight and head circumference.

Conclusions: The data shows evidence for a significant impact of ACEs affecting mothers self-perception and self-determined resiliency. Future research should focus on determining the relationship between maternal race, ACEs, and their impact on both maternal and infant health outcomes.

Spearman Rho Correlation	
R	0.370
P-Value	<0.001
N	98



Factors associated with failure of initial non-invasive respiratory support in late preterm and term infants and its impact on outcomes

Bethany Hunt, Amy Parikh, Deepak Jain

Rutgers Robert Wood Johnson Medical School

Background: Late preterm and term infants commonly receive non-invasive respiratory support (N-IRS) after birth with a small proportion of them failing and requiring escalation of this support. In contrast to extremely preterm infants, there are very limited data on the factors associated with this failure and its impact on outcomes.

Objectives: To determine the impact of failure of initial N-IRS on in-hospital outcomes and identify risk factors associated with this failure in late preterm and term infants.

Design/Methods: We conducted a retrospective cohort study of all inborn infants with gestational age (GA) ≥ 34w from 2012-19 at Rutgers Robert Wood Johnson University Hospital who required N-IRS within 12h of birth. Infants with congenital anomalies were excluded. N-IRS failure was defined as any of the following within 12h of admission: escalation in mode of respiratory support, surfactant administration, increase in FiO2 >0.2 above the baseline or absolute value >0.4 for at least 3h.

Results: Of 343 eligible infants during the study period, 52 (15%) failed initial N-IRS. Failure group had longer duration of respiratory support [1.8d (4.4) vs 0.5d (0.5), median (IQR); p < .001], duration of parenteral nutrition [3.0d (3.0) vs 2.0d (1.5), median (IQR); p < .001] and length of stay [8d (9) vs 4d (4), median (IQR); p < .001] as compared to N-IRS success. Higher proportion of these infants received prolonged course of antibiotics [15(29) Vs 29(10), n(%), p <.001].

There was no difference in GA, mode of delivery or neonatal resuscitation between the groups. Infants in N-IRS failure group were on higher FiO2 on admission to NICU. More infants in N-IRS failure group were exposed to maternal hypertension, born to GBS positive mothers.

On LRA, maternal hypertension (aOR 2.261 (95% CI 1.044 – 4.894) and positive GBS status (aOR 2.479 (95% CI 1.128 – 5.448) were associated with increased odds of failure of N-IRS.

Conclusions: Failure of initial non-invasive respiratory support in this population was associated with significantly longer duration of respiratory support, hospital stay and more frequent exposure to prolonged course of antibiotics. Interestingly, maternal hypertensive disorders and GBS positive status were associated with the failure. The pathophysiological basis of these associations and their potential role in prediction of failure of respiratory support need to be further investigated.

Poster Number: B4

Implementation of Continuous Positive Airway Pressure (CPAP) Protocol to Reduce Chronic Lung Disease (CLD) in Infants 22-29 Weeks Gestation

Christina Ferrucci-Da Silva, MD, Marybeth Gartland, MSN, CCRN, Kathleen Harrington, MS, APN-C, Billie Lesperance, RRT, Meera Kale, MD, Tuisha Desai, DO, MS, Erin Qualter, MD, MS, Renee Bolognese, MSN, APN-C, Christine Whelan, MSN, APN-C, Bonny Adler, MSN, RNC-NIC, Elsie Mainali, MD, PhD

Monmouth Medical Center

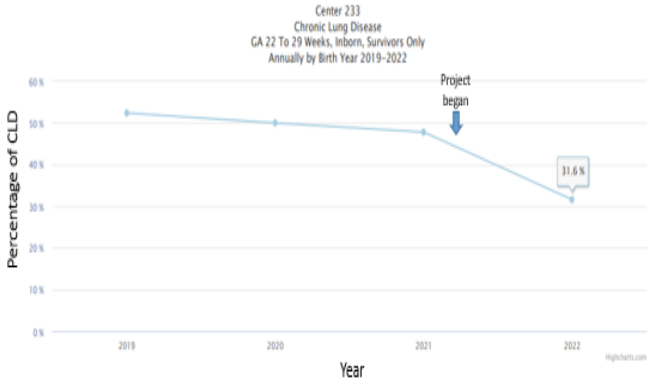
Background: CLD is a multifactorial disease that results in acute lung injury, altered lung development and leads to abnormal repair processes in the lung. The NICU Respiratory Quality Improvement Team working in conjunction with the NJ NICU collaborative reviewed outcomes of centers that had lower rates of CLD. We had an increase in CLD in 2019 to 52.4% according to the VON standard. We also thought it would be useful to determine CLD rates by Jensen grading, which best predicts early childhood morbidity.

Objectives: Decrease the rate of Chronic Lung Disease (CLD) in preterm newborns of 22-29 weeks by 20% from our Vermont Oxford Network rate of 52.4% in 2019 through implementation of a CPAP protocol.

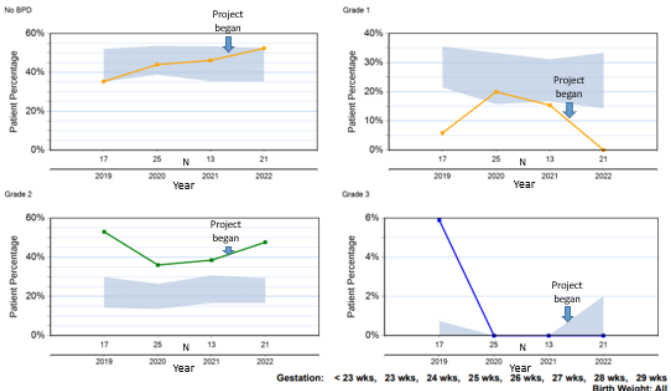
Design/Methods: An evidence-based CPAP protocol was developed to standardize use of CPAP in infants 22-29 weeks. The protocol emphasized not using the RAM cannula in these infants. Education to the staff was completed and the daily number of type of prongs applied in babies of GA 22-29 weeks was tracked. CLD defined by Jensen grading was also determined, which best predicts early childhood morbidity by categorizing disease severity according to the mode of respiratory support administered at 36 weeks.

Results: According to VON criteria, our rate of CLD decreased from 52.4% in 2019 to 31.6% in 2022, following implementation of the project in April 2021. In 2019, MMCs CLD rate of no BPD, grade 0 according to Jensen grading, was 35.3%. In 2022, our rate of no BPD increased to 52.4%.

Conclusions: A standardized approach to CPAP management made an impact in our CLD rates, enabling us to achieve our goal of decreasing CLD by 20% according to VON standard. We speculate that a CPAP protocol standardized care and led to a reduction in CLD by providing PEEP for a longer period of time. The addition of bubble CPAP aided in alveolar growth, initially decreasing our CLD rate prior to implementation of our protocol. The addition of NIV-NAVA in 2022 has likely also aided in decreasing CLD.



- Decrease in CLD from 52.4% in 2019 to 31.6% in 2022.



Grade 0: No respiratory support at 36 weeks CGA
Grade 1: Nasal cannula < or = to 2 LPM
Grade 2: Nasal cannula > 2 LPM or CPAP
Grade 3: Invasive mechanical ventilation

- Increase in no BPD from 35.3% in 2019 to 52.4% in 2022.

Poster Number: B5

Nurse-Led Education Contributions Support Interprofessional Quality Improvement Initiatives in the NICU

Susan Russell, MSN, RN-NIC; Fran Whichard, BSN, RNC; Tracey Koplik, MSN, RN, CCRN; Tom Murphy, MD; Joanne Hessler, MS, RN; Siddharta Silva, RRT-NPS; Christine Robinson, PharmD; Karen Gluck, MD; Denise Sweeney MSN, RN; Kathy Murphy, MSN, RNC-NIC; Michele Sylvester, RT; Laura McCluskey, RT; John Ladino, MD

Atlantic Health System

Background: The NICU Quality Improvement (QI) Team at Morristown Medical Center (MMC) actively monitors the components that contribute to the neonatal preventable harm index; a robust approach to monitor patient safety events. These components include hospital-associated infection (CLABSI), respiratory events (unplanned extubation), serious adverse drug events, IV infiltrates that require intervention, and other miscellaneous events. When an increase in preventable complications is identified, often the response is multifaceted and includes medical staff, nurses and other NICU specialists.

Objectives: Here we describe two instances in which nurse-led education played a pivotal role in the collaborative plan to improve patient safety.

Design/Methods: Scenario I: In early 2020, the MMC NICU observed an unexpected rise in CLABSI rate. The QI Team and Infection Prevention Surveillance group reviewed the CDC's Recommendations for the Prevention and Control of CLABSI and noted that MMC's core measures included all 14 recommendations. Nonetheless, a plan was created to re-educate staff, which included an extensive competency period.
Scenario II: In 2021, the MMC NICU had one unplanned extubation. In January 2022, the NICU had four UEs. An interprofessional education team was formed that included members of the QI and respiratory committees. They conducted an evidenced-based study on the care of ventilated patients and discovered an alternative approach to reduce UE sentinel events, which included a follow-up x-ray within 24 hours of tube adjustment, recommended weekly surveillance x-rays, and required immediate attention to concerns of tube position. The committee determined that updated education was needed.

Results: Scenario I: The revised CLABSI competency included specifics on catheter position, central line dressing changes (both aseptic and sterile technique), and skin slab boards were used to help learners demonstrate. The educational activity was experiential. Providers (MDs, PAs, APNs) completed the competencies alongside nurses, because the first central line dressing change is always done by both the RN and a provider. Nurses held hands-on competency sessions with 100% of staff.
Scenario II: Nurses from both committees developed a UE prevention educational program. The "Preventing Unplanned Extubations in the NICU Self Learning Packet" emphasized previous guidelines for care of intubated patients, monitoring of tube location (x-ray), close attention to tube fixation, and the use of two staff members for repositioning of all intubated patients. Nurses from the education committee ensured that 100% of staff that work with intubated neonates were educated with hands-on training.

Conclusions: Herein, we outline the importance of nurse-led education in meeting the QI goals of the preventable harm index.

A randomized controlled trial of oropharyngeal therapy with mother's own milk for premature infants, final report

Nancy A. Rodriguez, Fernando Moya, John Ladino, Adel Zauk, Preetha Prazad, Jorge Perez, Maximo Vento, Erika Claud, Chi-hsiung Wang and Michael S. Caplan

Department of Pediatrics, NorthShore University HealthSystem; University of Chicago Pritzker School of Medicine; Department of Pediatrics, UNC School of Medicine; Department of Pediatrics, Goryeb Children's Hospital; Neonatology, St Joseph's Children's Hospital; Neonatology, Advocate Children's Hospital-Park Ridge; Department of Pediatrics, South Miami Hospital; Division of Neonatology, University and Polytechnic Hospital La Fe, Valencia, Spain.

In memoriam Nancy A. Rodriguez

Background: OroPharyngeal Therapy with Mother's Own Milk (OPT-MOM) can serve as substitute for biofactor-rich amniotic fluid, providing oropharyngeal immunostimulation until per-oral feeds can be provided to preterm infants (PT). We hypothesized that OPT-MOM improves immune function and intestinal health, thereby improving feeding tolerance and reducing length of stay.

Objectives: To measure effects of OPT-MOM on reducing length of stay, time to full enteral feedings and to full oral feedings and reducing NEC incidence, late-onset sepsis (L-OS), and death in PT <1250 grams.

Design/Methods: A double-blind, placebo-controlled, randomized safety and efficacy trial of OPT-MOM among PT infants in 5 NICUs (Group A, OPT-MOM, n=113 v. Group B, placebo, n=107). Infants were randomized to receive 0.2mL of 'study substance' every 2hs for 48hs (beginning < 96hs of life), then every 3hs until 32w CGA.

Results: There were no differences in birthweight, GA, or Snappe Score for groups A and B. Compared to B, A had shorter length of stay (mean+/-SD: 79.8 ± 37.1 vs 88.0 ± 56.3, p=0.42), shorter time to reach full enteral feedings (24.0 ± 16.4 vs 31.6 ± 43.5, p=0.47), and reduced time to reach full PO feedings (68.5 ± 29.2 vs 75.2 ± 47.8, p= 0.28). L-OS was similar (13% vs 15%), as it was mortality (.3.5% vs 2.8%), with a trend towards less NEC (4.4% v. 5.6%, p=0.69) in A v. B, respectively.

Conclusions: We found a 9-day reduction in length of stay, 7-day reduction in time to full enteral feedings, a 6-day reduction in time to full PO feedings. We found no significant difference in L-OS, NEC or mortality. We speculate that less inflammation and improved commensal microbiome contributed to these improved outcomes. A 9-day reduction in stay for PT infants is a potential savings of 1.8 billion in USD yearly.
In memoriam : Nancy Rodriguez

Poster Number: C2

Improving Early Human Milk Fortification in Infants <1500g

Josh Johnikutty Daniel DO, Bethany Jung RD CNSC, Shakuntala Chandra MD

Saint Peter's University Hospital

Background: The nutritional requirement of premature infants cannot be fulfilled with exclusive breast milk due to the greater energy, protein, fatty acids, minerals, and micronutrients that they require compared to term newborns. Thus, the standard of care across most NICU's involves utilizing human milk fortifier to increase nutrient density to aid their growth. However, the optimal timing to initiate fortification has not been established. Although there is some provider hesitancy to fortify earlier due

Objectives: To first determine if very low birth weight infants fortified earlier (≤100 ml/kg/d of enteral feeding volume) versus delayed (>100 ml/kg/d) had lower extrauterine growth restriction (EUGR) rates. Sec

Design/Methods: Design: Retrospective chart review. The enteral feeds of fortification initiated, birth weight percentile, and discharge weight percentile, were compared between the 2 groups
Participants: 132 infants admitted to the NICU at Saint Peter's University Hospital with a birthweight <1500 grams from 4/1/2021 to 9/1/2022
Exclusions: Infants who were small for gestational age (SGA), intrauterine growth restricted (IUGR), had congenital anomalies, or expired during admission (n=32) were excluded
Statist

Results: Infants fortified earlier had a statistically significantly reduced percentage of being EUGR upon discharge (p-value: 0.03). Figure 1 below reveals that 18% of infants fortified earlier had EUGR versus 38% of infants fortified later. Figure 2 notes the gradual improvement in the earlier fortification initiative after the quality improvement study was implemented. The average enteral feeding volume that fortification was initiated prior to the study was 116 ml/kg/d but 105 ml/kg/d after the quality improvement initiative was implemented.

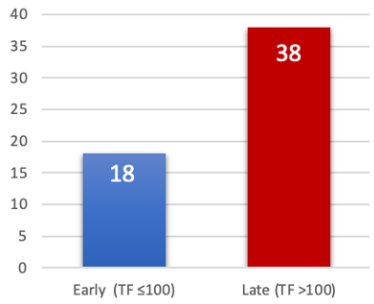


Figure 1: EUGR % in Early vs Delayed Fortification (p-value: 0.03)

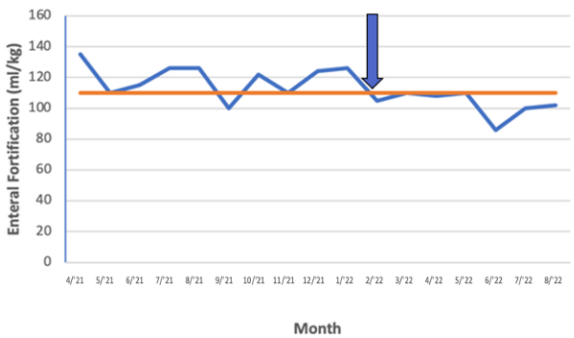


Figure 2: **Average Fortification Initiation per month from 4/'21-8/'22**
The quality improvement study was initiated on 2/'21 as depicted by the arrow above. An improving trend to earlier fortification is noted after 2/'21

Conclusions: The significant decline of being EUGR upon discharge in infants fortified early should pave the way to change current practices to fortify early. Extrauterine growth restriction is related to the impairment of growth during childhood and poor neurocognitive impairments. Thus, this study is one of the first methods to potentially combat childhood growth impairment in this cohort.

Poster Number: C3

Prevention of Problematic Metabolic Acidosis in Very Low Birth Weight Infants: A Quality Improvement Initiative

Ruth Snyder, NNP, Christine Robinson, PharmD, Christin Aikey, RDN, Colleen Quinn, RDN, Melissa Neavear, MD, Ian Griffin, MD, Christopher Stryker, MD

MidAtlantic Neonatology Associates, Atlantic Health System, Goryeb Children's Hospital

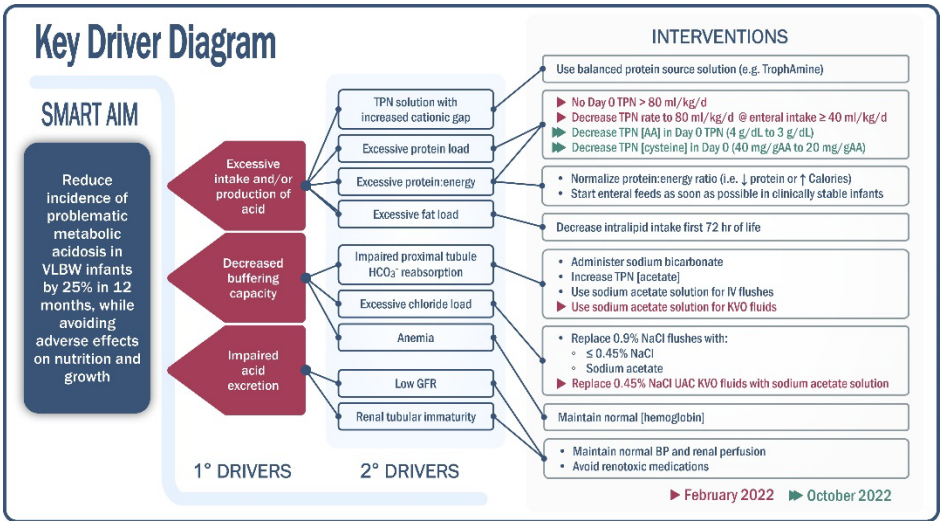
Background: VLBW infants (birth weight < 1500g) are predisposed to developing metabolic acidosis in early life due to increased acid production associated with clinical conditions that cause tissue hypoxia and an inability to effectively excrete acid due to renal immaturity. Metabolic acidosis may adversely affect organ function and growth. Nutritional practices, including provision of parenteral electrolyte and nutrition (TPN) solutions, may impact acid-base balance in preterm infants.

Objectives: Reduce the incidence of problematic metabolic acidosis (MA) in VLBW infants by 25% in 12 months, while avoiding adverse effects on short-term growth.

Design/Methods: MA was defined as BE ≤ -10 mmol/L, or if blood gas unavailable, CO2 < 15 mmol/L, with a normal anion gap (< 16 mmol/L) and lactate < 5 mmol/L occurring between days 2 and 5 of life. All VLBW infants born at Morristown Medical Center who survived > 5 days were included. Key drivers contributing to metabolic acidosis were identified and interventions were devised to optimize parenteral protein to energy ratio, decrease parenteral chloride administration, and increase parenteral acetate administration (Fig 1). The primary outcome measure was the proportion of infants with MA per cohort of 7 consecutively born VLBW infants. Secondary outcomes were MA rate pre- and post-intervention and monthly mean lowest base deficit in ELBW infants. Balancing measures included time to regain birth weight (BW) and extrauterine growth restriction (EUGR). Compliance with interventions was monitored.

Results: There was no special cause variation in the primary outcome within the study period. Compared to the historical cohort, there was a significant decrease in the rate of MA after implementation of interventions (MA rate = 42% in historical cohort, 28% after first round of interventions, 16% after second round of interventions, $p < 0.05$). There was a downward shift in the monthly mean lowest base deficit in ELBW infants. There were no differences between the historical and intervention groups in time to regain BW (9.1 d vs. 8.8 d vs. 8.2 d, respectively) or EUGR (ΔZ >1 at 36 wks CGA 23.7% vs. 15.4% vs. 18.2%, respectively). Eight protocol violations were identified; compliance with all interventions for each infant was 90%.

Conclusions: Using QI methodology, we devised and implemented interventions to decrease MA in VLBW infants. In the 12 months since implementation, there has been a significant decrease in the rate of MA in VLBW infants and a downward shift in MA severity in ELBW infants. While there was no special cause variation in the proportion of infants with MA by cohort, more time is needed to determine the impact of the 2nd round of interventions. Data collection and analysis are on-going.



Bile Acid Metabolism in Rat Pups Exposed to Phytosterols in Lipid Emulsions

Rebekah Muthalaly, DO, Chris Lee, PhD, Elizabeth Eckman, PhD, Aimee Herdt, PhD, and Naureen Memon, MD

Goryeb Children's Hospital

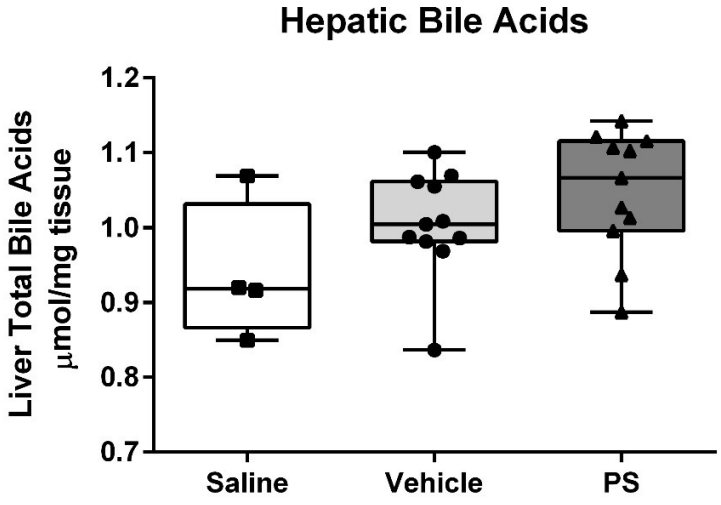
Background: Traditional lipid emulsions (LE) are derived from soybean oil and contain high concentrations of ω6 fatty acids (FA) and plant cholesterols, known as phytosterols (PS). Fish-oil (FO) containing LE contain high concentrations ω3 FA and lower concentrations of PS. Animal and human studies have repeatedly shown that FO containing LE are hepatoprotective; whether this protection is due to the altered FA profile, a decrease in PS concentration, or a combination thereof is currently unknown.

Objectives: To characterize hepatic BA concentrations and hepatic gene expression of key BA synthetic enzymes and transporters in rat pups exposed to PS.

Design/Methods: β-sitosterol, campesterol, and stigmasterol were dissolved in 2-hydroxypropyl-β-cyclodextrin (vehicle) to create a PS solution. Sprague-Dawley rat pups received daily intraperitoneal injections of PS solution from P0-P13 at a dose approximating PS content in 2 g/kg/d Intralipid (n=11), following which they were euthanized, and livers were extracted. Vehicle exposed pups (n=11) and saline injected pups (n=4) served as controls. Total BA in saline extracts of liver were quantified using an enzymatic colorimetric assay (GenWay). Expression of BA synthetic genes (Cyp7a1 and Cyp8b1) and transporters (Bsep, Mrp2, Abcg5/8) were measured using custom QuantiGene assays (ThermoFisher) and normalized to SDHA expression. Results were compared by ANOVA; differences between groups were considered significant if $p<0.05$. Pearson correlation was used to examine relationships between BA levels and hepatic gene expression.

Results: Median levels of soluble hepatic BA were 14% higher in PS exposed pups than in saline controls, but there were no statistically significant differences among the 3 groups (Fig 1). Similarly, no significant differences in the hepatic expression of selected genes were detected in PS-exposed pups. Hepatic BA content was negatively correlated with the expression level of BA synthetic genes Cyp7a1 ($p=0.022$) and Cyp8b1 ($p=0.015$) and positively correlated with sterol transporter Abcg5 ($p=0.031$).

Conclusions: PS exposure resulted in an increased trend towards hepatic BA accumulation; statistical significance was not reached most likely secondary to interindividual variation and small sample size. The relationship between hepatic BA content and gene expression of BA synthetic enzymes and sterol transporter reflects homeostatic mechanisms that prevent BA accumulation in the liver.



Poster Number: C5

The Role of Maternal Social Factors in Perinatal Outcomes

Shivani Rao, BA; Krystal Hunter, PhD; Vishwanath Bhat, MD; Sarah Davenport, MD; Alla Kushnir, MD

Rowan University

Background: The incidence of pregnancy-related complications and adverse neonatal outcomes has steadily increased in recent years, affecting over 30% of the US population. Studies show that social factors such as Black and American Indian/Alaska Native ethnicity, higher maternal body mass index (BMI) with its associated comorbidities, and lower rates of prenatal care impact the occurrence of adverse pregnancy, childbirth, and neonatal-perinatal outcomes.

Objectives: To assess the role of BMI, in addition to ethnicity and other social confounders on adverse pregnancy, birth, and neonatal outcomes

Design/Methods: A retrospective analysis was conducted on all mothers that delivered at a Tertiary New Jersey University Hospital in 2019 (prior to COVID-19) and their neonates. Electronic medical record (EPIC) was used to collect data on maternal demographics, BMI, insurance type, number of prenatal visits attended, substance use, and maternal morbidity, and neonatal characteristics, APGAR scores, and morbidity. The correlation between maternal social factors and neonatal outcomes was analyzed with $p<0.05$.

Patient Demographics				
		n		%
Age (Mean/SD)		2,133	28.73	6.04
Race (n/%)		2,055		
	White (Non-Hispanic)		631	30.7%
	African American		629	30.6%
	Hispanic		621	30.2%
	Asian/Pacific Islander		84	4.1%
	Native American		7	0.3%
	Other		83	4.0%
Ethnicity (n/%)		2,023		
	Non-Hispanic		1,318	65.2%
	Puerto Rican		381	18.8%
	Other		206	10.2%
	Central/South American		52	2.6%
	Mexican		66	3.3%
BMI (Mean/SD)		1,400	29.86	7.6
Marital Status (n/%)		2,102		
	Single		1,467	69.8%
	Married/Civil Union		593	28.2%
	Separated		39	1.9%
	Widowed		3	0.1%
Employment Status (n/%)		1,889		
	Not Employed		891	47.2%
	Full Time		174	9.2%
	Part Time		782	41.4%
	Student		36	1.9%
	Self-employed		6	0.3%
Insurance Type (n/%)		2,079		
	None		2	0.1%
	Medicare HMO		1,127	54.2%
	Medicare HMO		197	9.5%
	Medicaid		26	1.3%
	Medicaid HMO		6	0.3%
	Setna		98	4.7%
	NJBC		233	11.2%
	PABC		45	2.2%
	Commercial		34	1.6%
	Other HMO		139	6.7%
	Other		163	7.8%
	Under insured		9	0.4%
Number of Prenatal Care Visits Attended (Median/IQR)		2,133	7	0 - 11
Delivery Method (n/%)		2,078		
	Vaginal		1,539	74.1%
	Caesarean section		539	25.9%
Alcohol Use (n/%)		1,906		
	No		1,388	72.8%
	Yes		518	27.2%
Smoking Status (n/%)		2,133		
	Never smoker		1,652	77.4%
	Former smoker		181	8.5%
	Current some day smoker		47	2.2%
	Current everyday smoker		253	11.9%

Table 1: Patient Demographics

Characteristics of mothers and neonates expressed as sample size (N) and percentage (%), mean and standard deviation (SD), or median and interquartile range (IQR).

Results: Of the 2,080 mothers and 2,133 neonates studied, increased maternal BMI increased the odds of adverse perinatal outcomes (OR=1.44; CI 1.01-1.08) and C-section (OR=1.05; CI 1.03-1.07). African American babies compared to Caucasian babies had greater odds of being small for gestational age (SGA) (OR=10.4; CI 1.17-92.55). More prenatal care visits decreased the odds of negative outcomes (OR=0.86; CI 0.79-0.93). Increased maternal age increased the odds of preterm premature rupture of membranes (PPROM) (OR=1.79; CI 1.02-1.36) and C-section (OR=1.05; CI 1.02-1.08), but lowered the odds of the neonate requiring vigorous resuscitation (OR=0.93; CI 0.87-0.99). Greater gestational age was associated with decreased odds of C-section (OR=0.91; CI 0.89-0.94) and neonatal morbidity (OR=0.288; CI 0.16-0.52).

Conclusions: Among the social factors investigated, BMI, ethnicity, number of prenatal care visits, and gestational age all played a role in increasing the risk of adverse perinatal outcomes. While BMI had a significant effect on perinatal outcomes and the need for C-section, it is uncertain the extent of the overall effect compared to other confounders, given that each of the variables impacted different pregnancy, birth, and neonatal outcomes.