30th Annual Pediatric Research Education and Scholarship Symposium

Friday, April 15, 2016
ACKNOWLEDGEMENTS:

ABSTRACT GRADERS

Raghu Rao, MD
Associate Professor of Pediatrics
Division of Neonatology

Sarah Cusick, PhD
Assistant Professor of Pediatrics
Division of Global Pediatrics

Jen Poynter, PhD
Associate Professor of Pediatrics
Division of Epidemiology and Clinical Research

JUDGES

Muna Sunni, MBBCh
Assistant Professor of Pediatrics
Division of Pediatric Endocrinology

Lucie Turcotte, MD
Assistant Professor of Pediatrics
Division of Pediatric Hematology/Oncology

Phu Tran, PhD
Assistant Professor of Pediatrics
Division of Neonatology

The PRESS 2016 Committee would like to thank everyone for their assistance with making this event possible.

Gwenyth Fischer, MD
Aaron Kelly, PhD
Angela Panoskaltsis-Mortari, PhD
Ginny Oie, Office/Admin Services Supervisor
2:00pm  Thomas Bastian, Postdoctoral Fellow – Pediatric Neonatology
“IRON DEFICIENCY IMPAIRS MITOCHONDRIAL RESPIRATION AND DENDRITE COMPLEXITY IN DEVELOPING HIPPOCAMPAL NEURON CULTURES”
➢ Research Sponsor: Michael Georgieff

2:15pm  Katherine Berg, Graduate Student – General Pediatrics and Adolescent Health
“SUBSTANCE USE AMONG STUDENTS WITH INDIVIDUAL EDUCATION PLANS”
➢ Research Sponsor: Marla Eisenberg

2:30pm  Amy Borden, Pediatric Resident – Pediatric GME
“EFFECTIVENESS OF LOCAL PHOTOTHERAPY PRACTICES TO MEET MINIMUM AND INTENSIVE THERAPY GUIDELINES”
➢ Research Sponsor: Tina Slusher

2:45pm  Vasu Gooty, Fellow – Pediatric Cardiology
“VASCULAR CHANGES ASSOCIATED WITH CARDIOVASCULAR RISK FACTORS IN CHILDREN”
➢ Research Sponsor: Julia Steinberger

3:00pm  Elizabeth Mann, Pediatric Resident – Pediatric GME
“THE INCIDENCE AND TIMING OF HYPOGLYCEMIA AT A RESIDENTIAL DIABETES CAMP – A QUALITY IMPROVEMENT PROJECT”
➢ Research Sponsor: Brandon Nathan
3:15pm  Justin Ryder, Postdoctoral Fellow – Pediatric Epidemiology & Clinical Research
“EFFECT OF BARIATRIC SURGERY ON FUNCTIONAL MOBILITY AND MUSCULOSKELETAL PAIN IN TEENS WITH SEVERE OBESITY: THE TEEN-LABS STUDY”
➢ Research Sponsor: Aaron Kelly

3:30pm  Katie Satrom, Fellow – Pediatric Neonatology
“NEONATAL HYPERGLYCEMIA INDUCES OXIDATIVE STRESS AND CYTOKINE UPREGULATION IN THE DEVELOPING HIPPOCAMPUS OF RAT PUPS”
➢ Research Sponsor: Raghu Rao

3:45pm  Nathan Zaidman, Graduate Student – Pediatric Blood and Marrow Transplantation
“HYDROCORTISONE AFFECTS THE TRANSPORT PHENOTYPE OF DIFFERENTIATED NORMAL HUMAN BRONCHIAL EPITHELIAL CELLS”
➢ Research Sponsor: Angela Panoskaltsis-Mortari
Abstract #

[9] Ranych Aldekhyyel, Graduate Student – Pediatric Hospital Medicine
“BRINGING VIDEO EDUCATION TO THE BEDSIDE BY INTEGRATING AN INTERACTIVE PATIENT CARE TOOL WITH THE ELECTRONIC HEALTH RECORD”
➢ Research Sponsor: Michael Pitt

“PERSISTENT NEUROTRANSMITTER ALTERATIONS IN THE RAT CEREBRAL CORTEX AND HIPPOCAMPUS FOLLOWING INTRAUTERINE GROWTH RESTRICTION”
➢ Research Sponsor: Anne Hall

[10] Elisabet Ampudia-Mesias, Graduate Student – Pediatric Hematology/Oncology
“TUMOR DERIVED VACCINES CONTAINING CD200 INHIBITS IMMUNE ACTIVATION: IMPLICATIONS FOR IMMUNOTHERAPY”
➢ Research Sponsor: Michael Olin

“SYSTEMIC CHALLENGE OF NEWBORN GUINEA PIGS WITH CYTOMEGALOVIRUS RESULTS IN STRUCTURAL AND HISTOLOGICAL EVIDENCE OF BRAIN INJURY AND REDUCED NEUROCOGNITIVE PERFORMANCE IN A MORRIS WATER MAZE TEST”
➢ Research Sponsor: Mark Schleiss

[21] Eunice Areba, Postdoctoral Fellow – General Pediatrics and Adolescent Health
“FAMILY STRUCTURE AND WELL-BEING AMONG STUDENTS FROM 3 ETHNIC GROUPS IN MINNESOTA”
➢ Research Sponsor: Marla Eisenberg

[30] Sofi Asmundsson, Pediatric Resident – Pediatric GME
“A PRELIMINARY REPORT ON INPATIENT MANAGEMENT OF CROUP”
➢ Research Sponsor: Jeff Louie

[12] Henry Aubyn, Graduate Student – Pediatric Blood and Marrow Transplantation
“FACILITATION OF HUMAN INDUCED PLURIPOTENT STEM (iPS) CELL DIFFERENTIATION TO ENDODERM WITH A NOVEL HISTONE DEACETYLASE (HDAC) INHIBITOR”
➢ Research Sponsor: Angela Panoskaltsis-Mortari

[41] Ashley Bjorklund, Fellow – Pediatric Critical Care
“ADVANCEMENT OF MODIFIED BUBBLE CPAP FOR USE IN CHILDREN IN LOW RESOURCE SETTINGS”
➢ Research Sponsors: Tina Slusher, Gwen Fischer, Marie Steiner
[13] Malavika Chandrashekar, Undergraduate Student – Pediatric Infectious Diseases
“CHARACTERIZING gp134 IN GUINEA PIG CYTOMEGALOVIRUS”
➢ Research Sponsor: Mark Schleiss

[32] Brinda Desai, Pediatric Resident – Pediatric GME
“PEARLS: PROCEDURAL EDUCATION FOR ADAPTATION TO RESOURCE-LIMITED SETTINGS - A SUGAR SPIN-OFF CURRICULUM”
➢ Research Sponsor: Michael Pitt, Tina Slusher

[22] Jennifer Doty, Postdoctoral Fellow – General Pediatrics and Adolescent Health
“EFFECTS OF CYBERBULLYING ON DEPRESSIVE SYMPTOMS: ARE PARENTS PROTECTIVE?”
➢ Research Sponsors: Iris Borowsky, Barbara McMorris

[32] Michael Esan, Pediatric Resident – Pediatric GME
“SHOT@LIFE: IDENTIFYING BARRIERS AND SOLUTIONS TO LOW MMR VACCINATION RATE AMONG SOMALI CHILDREN IN MINNEAPOLIS”
➢ Research Sponsor: Michael Pitt

[23] Melissa Fischer, Postdoctoral Fellow – Pediatric Neuropsychology
“EARLY NEUROPSYCHOLOGICAL AND TREATMENT OUTCOMES AFTER HCT IN A CHILD WITH BETA-MANNOSIDOSIS”
➢ Research Sponsor: Julie Eisengart

“CAN POSITIVE RELATIONSHIPS WITH TEACHERS MODERATE THE RELATIONSHIP BETWEEN ADVERSE CHILDHOOD EXPERIENCES AND PRESCRIPTION DRUG MISUSE?”
➢ Research Sponsor: Iris Borowsky

“ENGAGING FATHERS IN PARENTING PROGRAMS: INSIGHTS FOR NEW INTERVENTIONS”
➢ Research Sponsor: Iris Borowsky

[33] Holly Gillis, Pediatric Resident – Pediatric GME
“COMPARISON OF CRITICAL PROCEDURES PERFORMED FOR CHILDREN IN A GENERAL VERSUS PEDIATRIC EMERGENCY DEPARTMENT”
➢ Research Sponsor: Mark Roback

[42] Nathan Gossai, Fellow – Pediatric Hem/Onc and BMT
“DRUG CONJUGATED NANOPARTICLES ACTIVATED BY CANCER CELL SPECIFIC mRNA”
➢ Research Sponsor: Peter Gordon

[34] James Gray, Pediatric Resident – Pediatric GME
“TACROLIMUS-ASSOCIATED HUS AND PRES IN PEDIATRIC HEART TRANSPLANT RECIPIENTS”
➢ Research Sponsor: Rebecca Ameduri

[35] James Gray, Pediatric Resident – Pediatric GME
“ONDANSETRON PRESCRIPTION FOR HOME USE IN GASTROENTERITIS”
➢ Research Sponsor: Marissa Hendrickson
[43] Alyssa Halper, Fellow – Pediatric Endocrinology
"HEALTH-RELATED QUALITY OF LIFE IN CHILDREN WITH CONGENITAL ADRENAL HYPERPLASIA"
➢ Research Sponsor: Kyriakie Sarafoglou

[44] Angela Hanson, Fellow – Pediatric Neonatology
"IUGR DECREASES GSTA4 EXPRESSION IN THE HIPPOCAMPUS OF THE NEWBORN RAT"
➢ Research Sponsor: Anne Maliszewski-Hall

[14] Aditi Hindka, Undergraduate Student – Pediatric Infectious Diseases
"DEVELOPMENT OF AN IgM ASSAY TO DOCUMENT PRIMARY AND FETAL INFECTION IN A CONGENITAL CMV INFECTION MODEL"
➢ Research Sponsor: Mark Schleiss

[36] Pallavi Kamra, Ellen Christiansen, Patricia Hickey, Heather Dahlquist, Pediatric Residents – Pediatric GME
"OVERCOMING MINNESOTA NICE: PROTECTED TIME FOR PEER FEEDBACK"
➢ Research Sponsor: Emily Borman-Shoap

[45] Heidi Kamrath, Fellow – Pediatric Neonatology
"IMPROVED PEDIATRIC RESIDENT KNOWLEDGE OF ETHICS THROUGH BLOCK EDUCATION"
➢ Research Sponsor: Jennifer Needle

[15] Rebecca Kehm, Graduate Student – Pediatrics Epidemiology & Clinical Research
"THE EFFECTS OF BIRTH CHARACTERISTICS AND SOCIOECONOMIC STATUS ON CHILDHOOD CANCER TRENDS: AN ECOLOGICAL TIME SERIES ANALYSIS"
➢ Research Sponsor: Logan Spector

[46] Sarah Kizilbash, Fellow – Pediatric Nephrology
"USE OF BORTEZOMIB IN THE TREATMENT OF ANTIBODY-MEDIATED REJECTION IN PEDIATRIC KIDNEY TRANSPLANT RECIPIENTS"
➢ Research Sponsor: Priya Verghese

[26] Katherine Klipfel, Postdoctoral Fellow – Pediatric Clinical Neurosciences
"THE RELATIVE CONTRIBUTION OF EXECUTIVE DYSFUNCTION TO PSYCHOLOGICAL, PHYSICAL, & SEXUAL DATING AGGRESSION"
➢ Research Sponsor: Margaret Semrud-Clikeman

[16] Leah Krause, Medical Student – Pediatric Infectious Diseases
"DEVELOPMENTAL DISABILITIES CAUSED BY CYTOMEGALOVIRUS INFECTION: EVALUATION FOR NEONATAL SENSORINEURAL HEARING LOSS IN A GUINEA PIG INFECTION MODEL"
➢ Research Sponsor: Mark Schleiss

[17] Daniel Larson, Medical Student – Pediatric Blood and Marrow Transplantation
"ADVANCED CHILDHOOD CEREBRAL ADRENOLEUKODYSTROPHY: RAPID PRE-TRANSPLANT RADIOGRAPHIC PROGRESSION PREDICTS POOR CLINICAL OUTCOMES"
➢ Research Sponsor: Wes Miller
Kanwaldeep Mallhi, Fellow – Pediatric Blood and Marrow Transplantation
“OUTCOMES FOLLOWING UMBILICAL CORD BLOOD TRANSPLANTATION FOR INHERITED METABOLIC DISORDERS: DOES UCB/RECIPIENT HLA ALLELIC DISPARITY MATTER FOR ENGRAFTED SURVIVAL?”
➢ Research Sponsor: Wes Miller

Ketzela Marsh, Fellow – Pediatric Infectious Diseases
“RISK BEHAVIORS LACK CORRELATION WITH HIV KNOWLEDGE IN A COHORT OF HIV+ AND HIV- YOUTH”
➢ Research Sponsor: Mark Schleiss

Christopher Mehus, Postdoctoral Fellow – General Pediatrics & Adolescent Health
“LIVING AS AN LGBTQ YOUTH AND A PARENT’S CHILD: OVERLAP OF TWO EXPERIENCES”
➢ Research Sponsor: Marla Eisenberg

Lee Meier, Medical Student – Pediatric Rheumatology
“DECIPHERING MECHANISMS OF INFLAMMATION AND FIBROSIS IN A MOUSE MODEL OF VALVULAR HEART DISEASE”
➢ Research Sponsor: Bryce Binstadt

David Mills, Pediatric Resident – Pediatric GME
“PEDIATRIC TRAUMA EXPERIENCE AFTER TRANSITION TO A FREESTANDING CHILDREN’S HOSPITAL”
➢ Research Sponsor: Jeff Louie

Kendahl Moser-Bleil, Pediatric Resident – Pediatric GME
“IgG4 DISEASE IN A TWO-YEAR OLD - AN UNCOMMON PRESENTATION OF A RARE DISEASE”
➢ Research Sponsor: Andrew Olson

Hai Nguyen-Tran, Medical Student – Pediatric Emergency Medicine
“PECTUS EXCAVATUM: EMERGENCY DEPARTMENT PRESENTATION AFTER NUSS PROCEDURE”
➢ Research Sponsors: Rahul Kaila, Mark Roback, Jeff Louie

Rachel Phelan, Fellow – Pediatric Hem/Onc and BMT
“PARENT AND PATIENT PERCEPTIONS OF BEHAVIORAL AND EMOTIONAL FUNCTIONING FOLLOWING HEMATOPOIETIC CELL TRANSPLANTATION FOR INHERITED METABOLIC DISEASE”
➢ Research Sponsor: Wes Miller

Erin Plummer, Fellow – Pediatric Neonatology
“PRENATAL LUNG-TO-HEAD RATIO IN INFANTS WITH CONGENITAL DIAPHRAGMATIC HERNIA DOES NOT PREDICT HOSPITAL COURSE”
➢ Research Sponsor: Cathy Bendel

Nathan Rodgers, Fellow – Pediatric Cardiology
“THIRTY YEAR FOLLOW-UP IN HURLER SYNDROME (MPS IH) PATIENTS AFTER HEMATOPOIETIC CELL TRANSPLANTATION (HCT) – THE UNIVERSITY OF MINNESOTA EXPERIENCE”
➢ Research Sponsor: Elizabeth Braunlin
Nicholas Ryan and Laura Fier, Pediatric Residents – Pediatric GME
"MENINGOCOCCEMIA UNTIL PROVEN OTHERWISE – A RARE PEDIATRIC CUTANEOUS ERUPTION"
➢ Research Sponsor: Emily Borman-Shoap

Bahey Salem, Fellow – Pediatric Blood and Marrow Transplantation
"HETEROGENEITY IN CORD BLOOD POPULATION"
➢ Research Sponsor: Michael Verneris

Emily Schaaf, Fellow – Pediatric Infectious Diseases
"CLINICAL RELEVANCE OF STAPHYLOCOCCUS AUREUS HEALTHCARE-ASSOCIATED BLOODSTREAM INFECTION CLASSIFICATION IN A CHILDREN'S HOSPITAL"
➢ Research Sponsor: Pui-Ying Iroh Tam

Nathan Schuldt, Postdoctoral Fellow – Pediatric Rheumatology
"ABSENCE OF DUAL TCR T CELLS PROTECTS NOD MICE FROM DIABETES DUE TO AN INCREASED INSULIN-SPECIFIC Treg:Teff RATIO"
➢ Research Sponsor: Bryce Binstadt

Ashish Shah, Pediatric Resident – Pediatric GME
"PRESENTATION, TREATMENT, AND OUTCOMES OF EMERGENCY DEPARTMENT VISITS OF CHILDREN AFTER RENAL TRANSPLANT"
➢ Research Sponsors: Christian Hanna, Ron Furnival

Ann Simones, Fellow – Pediatric Neonatology
"RANDOMIZED CONTROLLED TRIAL OF NEBULIZED N-ACETYLCYSTEINE IN A NEWBORN PIG MODEL OF MECONIUM ASPIRATION SYNDROME"
➢ Research Sponsors: Kari Roberts, Andrea Lampland

Allison Watts, Postdoctoral Fellow – Epidemiology & Community Health
"SOCIOECONOMIC DIFFERENCES IN OVERWEIGHT AND WEIGHT-RELATED BEHAVIORS ACROSS ADOLESCENCE AND YOUNG ADULTHOOD: 10-YEAR LONGITUDINAL FINDINGS FROM PROJECT EAT"
➢ Research Sponsor: Marla Eisenberg
Gardens of Salonica Catering (butler passed and buffet)

**APPETIZERS**
- Tyro dip with vegetables
- Tarama (fish roe) with pita crisps
- Spinach-feta bougatsa
- Skordalia (garlic blend) stuffed crimini caps

**SALADS/ENTREES**
- Greek salad (horiatiki) on a stick
- Gyros (with lettuce, tomato, onion)
- Chicken oregano style
- Tzatziki sauce and Pita

**DESSERT BUFFET**
- Handmade baklava, lemon cream bougatsa, gioconda truffles

Coffee, peppermint tea, Souroti sparkling water, home-made lemonade (100% honey sweetened)

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**AWARDS**
Wilf Family Center
5:30-6:00 p.m.

**JUDGES**
Muna Sunni, MBBCh
Lucie Turcotte, MD
Phu Tran, PhD
FORMAL ORAL PRESENTATIONS

(Abstracts 1-8)
Iron Deficiency Impairs Mitochondrial Respiration and Dendrite Complexity in Developing Hippocampal Neuron Cultures

Thomas W. Bastian, William C. von Hohenberg, Lorene M. Lanier, and Michael K. Georgieff

Background: Early-life iron deficiency (ID) impairs hippocampal development and causes learning and memory deficits in children. These impairments persist into adulthood despite iron treatment in infancy. Iron-dependent mitochondrial enzymes are required for cellular energy production, supporting metabolically demanding developmental processes such as dendrite growth/branching. Fetal/neonatal ID results in long-term dendritic structural abnormalities in adulthood. The molecular/cellular basis of these effects is unknown, but may be driven through reduced mitochondrial respiration during early-life neuronal maturation.

Objective: To determine whether neuron-specific ID impairs mitochondrial respiration, leading to truncated dendrite structure in developing hippocampal neurons.

Methods: Primary hippocampal neuron cultures from embryonic day 16 mice were treated with 10 µM deferoxamine (DFO, an iron chelator) beginning at 3 days in vitro (DIV). At the beginning of rapid dendritic maturation (11DIV), oxygen consumption rates were measured at baseline and following treatment with oligomycin (ATP synthase inhibitor), FCCP (uncouples oxygen consumption from ATP production), and rotenone/antimycin A (ETC complex I and III inhibitors). Key parameters of mitochondrial respiration were measured. At 11 and 18DIV, dendrite morphology was assessed using dendrite tracing and Sholl analyses.

Results: Neuronal ID reduced basal respiration by 39%, (p=0.06), maximal respiration by 49% (p=0.001), ATP production by 40% (p<0.05), and spare respiratory capacity by 58% (p<0.05). Dendrite complexity was reduced throughout the iron-deficient dendritic arbor reducing total branch length by 30% (p=0.05) and 25% (p<0.01) at 11 and 18DIV, respectively. DFO-treated neurons had 21% shorter average branch lengths at 11DIV (p<0.05) and 13-19% fewer primary dendrites/branches at 18DIV (p<0.05).

Conclusions: Our findings demonstrate decreased mitochondrial respiratory capacity and dendritic arbor complexity in developing iron-deficient neurons. Dendrite outgrowth is dependent on mitochondrial ATP production within dendrites. Thus, it will be important to interrogate specific energy pathways in order to isolate the cellular mechanism(s) driving the long-term dendrite structural deficits of early-life ID.
OBJECTIVE: Students within special education programs receive less education on substance use compared to the mainstream population, yet may be at greater risk of substance use due to mental health issues and other factors. The purpose of this study was to identify the relationship between receiving an Individual Education Plan (IEP) and substance use in a large, school-based sample of adolescents, with the goal of influencing changes to curriculum.

METHODS: Data for this study come from the Minnesota Student Survey, and includes 122,180 8th, 9th and 11th grade students from public, charter and tribal schools across the state. We assessed students who identified as having IEPs and their reported past 30-day use of marijuana, tobacco and alcohol. Race, gender, poverty, and emotional distress were accounted for. Chi-square tests and multiple logistic regression were used to compare substance use for students with and without an IEP.

RESULTS: Approximately 9.6% of participants reported having an IEP, 7.8% reported smoking, 16.8% reported drinking alcohol, and 10.1% reported using marijuana in the past 30 days. In general, it was found that students with IEPs use substances more than students without IEPs. Among adolescents who have IEPs, 14.1% smoke, compared to 7.2% who don’t have IEPs ($\chi^2=590.3?, p=<.0001$). Among adolescents who have IEPs, 18 drink alcohol, compared to 16.7% who don’t have IEPs ($\chi^2=17.65, p=<.0001$). Among adolescents who have IEPs, 13.6% use marijuana, compared to 9.8% who don’t have IEPs ($\chi^2=2722.9, p=<.0001$). The odds of smoking remained significantly elevated among students with IEPs even after adjusting for emotional distress and demographic covariates.

CONCLUSIONS: This study finds that students who receive IEPs experience a higher rate of substance use compared to peers who do not receive IEPs. Substance abuse prevention programming and treatment specifically targeted to young people with barriers to learning are essential as protective factor for this population, particularly in regards to smoking behavior.
Effectiveness of Local Phototherapy Practices to Meet Minimum and Intensive Therapy Guidelines

Amy R Borden, D.O.¹, Paul Wratkowski, D.O.¹, Katie M Satrom, M.D.¹, Austin P Johnson, M.D.¹, Kendall J Nichols, M.D.¹, Hendrik J Vreman, Ph.D.² and Tina Slusher, M.D.¹

¹Department of Pediatrics, University of Minnesota, Minneapolis, Minnesota, and ²Department of Pediatrics, Stanford University Medical Center, Stanford, California

**Background:** Phototherapy is widely used to prevent severe hyperbilirubinemia and its associated risks for kernicterus and long-term disability. Standard, effective phototherapy should have a spectral irradiance of 8-10 μW/cm²/nm. Intensive phototherapy, recommended for inpatient treatment of hyperbilirubinemia, is defined as a spectral irradiance of at least 30μW/cm²/nm.

**Objective:** To assess the efficacy of local phototherapy practices by measuring the irradiance of phototherapy devices in local neonatal intensive care units (NICUs) and newborn nurseries in the Twin Cities metro area.

**Design/Methods:** The irradiance of 43 phototherapy devices at 7 area hospitals, including 2 academic centers and 5 community hospitals, was measured according to current practices used in those facilities, as demonstrated by the NICU and nursery staff. Measurements were made with a BiliBlanket Meter II at the height of an average patient’s skin level (10cm above the mattress) along a 1.5 x 1.5 inch grid, the length and width of an average neonate. Finally, measurements were also collected at a distance of 20cm and 15cm from the light source (± 2cm if an isolette was used).

**Results:** The median standard distance from infant skin to light-emitting surface was 30.5cm. The centers used a variety of overhead devices with blue fluorescent, standard white, or light emitting diode (LED) lamps. The mean irradiance of all devices at the academic centers and the community hospitals at the standard distance was 18.3 ±4.4 μW/cm²/nm and 25.1 ±2.6 μW/cm²/nm, respectively. The mean irradiance at a distance of 20cm from the light for all devices at the academic centers was 29.9 ±4.05 μW/cm²/nm and at 15cm was 36.8 ±5.4 μW/cm²/nm. For the community hospitals, the mean irradiance at a distance of 20cm was 35.2 ± 2.5 μW/cm²/nm and at 15cm was 40.9 ±6.3 μW/cm²/nm.

**Conclusions:** Phototherapy practices at local Twin Cities’ hospitals produce standard effective phototherapy; however, on average, irradiance levels do not reach minimum intensive phototherapy guidelines of 30 μW/cm²/nm. Decreasing the space between the neonate and light by 10-15cm increases irradiance and is more likely to meet minimum requirements for intensive therapy.
Vascular Changes Associated With Cardiovascular Risk Factors in Children

Vasu D Gooty MD, Justin R Ryder PhD, Alan R Sinaiko MD, Donald R Dengel PhD, David R Jacobs PhD, Ronald J Prineas MD, Julia Steinberger MD, MS

1Department of Pediatrics, University of Minnesota Medical School, Minneapolis, Minnesota
2Laboratory of Integrative Human Physiology, School of Kinesiology, University of Minnesota, Minneapolis, Minnesota
3Division of Epidemiology and Community Health, University of Minnesota, School of Public Health, Minneapolis, Minnesota
4Department of Epidemiology & Prevention, Wake Forest University School of Medicine, Winston Salem, North Carolina

Background: In adults, carotid artery intima media thickness (cIMT) is correlated with adiposity and metabolic syndrome (MetS) which predicts CV disease. In children, these relations are not clear.

Objective: Determine relations of vascular measures: cIMT and brachial artery reactivity [(endothelium dependent dilation (EDD)] with adiposity and CV risk score in children.

Design/Methods: We examined 291 children M/F 158/133, age 6-18 years and measured height, weight, waist circumference; lipids, glucose, insulin; cIMT and EDD. A CV risk score was developed from sum of z scores of 5 MetS components (waist circumference, BP, triglycerides, inverse HDL cholesterol, glucose). Partial Pearson correlation coefficients were adjusted for sex, race, and age; EDD analyses were adjusted for baseline artery diameter.

Results: Analyses for whole cohort found that BMI and CV risk score were significantly correlated with cIMT (r=0.14, p=0.02 and r=0.16, p=0.006), and with greater brachial artery reactivity, [EDD (r=0.32, p<0.0001 and r=0.25, p<0.0001)]. To determine influence of adiposity on relations between CV risk score and vascular measurements, we repeated analyses with CV risk score without waist circumference, and the correlations remained unchanged. Due to wide age range, children were divided into two groups: 6-11y, n=140 and 12-18y, n=151, and correlations were similar for each group to those found for whole cohort. MetS was not correlated with any vascular measures, although the total number of children with MetS (n=10) was small.

Conclusions: There is: 1) Significant relationship of cIMT with CV risk score even without including measure of adiposity, suggesting early influence of non-adipose CV risk factors; 2) CV risk score did not show stronger relationship than BMI alone with cIMT, suggesting that BMI in itself may be surrogate for cIMT as an indicator of vascular changes associated with CV risk; 3) Paradoxical relationships with EDD may be due to increased circulating blood volume and cardiac output associated with obesity.
The Incidence and Timing of Hypoglycemia at a Residential Diabetes Camp – A Quality Improvement Project

Authors: Elizabeth A. Mann1; Trevor Omann1; Anne Kogler2; Brad Miller1,2; Muna Sunni1,2; Melena Bellin1,2; Brandon Nathan1,2

1Department of Pediatrics, University of Minnesota
2Division of Pediatric Endocrinology, University of Minnesota

Background
Hypoglycemia is common yet potentially preventable in children with diabetes who attend residential summer camps. To prevent hypoglycemia at camp, the American Diabetes Association (ADA) recommends considering an empiric decrease in insulin dosage prior to increased activity, but specific recommendations are not established.

Objective
Our aim was to establish the incidence and timing of hypoglycemia at a residential ADA sponsored diabetes camp for children with type 1 diabetes mellitus. There is no current policy for empiric insulin dose adjustment at camp to prevent hypoglycemia. We hypothesized that hypoglycemia was more common 1) during the first 48 hours of camp; and 2) during and after camp-wide evening games.

Methods
Blood glucose levels were recorded by counselors and medical staff before meals, at bedtime, and as needed during day and overnight to detect hypoglycemia per camp protocol. Hypoglycemia was defined as blood glucose level (BGL)<70 mg/dL (severe <50). Paired t-tests were performed to determine differences between groups with a p value <0.05 considered significant.

Results
Of the 223 campers, 89.7% experienced at least one hypoglycemic event and 44.8% had a severe event. Hypoglycemia accounted for 13% of all BGL recorded and 21% of all hypoglycemia events were severe. There were significantly more nighttime hypoglycemic events the first 48 hours of camp compared to later in the week (mean hypoglycemic events: 63 on nights 1-2 vs 43 on nights 3-6, \( p<0.05 \)). There was no difference in evening rates of hypoglycemia events following all-camp games.

Conclusions
Hypoglycemia and severe hypoglycemia were common at camp. The higher incidence of hypoglycemia early during camp suggests empiric insulin dose reduction at camp onset may be indicated. No pattern in hypoglycemic events following camp-wide games was identified, but further studies to predict patterns in BGL are needed.
Hypoglycemic Events by Day of Camp

- **Daytime (6a-7p)**
- **Nighttime (7p-6a)**

### Day of the Week
- Sunday
- Monday *
- Tuesday *
- Wednesday *
- Thursday *
- Friday
- Saturday

* Nights with camp-wide games
Effect of Bariatric Surgery on Functional Mobility and Musculoskeletal Pain in Teens with Severe Obesity: The Teen-LABS Study

Justin R. Ryder, Ph.D.\textsuperscript{1}, Nicholas M. Edwards, M.D., M.P.H.\textsuperscript{2}, Resmi Gupta, M.S., M.A.\textsuperscript{2}, Jane Khoury, Ph.D.\textsuperscript{2}, Todd M. Jenkins, Ph.D.\textsuperscript{2}, Marc P. Michalsky, M.D.\textsuperscript{3}, Carroll M. Harmon, M.D., Ph.D.\textsuperscript{4}, Thomas H. Inge, M.D., Ph.D.\textsuperscript{2}, Aaron S. Kelly, Ph.D.\textsuperscript{1}

1) University of Minnesota Medical School, Minneapolis, MN
2) Cincinnati Children’s Hospital Medical Center, Cincinnati, OH
3) Nationwide Children’s Hospital, Columbus, OH
4) Women and Children’s Hospital of Buffalo, Buffalo, NY

Abstract

Introduction: Severe obesity is associated with mobility limitations and higher incidence of musculoskeletal pain. Whether substantial weight loss due to bariatric surgery improves these outcomes in adolescents is unknown.

Methods: We examined the effect of bariatric surgery on functional mobility and musculoskeletal pain in adolescents with severe obesity (n=242; mean±SD: 17±2 years; BMI = 53±9 kg/m\textsuperscript{2}) up to 2 years post-surgery. Participants completed a 400m walk test prior to bariatric surgery (Roux-en-Y gastric bypass, sleeve gastrectomy and adjustable gastric band) and at 6mo, 12mo, and 24mo post-surgery. Time-to-completion, resting heart rate (HR), immediate post-test HR, HR difference (resting HR-post-test HR) were measured and musculoskeletal pain complaints were documented.

Results: At 6mo, after adjusting for age, sex, race, baseline BMI, and surgical center, significant improvements were observed in time-to-completion (mean±SE (throughout): 376±1 to 347±1 sec, p<0.01) and resting HR (85±1 to 75±1 bpm, p<0.01). After further adjusting for changes in time-to-completion, 6mo changes were observed in post-test HR (128±2 to 113±2 bpm, p<0.01), and HR difference (38±1 to 33±1 bpm, p<0.01). We additionally observed significant reductions in musculoskeletal pain complaints (p<0.01). Improvements at 6mo were independent of changes in BMI. The changes from baseline in time-to-completion, resting HR, HR difference, and musculoskeletal pain persisted at 12mo and 24mo. However, post-test HR further improved from 6mo to 12mo (113±2 to 108±2 bpm, p=0.02).

Conclusion: These data provide evidence that bariatric surgery in adolescents significantly improves functional mobility and reduces musculoskeletal pain, independent of the magnitude of reductions in BMI. The data further suggest that the underlying mechanism by which these changes occur may be unrelated to degree of weight loss.
Neonatal Hyperglycemia Induces Oxidative Stress and Cytokine Upregulation in the Developing Hippocampus of Rat Pups

Katie M Satrom, MD¹, Kathleen M Ennis¹, Chen Chen¹ and Raghavendra Rao, MD¹
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Background: Recurrent hyperglycemia is common in extremely low birth weight (ELBW) infants. While acute complications of hyperglycemia are known, the long-term neurological complications are not well understood. In animal models of diabetes mellitus hyperglycemia has been shown to affect the hippocampus. A study from our lab demonstrated upregulation of poly(ADP-ribose) polymerase-1 (PARP-1) and NFκB expression in the cortex with neonatal hyperglycemia suggesting that hyperglycemia causes oxidative stress and affects immune modulation. The effects on the hippocampus, however, are not known.

Objective: To determine the expression of inflammatory cytokines and markers of oxidative stress in the hippocampus of hyperglycemic rat pups.

Design/Methods: Hypoinsulinemic hyperglycemia was induced in rat pups by injecting streptozotocin (STZ) on postnatal day one (P1) in two doses, 50 mg/kg (n=9) and 100 mg/kg (n=7). Pups in the control group were injected with citrate buffer (n=6). Daily body weights and blood glucose levels were monitored. On P6, rats were killed and the mRNA expression of markers of oxidative stress (PARP-1) and inflammatory cytokines (CXCL-10) in the hippocampus were determined using qPCR.

Results: STZ administration induced hyperglycemia in a dose-dependent manner, with the 100 mg/kg group having 20% higher mean blood glucose level on P6 than the 50 mg/kg group (p=0.01). CXCL10 expression was upregulated (+40% in the 50 mg/kg group; p = 0.04 and +80% in the 100 mg/kg group; p = 0.005), relative to the control group. PARP-1 expression was increased by 50% in the hippocampus (p = 0.03).

Conclusions: Similar to adult data, the developing hippocampus is sensitive to the effects of hyperglycemia. Upregulation of CXCL10 suggests the presence of excitotoxicity and altered neuron-glia signaling in the hippocampus. Upregulation of PARP-1, a nuclear enzyme involved in DNA repair suggests the presence of oxidative stress. These results may explain the hippocampus-specific cognitive deficits common in ELBW infants with neonatal hyperglycemia.
The Effects of Birth Characteristics

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Glucocorticoids play a crucial role in transitioning the developing lung epithelium from a secretory to an absorptive tissue. The objective of this study was to evaluate the effects of hydrocortisone (HC) on the transport phenotype of the bronchial epithelium during differentiation. Normal human bronchial epithelial cells (NHBE) were differentiated on polyester membranes and harvested at four time points over a 24 day time period. NHBE cells differentiated in the presence and absence of HC (HC0) along with cells withdrawn from HC after 8 days (HC8) all formed pseudostratified layers, as confirmed by confocal microscopy, and developed transepithelial resistances (TER) greater than 1000 Ωcm² by day 8. mRNAs associated with bronchial basal cells (p63, NKX2.1) were detected at days 0, 4, 8 and 24 while airway surface markers (FOXJ1, MUC5ac, MUC5b) were not detected until day 4. HC0 and HC8 NHBE cells expressed lower levels of mucin mRNA than control cells at day 24. At day 8, Ussing chamber experiments showed that the total and benzamil sensitive currents were significantly decreased under HC0 conditions (4.0±0.13, 0.46±0.14, respectively) but not under HC8 conditions (8.8±1.2, 5.7±1.3) compared to control (7.1±0.44, 3.9±0.53). At day 24, total and benzamil sensitive currents were significantly decreased under HC0 and HC8 conditions. HC had no effect on CFTRinh-172 sensitive current, indicating that there was no detectable effect on CFTR-dependent anion secretion. ENaCα and γ subunits as well as CFTR co-localized at the apical membrane in control and HC8 cells at day 24 as observed by immunofluorescence. HC0 cells had noticeably less apical fluorescence at day 24 corresponding to reduced ENaCα and γ expression compared to control cells. Interestingly, ENAC subunits and CFTR appeared to localize within the cilia. Control and HC0 NHBE cells stimulated with the selective β2-AR agonist salbutamol produced outward currents which resulted in increased benzamil sensitive current in control but not HC0 cells. Additionally, NHBE cells stimulated with UTP initially exhibited inward, paxilline-sensitive current characteristic of KCa1.1 channel activation, followed by an outward, DIDS-sensitive current (TMEM16a/ANO1) in control and HC8 cells at days 8 and 24. HC0 cells stimulated with UTP at day 8 produced only outward currents consistent with reduced KCNMA1 mRNA expression and K⁺ channel activity. There was a significantly reduced UTP-induced inward current at day 24 for both HC0 and HC8 cells. Expression of TMEM16a and P2RY₂ receptor mRNA was not affected by HC, whereas P2RY₄ receptor expression was not detectable at days 8 and 24 in HC0 cells. Immunofluorescence indicated co-localization of TMEM16a, KCa1.1, and P2Y₂ at the apical membrane in control cells suggesting that these proteins form a signaling complex at the apical membrane that may also include P2Y₄ receptors. These results demonstrate an important role for glucocorticoids in development of the transport phenotype of bronchial epithelial cells during differentiation.
UNDERGRADUATE / GRADUATE / MEDICAL STUDENTS

Abstracts (9-19)
Bringing Video Education to the Bedside by Integrating an Interactive Patient Care Tool with the Electronic Health Record

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\textbf{Background:} The University of Minnesota Masonic Children's Hospital uses an Interactive Patient Care (IPC) tool, which is viewable through a patient's television and includes access to entertainment, information specific to their care, and educational health videos. While there were many patient education videos accessible, few providers were aware of their existence. As such, utilization of these videos as an adjunct to bedside teaching among providers was low.

\textbf{Objective:} Increase the utilization rates of bedside educational videos among providers by integrating the IPC tool to the Electronic Health Record (EHR) allowing for bi-directional communication between the two systems.

\textbf{Design/Methods:} The hospital's information technology team created a bi-directional interface to integrate the EHR with the IPC tool. An order for educational videos with a checklist was created to assign for patient/guardian viewing. Several video orders were linked with automatic prescribing to relevant order sets. Using data stored in both systems, we compared the overall number of videos ordered and viewed during the period of January to August 2014 (pre integration) and January to August 2015 (post integration).

\textbf{Results:} Prior to integration of the EHR and IPC tool, there were 0.25 videos ordered per inpatient (998/3986). After the integration, this increased by 43.2\% to 0.44 videos ordered per inpatient (1570/3553). While the absolute number of videos viewed increased by 57.3\%, the percentage of ordered videos viewed by patients/guardians decreased from 37.8\% to 32.8\%.

\textbf{Conclusions:} By linking the interfaces of the hospital's interactive patient care tool with the EHR, we were able to increase providers ordering of educational videos at the bedside by 43.2\%. While the percentage of ordered videos being viewed did not increase, this integration led to a 57.3\% increase in the amount of videos viewed by patients at the bedside.
Tumor Derived Vaccines Containing CD200 Inhibits Immune Activation
Implications for Immunotherapy

Despite the extensive use of tumor-derived vaccines, researchers overlooked the suppressive tumor-bound protein CD200, inhibiting an anti-tumor response. The immunosuppressive protein CD200 acts as a checkpoint blockade when engaging its receptor CD200R. CD200 upregulates peptidylprolyl isomerase A (PPIA), resulting in immune suppression. We developed a competitive CD200 inhibitor peptide overcoming CD200-induced immunosuppression. CD200 inhibitor peptide inhibits PPIA upregulation, enhances cytokine and chemokine production, and significantly enhances survival in a murine GL261 model. In addition, the CD200 inhibitor resulted in tumor regression and enhanced survival benefit in our canine model. However, CD200 is expressed on endothelial cells with blood vessels in CNS tumors including WHO Grade III and IV astrocytoma down-regulating T-cell activation. We demonstrated the use of the peptide inhibitor along with anti-CD200R antibody resulted in further benefit. To translate to the clinic, we developed a human CD200 peptide inhibitor. Pulsing immature dendritic cells with the CD200 inhibitor enhances MHC-II and CD86 expression and cytokine production.

**Impact:** We are the first to correlate CD200 within brain tumors and tumor-derived vaccines as a potential inhibitor of immune activation. Our data suggest that we are suppressing the immune system with the same vaccines designed specifically to induce an anti-tumor response. Tumor endothelial expression of CD200 is also a likely reason for escape from native immune surveillance and failure of other immunotherapeutic approaches. We are optimistic that use of our competitive inhibitor peptide against CD200 and anti-CD200R antibody will ultimately lead to the development of novel therapeutics that improve the efficacy of cancer immunotherapy.
Systemic Challenge of Newborn Guinea Pigs with Cytomegalovirus Results in Structural and Histological Evidence of Brain Injury and Reduced Neurocognitive Performance in a Morris Water Maze Test

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Background: Congenital cytomegalovirus (cCMV) is a leading infectious cause of neurologic deficits in children. Vaccines against cCMV are a major priority.

Objective: This study explored the impact of neonatal guinea pig CMV (GPCMV) infection in naïve pups on brain function using a Morris water maze model and histological analysis.

Methods: Eight pups were inoculated intraperitoneally with a virulent, recombinant mCherry (RFP)-expressing GPCMV (5 x 10⁶ PFU) within 96 hours of birth. Six pups were mock-infected. On days 15-19 post-infection (pi), the animals performed the Morris water maze to evaluate learning and memory. Viral load in blood and tissue was determined by qPCR. In addition, brain samples were collected to examine for histological abnormalities and evidence of T-lymphocyte infiltrate by immunofluorescence.

Results: One infected pup died at day 14 prior to maze testing. RFP positive cells were detected in the brain, and these results were confirmed by qPCR. The remaining infected animals were viremic at day 7 pi, with a mean systemic viral load of 1.5 x 10⁴ copies/ml. End-organ dissemination occurred in lung (1/7), liver (6/7), and spleen (6/7). CD4⁺ and CD8⁺ inflammatory T-cell infiltrates were present throughout the brains of infected animals, including periventricular and hippocampal regions. Infected animals showed brain damage evidenced by neuronal necrosis and, in one case, dilated lateral ventricles. Multiple water maze parameters were evaluated, including escape latency, total distance traveled, and platform crossings. Significant differences were observed between infected and uninfected pups in total distance traveled (p<0.0001) and escape latency (p<0.0001) on the final day of acquisition.

Conclusions: Neonatal infection in guinea pigs produces brain damage leading to significant cognitive and learning defects, as evaluated by histology and the Morris water maze. This model should prove valuable in evaluation of therapies and vaccines targeting prevention of neurodevelopmental sequelae caused by neonatal CMV infection.
Figure 1: Graphical representation of the average distance traveled per group on each of the four training days during the Morris water maze protocol. The infected pups (n=7), on average, swam further than the mock-infected pups (n=6), suggesting that neonatal GPCMV infection negatively affects spatial learning and memory. Significance was determined by one-way ANOVA, p<0.0001.
Facilitation of Human Induced Pluripotent Stem (iPS) Cell Differentiation to Endoderm
With A Novel Histone Deacetylase (HDAC) Inhibitor

The use of patient iPS-derived cells for lung regeneration has emerged as a potential tissue engineering strategy for patients with end-stage lung diseases. The ability to efficiently derive lung cells from iPS cells would greatly facilitate the engineering process. Histone deacetylase inhibitors (HDACis) alter gene transcription through the inhibition of the deacetylation of lysine residues and have been reported to induce differentiation of cancer stem cells (Botrugno et al, Cancer Letters, 2009). We are evaluating the ability of a novel HDACi that is an analogue of suberoylanilide hydroxamic acid, called SMAHA (Chen et al, J. Medicinal Chem, 2007), to facilitate differentiation of iPS cells into endoderm. Human iPS cells were generated as previously described (Hirai et al, PLoSOne 2012). Endoderm differentiation was induced using the Rajagopal method (Mou et al, Cell Stem Cell, 2012) with and without SMAHA at a concentration 100 nM for 4 days of culture on Vitronectin. Gene expression of pluripotency markers Nanog and Oct-4, and endoderm markers FoxA2 and Sox 17 were assessed by qRT-PCR. The efficacy of the drug for inducing iPSCs to definitive endoderm is still under investigation. Preliminary results have not demonstrated a significant difference in endoderm induction between iPSCs exposed to SMAHA and those that were not. Further experiments are currently ongoing to conclusively determine the potential of SMAHA as a facilitator for efficient induction of iPS-derived endoderm for use in lung tissue engineering.
Characterizing gp134 in Guinea Pig Cytomegalovirus

Malavika Chandrashekar, Claudia Fernández-Alarcón, Jason C. Zabeli, Katilyn M. Anderholm, and Mark R. Schleiss, MD

**Introduction**: Cytomegalovirus (CMV) is the most common congenital viral infection in the U.S. Sequelae include sensorineural hearing loss and mental retardation. Research targeted to prevent these conditions focuses on developing pre-conceptual vaccines against CMV. Guinea pig CMV (GPCMV) can serve as a model for congenital CMV transmission. Analysis of GPCMV proteins provides an improved understanding of CMV pathogenesis and antiviral intervention in this model. In this investigation, the “gp134” protein was studied, toward the goal of elucidating its role in GPCMV infection in vivo.

**Methods**: The gp134 ORF was amplified from GPCMV strain 22122 by conventional PCR and cloned into pAcHLT-A-GFP, resulting in a 6His-tagged protein pKTS935. Linearized Baculovirus DNA was cotransfected with pKTS935 in Sf9-insect cells to construct the recombinant baculovirus. The gp134 protein was harvested from these cells and purified via nickel column affinity chromatography. Two guinea pigs (MZ8 and MZ8.1) were immunized with 50 μg purified gp134 and incomplete Freund’s adjuvant three times over 3 months. Sera were tested for antibody production through western blotting and ELISA. A northern blot was performed with a gp134 dsDNA probe to analyze gp134 RNA expression during the course of viral infection.

**Results**: We report the successful generation of an infectious GFP-gp134 baculovirus. Recombinant virus replication was examined by fluorescence microscopy in transfected Sf9-insect cells. An ELISA identified gp134 antibodies at day 7 post-immunization. Western blot analysis of purified gp134 protein with antisera confirmed these results (Fig.1). The northern blot results indicated that a ~3.5 Kb gp134 transcript is expressed at 4-hours post-viral infection, defining this as an early gene during CMV infection.

**Conclusion**: These results demonstrate that gp134-immunization elicited a humoral immune response in the guinea pigs. Further analyses are required to understand the specific function of this protein and determine its use in CMV vaccine development.
Figure 1. gp134-immunized guinea pig serum western blot of purified gp134 protein. ~1.0 μg proteins were immunoblotted to nitrocellulose membrane following SDS-PAGE and probed with sera collected before immunization (Pre-immune), and 3, 7 and 10 days after guinea pigs received first dosage of purified gp134 and incomplete Freund's adjuvant. All sera were diluted 1:2000. The secondary antibody was Anti-Guinea pig Rabbit HRP-linked IgG (1:40,000 dilution). The green arrow indicates the gp134 band at ~57 kDa.
Development of an IgM Assay to Document Primary and Fetal Infection in a Congenital CMV Infection Model

Aditi Hindka, Jason C. Zabeli, Claudia Fernández-Alarcón, and Mark R. Schleiss, MD

Background: The most common infectious cause of developmental disabilities is congenital cytomegalovirus (CMV) infection. Serological assessment of CMV infection in newborns is complicated because transplacental transfer of IgG antibody makes IgG-based assays diagnostically unreliable.

Objective: To develop an IgM specific assay for CMV antibodies for use in a relevant rodent model of congenital infection, the guinea pig.

Methods: To validate the IgM assay, a guinea pig was infected subcutaneously with 5x10^6 PFU of guinea pig CMV (gpCMV). Serum was collected at days 0, 3, 7, 10, 14, and 21. An IgM-specific ELISA was developed, targeting gpCMV viral particles. Goat and/or rabbit HRP-conjugated anti-guinea pig IgG or IgM secondary antibodies were utilized in an endpoint dilution assay (1:80-1:2560). Next, serum was collected at delivery from twelve congenitally infected guinea pigs born to dams challenged mid-gestation with 1x10^5 PFU gpCMV.

Results: For the initial experiment, IgM antibodies were detected within 72 hours post-infection, increasing to a titer of 1:2560 by day 7 and clearing by day 21. In contrast, IgG antibodies appeared later (day 7) and increased at day 21. Western blot assay using both anti-IgM and anti-IgG confirmed the specificity of the response, with viral proteins of ~40, ~50, and ~75 kDa dominating the humoral response. In pups with virologically confirmed congenital CMV infection, ten of twelve pups (83%) had positive IgM titers (mean, 1:160 ± 92.8). All pups had positive IgG titers (>1:2560), presumably reflecting transplacental maternal IgG transfer.

Discussion: Clinical assessment of congenital infection relying on IgG-based “TORCH” titers is unreliable, since IgG crosses the placenta. This is the first demonstration of a guinea pig-specific IgM assay. The IgM assay identified congenital infection in 83% of virologically-confirmed cases. The use of the IgM assay will be a useful adjunct to the study of vaccines in the GPCMV model.
The Effects of Birth Characteristics and Socioeconomic Status on Childhood Cancer Trends: An Ecological Time Series Analysis

Background: In recent decades, the overall childhood cancer incidence rate has steadily increased in the United States at annual percent change of approximately 0.6%. The reason for this increase remains largely unknown. The aim of this study is to test whether temporal changes in the population-level distribution of suspected perinatal risk factors account for the increasing trend. Specifically, we test whether changes in the distribution of (1) maternal age, (2) birth weight, and (3) parity associate with changes in childhood cancer rates. To further explore the relationship between these perinatal risk factors and childhood cancer risk, we test whether socioeconomic status (SES) operates as an upstream risk factor of the association. Therefore, this study also provides insight into the role of SES in childhood cancer risk, an understudied area of research.

Methods: To test our specific aims, we conducted a county-level ecological time series analysis. This study was feasible through data linkage of three sources: (1) the Surveillance, Epidemiology, and End Results Program (SEER), (2) the National Center for Health Statistics (NCHS), and (3) the US Census Bureau. Overall and type specific childhood cancer incidence rates were calculated for 194 counties available in SEER registries, 1975-2012. NCHS birth characteristics were aggregated at the county-level (e.g. mean maternal age), and county-level SES indicators were obtained from the US Census (1970-2010). To assess the association between childhood cancer incidence trends and perinatal risk factors, we created exposure trajectories using the Proc Traj procedure, which runs on the SAS platform. Proc Traj is a specialized mixture model that estimates multiple groups within a population. Counties were grouped into exposure trajectories (e.g. low, medium, and high mean maternal age); incidence trends were compared across groups. Counties were further stratified by SES (e.g. high vs. low poverty counties), and incidence rates were again compared.

Results: We found descriptive evidence of an association between overall childhood cancer risk and both maternal age and birthweight. However, the increasing trend in childhood cancer incidence most closely tracks with the rise in mean maternal age over time. Temporal trends in birthweight and parity do not appear to explain the increase in childhood cancer incidence. We also found descriptive evidence that SES is associated with perinatal risk factors, as well as with childhood cancer risk, suggesting that SES may function as an upstream risk factor and/or confounder of the association.
Developmental Disabilities Caused by Cytomegalovirus Infection: Evaluation for Neonatal Sensorineural Hearing Loss in a Guinea Pig Infection Model

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Background: Congenital cytomegalovirus (cCMV) is the most important non-genetic cause of sensorineural deafness in children. Guinea pig cytomegalovirus (GPCMV) produces cCMV infection, but there have been limited studies of hearing loss in this model. These studies were therefore undertaken to evaluate for auditory abnormalities following cCMV infection in newborn guinea pig pups.

Objective: This study assessed the ability of a virulent, red fluorescent protein (RFP)-tagged virus to cause maternal disease following 3rd trimester challenge of dams and to induce hearing loss in congenitally infected guinea pigs, assessed through auditory brainstem response (ABR) testing and histopathology.

Design/Methods: An RFP-tagged version of GPCMV was engineered and had wild-type replication kinetics in vitro. Six pregnant dams were challenged (late second trimester) subcutaneously. Viral load in maternal and pup blood was monitored. ABR testing was conducted at five frequencies: 2kHZ, 4kHz, 8kHz, 16 kHz, and 32 kHz. Auditory thresholds and peak III latencies were recorded, and latency-intensity curves constructed to differentiate sensorineural and conductive hearing loss. Pups were monitored for seroconversion and at necropsy visceral organs were harvested for histopathology.

Results: Evidence of maternal viremia was detected at 7 days post-infection with an average viral load of 2.7 x 10^4 copies of genome/mL. Six litters were born (total of 17 pups). Pup mortality was 29% (compared to 4% in controls). Mean pup birth weight was 79.9 g compared to 95.7 g in controls (p=0.024). Seropositivity was observed by ELISA in two pups (17%) with unilateral tonal hearing loss on ABR. Liver sections demonstrated periportal inflammatory infiltrates with hepatocyte steatosis compatible with GPCMV-induced hepatitis.

Conclusions: A recombinant CMV tagged with a RFP reporter gene can produce infection and disease in a guinea pig model. Hearing loss will be a useful and translationally relevant end-point for future vaccine and antiviral studies in this model.
Advanced Childhood Cerebral Adrenoleukodystrophy: Rapid Pre-Transplant Radiographic Progression Predicts Poor Clinical Outcomes

Daniel Larson, David Nascene, MD, Troy Lund, MD PhD, Gerald Raymond, MD, Paul Orchard, MD, Weston Miller, MD

Background: Clinical outcomes following HSCT for boys with advanced cerebral adrenoleukodystrophy (cALD) are variable. While an MRI severity score (Loes score) ≥10 is a risk factor for unfavorable long-term neurologic function, not all such boys go on to have severe disease progression after transplant. Additional prognostic factors are sought.

Objectives: We assessed the impact of pre-transplant disease “velocity” (rate of change of Loes score over time) on post-transplant outcomes in boys with advanced cALD (pre-HSCT Loes score ≥10).

Design/Method: 98 consecutive patients with cALD underwent MRI for evaluation for HSCT at the University of Minnesota from February 2000 to March 2015. In most instances, >1 previous scans were available for review, thus allowing for determination of pre-transplant rate of change of radiographic Loes score (dLoes/dt). HSCT was performed in 90 patients, 74 of whom had sufficient imaging to meet inclusion criteria. Clinical disease progression was evaluated with the ALD neurologic function scale (NFS). Correlations were assessed between dLoes/dt and post-HSCT changes in Loes and NFS scores (∆Loes and ∆NFS, difference between most recent and pre-HSCT values).

Results: Of the 74 patients included, two groups were defined: “standard-risk” patients with pre-HSCT Loes scores <10 (n=35), and “higher-risk” patients with pre-HSCT Loes scores ≥10 (n=39). Standard-risk patients had a median ∆NFS of 0 (IQR 0 – 0) after HSCT, with no correlation with pre-HSCT dLoes/dt. Higher-risk patients had highly variable ∆NFS scores following transplant. For these patients with slow pre-transplant MRI progression (dLoes/dt <1.00 Loes/100 days, n=15), the median ∆NFS was 5 (IQR 1.5-7) at a median follow-up of 19 months (IQR 12-39). In contrast, higher-risk patients with rapid pre-transplant MRI progression (dLoes/dt ≥ 2.00 Loes/100 days, n=11) had a median ∆NFS of 20 (IQR 15-22; p < 0.001) at a median follow-up of 15 months (IQR 13-22). In contrast, the change in MRI severity score following transplant did not depend upon the pre-transplant dLoes/dt (median ∆Loes = 4; IQR 2-6 at median 15 months follow-up).

Conclusion: When evaluable for boys undergoing HSCT for advanced cALD, pre-HSCT dLoes/dt may be a useful predictor of long-term clinical outcomes.
Deciphering Mechanisms of Inflammation and Fibrosis in a Mouse Model of Valvular Heart Disease

Lee Meier, Jennifer Auger, Brianna Engelson, Bryce Binstadt

Fibrosis contributes to nearly half of all natural deaths in westernized nations. Diseases that are driven by fibrotic processes include pulmonary fibrosis, liver cirrhosis, atherosclerosis, and valvular heart disease, among many others. The understanding of fibrosis pathogenesis is based on a model of aberrant wound healing. Normally, wounds heal in sequential phases. In fibrosis, these phases are dysregulated and chronic inflammation and extracellular matrix deposition are superimposed. The K/B.g7 mouse develops spontaneous arthritis and inflammatory fibrotic valvular heart disease (VHD) with complete penetrance, a key feature that distinguishes it from other fibrosis models that employ parasite infections or exogenous toxins. Use of the K/B.g7 model favorably positions us to work toward achieving a comprehensive understanding of the mechanisms governing the pathogenesis of inflammatory CVD and fibrosis. Studies in our lab have demonstrated VHD in this model is critically dependent on inflammatory macrophages; systemic macrophage depletion imparts disease protection. Additionally, K/B.g7 mice deficient in activating Fc gamma receptors or treated with inhibitors of tumor necrosis factor α are similarly protected from disease. These observations provide insight into key processes governing K/B.g7 VHD pathogenesis. Ongoing studies aim to expand this mechanistic understanding through utilization of lineage-specific gene deletions to probe elements in these disease-contributing pathways. Additionally, single-cell whole transcriptome sequencing of pathogenic macrophage populations isolated from inflamed valves will be conducted to understand better the full spectrum of activated macrophage phenotypes using an unbiased approach. These experiments are aimed at providing much needed insight into the underlying processes that govern inflammatory CVD and fibrosis. Not only will these studies contribute to the understanding of fibrosis and inflammation in the cardiovascular system but will be applicable to the general understanding of fibrotic disease.
Pectus Excavatum: Emergency Department Presentation After Nuss Procedure

**Background:** Pectus excavatum (PE) is an anterior depression of the chest with dorsal deviation of the sternum and 3rd-7th ribs. One surgical option for correction, in severe PE, is the Nuss Procedure where a stainless steel bar is guided using minimally invasive techniques to elevate the sternum and left in place for 3 years. No studies to date have investigated emergency department (ED) visits due to issues s/p Nuss Procedure.

**Objective:** To investigate the incidence and etiology of ED visits following Nuss Procedure for PE.

**Methods:** We performed a retrospective chart review to identify patients who received a Nuss Procedure from 2011-2015. Records of patients who presented to the ED s/p Nuss were reviewed and patient age, gender, ED visit number, diagnosis, interventions performed and disposition were abstracted.

**Results:** 78 patients, age 12-34 years, 84.6% male, were identified; 13 (16.6%) patients presented 19 times to the ED with Nuss Procedure related complaints. The most common presentation was chest pain and difficulty breathing, occurring in all 13 (100%) patients. Three patients had chest pain after bar removal 3 years s/p Nuss Procedure. Of the 10 patients who presented prior to bar removal, four (5.1%) had pleural effusion and three (3.8%) had pneumonia. One patient developed recurrent spontaneous pneumothorax and another developed pericardial effusion. A third patient experienced bar movement pain, developed hardware infection, and pericardial effusion resulting in chest tube placement and IV antibiotics. Of the 19 times patients presenting to the ED, 8 (42%) visits resulted in hospital admission.

**Conclusions:** One in 8 patients had ED visits prior to bar removal s/p Nuss Procedure. All patients presenting to the ED had chest pain and difficulty breathing. Although over 40% of ED visits resulted in hospital admission, only one patient received surgical intervention.
PEDIATRIC POSTDOCTORAL FELLOWS

(Abstracts 20-29)
Persistent Neurotransmitter Alterations in the Rat Cerebral Cortex and Hippocampus Following Intrauterine Growth Restriction

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Background: Children who are born after intrauterine growth restriction (IUGR) are at increased risk for long-term neurodevelopmental deficits including motor, cognitive and attention impairments. The nature of these deficits suggests that the cerebral cortex and hippocampus are particularly vulnerable to injury, however the mechanisms of injury are unknown. Using in vivo, high-field (9.4T) \textsuperscript{1}H MRS, we recently showed lower concentrations of several metabolites responsible for energy metabolism and neurotransmission in the cerebral cortex of postnatal (P) day 7 IUGR rats vs. normally grown (NG) controls. Whether or not the early changes in neurometabolites persist throughout development is unknown.

Objective: To evaluate the neurochemical profile of the cerebral cortex and hippocampus in adult IUGR and NG rats using \textit{in vivo} \textsuperscript{1}H MRS at 9.4T.

Methods: IUGR was induced using bilateral uterine artery ligation on gestational day 19 in pregnant Sprague Dawley dams (term=22.5d). MR spectra were obtained from the cerebral cortex and hippocampus at P60 in IUGR (N=8) and NG (N=7) rats. All MR spectra were acquired using previously described methods. All neurochemicals and ratios were quantified using LCModel. Differences in neurochemical concentrations in each region were compared between IUGR and NG using Student’s t-test.

Results: IUGR resulted in lower concentrations of Gln in the cerebral cortex compared to NG. In the hippocampus, IUGR resulted in lower concentrations of GABA and higher concentrations of Lac compared to NG.

Conclusions: IUGR differentially affects the neurochemical profile in a regional dependent manner in the adult rat brain. Specifically, IUGR resulted in lower Gln concentrations in the cerebral cortex and lower GABA and higher lactate concentrations in the hippocampus. We speculate that these alterations may reflect an imbalance of excitatory vs. inhibitory neurotransmission and energy metabolism contributing to might long-term cognitive impairments in human formerly-IUGR adults.
Family Structure and Well-being Among Students from 3 Ethnic Groups in Minnesota

Eunice Areba, Marla Eisenberg and Barbara McMorris

Background: Family structure has been associated with various child health outcomes, such as physical and emotional disabilities and drug use, with nuclear households being the most protective. Minnesota hosts many immigrant and refugee groups but their living arrangements are not well documented. There are scarce data on relationships between child health and family structure for immigrant and refugee families.

Objective: Describe different family structures and their associations with disability and access to healthcare for Somali, Hmong and Latino students, and to explore whether associations are moderated by ethnicity group.

Method: Data were derived from the 2013 statewide Minnesota Student Survey. This anonymous, population based cross-sectional survey is administered to 5th, 8th, 9th and 11th graders. The analytic sample consisted of 17,494 students aged 10-19 years old (M = 13.7, SD = 2.2). Variables included: age, gender, grade, 6 mutually exclusive family structure categories and health outcomes (access to healthcare, disability status) and drug use. Descriptive statistics and logistic regression models were used to compare health outcomes across family structures.

Results: Students’ ethnicity consisted of Latino (66%), Hmong (23%) and Somali (11%). Most students (50%) reported living in nuclear households, 4.4% in extended households and 1.8% in grandparent-headed households. Healthcare access ranged from 2% - 52%. Significantly higher odds of having mental disabilities (1.6 - 2.8 times), physical disabilities (1.2 - 1.8 times) and using drugs (1.5 - 3.5 times) were noted across all family structures compared to youth in nuclear families. For extended households, odds of having physical disabilities and using drugs were not significantly different from nuclear families. There were no significant interactions by ethnicity.

Conclusions: Children in nuclear families were advantaged in all health outcomes over other family structures. Prevention efforts should address the needs of children in diverse family structures, future research should focus on probable modifiers such as acculturation.
Effects of Cyberbullying on Depressive Symptoms: Are Parents Protective?

Being the victim of cyberbullying is associated with time spent online and youth health outcomes such as anxiety, depression, and suicide. Few studies examine the potential protective effect of parenting on these relationships. The purpose of this study was to examine relationships between cyberbullying, symptoms of depression, and parenting. We hypothesized that 1) cyberbullying would be positively related to depressive symptoms controlling for hours online, and 2) parenting factors would moderate the relationship between cyberbullying and depressive symptoms.

Methods: Data were from the 2013 Minnesota Student Survey of 8th, 9th, and 11th graders (n=66,409; M age=14.1); 51% were female; 79% were White. Depressive symptoms were the dependent variable, measured by five survey items used to screen for internal mental distress (range: 1-5 symptoms). Independent variables included cyberbullying victimization in the last 30 days; questions regarding family relationships (“How much do you feel your parents care about you?” and “Can you talk to your father/mother about problems you are having?”); responses ranged from 1=not at all to 5=very much. Covariates included hours online (cumulative daily hours spent on electronic devices on school days), gender, age, race/ethnicity, free or reduced lunch, and family structure.

Results: Regression analyses found being cyberbullied was positively related to depressive symptoms controlling for hours online ($\beta=0.212, p<.000$). Perceived parental caring ($\beta=-0.234, p<.001$) and talking with father/mother were negatively and independently related to depressive symptoms ($\beta=-0.124, p<.001; \beta=-0.086, p<.001$); however, no evidence of significant moderation of the relationship between being a cyberbullying victim and depressive symptoms was found (see Figure).

Conclusions: Although being cyberbullied was related to greater depression after controlling for hours online, results suggest a direct, protective effect of close parent-child relationships regardless of victim status. This research underscores that parenting-adolescent relationships are a leverage point for addressing mental health, for cyberbullied and non-cyberbullied youth.
Figure. Depressive symptoms modeled on perceived cyberbullying victimization by high and low perceived parental caring. *Note:* Parallel lines illustrate non-significant moderation.
Early Neuropsychological and Treatment Outcomes After HCT in a Child with Beta-Mannosidosis

Fischer, M., Orchard, P., Miller, W., Raymond, G., McKinney, A., & Eisengart, J.B.
Department of Pediatrics, University of Minnesota Medical School

Objective: β-mannosidosis is an extremely rare lysosomal storage disorder (approximately 20 individuals described) with varying progressive symptoms, including intellectual disability, speech impairment, hyperactivity, hearing loss, hypotonia, and skeletal deformities. A standard treatment is not defined, but based on experience with other lysosomal disorders, hematopoietic cell transplantation (HCT) was theorized to halt disease progression. We present neuropsychological and imaging data related to disease and HCT outcomes in a 4-year-old male.

Participant and Methods: The patient has a history of developmental delays and autism spectrum disorder (ASD), macrocephaly, and hypomyelination. Clinical data including neuropsychological evaluations and brain imaging were reviewed before and after HCT.

Results: Initial testing showed average quantitative and nonverbal fluid reasoning, working memory, and multimodal learning, but below average language and fine-motor speed. Five months after HCT, testing was complicated by fatigue and significant speech and motor decline (diagnoses of ataxia and dysarthria). Nonverbal fluid reasoning and multimodal learning continued to be average, while knowledge was below average. Imaging abnormalities that were not significantly changed after HCT showed diffuse deep and subcortical white matter hypomyelination that relatively spared the basal ganglia and thalami (except the internal capsules) and the brainstem (except the medial lemnisci dorsally).

Conclusions: The patient’s history of developmental delays, speech difficulties, and abnormal imaging are consistent with β-mannosidosis literature, while his features of ASD and areas of average cognitive functioning are unusual. To our knowledge, this is the first patient to receive HCT for this rare disorder. Initial treatment response includes motor and speech decline, and some unchanged neurocognitive functioning. Follow-up evaluation will be crucial to characterize outcomes.
Can Positive Relationships With Teachers Moderate the Relationship Between Adverse Childhood Experiences and Prescription Drug Misuse?

Myriam Forster, Iris Borowsky, Amy Gower, Barbara J. McMorris

Background: Adverse childhood experiences (ACEs) are predictive of numerous risk behaviors including substance use. However, few studies have investigated whether positive, caring relationships with teachers buffer the association between ACEs and nonmedical use of prescription drugs (NMUPD).

Objective: To assess whether positive teacher-student relationships moderate the relationship between ACEs and NMUPD among high school students.

Methods: The sample was comprised of 8th, 9th, and 11th grade public school students (n=104,335) participating in the 2013 Minnesota student survey. Separate logistic and negative binomial regression models assessed the association between ACEs and NMUPD (stimulants, ADHD medication, opiate-based pain relievers, tranquilizers) and poly-prescription drug use, adjusting for gender, ethnicity, socioeconomic status, school district size, family structure, and past year alcohol and marijuana use. Interaction terms (positive teachers*ACEs) were calculated to assess moderation effects.

Results: For every additional ACE there was a 56%, 51%, 47%, and 52% increase in the odds of past year stimulant use (n=868), ADHD medication use (n=1957), opiate-based pain reliever use (n=1917), and tranquilizer use (n=1067), respectively (p < .001). For every additional ACE the estimated rate of the number of prescription drugs used increased by 62% (p < .001). Positive teacher relationships moderated the association between ACEs and every category of prescription drug and poly-prescription drug use, with the greatest positive benefits among students reporting the highest number of ACEs (p’s < .001) (Figure 1).

Conclusions: Schools are a leading child-serving agency with the potential to influence the greatest number of students. Teachers, who have concentrated interactions with students, are a key resource in substance abuse prevention efforts. Facilitating the development of strong, caring bonds between teachers and students, especially with students who do not have positive adult role models in their home, is a promising area of future prevention work.
Note: Model adjusts for age, gender, ethnicity, SES, family composition, past year alcohol use, district size (p’s < .001)
Engaging Fathers in Parenting Programs: Insights for New Interventions

Introduction: Parenting programs are one of the most effective strategies to prevent multiple risky outcomes during adolescence, including substance use, sexually transmitted infections, and teen pregnancies. Parenting programs that engage two parents when available have reported better outcomes. However, these programs are mostly attended by mothers. Using mixed methods, this study evaluated delivery preferences of fathers and other non-attenders in a parenting program targeting immigrant Latino families with adolescents: Padres Informados, Jovenes Preparados (PIJP).

Methods: A convergent parallel study, including a simultaneous individual interview and survey, was used with 1) fathers who could have enrolled in PIJP but did not, 2) mothers with low attendance at PIJP, and 3) Latino parents with adolescents without exposure to PIJP.

Results: 36 participants (18 fathers and 18 mothers) enrolled in this study. Qualitative findings grouped in: 1) general preferences: want to have fun, choose topics, and importance of the program needs to be highlighted, 2) delivery preferences (want group component including sessions with mothers and fathers separated, as well as an individual option in case unable to attend a meeting with online videos and follow-up phone calls, or home visits), 3) recruitment strategies (pre-intervention engagement home visit), and 4) participation strategies (incentives that promote family connection such as tickets events where the whole family could attend). Quantitative findings identified preferences regarding scheduling (day of the week and time of the day) and delivery of group and individual components (location, gender of the facilitator, among others).

Conclusions/Translation to Practice: The preferences of fathers and non- or low-attenders of PIJP informed the adaptations to this curriculum that will be piloted during the Spring of 2016. Interventions including these preferences are more likely to engage a higher number of fathers and other participants in order to reduce adolescent health-risk behaviors.
The Relative Contribution of Executive Dysfunction to Psychological, Physical, & Sexual Dating Aggression

Katherine Klipfel, PhD (University of Minnesota Masonic Children’s Hospital), Elizabeth Baker, MA (Kent State University), John Gunstad, PhD (Kent State University), John Dunlosky, PhD (Kent State University), Christopher Was, PhD (Kent State University), and Manfred van Dulmen, PhD (Kent State University)

Abstract:

Preliminary research has shown associations between executive dysfunction and dating aggression, though the relative contribution of executive dysfunction to subtypes of aggression is unexamined. The current study comparatively examined the magnitude of the association of indicators of executive dysfunction with psychological, physical, and sexual aggression. Members of heterosexual dating couples ($N = 138$; 18-29 years of-age) completed tasks of executive dysfunction, including a clinically-normed indicator (perseverative errors of the WCST; Heaton & PAR staff, 2003) and indicators of shifting (Plus-Minus Task; Jersild, 1927), updating (Letter Memory Task; Morris & Jones, 1990), and inhibition (Go/No-Go Task) difficulties. Psychological, physical, and sexual aggression perpetration were assessed via the Conflict in Adolescent Dating Relationships Inventory (Wolfe et al., 2001). Estimated intelligence (Spot-the-Word; Baddeley & Crawford, 2012) and relationship satisfaction (Relationship Assessment Scale; Hendrick et al., 1998) served as controls. Within structural equation models, pairwise equality constraints revealed that female updating difficulties differed in magnitude of association with psychological ($\beta = -.02$, $p = .77$) and physical ($\beta = .13$, $p = .23$) dating aggression [$\Delta \chi^2(1) = 3.77$, $p = .05$; $\Delta CFI = -.05$]. Female inhibition difficulties differed in magnitude of association with physical ($\beta = -.17$, $p = .04$) and sexual ($\beta = .01$, $p = .90$) aggression [$\Delta \chi^2(1) = 5.23$, $p = .02$; $\Delta CFI = -.06$]. Male shifting difficulties differed in magnitude of association between physical ($\beta = -.08$, $p = .32$) and sexual ($\beta = .16$, $p = .05$) aggression [$\Delta \chi^2(1) = 10.36$, $p = .001$; $\Delta CFI = -.04$], as well as psychological ($\beta = -.02$, $p = .84$) and sexual ($\beta = .16$, $p = .05$) aggression [$\Delta \chi^2(1) = 4.77$, $p = .03$; $\Delta CFI = .00$]. Generally, executive dysfunction contributes more strongly to physical aggression for females and sexual aggression for males, though indicator of executive dysfunction impacted findings.
Living as an LGBTQ Youth and a Parent’s Child: Overlap of Two Experiences

Mehus C, Watson R, Eisenberg M, Corliss H, Porta C,

Aim. The overall well-being of LGBTQ youth is related to both parental and community support. However, we know little about the ways in which parent-child relationships impact youths’ experiences interacting with resources and their environments. In this study we inquired, how do youth describe and experience the intersection of their relationships with their parents and their interaction with the broader community?

Methods. Go-along interviews were conducted with 66 LGBTQ youth (14-19 years old, $m=16.6$) across British Columbia, Massachusetts, and Minnesota. Descriptive and inductive coding resulted in a broad category of quotes related to family. This category was coded through a process of open and axial coding.

Results. The primary theme that arose was the varying extent to which youth’s experiences in their parent-youth relationships overlapped (or remained separate from) their experience as an LGBTQ youth (see figure 1). On one end of the continuum, youth experience significant overlap: “[My parents are] just really focused on loving their kids and loving me. Even last night, I was talking, telling my family about how I identify gender- and sexuality-wise.” On the other end of the continuum, these two experiences are distinct and separate. For example, one participant talked about receiving support from a youth group but not home, “I go home, I'm in my room a lot. My parents aren't accepting, but they just accept it […] so I really don't talk much at home.” Parents and youth both contribute to and reinforce this overlap or separation. Youth who experience much overlap may not feel the need for external resources but are more freely able to access them if they choose. For youth who experience these as separate and distinct, navigating the gap to access resources or LGBTQ-focused healthcare can be difficult even though these youth may benefit most.

Figure 1: Reinforcement of overlap/separation between two experiences
Absence of Dual TCR T Cells Protects NOD Mice from Diabetes Due to an Increased Insulin-Specific Treg:Teff Ratio

Schuldt NJ, Spanier JA, Auger JL, Hogquist KA, Fife, BT, Binstadt BA

Due to allelic exclusion, most αβ T cells express only a single αβ TCR specificity. However, around 10% of human and mouse T cells express two different α chains with the potential for dual specificities. Dual β-expressing T cells also exist and account for ~1% of all T cells. Expression of two different TCR specificities by a single T cell is one hypothesized mechanism by which self-reactive TCRs escape central tolerance to initiate autoimmunity. While peripheral tolerance mechanisms typically control any self-reactive T cells in healthy animals, these mechanisms are hypo-functional in NOD mice. We hypothesized that eliminating dual TCR T cells would protect NOD mice from diabetes. To test this hypothesis we generated NOD mice hemizygous at both the TCRα and β loci (TCRα⁺β⁺/⁻). Indeed, we found that NOD mice incapable of generating dual TCR T cells were protected from diabetes with both lower diabetes incidence than wildtype (WT) NOD mice (0% versus 70% at 30 weeks of age) and also lower insulitis scores at 10 weeks of age. Examination of the insulin-specific T cell population in the pancreas-draining lymph node revealed a lower Treg:Teff ratio in WT NOD mice compared to single TCR T cell NOD mice. Anti-PD-1 treatment resulted in the rapid development of diabetes in 100% of WT NOD mice but in only 30% of single TCR T cell mice, suggesting that the diabetes resistance phenotype of single TCR T cell mice is not primarily due to increased anergy. These data support the hypothesis that the presence of dual TCR T cells increases the risk of diabetes in NOD mice by altering the insulin-specific Treg:Teff ratio.
Socioeconomic Differences in Overweight and Weight-Related Behaviors Across Adolescence and Young Adulthood: 10-Year Longitudinal Findings from Project EAT

Allison W Watts, Susan Mason, Katie Loth, Nicole Larson, Dianne Neumark-Sztainer

Reducing socioeconomic disparities in weight-related health is a public health priority. The purpose of this paper was to examine 10-year longitudinal patterns in overweight and weight-related behaviors from adolescence to young adulthood as a function of family-level socioeconomic status (SES) and educational attainment. Project EAT (Eating and Activity in Teens and Young Adults) followed a diverse sample of 2,287 adolescents from 1999 to 2009. Mixed-effects regression tested longitudinal trends in overweight, fast food, breakfast skipping, physical inactivity, and screen use by family-level SES. The influence of subsequent educational attainment in young adulthood was examined. Results revealed that the prevalence of overweight increased significantly from adolescence to young adulthood with the greatest change seen in those from low SES (mean change = 30.7%, 95% CI = 25.6%-35.9%) as compared to high SES families (mean change = 21.7%, 95% CI = 18.2% to 25.1%). Behavioral changes from adolescence to young adulthood also differed by SES background; the prevalence of frequent fast food intake (≥ 3 times/wk) increased most dramatically in those from low SES (mean change = 6%, 95% CI = 0.5%-11%) as compared to high SES families (mean change = -1.2%, 95% CI = -5.2%-2.9%). Overall trends suggest that a higher educational attainment mitigates the negative impacts of a low SES background. These findings suggest that continued effort is needed to ensure that public health strategies addressing obesity and related behaviors reach adolescents and young adults from low SES backgrounds and do not contribute to widening socioeconomic gaps in weight-related health.
<table>
<thead>
<tr>
<th>Family-level SES</th>
<th>% Overweight</th>
<th>Vocational Degree</th>
<th>Bachelor Degree</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ High School</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low SES</td>
<td>62.6 (56.6-68.6)(^a)</td>
<td>62.9 (54.2-71.6)(^a)</td>
<td>50.2 (39.1-61.3)(^{abc})</td>
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<td>Middle SES</td>
<td>53.9 (46.8-61.1)(^{ab})</td>
<td>55.5 (46.3-64.7)(^{ab})</td>
<td>44.7 (35.4-54.0)(^{bc})</td>
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<tr>
<td>High SES</td>
<td>46.4 (39.3-53.6)(^{bc})</td>
<td>50.0 (40.8-59.1)(^{b})</td>
<td>39.6 (34.3-44.9)(^c)</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>Family-level SES</th>
<th>% Overweight</th>
<th>Vocational Degree</th>
<th>Bachelor Degree</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥ Bachelor Degree</td>
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### Fast Food, ≥ 3 times/week

<table>
<thead>
<tr>
<th>Family-level SES</th>
<th>% Overweight</th>
<th>Vocational Degree</th>
<th>Bachelor Degree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low SES</td>
<td>24.0 (18.9-29.0)(^a)</td>
<td>31.8 (23.6-39.9)(^a)</td>
<td>26.7 (16.0-37.4)(^{ab})</td>
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<td>Middle SES</td>
<td>27.9 (21.5-34.3)(^a)</td>
<td>24.5 (16.9-32.1)(^{ab})</td>
<td>13.2 (6.1-20.3)(^c)</td>
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<tr>
<td>High SES</td>
<td>29.1 (22.8-35.4)(^a)</td>
<td>15.4 (9.6-21.3)(^{bc})</td>
<td>13.7 (10.4-17.0)(^c)</td>
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</table>

### Breakfast Skipping, ≥ 5 days/week

<table>
<thead>
<tr>
<th>Family-level SES</th>
<th>% Overweight</th>
<th>Vocational Degree</th>
<th>Bachelor Degree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low SES</td>
<td>42.3 (36.4-48.2)(^a)</td>
<td>38.3 (30.0-46.7)(^{ab})</td>
<td>38.3 (26.9-49.6)(^{ab})</td>
</tr>
<tr>
<td>Middle SES</td>
<td>44.6 (37.8-51.4)(^a)</td>
<td>37.7 (29.2-46.2)(^{ab})</td>
<td>29.4 (21.1-37.6)(^{bc})</td>
</tr>
<tr>
<td>High SES</td>
<td>44.2 (37.3-51.1)(^a)</td>
<td>37.0 (28.9-45.1)(^{ab})</td>
<td>21.9 (18.0-25.8)(^{c})</td>
</tr>
</tbody>
</table>

### Physical Inactivity, % not meeting MVPA guidelines

<table>
<thead>
<tr>
<th>Family-level SES</th>
<th>% Overweight</th>
<th>Vocational Degree</th>
<th>Bachelor Degree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low SES</td>
<td>49.0 (43.0-55.0)(^a)</td>
<td>46.4 (37.7-55.0)(^{ab})</td>
<td>35.3 (25.4-45.3)(^{bc})</td>
</tr>
<tr>
<td>Middle SES</td>
<td>59.8 (43.1-56.5)(^a)</td>
<td>46.1 (37.6-54.6)(^{ab})</td>
<td>40.7 (32.1-49.4)(^{ab})</td>
</tr>
<tr>
<td>High SES</td>
<td>43.5 (36.4-50.6)(^{ab})</td>
<td>45.4 (37.3-53.5)(^{ab})</td>
<td>28.9 (24.0-33.8)(^c)</td>
</tr>
</tbody>
</table>

### Screen Use, > 2 hours/day

<table>
<thead>
<tr>
<th>Family-level SES</th>
<th>% Overweight</th>
<th>Vocational Degree</th>
<th>Bachelor Degree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low SES</td>
<td>88.4 (84.2-92.5)(^a)</td>
<td>86.0 (79.8-92.1)(^{ab})</td>
<td>86.2 (79.8-92.7)(^{ab})</td>
</tr>
<tr>
<td>Middle SES</td>
<td>84.1 (78.6-89.6)(^{ab})</td>
<td>85.5 (79.1-91.8)(^{ab})</td>
<td>85.9 (80.3-91.4)(^{ab})</td>
</tr>
<tr>
<td>High SES</td>
<td>86.7 (81.5-91.8)(^{ab})</td>
<td>88.7 (84.4-93.0)(^a)</td>
<td>82.7 (79.5-86.0)(^b)</td>
</tr>
</tbody>
</table>

SES, socioeconomic status; MVPA, moderate-to-vigorous physical activity

Superscript letters distinguish significant differences (p<0.05) between the nine family-level SES and educational attainment categories for each weight-related outcome.
PEDIATRIC RESIDENTS (Abstracts 30-40)
A Preliminary Report on Inpatient Management of Croup

Anna Sofi Asmundsson, MD, Joseph Arms MD, Carly Thieler MD, Rahul Kaila MD, Dan Nerheim BS, Jeff Louie MD, University of Minnesota

**Background:** Croup is a common reason for visits in pediatric emergency departments (ED). Traditional practice has been to admit patients needing more than one dose of nebulized racemic epinephrine (RE). There are few studies documenting inpatient management and natural course of children admitted for croup but there is evidence supporting discharging patients home from the ED is safe if stridor has resolved after multiple RE.

**Objective:** Our aim was to describe inpatient management of patients admitted from the emergency department with a diagnosis of croup.

**Methods:** This was a multi-center, retrospective case-series involving 3 pediatric hospitals. We identified children who were diagnosed with croup (ICD code 464.4).

**Results:** Of 682 patients admitted with croup, 439 (64.4%) were male. The overall mean age was 17.3 ± 7.16 months. The majority of patients, 516 (75.7 %) did not receive any further respiratory treatments (RE or heliox) after admission, or needed admission to the PICU. Of the patients that did need further interventions most received only one RE after admission. Only 67 patients (9.8%) received 2 or more RE or heliox. Male gender was found to be statistically significant for requiring more inpatient interventions while a history of intubation or initial vitals in the ED were not significantly different among those who did require further inpatient racemic treatments versus those who did not. Patients who received respiratory treatments after admission had more imaging performed in the ED and the average length of stay was longer compared to patients that did not need further treatments. The mean age for patients admitted without further intervention was 17.2 ± 7.14 months while the mean age for those who did need further treatments and/or PICU was 17.6 ± 7.25 months. Of those patients who were managed in the PICU, 18 were directly admitted from the ED while 3 children were initially inpatient and then transferred.

**Conclusion:** This study demonstrates that the majority of patients admitted for croup did not require any significant interventions or transfer to a higher level of care. However, prospective studies may be needed to accurately identify patients who are at high risk of needing more inpatient treatments.
PEARLS: Procedural Education for Adaptation to Resource-Limited Settings - A SUGAR Spin-Off Curriculum

Brinda Desai MD, University of Minnesota, Minneapolis, MN; Rachel S. Bensman MD, Cincinnati Childrens Hospital Medical Center/University of Cincinnati College of Medicine, Cincinnati, OH; Tina M. Slusher MD, University of Minnesota, Minneapolis, MN; Michael B. Pitt MD, University of Minnesota, Minneapolis, MN, On Behalf of the SUGAR PEARLS Investigators

Background: Residents are increasingly participating in global health rotations in resource-limited settings. Often they do not have access to the supplies they are accustomed to using to perform procedures. SUGAR (Simulation Use for Global Away Rotations) is a standardized simulation curriculum developed by a multi-institutional consortium to prepare learners for the emotional challenges of working in resource-limited settings, yet it does not provide skill training for performing procedures in these settings.

Methods: We polled the pediatric global health educators in the seven-institution consortium who developed, piloted, and disseminated the original SUGAR curriculum to determine common procedures residents may be asked to perform while on a global health elective. We used a modified Delphi method to reach consensus on a list of core procedures. Using existing literature and clinical expertise of those with extensive work abroad, we determined the most valuable strategies to address resource limitations and make modifications to perform each procedure.

Results: Ten core procedures were identified: IV and IO access, administration of IV infusions, application of nasal cannula oxygen, bag-valve-mask ventilation, application of bubble CPAP, administration of nebulized and inhaled medications, burns and wound care, lumbar puncture, thoracentesis and tube thoracostomy, and routine neonatal care. Investigators have selected procedures within their expertise and are developing consortium-reviewed procedural instruction modified for resource-limited settings. We produced short videos of instruction, each corresponding to a core procedure, along with an introductory video to explain the goals and limitations of the PEARLS curriculum.

Conclusions: These PEARLS videos will supplement the SUGAR curriculum and will be available on the sugarprep.org website for free for global health educators and trainees to use. As SUGAR is already in use at dozens of institutions, we hope the addition of easily accessible training videos will be a valuable addition to the curriculum.
Shot@Life: Identifying Barriers and Solutions to Low MMR Vaccination Rate Among Somali Children in Minneapolis

Michael O. Esan M.D.1, Emily Moulton1, Ifelayo P. Ojo M.D1, Michael B. Pitt M.D1
University of Minnesota Pediatric Residency Program, Minneapolis, Minnesota

Background: Minneapolis has over 25,000 immigrants/refugees from Somalia. Resistance to the Measles, Mumps, and Rubella (MMR) vaccine in this community is high, with less than 50% of Somali children having received the vaccine series at 24 months.

Objective: Identify barriers and solutions to low MMR vaccination rates among Somali children in Minneapolis.

Methods: With grant funding from Shot@Life, we held a multidisciplinary conference on 12/09/2014 to address barriers to vaccination in the Minneapolis Somali community. The conference proceedings were recorded and transcribed. Two authors independently reviewed the transcriptions and identified themes. The two authors compared identified themes, discussing areas of disagreement until consensus was reached. Themes identified were classified into causal and interventional, and stratified for significance based on recurrence.

Results: Twenty-eight people attended the conference. Several themes were identified from group discussion, with the fear of autism thought to be the principal reason for vaccine refusal. While this is similar to non-Somali parents who resist vaccines, this fear was thought to be compounded by the fact that there is a higher prevalence of autism in the Somali population (49.3 per 1000 Minneapolis Somali boys aged 7-9 years). This increased prevalence as a factor that was brought up the most during the conference (13 times). Perception that there is very little known about the etiology of autism was also thought to be a factor as was the fear of the stigma of autism within the culture. Interventional themes included personalized patient encounters, emphasis on education, highlighting normal developmental milestones and use of a trusted interpreter.

Conclusions: Multiple themes were identified as factors which play a role in MMR vaccine resistance in the Somali community in Minneapolis. Similar to other groups who resist this vaccine, the fear of autism and its unknown etiology were thought to be key factors, however more unique to this group were cultural fears of the stigma of autism and its increased baseline prevalence in this group. Personalizing parent encounters, emphasis on parental education, access to available autism resources and use of a trusted medical interpreter were identified as key tools for improving Somali MMR vaccination rates.
Comparison of Critical Procedures Performed for Children in a General Versus Pediatric Emergency Department

Holly C. Gillis, Abigail Faulman, Rebecca L Kornas, Daniel A Nerheim, Jeffrey Louie, and Mark G. Roback

Background: Critically ill and injured children receive care and critical procedures in a variety of settings, by a range of emergency providers.

Objective: To compare the number, type, frequency and providers of critical procedures performed for children between academic general vs. pediatric emergency departments (GED vs. PED).

Methods: We defined critical procedures as endotracheal intubation (EI), chest compressions (CC), cardioversion/defibrillation (CV), central venous catheterization (CVC), intraosseous catheterization (IO), and thoracostomy tube placement (TT). We performed a retrospective chart review of all children, less than 18 years old, admitted from two EDs to their respective pediatric intensive care units (PICU) between January 2014 and April 2015. We identified children for whom critical procedures were performed in the ED and abstracted data points including age, gender, diagnosis (medical vs. trauma), critical procedure received, and provider who performed the procedure.

Results: During the study period, 13,867 children presented to the GED and 513 (3.7%) were admitted to the PICU while 18,277 children presented to the PED with 370 (2.0%) admitted to the PICU. Children who received critical procedures in the GED vs. PED were mean age 5.3 vs. 2.0 years and male 53% vs. 48%. Trauma was the primary diagnosis in 214 (41.8%) GED vs. 18 (4.8%) PED patients. Critical procedures performed in GED vs. PED were: EI (45 vs. 18), CC (0 vs. 1), CV (2 vs. 2), CVC (13 vs. 2), IO (7 vs. 4), and TT (0 vs. 0); total 67 vs. 27. Fifty-seven (11.1%) children, admitted to the PICU, received at least one procedure in the GED vs. 27 (7.3%) in the PED. Twelve children received more than 1 procedure in the GED and 5 in the PED. Trainees performed 94% of critical procedures in the GED vs. 56% in the PED.

Conclusions: Critically ill children in the GED were older, more likely to be victims of trauma, and more likely to receive a critical procedure than those who received care in the PED. Trainees performed the majority of critical procedures in both EDs.
Tacrolimus is a calcineurin inhibitor used commonly in orthotopic heart transplant. It is generally well-tolerated, but is occasionally associated with significant adverse events, including hemolytic uremic syndrome (HUS) and posterior reversible encephalopathy syndrome (PRES).

HUS is a well-described entity primarily caused by bacterial infection and is characterized by a classic triad of anemia, thrombocytopenia, and kidney injury. Its atypical form has been associated with calcineurin inhibitors, and has been extensively discussed in renal transplantation. PRES is a constellation of clinical and radiological findings including headache, altered mental status coupled with characteristic white matter edema of the parieto-occipital region. Tacrolimus and other calcineurin inhibitors have also been implicated in PRES, including rarely in pediatric orthotopic heart transplantation.

Here, we present two cases: one of tacrolimus-associated HUS and one of tacrolimus-associated PRES in pediatric heart transplant recipients.
Ondansetron Prescription for Home Use in Acute Gastroenteritis

Gray JM, Maewal JD, Lunos SA, Furnival RA, Hendrickson MA

Ondansetron is widely used to control vomiting due to a variety of conditions. In children cared for in emergency departments (EDs) with acute gastroenteritis (AGE), it has been shown to decrease admission rates and the need for intravenous fluids. However, existing literature does not address the practice of prescribing it at ED discharge for home use. Here, we aim to describe prescribing patterns for ondansetron in AGE and to assess the effects of ondansetron prescription on rate of return to the ED.

The study is a retrospective evaluation of children discharged from a pediatric ED during a 3-year period. We assessed two separate groups of patients: all patients with a discharge diagnosis of AGE and all patients who received ondansetron.

Over this 3-year period, a total of 996 patients with a diagnosis of AGE were identified. Of these, 756 (75.9%) received ondansetron in the ED, and 705 (70.8%) were discharged with prescriptions for ondansetron. Return to the ED within 7 days was 6.1% for patients with ondansetron prescriptions and 5.2% for those without prescriptions (p=0.66).

Overall, 2287 patients received prescriptions for ondansetron from the ED during the study period. Of these, 1698 (74.2%) also received ondansetron in the ED. Of a total of 4071 diagnoses, 54% were primary gastrointestinal complaints, 14% other infectious conditions, 9% respiratory, and 4% injuries, with wide variation in the remaining diagnoses. Return rate for these patients was 6.0%.

Home-use ondansetron is widely prescribed in this urban, academic pediatric emergency department, both for AGE and for other diagnoses that may cause vomiting. Seven-day return rates were similar for patients who did and did not receive prescriptions. Further prospective studies are necessary to determine the efficacy of this practice.
Overcoming Minnesota Nice: Protected Time for Peer Feedback

Ellen Christiansen, Heather Dahlquist, Patricia Hickey, Pallavi Kamra

BACKGROUND: Providing feedback to physicians increases self-awareness and promotes behavioral change, which may result in better patient care. Unfortunately, giving peer-to-peer feedback is often avoided in the workplace due to time constraints and/or discomfort with critiquing colleagues. At our institution, residents received intermittent, anonymous written feedback and only 50% reported satisfaction with this feedback, compared to the national average of 70%.

OBJECTIVE: To increase the frequency and quality of resident peer feedback and improve residents’ comfort engaging in verbal feedback

METHODS: Baseline data was obtained from pediatric and internal medicine-pediatric residents at the University of Minnesota with an online survey. Chief residents implemented weekly peer feedback sessions at four inpatient pediatric sites. Time was protected and residents were instructed to share personal improvement goals and provide each other with feedback. A follow up survey was sent at 6 months.

RESULTS: Response rates for the baseline and 6 month surveys were 38% and 51% (n=102) respectively. Residents participating in weekly verbal peer feedback increased from 13% to 69%. 75% of residents felt comfortable giving feedback compared to 49% at baseline, while 87% reported comfort receiving feedback compared to 77%. The percentage who felt their peer feedback was useful increased from 74 to 79%. 81% believed that peer feedback had caused a change in their practice compared to 71% at baseline.

CONCLUSION: This qualitative study suggests that chief-facilitated peer feedback sessions increase the frequency of and comfort with peer feedback. This feedback can lead to a perceived change in practice with the goal of improved patient care.
Pediatric Trauma Experience After Transition to a Freestanding Children's Hospital

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Background: Transition of pediatrics services from large multi-specialty medical centers to pediatrics-focused centers is a common trend over the past three decades. In 2011, The University of Minnesota (UMN) Children's hospital, previously located at the UMN Medical Center on the East Bank of the Mississippi river, transitioned to a freestanding children's hospital at a location previously without dedicated pediatrics services. The pediatric emergency department also downgraded from a level II adult/pediatrics ACS verified trauma center to a level III state designated center.

Objective: Determine impact on Index of Severity (ISS) score and trauma volume after transitioning to a freestanding children's hospital and downgrading to a designated level III trauma center.

Design/Methods: A retrospective analysis of Pediatric trauma visits (age <15) from 2008 to 2014 from the Masonic Pediatric Trauma Registry was conducted. Total pediatric trauma volume per year, method of trauma (blunt, penetrating, thermal), and index of severity score (ISS) were collected. Patients were differentiated into groups based on pre-move years (2008 to 2010) and post-move years (2012-2014).

Results: 833 trauma patients were admitted to the ED between 2008 and 2014. A two-sample t-ISS scores: Mean of the pre-move group is 5.33 (n=257, SD = 4.98). The mean of the post-move group is 5.83 (n=502, SD = 5.33, p-value= 0.21). Pre-move average (85.7) compared with post-move average (167.3) yearly volume of admissions to the ED.

Conclusions: Results demonstrate an almost 200% increase in yearly trauma admissions with no statistically significant difference in ISS trauma scores. Characteristics of the UMMCH emergency department may suggest that easy access to the new location, parental preferences for specialized pediatrics services, and emergency medical service preferences may impact trauma volume. Downgrading to a level III designated center did not affect trauma volume.
IgG4 Disease in a Two-Year Old - An Uncommon Presentation of a Rare Disease

A two year-old Somali born male with history of recurrent pneumonias and iron-deficient anemia presented to the Emergency Department with complaints of worsening cough, emesis, and fever. CXR revealed perihilar and lingular opacities and he was admitted for IV antibiotics. On further history the patient was noted to have had 4 episodes of pneumonia since 8 months of age. Review of systems was positive for intolerance of solid foods – his mother noted she often had to soak solids in milk for the patient to accept them. However, he remained at the 30th percentile for weight. Given the history of recurrent pneumonias he underwent an esophagogram and upper endoscopy which was significant for a benign-appearing 2mm x 5cm esophageal stricture. Esophageal biopsies demonstrated mild chronic inflammation in the upper/distal esophagus, rare mucosal eosinophils in proximal esophagus, and active gastritis with Helicobacter-like organisms. A G-tube was placed for nutrition with concern for recurrent aspiration. He later underwent a thoracotomy with biopsies after imaging demonstrated enlarged mediastinal lymph nodes—esophageal pathology was significant for plasma cell infiltrates, with a significant IgG-4 component. Ultimately the patient was diagnosed with IgG 4 disease. Other autoimmune diseases were considered including MCTD, Sjogren’s, SLE, Crohn’s, etc. Notably his circulating IgG3 and IgG4 levels were elevated which is not atypical. Thus far he has no other manifestations of this condition however this disease is rare in children and not well-understood.

This case emphasizes the importance in obtaining a full history for common conditions and describes a rare condition in a young child. Treatment options typically include corticosteroids and steroid sparing medications in the long-term.
Meningococcemia Until Proven Otherwise – A Rare Pediatric Cutaneous Eruption

Meningococcemia is an often devastating and frequently fatal infectious disease (Betrosian et al, 2006). Since the advent of widespread vaccination, the disease is rare in the United States. Hallmark clinical features include fever, septic shock, meningoencephalitis, and purpuric eruption.

We describe an 8 month old female with a widespread purpuric, hemorrhagic-appearing rash and minimal facial edema with a relative paucity of other symptoms. She received her 6 month vaccinations the day of presentation. On presentation she was well appearing and vitally stable with a purpuric rash on her arms, legs, and abdomen (figure 1). Because of the concern for meningococcemia, a full septic workup was initiated. CSF was frankly bloody and revealed 8760 RBCs, 28 WBCs, protein <5, glucose <1, and no organisms on gram stain. Because of the profoundly low glucose and her purpuric rash, concern remained for bacterial meningitis despite her stable clinical status. Broad spectrum antibiotics were started and she was admitted for further monitoring and workup. Coagulopathy was ruled out by normal platelet count and coagulation studies. HSP was ruled out by normal IgA level. Shortly after admission, her purpura became palpable. On day two of admission her edema worsened and involved the extremities. Renal function and urinalysis remained normal. She continued to appear well with improvement of the rash, which changed to ecchymotic and no longer palpable in appearance. Cultures remained negative prompting CSF PCR analysis for *H. flu, S. pneumoniae, and N. meningitidis* (all negative). Repeat CSF analysis of the original sample revealed normal glucose and protein. Pediatric dermatology was consulted and diagnosed Acute Hemorrhagic Edema of Infancy. Acute Hemorrhagic Edema of Infancy is a benign, self-limiting, vasculitic rash that typically presents at 4-24 months of age and is frequently seen after upper respiratory tract infection or vaccinations (Glamann et al, 2014).
Presentation, Treatment, and Outcomes of Emergency Department Visits of Children After Renal Transplant

Ashish Shah, MD, Daniel A Nerheim, BS³, Lei Zhang, MS, Mark G Roback, MD and Ronald A Furnival, MD, Christian Hanna, MD, MS

Background: University Children's Hospital performs over 3% of all Pediatric Kidney Transplants (PKTx) in the U.S. annually. Emergency Department (ED) visits, treatment, or outcomes of medically complex PKTx patients have not been studied.

Objective: Describe ED clinical presentations, treatments, and outcomes for PKTx patients.

Design/Methods: Retrospective medical record review of all children who received PKTx from 6/1/2012 - 7/30/2015 and presented to our ED for care.

Results: During the 3 year study period, 69 children received a kidney transplant, and 51 (74%) PKTx patients (24 M:27 F) presented to our ED a total of 145 times, for an average of (2.9) visits each (range 1-11). Most PKTx were for congenital anomalies of the kidney and the urinary tract (39%), focal segmental glomerulonephritis (20%), or other primary diagnoses (41%). Their ED presentation was most frequently for fever (39%), abdominal pain (19%), vomiting (17%), or respiratory symptoms (8%). Laboratory studies (83%, 121/145) or kidney imaging (24%, 35/145) were commonly performed, and ED treatment consisted most often of antibiotics (43%) and intravenous fluid resuscitation (54%). ED-obtained infectious studies were positive for pathogens in 17% (25/145) of visits, including 2 blood cultures and 23 urine cultures. Hospital admission (55%, 80/145) was the most frequent ED disposition. No patient died in the ED. Sixty-five patients (45%) were discharged from the ED. Of the 80 RTx hospitalizations, 79 patients were ultimately discharged, and one patient died.

Conclusions: PKTx recipients frequently present to the ED for evaluation and care after transplant. While many were safely discharged after ED evaluation, the majority of PKTx patients require inpatient hospitalization and significant medical support.
PEDIATRIC FELLOWS

(Abstracts 41-54)
Advancement of Modified Bubble CPAP for Use in Children in Low Resource Settings

Pneumonia is the number one cause of childhood mortality worldwide. The majority of the burden of disease is distributed among low resource countries where there is minimal respiratory support for children. Bubble Continuous Positive Airway Pressure (bCPAP) is a simple form of respiratory support that has decreased mortality in neonates with respiratory distress. BCPAP use has been limited to primarily neonates thus far. We hypothesize that a modified bubble CPAP device is safe and efficacious for use in older children with respiratory distress in low resource settings.

We constructed a simple low-cost bCPAP device using a nasal cannula, oxygen tubing, water bottle, and oxygen source. We modified the nasal prongs to improve the nasal seal using compressible earplug material. Patients evaluated at Gulu Hospital in Gulu, Uganda age 1 month to 5 years with respiratory distress or hypoxia were enrolled and started on bCPAP therapy. They were monitored for development of complications due to the device. Trends in respiratory scores, vital signs, and outcome were recorded. Prior to study initiation, historical data was collected for comparison.

The trial is two thirds through enrollment. Preliminary results show that out of 66 patients there have been three complications; two mild nasal erosions that did not require intervention and abdominal distension which resolved with nasogastric tube decompression. These were expected possible complications. Efficacy data is being analyzed but there has not been any noted increased mortality due to use of bCPAP.

In conclusion, preliminary results show our simple modified bCPAP device appears to provide safe respiratory support for children outside of the neonatal period. Observed complications have been minimal. Use of this simple device could be instrumental in decreasing morbidity and mortality from respiratory illness in low resource settings.
Drug Conjugated Nanoparticles Activated by Cancer Cell Specific mRNA

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We describe a customizable approach to cancer therapy in which a gold nanoparticle (Au-NP) delivers a drug that is selectively activated within the cancer cell by the presence of an mRNA unique to the cancer cell. Fundamental to this approach is the observation that the amount of drug released from the Au-NP is proportional to both the presence and abundance of the cancer cell specific mRNA in a cell. As proof-of-principle, we demonstrate both the efficient delivery and selective release of the multi-kinase inhibitor dasatinib from Au-NPs in leukemia cells with resulting efficacy in vitro and in vivo. Sequence specific kinase inhibition was noted with both p-SRC and p-CRKL assays. (Fig 1a) As a result of diminished kinase activity, three distinct leukemia cell lines (Kasumi-1, SKNO-1 and K562) demonstrated decreased viability. (Fig 1b) In vitro assays established Au-NP dose dependence and reinforced sequence specificity. (Fig 1c-d) Additionally, these Au-NPs reduce toxicity against hematopoietic stem cells and T-cells. Preliminary murine xenotransplantation experiments resulted in statistically significant survival advantage in those mice treated with Dasatinib-Au-NPs. (Fig 1e). This novel approach has the potential to improve the therapeutic efficacy of a drug and minimize toxicity while being highly customizable with respect to both the cancer cell specific mRNAs targeted and drugs activated.
Health-Related Quality of Life in Children with Congenital Adrenal Hyperplasia

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4Minnesota Department of Health, St. Paul, MN

Background: Children with congenital adrenal hyperplasia (CAH) require life-long glucocorticoid replacement and have intermittent hyper/hypocortisolemia and hyperandrogenemia each day. Understanding health-related quality of life (HRQL) is important for understanding the impact this chronic disease and therapy have on physical, mental, emotional and social functioning. Little is known about HRQL in CAH.

Objective: To compare HRQL in children with CAH to healthy norms and examine how these scores relate to physiological variables.

Methods: 45 patients (mean age 8.4 +/- 4.5); 20 males; 25 salt-wasting, 13 simple-virilizing, and 7 non-classic. 32 patients (5-19 years), self-reported their quality of life (QoL) on the PedsQL™ Generic Core Scale and PedsQL™ Fatigue Scale, and 44 parents of children (2-19 years) completed a parent report. Cortisol pharmacokinetics (PK) were measured in 35 children by 12 serum samples over 6 hours after morning oral hydrocortisone (HC) dose. Bone age Z-scores were calculated from most recent bone age

Results: Child QoL reports (n=32) were not lower than healthy norms. Parent reports for their child (n=44) were significantly lower in generic QoL (p=0.047) and fatigue (p=0.001) than parent reports for healthy norms. Children rated sleep poorer (p=0.016) than their parents. QoL scores did not differ by sex, subtype, and cortisol PK (clearance or half-life). Bone age Z-scores were negatively associated with emotional health (p=0.006) and cognitive fatigue (p=0.016). Generic QoL scores and fatigue scores from children and parents were not associated with total daily HC dose (10+2.8 mg/m²).

Conclusion: Parents of children with CAH see a negative impact of disease on their child’s QoL. The negative association of bone age Z-score with child-reported emotional and cognitive fatigue scores suggests an impact from chronic hypocortisolemia and hyperandrogenemia. The discrepancy between parent and child generic and fatigue QoLs may be due to the child’s lower expectation due to chronic hypocortisolemia.
IUGR Decreases GSTA4 Expression in the Hippocampus of the Newborn Rat

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Background: Infants born with intrauterine growth restriction (IUGR) are at increased risk for neurodevelopmental deficits later in childhood, including motor and cognitive abnormalities. The etiology is unknown however oxidative stress and mitochondrial dysfunction in regions of the brain have been implicated. GPX4 (glutathione peroxidase 4), PRDX3 (peroxiredoxin 3), GSTA4 (glutathione S-transferase alpha-4), and SOD2 (superoxide dismutase) are nuclear genes regulated by the mitochondria that are involved in protecting against antioxidant stress.

Objective: To determine if IUGR affects regional expression of GPX4, PRDX3, GSTA4 and SOD2 in the cerebral cortex, hippocampus and striatum in the newborn rat.

Methods: IUGR was induced using bilateral uterine artery ligation at gestational day 19 in pregnant Sprague Dawley dams (term = 22.5 days). Normally grown (NG) control rats were generated without manipulation of the uterine arteries. We performed quantitative PCR (qPCR) on postnatal (P) day 7 rats to compare the expression of GPX4, PRDX3, GSTA4, and SOD2 in the cerebral cortex, hippocampus, and striatum.

Results: In the P7 hippocampus, IUGR resulted in a 27% downregulation of GSTA4 (P<0.05). There were also changes in expression of other genes in the other regions of the brain but these were not significant.

Conclusion: IUGR down-regulates gene expression of GSTA4 in the hippocampus at P7. We speculate that abnormal regulation of the glutathione antioxidant defense system due to mitochondrial dysfunction in the hippocampus might be one mechanism of long-term neurodevelopmental deficits in children born IUGR. Studies examining regional effects of IUGR on mitochondrial function are currently underway.
Improved Pediatric Resident Knowledge of Ethics Through Block Education

Heidi Kamrath, DO and Jennifer Needle, MD

**Background:** Pediatric residents are evaluated throughout training on professionalism which incorporates ethical concepts. The Test of Residents Ethics Knowledge for Pediatrics (TREK-P) is a 23 item standardized questionnaire which reliably identifies who would benefit from further instruction in pediatric ethics; the minimal threshold is a score of 20 to indicate competency in pediatric ethics.

**Aim:** To improve pediatric resident ethics knowledge through a single block education session.

**Methods:** A cross-sectional needs assessment survey was distributed to PGY1 through PGY4 pediatric and medicine-pediatric residents. Using the data from this survey we developed our block education session focusing on the basic principles of ethics, limits of viability and end-of-life decision making. We did pre- and post- testing using the TREK-P to evaluate residents’ ethics knowledge immediately before and after the session.

**Results:** Forty-three residents completed the block education needs assessment survey. Of these, only 15 (34%) answered “Yes” to the question “Do you feel prepared to handle ethical dilemmas?” Additionally, 37 (86%) answered “Yes” to the question “Do you think you need more ethics education in your residency?” The baseline TREK-P was taken by 49 residents with an average score of 16.9 while the post TREK-P was taken by 42 residents with an average score of 17.8. While there was not a statistically significant differences between the average scores pre- and post- block education, the number of residents scoring ≥20 increased from 8% to 12% (p=0.01).

**Conclusions:** We were able to demonstrate measurable improvement in the number of residents demonstrating competency in ethics on the TREK-P following a single block education session. Given that the majority of residents still scored <20, additional ethics education is needed. This is now being implemented with quarterly ethics educational seminars using the American Academy of Pediatrics Bioethics Curriculum.
Use of Bortezomib in the Treatment of Antibody-Mediated Rejection in Pediatric Kidney Transplant Recipients

Abstract

Background: The outcomes of antibody-mediated renal allograft rejection (AMR) remain poor despite the use of a number of therapeutic options. In the recent decade, there have been several reports of successful use of bortezomib for the treatment of AMR in adult kidney transplant recipients. However, little is known about the experience with bortezomib in children.

Objective: To characterize the use of bortezomib for the treatment of AMR in pediatric kidney transplant recipients.

Methods: It was a retrospective study by nine member institutions of the Midwest Pediatric Nephrology Consortium. It included all pediatric kidney transplant recipients who received bortezomib for the treatment of biopsy-proven AMR between 01/2008 and 01/2015.

Results: Thirty-three pediatric kidney recipients with biopsy-proven AMR received bortezomib at nine pediatric transplant centers. The mean age at the time of transplant was 11.3 years (SD 5.4). The participants were predominantly male (63.6%) and white (51.5%). The mean time to AMR after the kidney transplantation was 49.6 (SD 42.6) months. Besides bortezomib, 90.1% of patients received IVIG, 78.8% received plasmapheresis and 78.8% received rituximab. The median time to bortezomib initiation after the diagnosis of AMR was 23 days (range: 1 – 185). The mean duration of follow-up was 19.2 (15.6) months. At the end of follow-up, 19/29 (64.5%) patients had functioning grafts. Patients who lost their graft had a significantly greater decline in their eGFR at the time of diagnosis compared to patients who retained their graft (30 vs. 40 ml/min/1.73m², p value). Side effects were documented in 21/33 patients. The most common side effects were anemia and thrombocytopenia followed by hypertension.

Conclusion: Bortezomib was tolerated by pediatric kidney transplant recipients without any life-threatening side effects. Bortezomib was associated with a stable eGFR in patients with relatively preserved renal function. The efficacy and safety of bortezomib in the treatment of AMR in pediatric kidney transplant recipients should further be evaluated in randomized controlled studies.
Outcomes Following Umbilical Cord Blood Transplantation for Inherited Metabolic Disorders: Does UCB/Recipient HLA Alleleic Disparity Matter for Engrafted Survival?

Kanwaldeep K. Mallhi, Angela R. Smith, Todd E. DeFor, Paul J. Orchard, Weston P. Miller

Background: Umbilical cord blood transplant (UCBT) has demonstrated efficacy for numerous inherited metabolic disorders (IMD), and post-transplant donor chimerism may correlate with treatment effectiveness.

Objective: We evaluated the impact of UCB/recipient HLA alleleic disparity on engrafted survival (>90% donor myeloid chimerism) and other outcomes following UCBT for IMD.

Design/Methods: 106 consecutive first, single UCBT for IMD at the University of Minnesota from 2003 to 2015 were evaluable for UCB/recipient HLA alleleic matching (HLA-A, -B, -C, and -DRB1). Disease-, patient- and transplant-related characteristics, as well as major outcomes, were assessed.

Results: The median age at UCBT was 1 year; 87 patients (82%) received myeloablative conditioning. Primary diagnoses were Hurler syndrome (41%), cALD (35%), MLD/GLD (9%), and other (16%). The median TNC was 8 x10^7/kg. The 5 year estimated overall survival was 70% (95% CI, 59-79%). The median time to neutrophil and platelet recovery was 20.5 and 60 days, respectively. Rates of severe acute and chronic GvHD were low (each 6%). Of 46 conventional matched UCBT, 20 (43%) were mis-matched at ≥1 allele. Of 49 conventional 5/6 UCBT, 34 (69%) were mis-matched at ≥2 alleles and 19 (39%) were disparate at ≥3 alleles. Engrafted survival at 1 year was observed in 67%, 63% and 36% of conventional 6/6, 5/6 and 4/6 UCB recipients, respectively (p = 0.15). Using alleleic criteria, one-year engrafted survival was observed in 73% of (6-8)/8 recipients and 42% of (2-5)/8 recipients (p < 0.01). Overall graft failure rate for conventional 5/6 UCBT was 27%. Analysis of the same patients using alleleic criteria revealed the graft failure rate was 17% for (6-8)/8 recipients and 42% for (2-5)/8 recipients (p < 0.05).

Conclusion: In a large, single-center cohort of patients undergoing UCBT for IMD, HLA alleleic matching considerations may better predict fully engrafted survival post-transplant.
Risk Behaviors Lack Correlation with HIV Knowledge in a Cohort of HIV+ and HIV- Youth

Marsh K, Scheiner N, Wang Q, Rothenberger M

**Background:** 26% of new HIV infections in the US were in youths aged 13-24 in 2010; the majority occurred in young men who have sex with men (YMSM). We aimed to better understand risk behaviors in a cohort of youth who are HIV infected (HIV+) or at high-risk of acquisition (HIV-) to develop prevention strategies. We hypothesized that risk behaviors are common in this population and are associated with lack of HIV knowledge.

**Methods:** The University of Minnesota Youth and AIDS Projects provides HIV case management and prevention education for youths aged 13-24. A 290 question survey was administered at program intake to HIV+ and HIV- high-risk youth (self-identified or referred due to sexual or needle-sharing contact with HIV+ individuals). Analysis used two-sample t test for continuous variables and Chi-square or Fisher’s exact test for categorical variables.

**Results:** 55 HIV+ and 91 HIV- youth completed surveys. 83% of HIV+ were male and 89% identified as MSM. 96% of HIV- were male and 92% identified as MSM. Risk behavior was high in both groups (Table). HIV knowledge scores were also high, with average scores of 17.3 and 17.8 out of a maximum of 19 among HIV+ and HIV- groups respectively. HIV knowledge scores did not correlate with risk behaviors in the HIV- group, and increased knowledge was associated with more frequent reporting of 4 risk behaviors in the HIV+ group (Table). We also found a correlation (p = 0.02) between mental illness and forced sex in both groups.

**Conclusions:** Self-reported risk behaviors were frequent in this cohort in which the majority were YMSM. Higher HIV knowledge was not associated with less frequent risk behavior. These findings suggest that knowledge-based HIV prevention programs may not change risk behaviors in high-risk youth and highlight the importance of addressing the complicated psychosocial factors that affect this unique population.
### Table. Reported risk behaviors and correlation between behavior and HIV knowledge among survey participants. Percent values represent the proportion of HIV+ or HIV- respondents who had participated in the risk behavior.

<table>
<thead>
<tr>
<th>Risk Behavior</th>
<th>HIV+ (n=55)</th>
<th>HIV- (n=91)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sharing needles†</td>
<td>7.27%</td>
<td>1.11%</td>
</tr>
<tr>
<td>Does behavior correlate with HIV knowledge score?</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>IV drug use†</td>
<td>12.96%</td>
<td>4.67%</td>
</tr>
<tr>
<td>Does behavior correlate with HIV knowledge score?</td>
<td>Yes; p=0.02^</td>
<td>No</td>
</tr>
<tr>
<td>Drug use during sex†</td>
<td>66.67%</td>
<td>50.00%</td>
</tr>
<tr>
<td>Does behavior correlate with HIV knowledge score?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Substance Abuse†</td>
<td>34.55%</td>
<td>16.85%</td>
</tr>
<tr>
<td>Does behavior correlate with HIV knowledge score?</td>
<td>Yes; p=0.05^</td>
<td>No</td>
</tr>
<tr>
<td>Condomless intercourse with a woman†</td>
<td>41.82%</td>
<td>25.61%</td>
</tr>
<tr>
<td>Does behavior correlate with HIV knowledge score?</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Condomless receptive anal intercourse†</td>
<td>80.00%</td>
<td>57.14%</td>
</tr>
<tr>
<td>Does behavior correlate with HIV knowledge score?</td>
<td>Yes; p=0.03^</td>
<td>No</td>
</tr>
<tr>
<td>Condomless insertive rectal intercourse†</td>
<td>63.64%</td>
<td>47.62%</td>
</tr>
<tr>
<td>Does behavior correlate with HIV knowledge score?</td>
<td>Yes; p=0.03^</td>
<td>No</td>
</tr>
<tr>
<td>Anonymous sex*</td>
<td>48.15%</td>
<td>37.65%</td>
</tr>
<tr>
<td>Does behavior correlate with HIV knowledge score?</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Unprotected sex#</td>
<td>73.65%</td>
<td>65.71%</td>
</tr>
<tr>
<td>Does behavior correlate with HIV knowledge score?</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Exchanging sex for money†</td>
<td>35.85%</td>
<td>24.71%</td>
</tr>
<tr>
<td>Does behavior correlate with HIV knowledge score?</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Coerced or forced sex†</td>
<td>57.69%</td>
<td>39.00%</td>
</tr>
<tr>
<td>Does behavior correlate with HIV knowledge score?</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

† Participant reported this risk behavior at any point in their lifetime.
^ Response of “yes” was correlated with a higher HIV knowledge score.
★ Participant reported receiving professional counseling or attending a treatment program for alcohol or drug abuse.
✚ Participant reported initiating sexual activity with at least 1 of 3 most recent partners after knowing the partner for <1 day.
# Participant reported using condoms less than 100% of the time during vaginal or rectal intercourse with at least 1 of 3 most recent partners.
Parent and Patient Perceptions of Behavioral and Emotional Functioning Following Hematopoietic Cell Transplantation for Inherited Metabolic Disease

Rachel Phelan, MD, MPH¹; Paul Orchard, MD¹; Margaret Semrud-Clikeman, PhD²; Nicholas Smiley²; Weston Miller, MD¹

Affiliations: ¹Division of Blood and Marrow Transplant, Department of Pediatrics, University of Minnesota; ²Division of Clinical Behavioral Neuroscience, Department of Pediatrics, University of Minnesota

Background: Hematopoietic cell transplantation (HCT) remains standard therapy for various inherited metabolic diseases (IMD). As survival improves, assessment of long-term outcomes is hampered by patient attrition.

Objectives: We piloted a methodology to remotely study parental and patient perspectives of behavioral and emotional functioning following HCT for IMD.

Design/Methods: The University of Minnesota BMT Database was queried for surviving IMD patients. Parents/patients were invited for study participation. The Research Electronic Data Capture (REDCap™) system was used to electronically administer and retrieve the Behavior Assessment System for Children, Second Edition (BASC-2) survey in a one-time cross-sectional analysis. The responses for parent/patient pairs were analyzed by paired samples t-test in the subscale areas of anxiety, depression, atypicality, and attention.

Results: We identified 421 patients transplanted for IMD from 1982-2015. Of 239 survivors, 96 parents and/or patients (40%) enrolled. Eight parent/patient pairs completed BASC-2 surveys. IMD diagnoses included Hurler syndrome, adrenoleukodystrophy, mannosidosis and Maroteaux-Lamy syndrome. The median time from transplant to assessment was 9.8 years (range 2.1 to 19.9). There were no significant differences in perception of anxiety (p = 0.38), depression (p = 0.16), atypicality (p = 0.11) or attention problems (p = 1.0) when comparing parent and patient responses. The majority of patients performed at average level in comparison to age and gender based norms from a parent (84% of scores) and patient (88% of scores) perspective.

Conclusions: Effective, remote assessment of behavioral and emotional function via electronic methods is feasible in a cohort of IMD survivors. Importantly, scores for the analyzed subscales did not significantly differ between parent and patient report. This suggests that when patients are unable to provide self-reported functioning, parent perspectives may serve as adequate representation. Continued follow-up of this population is critical to provide counseling regarding long-term outcomes for families considering HCT as a treatment for IMD.
Prenatal Lung-to-Head Ratio in Infants with Congenital Diaphragmatic Hernia Does Not Predict Hospital Course

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BACKGROUND: Congenital Diaphragmatic Hernia (CDH) is a high mortality birth defect. In April 2006, we implemented a standardized protocol for management of CDH patients, which includes prenatal measurement of the lung to head ratio (LHR). The goal of this study was to assess the predictive value of LHR for hospital course in CDH patients at our institution.

METHODS: Data was collected from 96 infants identified in our CDH database between January 1, 2006 and December 21, 2013. Patients transferred without a prenatal diagnosis or without a prenatal LHR measurement were excluded, leaving a total of 46 patients. Patients were divided into 3 LHR groups: severe (<1), moderate (≥1-1.49), and mild (≥1.5). Logistic regression was used to determine the association of LHR category with multiple variables including length of hospital stay, days intubated, days on oxygen, need for gastrostomy tube, extracorporeal membrane oxygenation (ECMO) use, and survival.

RESULTS: Overall, 84.8% of patients survived. Regression analysis showed no statistically significant correlation between increasing LHR severity and the parameters evaluated.

<table>
<thead>
<tr>
<th>LHR severity (n)</th>
<th>Mean Length of Hospital Stay</th>
<th>Mean Length of Intubation</th>
<th>Mean Length of Oxygen Use</th>
<th>G-tube Placed (%)</th>
<th>Use of ECMO (%)</th>
<th>Survival (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild (15)</td>
<td>59.87 days</td>
<td>20.87 days</td>
<td>43.00 days</td>
<td>2 (13.3)</td>
<td>9 (60)</td>
<td>12 (80)</td>
</tr>
<tr>
<td>Moderate (22)</td>
<td>59.95 days</td>
<td>24.73 days</td>
<td>39.09 days</td>
<td>7 (31.8)</td>
<td>10 (45.5)</td>
<td>19 (86.4)</td>
</tr>
<tr>
<td>Severe (9)</td>
<td>68.78 days</td>
<td>39.00 days</td>
<td>43.56 days</td>
<td>5 (55.6)</td>
<td>6 (66.7)</td>
<td>8 (88.9)</td>
</tr>
<tr>
<td>TOTAL (46)</td>
<td>61.65 days</td>
<td>26.26 days</td>
<td>41.24 days</td>
<td>14 (30.4)</td>
<td>25 (54.3)</td>
<td>39 (84.8)</td>
</tr>
</tbody>
</table>

P-value: 0.846 0.222 0.911 0.092 0.472 0.808

CONCLUSIONS: In our center, LHR does not predict the hospital course for infants with CDH as evaluated by length of hospital stay, duration of intubation, time on oxygen, need for G-tube placement, use of ECMO, or survival. However, LHR may be beneficial in predicting long term pulmonary and developmental outcomes.*

*Study in process; data currently being analyzed.
Thirty Year Follow-Up in Hurler Syndrome (MPS IH) Patients After Hematopoietic Cell Transplantation (HCT) – The University of Minnesota Experience

Nathan Rodgers, Elizabeth Braunlin, Kyle Rudser, Alex Kaizer and Paul Orchard

Little is known about the survival and cause of death in MPS IH > 10 years after HCT. We identified MPS IH patients who underwent HCT at our institution between 9/1983 and 7/2013 from the institution’s HCT Registry and determined follow-up status for each up to 12/31/2013. Data collected included sex, age at transplant, type of transplant (related marrow, unrelated marrow and umbilical cord blood (UCB)) and use of peri-HCT enzyme replacement therapy (ERT). Patient vital status was verified by chart review, the Centers for Disease Control’s National Death Index (NDI), social media and an unrelated study. One-hundred thirty-four patients with MPS IH (69 M/65 F; mean age at HCT (SD) 21.8 (20.8) months; median follow-up time (IQR) 10.7 (5-17.2) years), were identified. Vital status of 12 patients (9%) was unknown prior to 12/31/2013, whom were censored at date of last follow-up. Two cohorts were created based on era of HCT: < 2004 and ≥ 2004, corresponding to availability of ERT and predominance of UCB as a donor source. Mean age at HCT and sex distribution were similar. Overall survival at one- and 30-years was 70% (95% CI 62%-78%) and 37% (19%, 55%), respectively. For the ≥ 2004 era, survival at one- and 8-years, was 84% (73%, 96%) and 81% (69%, 94%), respectively. Contrary to other institutions’ experience, survival with UCB and related marrow as a donor source was equal. Survival was superior for males and ≥ 2004 era, hazard ratio (HR) (95% CI) 0.43 (0.24, 0.78), p=0.006 and 0.47 (0.21-1.06), p=0.070, respectively. Mortality was primarily due to pulmonary and infectious etiologies, regardless of era or length of survival. Long-term survival after HCT for patients with MPS IH has improved since 2004 as a result of many factors; use of peri-HCT ERT and survival non-benefit in females merit further study.
Figure 1.
Heterogeneity in Cord Blood Population

Abstract:

Cord blood (CB) is routinely used as an alternative stem and progenitor cell source for allogeneic Hematopoietic Cell Transplantation (HCT) in both, adult and pediatric patient populations who lack an HLA-matched sibling donor. While CB has the benefits of rapid availability and low rates of graft vs. host disease (GVHD), it has the downside of an increased incidence of graft failure and slower neutrophil and lymphocyte recovery. We hypothesize that the variation in the time to engraftment and immune reconstitution after CB transplantation is due to heterogeneity in the progenitor cell content among CB unit.

As hematopoietic stem cells (HSC) differentiate they progress through a series of progenitor stages, each with limited potential to give rise to cell populations. These include multipotent progenitor cells (MPP) which then differentiate into common lymphoid progenitor (CLP) and common myeloid progenitor (CMP) cells. The latter further differentiate into megakaryocyte-erythroid progenitor (MEP) and granulocyte-macrophage progenitor (GMP) cells.

We analyzed clinical-grade UCB units (n=122) using multicolor FACS to determine the percentage of cells with surface markers for HSC, MPP, CLP, CMP, MEP and GMP cells. We found a surprisingly wide range for each cell population among cord blood units. These include HSCs (0.00187-0.21%), MPP (0.041-0.8%), CLP (0.51-96.4%), CMP (0.000105-0.062%) MEP (0.00688-0.87%) and GMP (0.000039-0.049%).

These results provide the first detailed evaluation of the progenitor cell content of clinical-grade UCB units. These studies provide evidence of significant diversity in the progenitor cell content across different CB units. This variation may account for variations in the success and speed of engraftment and lymphocyte recovery. Further studies are ongoing to determine the correlation between CB unit progenitor content and lymphocyte recovery.
Not All Cord Units Are The Same....
Clinical Relevance of *Staphylococcus aureus* Healthcare-Associated Bloodstream Infection Classification in a Children's Hospital

**Background:** Studies have shown differences in susceptibility patterns and risk factors between hospital-acquired (HA), community acquired (CA) and health care-associated (HCA) *Staphylococcus aureus* (SA) bacteremias. The aim of this study was to evaluate characteristics of HA, CA and HCA SA bacteremias in a pediatric cohort.

**Methods:** We conducted a retrospective chart review of all pediatric patients admitted to our children's hospital from 2011-2014 who had a blood culture positive for SA. Each bacteremia episode was classified as CA, HCA, or HA based on predefined criteria. Risk factors, underlying conditions, concomitant infection sites, antibiotic susceptibility profile, and outcomes were recorded. Statistical analysis was done using R software and GraphPad Prism, and p<0.05 was considered significant.

**Results:** Forty-four children had 63 episodes of SA bacteremia over this period. Two episodes were considered contaminants by the treating team and excluded. History of prior SA infection varied significantly between groups (HCA 77%, HA 45%, CA 0%; p=0.0005), as did history of prior SA bacteremia (HCA 51%, HA 15%, CA 0%; p=0.004). Concomitant osteomyelitis was present in 83% of CA bacteremia cases, compared with 0% of the HCA and HA cases (p<0.001). CA SA bacteremia isolates were more likely to be clindamycin susceptible (100%) compared with the HCA (42%) and HA (60%) isolates (p=0.028). Patients with HCA SA bacteremia had higher rates of readmission in the next 30 days (57%), compared with 17% for the CA group, and 20% for the HA group (p=0.01). Differences between groups were also observed in antibiotic prescribed and in utilization of infectious disease consultation.

**Conclusion:** CA, HCA and HA pediatric bacteremia cases differ in their clinical characteristics, antibiotic susceptibility and outcome measures. These data support the clinical relevance of these classifications in the pediatric population.
Randomized Controlled Trial of Nebulized N-Acetylcysteine in a Newborn Pig Model of Meconium Aspiration Syndrome

Ann Simones, Andrea Lampland, Robyn Reed, Mark Mammel, Cathy Worwa, Michael Toombs, Alexander Ginder, Kari Roberts

Meconium aspiration syndrome (MAS) accounts for approximately 1,000 infant deaths in the United States each year. Exogenous surfactant has shown clinical benefit in both laboratory and clinical studies, however since institution into clinical practice overall mortality rates are unchanged. Agents that alter the physical properties of meconium have not been studied. We hypothesized that nebulized N-acetylcysteine (NAC), a drug with known mucolytic and anti-inflammatory properties, in addition to surfactant will improve oxygenation and ventilation and decrease short-term markers of inflammation in a piglet model of MAS.

We induced MAS in thirty newborn piglets by intra-tracheal administration of 20% human meconium. Once MAS was achieved (P_{aO2} < 100 torr on two serial blood gases 10 min apart) piglets were randomized into one of three groups: 1) Control 2) Surfactant and 3) Surfactant plus nebulized N-acetylcysteine. Short-term respiratory physiology endpoints, ventilator settings, vital signs, and arterial blood gases were monitored and recorded every 15-30 minutes for the 6-hour study period. At study end, blood was sampled for inflammatory cytokine levels. Lungs were dissected for analysis of wet/dry ratio, histologic scoring, and analysis of cytokine levels in tissue homogenate.

Compared to controls both treatment groups showed trend toward increased compliance (p = 0.09) and decreased peak inspiratory pressures (p = 0.09). Atelectasis scores were lower in both treatment groups (p = 0.1). Wet-dry ratios and interleukin levels/TNF-α were not different between any of the groups.

Nebulized NAC does not appear to be a beneficial adjuvant to surfactant in this MAS model.