

## Undergraduate Research Symposium May 18, 2018 Mary Gates Hall

### Online Proceedings

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#### POPULATION HEALTH

*Session Moderator: Clarence Spigner, Health Services*

**JHN 026**

*12:30 PM to 2:15 PM*

\* Note: Titles in order of presentation.

##### **Establishing and Sustaining Walking School Buses in Seattle Elementary Schools**

*Carolyn Celia Birkenfeld, ,*

*Mentor: Megan Herzog, Urban Design & Planning, Community, Environment & Planning*

A Walking School Bus is a safe, physically active way for children to commute to and from school with adult supervision. Volunteers walk along designated routes through the neighborhood, as students join the group to walk to school while practicing pedestrian safety skills and starting the day with exercise. With 21% of Seattle youth suffering from obesity and 83% of students living within the walk-zone of their school, there is a clear need and opportunity to provide students with a viable option to walk to school. The Seattle Department of Transportation (SDOT) Safe Routes to School (SRTS) division recognizes this gap and is looking toward Walking School Buses as a strategy to increase the number of children walking to school and improve traffic safety for children. I plan use this project to determine the most effective way that SDOT can provide support for schools across Seattle to establish their own Walking School Buses. One of the primary challenges in determining what support looks like, is identifying what schools need. Since every school has a different assortment of resources, assets, cultures, geographies, and capacities, a Walking School Bus will likely look very different from one school to the next. I plan to develop a set of recommendations that outline how SDOT can best support schools, what support looks like, and how that varies based on the school. I will conduct interviews with parents and schools staff who have had experience with Walking School Buses, develop case studies of Seattle walk-to-school programs, and research national and international examples. I hope to create a resource that can provide all elementary students in Seattle with a safe and viable way to walk to school.

##### **Placentomal Conversion as Adaptive Response to Maternal Pregnancy Stress: Pilot Findings in Pregnant Sheep Model**

*Yael Leah (Leah) Frank, ,*

*Mentor: Martin Frasch, Obstetrics and Gynecology*

Placentation, the formation of the placenta, is a dynamic process which is vital for the development of a fetus. A key structural feature of placenta in ruminants, such as sheep, is a placentome. Placentomes are thickenings in tissue that form along both the maternal and fetal sides of the placenta. During pregnancy, placentomes generally begin with the same type of structure, called Type A. Over the course of a gestation, Type A placentomes are found to convert to functionally more efficient forms (Types B, C, or D). Prenatal stress (PS) has been shown to reduce uterine blood flow in pregnant sheep model. This would influence placental blood flow, supply of nutrients, clearance of metabolites and exposure to stress hormones. Undernutrition accelerates the placentomal conversion in pregnant ewes of certain breeds as an adaptive response to maintain the fetal developmental growth curve, while other breeds are not able to adapt. We hypothesized that placentomal conversion is influenced by PS. We modeled chronic PS in the last trimester in pregnant sheep through re-occurring and unpredictable bouts of maternal isolation over a period of 30 days, a validated paradigm to model human PS. At ~136 days of gestation (full term is 145 days), the placentomes were collected, weighed, and sorted according to their morphology. The weights of Type B, but not Type A, placentomes were found to be lower for the stressed sheep when compared to the control. These findings confirm our hypothesis that PS reduces the degree of the placentomal conversion from Type A to a more advanced form, Type B. This may be caused by a chronic reduction in placental perfusion (blood circulation) during PS. The found reduction in placentomal conversion may be one of the missing mediating factors linking PS to known postnatal developmental abnormalities in metabolism and phenotype.

### **Development of a Healthcare Utilization Survey to Assess Costs of Preventive Healthcare Services for Infants, 0-3 years old**

*Rachel Juanita Hurst, ,*

*Mentor: Tumaini Coker, Pediatrics*

The American Academy of Pediatrics recommends 10 preventive care visits, known as “well child care” for all children during the first three years of life. Multiple innovations in the delivery of these visits have been proposed, including group visits, team-based care, and e-visits. While some of these interventions have evidence of effectiveness, it is critical to understand how changes to delivery of care will impact utilization, and thus costs of health-related services for children. The objective of this study is to develop a parent-reported utilization survey to allow a full assessment of potential costs for making improvements to the structure of well child care. After a review of the literature, we developed the utilization survey, which included health and health-related services applicable to infants and new mothers. We included utilization for multiple services, including emergency department visits, inpatient hospitalizations, urgent care visits, early intervention services, maternal mental health services, support groups for new mothers, dental visits, and case management/social services. Each component collects data on how many times the child and/or parent utilized each service and the reason for service use. Each service is also matched to an estimated average cost, specific to California and Washington state. Once completed, the survey will be used in a large, cluster randomized controlled trial of a redesigned system for the delivery of well-child care at ten community clinics, serving a primarily Medicaid-insured population of children. This utilization survey may also be applicable to other efforts to implement well-child care delivery design in other settings.

### **Isotachophoretic Extraction of Nucleic Acids from Human Serum for Point-of-Care Viral Load Test**

*Amanda Moon Levenson, ,*

*CoMotion Mary Gates Innovation Scholar; Levinson*

*Emerging Scholar; Mary Gates Scholar*

*Mentor: Jonathan Posner, Mechanical Engineering*

*Mentor: Andrew Bender, Mechanical Engineering*

36.7 million people worldwide are living with HIV/AIDS, of which almost 15 million receive antiretroviral therapy (ART). These patients require regular HIV-1 viral load (VL) tests to monitor ART effectiveness and compliance. However, the majority of affected people live in low-resource settings where disease monitoring through medical laboratory-based systems, such as nucleic acid amplification tests (NAATs), are inaccessible. There is an increasing need for accurate, affordable HIV-1 VL tests at the point-of-care (POC). We previously demonstrated the ability to leverage an electrokinetic separation and preconcentration technique, isotachopheresis (ITP), and an isothermal nucleic acid amplification method to

develop a proof-of-concept POC NAAT for extraction, amplification, and detection of nucleic acids from human serum. The limit of detection (LoD) of our paper-based test was hampered by the loss of nucleic acids during ITP across the paper membrane. This work is focused on lowering the LoD of our test by improving the isotachophoretic extraction of nucleic acids from human serum. We have addressed the adsorption of nucleic acids by screening membrane types and pre-treatment methods. We have observed significant nucleic acid entanglement of DNA greater than 50,000 base pairs in length, which we can mitigate using DNA shearing techniques. We have also developed specialized ITP chemistries for increased extraction efficiency. The completion of this work will result in more effective separation and purification of nucleic acids from human serum, ultimately leading to a reduction of target loss and improved test sensitivity. Employing the ITP extraction techniques developed in this work will aid our lab’s ongoing efforts to create a POC NAAT for monitoring HIV-1 viral load.

### **Novel Photo-Based Food Diaries to Support Patient-Provider Collaboration**

*Chelsea Wang, ,*

*Mentor: Sean Munson, Human Centered Design & Engineering*

*Mentor: Christina Chung, Human Centered Design & Engineering*

Patients and providers are beginning to use patient generated-health data (PGHD) to collaborate to understand patient routines, identify health problems, and tailor treatment strategies. However, current technology designs fail to support key aspects of collaboration, including planning, data collection, review, and analysis. Among all the health data people track, food data is essential for preventing and managing many health concerns. Although numerous tools exist to help people track and understand their diet and its consequences, these tools are often high burden, can lead people to focus on what is easily tracked rather than what is most relevant for their health, and fail to support effective collaboration between providers. In this study, we designed, developed, and deployed novel food tracking diaries to support healthy eating and the management of irritable bowel syndrome (IBS). Eighteen people with healthy eating goals used the food diaries for at least two weeks, and then worked with their health providers to plan changes to their diet. Sixteen IBS patients used the IBS version of the diary for at least nine days and then worked with providers to identify food triggers and plan changes. We interviewed patients and providers and observed their collaborations. The photo-based food diaries we designed supported patient-provider communication for both healthy eating and IBS. Compared to traditional food diaries, the photo-based food diaries make data collection, review, and analysis easier for patients and providers. However,

patients and providers described scenarios when specific nutritional information – beyond what they can see in photos – helped the diagnostic or management process, such as when identifying IBS triggering nutrients. Our research will lead to better use of PGHD to give patients more tailored, accurate, efficient and informed treatment plans. Our results also inform the design of food diaries that will better support people with different various health goals.

### **Multiracial Microaggressions in Healthcare**

*Prince Wang, ,*

*Mary Gates Scholar, UW Honors Program*

*Mentor: Cyndy Snyder, Family Medicine*

Research into health disparities often focuses on minority groups, but there is a distinct lack of literature surrounding multiracial peoples' experiences in healthcare, especially with racial microaggressions. Improving our understanding of their experiences with microaggressions presents an opportunity to enhance the communication process between providers and patients. This study aims to characterize the manners in which microaggressions manifest in the healthcare setting for multiracial individuals and families. Thirty one individuals who (1) identified as multiracial (i.e., more than one race) or were part of a multiracial family and (2) who received or had a family member receive healthcare within the past 12 months shared their healthcare experiences with racism, racial bias, and racial microaggressions in an interview or focus-group setting. Using content analysis, we identified six predominant racial microaggressions: mistaken identity, mistaken relationships, fixed forms, entitled interrogator, pervasive stereotypes, and intersectionality. Multiple participants stated that although these microaggressions were similar to those they experienced in everyday life, it was fundamentally different in the healthcare setting due to the power dynamic between patients and providers. Obtaining a more nuanced understanding of how multiracial microaggressions present in healthcare allows for the identification of areas in patient-provider communication that can be improved to provide more culturally competent care, as well as encourage greater patient engagement with their own health in this setting.