*Medicine of the Highest Order*

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# Abstract Journal

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**SUMMER RESEARCH**

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Basic Clinical Translational Science Research

## "Assessing the Musculoskeletal Health Literacy and Social Network Distribution of Hip and Knee Osteoarthritis Patients at an Academic Medical Center"

**Burger, Philomena**

Preceptor
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**Background**

In the United States, osteoarthritis (OA) care expenditure – inclusive of total joint arthroplasty (TJA) – surpasses $300 billion annually with further escalation of spending anticipated. As a result, the U.S. has begun a transition to value-based TJA healthcare, rewarding quality of professional services and patient-care experience over traditional fee-for-service transactions. Health literacy (HL), defined as the ability to obtain, process, and understand health information in order to make appropriate health care decisions, has been identified as a social determinant of healthcare, potentially impacting patient-care experiences. Limited HL contributes to health disparities and ineffective care, and negatively affects healthcare outcomes in TJA as well as non-Orthopedic medical disciplines. HL is predominantly distributed in social networks, where patients draw upon the knowledge of others to make healthcare decisions. Patients may rely on physicians, family, friends, and acquaintances, as well as the internet and social media to shape their healthcare knowledge. The aim of our study is to explore the association of individual musculoskeletal HL on preferred lower-extremity osteoarthritis information sources. Our hypothesis is that patients with low musculoskeletal health literacy (LiMP score < 6) will preferentially utilize human informational sources.

**Methods**

Patients presenting to the University of Rochester Department of Orthopaedics Ambulatory Care clinic with a primary diagnosis of severe hip and/or knee osteoarthritis were recruited. Patients with prior TJA were excluded. Participants completed a one-time 3-part survey which assessed patient desire for total hip/knee surgery, Literacy in Musculoskeletal Problems (LiMP) score**,** and patient healthcare informational sources. Mean LiMP scores were calculated for each information source and p-values were generated by comparing LiMP scores among participants who reported an information source, and participants who did not report that information source.

## Results

39 patients (39%) generated a LiMP score below 6. Participants identified their joint surgeon and staff (82%), friends/extended family with TJA (69%), friends/extended family without TJA (9%), primary care physician (42%), internet/media (33%), and coworkers/acquaintances with TJA (25%) as information sources. Out of the participants who reported internet/media sources, 29 (87.9%) used multiple websites through the use of search engines (Google, Yahoo, Bing), 13

(39.4%) used social media (YouTube, Facebook, Twitter, etc.), and 12 (36.4%) utilized University of Rochester websites. The mean LiMP scores were: 6.06 (±1.56, p=0.03) for the selection of total joint surgeon and staff and 5.90 (±1.81, p=0.98) for the selection of primary care doctor.

**"Assessing the Musculoskeletal Health Literacy and Social Network Distribution of Hip and Knee Osteoarthritis Patients at an Academic Medical Center"**

The mean LiMP scores were 5.62 (±1.94, p=0.50) for the selection of spouse/partner, 6.00 (±1.41, p=0.90) for the selection of children, 6.52 (±1.42, p=0.03) for the selection of coworkers/acquaintances, and 6.36 (±1.43, p=0.05) for the selection of internet/media.

## Conclusion

A LiMP score of <6 indicates a limited musculoskeletal health literacy. All information-source groups, except for spouse/partner and primary care doctor, had an average LiMP score above six. Participants who chose spouse/partner as a source of information and participants who chose primary care doctor as a source of information had an average score below 6. Although not statistically significant, our findings suggest TJA health literacy interventions should target both individual patients and patients' social networks. Additionally, increasing the incidence of quality TJA experiences in undeserved social networks will help promote TJA in underserved populations.

**Cafro, Carolyn**

Preceptor

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**Early Pulmonary Hypertension Phenotypes in the CRADLE Study Cohort of Extreme Preterm Neonates**

**Introduction**: Advances in perinatal care have contributed substantially to the survival of preterm-born infants. Nevertheless, mortality in the first years of life remains high, ranging from 8% to 35%, depending on gestational age. Respiratory and neurodevelopmental morbidities are frequent. Pulmonary hypertension (PH) is being increasingly recognized in preterm-born infants and is associated with mortality and long-term cardiorespiratory morbidity.

**Objective**: To better identify early pulmonary hypertension phenotypes in extremely preterm neonates.

**Methods**: Data was extracted on extremely low gestational age neonates (n=438) from birth year 2016-2021. Neonates who underwent an echocardiography within the first 10 days of life and underwent a subsequent echocardiogram between 30-36 weeks adjusted gestational age were included. Infants with congenital heart disease (except for PDA and small ventricular septum defect) or other congenital anomalies such as congenital diaphragmatic hernia were excluded. Echocardiograms were assessed though medical archives and pulmonary vascular resistance index and eccentricity indexes were measured.

**Results**: Early PH was identified in 46% of 340 included infants, including 11% with persistent PH of the newborn (PPHN), 80% with flow-associated PH, and 9% PH without shunt. Chi-squared analysis indicated a trend of increased oxygen use for neonates with early PH.

**Conclusions**: Early PH was found to be highly prevalent (46%) in extremely preterm neonates. No clear associations of the PH phenotypes can be made with the maternal, neonatal and postnatal parameters tested. Further data extraction and analysis is needed to identify significant early indicators of PH and its phenotypic subtypes. The most prevalent phenotype observed was flow mediated PH.

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### Title: Patient-Focused Narratives on Adolescents and Young Adults' Lived Experiences with Sickle Cell Disease

**Background:** Sickle cell disease (SCD) is a homozygous recessive disease that results in abnormal hemoglobin production increasing the likelihood of serious medical complications and extreme episodes of pain. SCD affects roughly 100,000 individuals in the United States with increased rates reported in Black/African American and Hispanic populations. Optimal care is complicated by stigma, bias, and racism. Quantitative research of adolescent and young adults (AYA) experiences is underrepresented in outcomes literature. The present study utilizes narrative interviews and thematic analysis to better understand patient experiences and inform points of intervention.

**Methods:** In this IRB-approved study, a single semi-structured interview was administered to patients aged 13-21 with sickle cell disease (Hemoglobin SS, SC, and SBeta-Thal genotypes) living in a mid-sized metropolitan center and receiving care at an academic teaching hospital with community affiliates. Patients were recruited from inpatient units, ambulatory continuity clinics, and community advocacy groups. Interviews were conducted and recorded either in-person or remotely according to patient preference. Interviews were transcribed and independently checked for accuracy by the research team. Interview questions included topics such as: coping with pain in medical and non-medical settings,

interactions with the healthcare team, impacts of pain on social and community life, and what they wished others could understand about living with SCD. Transcripts were analyzed for thematic coding by 2 independent coders using a deductive approach with latent textual analysis (Braun & Clarke, 2013). Codes were translated into (Ryan, 2011). Study team members performing thematic coding were not members of the patient's clinical care teams, and patients did not provide interviews during acute pain crises. Based on preliminary analysis of key interview themes, a systematic literature review of >150 existing citations was used to inform targeted hospital and community-based education strategies to address points in the pediatric sickle cell trajectory vulnerable to bias and disparate outcomes.

**Results**: A total of 8 interviews were completed and analyzed for thematic coding with the median patient age of 17 years since the opening of the study.  Concordant coding revealed five primary themes: (1) the relationship between acute and chronic pain, (2) coping with rituals and cycles of care, (3) the unpredictable nature of pain, (4) navigating a biased healthcare system, and (5) social isolation. Results of thematic coding can be found in Table 1. Using these themes, a second review of all narrative interview transcripts, and based on the systematic literature review of qualitative education interventions for sickle cell disease, we identified ***hospital emergency care*** settings and ***school-based health offices*** as high-impact targets for quality improvement education interventions to reduce bias and stigma for pediatric sickle cell pain. A comprehensive and systematic review of publicly available, peer-reviewed education resources for pediatric sickle cell education was then undertaken to inform the development of best practices for sickle cell education in these two settings for pre- and post-intervention piloting.

**Discussion and Ongoing Research:**

Patient narratives remain largely underrepresented in the literature on SCD outcomes. The present findings, in the context of the larger body of literature, suggest that the transition from pediatric to adult care is a crucial point for intervention and education to improve patients' outcomes. Patients with SCD described the challenges of navigating a biased healthcare system with providers dismissing or doubting their pain and using stigmatizing language. With acute-onset pain management being vulnerable to bias and under treatment, we are developing an education tool aimed at improving recognition of qualitative pain experiences and improved pain control in the pediatric emergency setting, and we will be piloting in the University of Rochester Pediatric Emergency Medicine Fellows education conference. Likewise, and based on these results, we are developing an evidence-based toolkit for distribution to the Rochester City School District health offices- starting with schools that participate in our school-based TeleHealth program- to increase awareness, reduce stigmatizing language, and improve ambulatory management of mild-moderate pain crisis.

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| Themes | Subthemes | Example Codes | Frequency |
|---|---|---|---|
| **Relationship between acute and chronic pain** | Intense Physical Pain | Excruciating and horrendous pain<br>Pain in specific areas of the body | 6/8 |
| | Emotional Pain | Stress and exhaustion from pain<br>Feelings of frustration, sadness, and anger | 4/8 |
| | Progressive Pain | Increased pain episodes<br>Increased hospitalizations | 2/8 |
| **Cycles of Care** | | "Constantly taking medications"<br>"Transfusions every month" | 5/8 |
| **Unpredictable Journey** | Sense of Foreboding | "Unpredictability"<br>"Sudden onset of pain" | 4/8 |
| | Perseverance | "Stay-strong mentality"<br>"Constant battle" | 5/8 |
| **Navigating a Challenging Care System** | Doubt and Marginalization | "Disbelief from providers"<br>"Dismissal" by providers<br>"Refusing to listen to me" | 4/8 |
| | Difficulty with Transition | "Negative attitudes from adult providers compared to pediatrics"<br>"Increased wait times in adult clinic and emergency" | 2/8 |
| | Lack of Awareness | "Lack of experience with SCD patients in adult medicine"<br>"Lack of awareness' from adults in school settings | 3/8 |
| | Patient Advocacy | Advocates as providers or family members<br>Increased understanding in the presence of an advocate | 2/8 |
| **Isolation** | Unrelatable Aspect of Pain | Pain being "indescribable"<br>"Not fully understandable unless you have SCD" | 4/8 |
| | Isolation from Social Life | "Missing out due to pain and hospitalizations"<br>Separation from "normal" teenagers and teenage life | 6/8 |
| **Community Support** | | Local community groups<br>Friends who have SCD | 4/8 |

**Table 1: Key themes derived from concordant narrative codes. Frequency denotes the number of interviews/total interviews in which a code appears via key-words-in-context.**

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Preceptor

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## Demographics and Clinical Profiles of Patients Visiting the Pediatric Allergy and Immunology Clinic at URMC

**Background:**

The impact of social determinants on health outcomes is well-established, encompassing factors like socioeconomic status, housing conditions, and educational access [1]. One growing concern is the rising prevalence of life-threatening food allergies, affecting over 5.9 million children, with 40% of cases considered life-threatening [2]. Furthermore, studies have established a correlation between income status and the severity of allergies, with children from lower-income backgrounds being hospitalized 2.5 times more often for food allergies than those from higher-income backgrounds. [2]

A parallel concern revolves around asthma, particularly in urban settings, where residents suffer from worsened severity compared to other populations in the US [3, 4]. This is notably attributed to continued exposure to pollutants and allergens like cockroaches, mice, and pests, which have led to an increase in asthma prevalence and sensitization among adolescents [5].

Moreover, a combination of various elements, including pollution from inner-city living, socioeconomic status, transportation access, healthcare availability, and referral rates, collectively influence the development and severity of asthma.

**Objective:**

The purpose of this study is to create a preliminary demographic analysis of the patient population seen at the Pediatric Allergy and Immunology Clinic at URMC. Our main goal is to thoroughly investigate how often various allergic conditions are diagnosed, how severe they are, whether patients stick to their follow-up appointments, and where referrals come from within this group of children. Additionally, we explore the types and extent of allergy testing, such as food and environmental assessments, spirometry, FeNO measurements, and allergen immunotherapy, that are performed.

Secondarily, we aim to pinpoint the most common allergens found during testing and explore possible relationships between eczema diagnoses and the future diagnoses of food allergies. In future studies, we aim to explore potential links and correlations between various factors, including race/ethnicity, demographics, and socioeconomic status, and how they impact the diagnosis, treatment, and outcomes of allergic conditions in our pediatric population.Ultimately, our study seeks to paint a detailed picture of our young allergy patients, exploring the critical factors that shape their diagnoses, referral sources, and appointment attendance.

**Methods:**

This retrospective study involves a review of patient records from 2018 to 2023, with data being collected from approximately 3,359 individuals of both male and female genders, aged 0-21, who sought treatment at the Pediatric Allergy & Immunology Clinic at URMC between February 2018 and February 2023, 122 of which provided sufficient data for analysis.

Data points to be collected include: gender, age, race/ethnicity, zip code, BMI (>=85%ile), eczema presence (yes or no), past medical history, reason for referral, referral source (PCP, specialist, community health center), eczema severity (mild, moderate, or severe), exposure to smoking in the home (yes or no), exposure to indoor allergens (mouse, other rodents, cockroach, dust), allergic rhinitis presence (yes or no), management of allergic rhinitis (nasal spray, daily $1^{st}/2^{nd}$ gen anti-histamine, lifestyle changes – allergy bedding/HEPA filter), asthma presence (yes or no), severity of asthma (mild, moderate, severe; on any controller medication for asthma, recent steroid use in the last year, hospitalizations in the last year, ICU admission (due to asthma), biologic medication use (Yes/No), eosinophilic esophagitis (yes or no), food allergy presence (yes or no), use of prevention strategies (HEPA filter, allergy bedding/pillowcases, pest control ), exposure of animals (if so, which ones), extent of allergy testing performed (whether they have skin prick testing (SPT), IgE levels, spirometry, or oral food challenges performed and is so, at what age).

All information is gathered via the electronic medical record (EMR) and entered into REDCap for data gathering and further statistical analysis.

**Results:**

In a study involving 3,359 participants, only 122 provided sufficient data for analysis. The analysis revealed key demographic insights regarding patients visiting the Pediatric Allergy and Immunology Clinic at URMC. Notably, zip codes 14621 and 14580 were the most frequently served, followed by 14612, 14613, 14611, 14616, and 14624. The most common age range for initial clinic visits was 3-5 years old, with Dust mites (F), Dust mites (P), Cat Dander, Grass mix 5, and Smooth Brome as the top five common aeroallergens during initial visits. During subsequent visits, Ragweed became a more prevalent aeroallergen. Primary care providers were the primary referral source, and 68% of patients with breathing issues reported no smoking exposure. For follow-up, 89% of our patients in the study were offered appointments, with 53.21% on average presenting for follow up within 1 year. Within each ethnicity, the breakdown of who presented for follow up was 51.8% for White, 43.8% for Black, 62.5% for Hispanic, and 100% for Unknown. Of those that did not return for follow up within 1 year, only 14.3% of them

reestablished care later. Based on total patients seen in each respective ethnicity, Black patients had the highest occurrence (57.6%) of eczema, followed by White patients (29.4%). Of food allergies, Lobster, Egg white, Peanut, Shrimp, and Almond were the top five allergens during initial visits. By demographics, Black patients had the worst average severity of asthma, followed by Hispanic patients, and then White and Unknown being tied for least severity. Lastly, in the course of management of asthma, most patients remained stagnant in their diagnosis, with 50% remaining stagnant with a positive diagnosis, 28% improving, and 22% aggravating or developing asthma.

Conclusions:

This study has developed a preliminary demographic description of the pediatric patients within our clinic to better serve our population. It is important to acknowledge that our initial sample size is relatively small, and there is a noticeable skew towards self-reported White ethnicities among our patient demographics. Nonetheless, our study provides valuable demographic insights into the patients visiting the Pediatric Allergy and Immunology Clinic at URMC, providing data regarding follow up rates, reestablishing care, and highlighting the most common allergens encountered during patient visits, which in turn informs our clinical practices, prevention, and treatment strategies. It is worth noting, however, that further research and rigorous statistical analysis are essential to better serve our continually growing patient population at the Pediatric Allergy and Immunology Clinic at URMC.

References:

1.      Viner, R.M., et al., *Adolescence and the social determinants of health.* The Lancet, 2012. **379**(9826): p. 1641-1652.
2.      Bilaver, L.A., et al., *Socioeconomic Disparities in the Economic Impact of Childhood Food Allergy.* Pediatrics, 2016. **137**(5).
3.      Matsui, E.C., et al., *Asthma in the inner city and the indoor environment.* Immunol Allergy Clin North Am, 2008. **28**(3): p. 665-86, x.
4.      Matsui, E.C., *Role of mouse allergens in allergic disease.* Curr Allergy Asthma Rep, 2009. **9**(5): p. 370-5.
5.      Matsui, E.C., *Environmental exposures and asthma morbidity in children living in urban neighborhoods.* Allergy, 2014. **69**(5): p. 553-8.

# Deacon, Alyssa

**Title**
The Diabetes in Pregnancy Program: Comparing Centralized Multidisciplinary Management with Traditional Diabetes Care

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**Site of Research**
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**Abstract**

Objective
Diabetes mellitus (DM) during pregnancy requires complex care coordination to affect individualized management and engagement in care. Interdisciplinary healthcare teams composed of maternal-fetal medicine, endocrine, and nutrition specialists have been proposed as a centralized model. At our institution, an integrative Diabetes in Pregnancy Program (DiPP) was initiated in 2022. We sought to evaluate whether DiPP promoted tailoring of medication management and patient engagement.
Study Design
In a pre-post observational study, data were collected from patients who participated in standard DM management and compared to those who enrolled in DiPP. The primary outcome was the number of treatment adjustments per pregnancy. Secondary outcomes included maternal and neonatal outcomes. Binary data was analyzed with Fisher's exact test or chi-square test. Continuous data was analyzed with a Mann- Whitney U test or ANOVA, pending distribution.
Results
293 patients met inclusion criteria, with 166 in traditional management and 127 enrolled in DiPP. Maternal characteristics did not differ between the groups. Type of DM differed between groups, with less individuals with GDM and more with T2DM in the DiPP cohort (T2DM: 29(17.3%) traditional vs. 42(33.6%) DiPP; GDM: 130(77.4%) traditional vs. 78(62.4%) DiPP, $p < 0.005$ for both). DiPP participants had significantly more adjustments to their treatment regimen ($p = 0.001$, Cohen's d = 0.614). DiPP participants also had significantly more prenatal ($p = 0.001$) and nutrition visits (0.004) (Table 1). No maternal or neonatal outcomes reached statistical significance.
Conclusion
An interdisciplinary and centralized DM care model during pregnancy enhances engagement with the healthcare team and allows for precise tailoring of treatment plans across gestation.

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Table 1: Prenatal Care Factors

| | Pre-DIPP (n = 166) | DIPP (n = 127) | P-Value |
|---|---|---|---|
| Number of prenatal visits | 11.0 ± 3.3 | 13.3 ± 4.4 | 0.001 |
| Number of Triage Visits | 1.16 ± 1.95 | 1.14 ± 1.62 | 0.743 |
| Number of Nutrition Visits | 1.63 ± 2.2 | 2.0 ± 2.2 | 0.004 |
| Use of Medications for DM | 92(54.8%) | 96(76.8%) | 0.001 |
| Number of Treatment Adjustments | 2.9 ± 2.6 | 4.8 ± 3.5 | 0.001 |
| Use of Short-Acting Insulin | 48(28.9%) | 58(47.2%) | 0.002 |
| Use of Long-Acting Insulin | 68(40.7%) | 75(61.5%) | 0.001 |
| Use of Metformin | 41(24.8%) | 43(34.4%) | 0.076 |
| Use of Glyburide | 1(0.6%) | 4(3.3%) | 0.167 |
| Use of CGM | 17(10.1%) | 39(31.5%) | 0.001 |

Legend: Data are reported as mean; DiPP – Diabetes in Pregnancy Program; cgm – continuous glucose monitoring; dm – diabetes mellitus

**Dexter, Brandon**


Title:       **Recent advances in peripheral nerve regeneration and technologies**


Authors:       Brandon Dexter, Danielle Mayorga-Young, Richa Patel, Timothy Olsen, Mark Noble, Jonathan Leckenby

A significant hurdle in the field of plastic surgery and reconstruction remains the inability to repair peripheral nerves after traumatic injury. While small and non-invasive injuries can be surgically ligated with high efficacy in reanimating target tissues, larger more invasive injuries have limited and often poor sensory and motor outcomes due to limited repair techniques and our limited knowledge of peripheral nerve regeneration mechanisms. Peripheral nerve injuries constitute 3% of all visits to level 1 trauma centers, and limited medical interventions to repair these injuries constitute a range of comorbidities and disabilities for these patients. However, research over the past 10 years has improved our understanding of peripheral nerve regeneration. Key to developing newer and better interventions is the understanding of the mechanisms and pathways of peripheral nerve regeneration. The purpose of this study is to summarize key findings in the realm of peripheral nerve regeneration as a means to consolidate improvements and key findings to improve patient care for those experiencing peripheral nerve injuries.

Significant research has been done to elucidate drug targets in the pathways of nerve regeneration and this research into drugs like tacrolimus, which functions as an immunosuppressant, has shown promising results in nerve regeneration in murine animal models. Even more exciting, is research that has been done into the development of new synthetic nerve sheaths that function as scaffolds to direct regenerating neurons. Current limitations of auto/allo/xenografts have motivated interest in new grafts and scaffolds to aid in repair of large and invasive nerve injuries. Groups interested in this research have begun pairing these scaffolds with drugs and electrical stimulation, demonstrating increased capacity for peripheral nerve regeneration via increased ROS and its associated influence of stem cell differentiation. Advances in drugs, materials of scaffolds and grafts outlined in this review, as well as advances in our understanding of electrical stimulation and PEG fusion, and their potential and efficacy will be discussed in this review. Many of these advancements demonstrate promising results and have the potential to benefit many patients suffering from irreparable sensory and/or motor function loss as a result of a peripheral nerve injury.

This research was conducted at the University of Rochester Medical Center.

Evans, William

## Brain Metastasis Free Survival of <u>HER2</u> <u>Low</u> and <u>HER2</u> <u>Zero</u> Triple <u>N</u>egative Metastatic <u>B</u>reast <u>C</u>ancer: A Wilmot Cancer Institute Experience (The HERZELO-TNBC Study)

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**BACKGROUND:**
Brain metastasis (BM) is associated with poor prognosis in metastatic breast cancer (MBC) patients. Most systemic therapies have limited activity against brain metastasis. Additionally, BM may have a different and more evolved resistance pattern than primary malignancy or other extra CNS metastasis. Breast cancer can be histologically categorized into 1. hormone receptor positive (HR+) HER2 negative (HER2 -) type, 2. HER2 + type and 3. Triple-negative (HR-, HER2-) type based on the tumor expression of HR and HER2 protein. HER2+ and triple-negative BC are more likely to have CNS failure (development of BM) compared to HR+ HER2- BC. "HER2 low" is an evolving subcategory of HER2- types (HR+/HER2- and triple-negative) where there are some HER2 protein expressions on the tumor but inadequate to meet the cut-off for being HER2+. HER2- BC with no HER2 protein expression is now designated as "HER2 zero". It is unclear whether, among HER2- BC, the level of HER2 expression is associated with CNS failure.

**OBJECTIVE:**
Compare the central nervous system (CNS) metastasis-free survival of HER2 low vs. HER2 zero histology among triple negative MBC patients.

**METHODS:**
This study involved a retrospective chart review of metastatic breast cancer patients in the UR Medicine health system. A list of possible patients obtained from the URMC informatics team was screened for eligibility. Key inclusion criteria were 1. pathologically proven metastatic breast cancer patients, 2. treated at URMC between January 1, 2010 and January 1, 2022, 3. pathology

results available from a biopsy of the metastatic site, 4. Triple-negative histology. Patients with de novo brain metastasis at the time of stage 4 cancer diagnosis were excluded. Descriptive statistics of baseline patient characteristics for the study sample are summarized using medians (IQR) for continuous factors and frequencies and percentages for categorical factors. Data are analyzed using standard survival methods to assess the cause-specific risk of CNS failure. In addition, a competing risk approach is presented, which will evaluate the incidence of CNS failure in the context of systemic disease mortality.

Cause-Specific Analysis: Plots of the estimated CNS-failure-free survival distribution are created using the Kaplan-Meier (KM) method. Differences between estimated survival by Her2 status (low vs. zero) are assessed using the log-rank test. The cause-specific hazard is modeled using a Cox model, which includes a predictor for Her2 status and adjusted for other important covariates.

Competing Risks Analysis: Plots of the cumulative incidences functions are produced for time to first CNS failure stratified by Her2 status (low vs zero), and incidence rates are reported with 95% confidence intervals (CI). Differences in CNS failure incidence are evaluated using the Gray's test. A sub-distribution (Fine-Gray) hazard model for time to first CNS failure accounting for death from any cause as a competing risk is fit, including predictor for Her2 status and adjusted for other important covariates.

Definitions and Data Description:

HER2 0 for this study is defined as breast cancer with a HER2 immunohistochemistry (IHC) score of 0. HER2 low for this study is defined as either HER2 IHC 1+ Or HER2 IHC 2+ with HER2 Fluorescence In-situ Hybridization (FISH) not amplified.

Hormone receptor-negative cancer is defined as estrogen receptor negative (ER-) AND progesterone receptor (PR-) cancer. CNS-failure-free survival is defined as the time from the date of MBC diagnosis to the date of first CNS metastasis. Overall survival is defined as the time from the date of MBC diagnosis to the date of death from any cause.

**RESULTS:**

Of 91 patients screened, 86 were eligible for analysis. Among the 86 eligible, 29 (34%) have low HER2, and 57 (66%) have HER2 zero metastatic triple-negative breast cancer. All eligible patients are females. Baseline characteristics between these two groups are shown in Table 1.

As of July 30, 2023, we have observed 32 CNS failures and 38 deaths without CNS failure among the 86 eligible hormone-negative subjects. KM survival analysis for OS (Figure 1) showed no statistically significant difference between HER2 low and HER2 zero groups (p=0.5110). After adjusting for covariates, there is no statistical difference in the rate of death for subjects with HER2 Low vs. Zero (Table 2). KM survival analysis for a composite endpoint of CNS failure OR death (Figure 2) showed no statistically significant difference between the two groups (p= 0.5322). Of note, only 45% of the events in this analysis were CNS failure before death.

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Cause-Specific Analysis for CNS Failure: 38 subjects who died without CNS failure are censored at the date of death. Without adjusting for other covariates that may predict CNS failure, the group with zero HER2 had a longer time to CNS failure than Low Her2 at the 8% significance level (Figure 3). After adjusting for important covariates in the Cause-Specific Cox model (Table 3), the time to CNS failure was significantly shorter for those with Low HER2 vs. Zero HER2 (HR=2.29, p=0.035).

Competing Risk Analysis: 38 subjects who died without CNS failure are not censored but kept in the "risk set" even though they have died. Cumulative incidence curves of CNS failure are shown in Figure 4. Without adjusting for other covariates that may predict CNS failure, the Gray test showed that the group with Zero HER2 had a significantly lower cumulative risk of CNS failure than Low Her2 (p=0.0491). The cumulative risk of CNS failure 24 months after MBC diagnosis is 44.2% (95%CI=27.7-70.7%) for those with HER2 Low vs 22.6% (95%CI=13.6-37.5%) for HER2 Zero. After adjusting for important covariates in a Sub-distribution Hazard Regression Model (Table 4), the cumulative rate of CNS failure was significantly higher for those with Low HER2 vs. Zero HER2 (HR=2.69, p=0.011).

## CONCLUSIONS:

Triple-negative metastatic breast cancer with HER2 low histology are more than two times at risk of developing CNS metastasis compared to those with HER2 zero histology. This higher risk with the HER2 low group was maintained while considering the death before CNS metastasis as a competing risk. Further validation of this interesting single institution study results in a larger dataset is required.

Table 1: Description of Sample

| Demographic and Disease Characteristics at MBC diagnosis | Total N=86 | HR Negative MBC | |
|---|---|---|---|
| | | Her2 Zero N=57 | Her2 Low N=29 |
| Age, years mean (SD) | 59.2 (12.9) | 58.7 (13.1) | 60.1 (12.7) |
| Race | | | |
| Asian | 2 (2.3) | 1 (1.8) | 1 (3.5) |
| Black | 13 (15.1) | 9 (15.8) | 4 (13.8) |
| White | 63 (73.3) | 44 (77.2) | 19 (65.5) |
| Other/Refused | 8 (9.3) | 3 (5.3) | 5 (17.2) |
| Hispanic Ethnicity | 6 (7.0) | 6 (10.5) | 0 |
| Any deleterious mutation | | | |
| No testing done | 25 (29.1) | 19 (33.3) | 6 (20.7) |
| None found | 55 (64.0) | 33 (57.9) | 22 (75.9) |
| At least one mutation | 6 (7.0) | 5 (8.8) | 1 (3.5) |
| Bone Involved | 42 (48.8) | 24 (42.1) | 18 (62.1) |
| Lymph Nodes involved | 66 (77.7) | 42 (75.0) | 24 (82.8) |
| missing | 1 | 1 | |
| Viscera Involved | 55 (64.0) | 35 (61.4) | 20 (69.0) |

Table 2:

| Proportional Hazards Model for Overall Survival | | | |
|---|---|---|---|
| Parameter | Hazard Ratio (HR) | 95% Hazard Ratio Confidence Limits | ChiSq Test: HR=1 P-value |
| HER2 (Low vs. Zero) | 1.117 | 0.664, 1.879 | 0.6760 |
| Age (per decade) | 0.934 | 0.764, 1.143 | 0.5070 |
| Race (white vs. non-white) | 1.268 | 0.694, 2.316 | 0.4407 |
| Bone Metastases (Y vs. N) | 1.806 | 1.080, 3.019 | 0.0242 |
| Lymph Node Involve (Y vs. N) | 1.451 | 0.728, 2.891 | 0.2898 |
| Visceral Metastases (Y vs. N) | 1.692 | 1.001, 2.859 | 0.0496 |

Table 3:

| Cause-Specific Cox Model for CNS Failure | | | |
|---|---|---|---|
| Parameter | Hazard Ratio (HR) | 95% Hazard Ratio Confidence Limits | ChiSq Test: HR=1 P-value |
| HER2 (Low vs. Zero) | 2.291 | 1.060, 4.952 | 0.0350 |
| Age (per decade) | 0.665 | 0.483, 0.917 | 0.0126 |
| Race (white vs. non-white) | 1.726 | 0.669, 4.453 | 0.2592 |
| Bone Metastases (Y vs. N) | 0.968 | 0.451, 2.078 | 0.9339 |
| Lymph Node Involve (Y vs. N) | 2.141 | 0.697, 6.572 | 0.1835 |
| Visceral Metastases (Y vs. N) | 1.526 | 0.682, 3.412 | 0.3033 |

Table 4:

| Sub-distribution Hazard Regression Model for CNS Failure | | | |
|---|---|---|---|
| Parameter | Hazard Ratio (HR) | 95% Hazard Ratio Confidence Limits | ChiSq Test: HR=1 P-value |
| HER2 (Low vs. Zero) | 2.694 | 1.254, 5.788 | 0.0111 |
| Age (per decade) | 0.688 | 0.505, 0.938 | 0.0179 |
| Race (white vs. non-white) | 1.304 | 0.536, 3.172 | 0.5589 |
| Bone Metastases (Y vs. N) | 0.691 | 0.321, 1.486 | 0.3441 |
| Lymph Node Involve (Y vs. N) | 1.293 | 0.506, 3.308 | 0.5912 |
| Visceral Metastases (Y vs. N) | 1.057 | 0.474, 2.354 | 0.8925 |

Basic

Basic

Figure 1:

Figure 2:

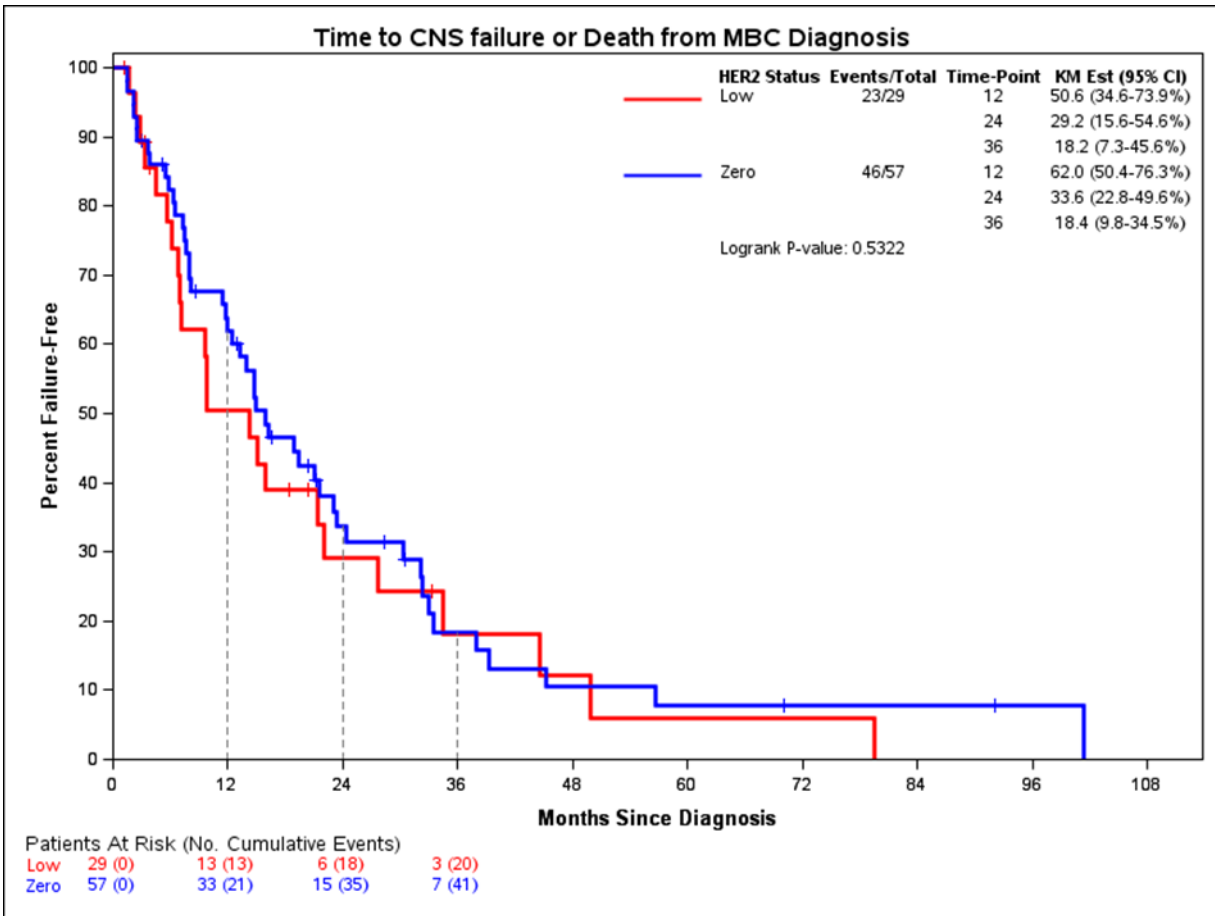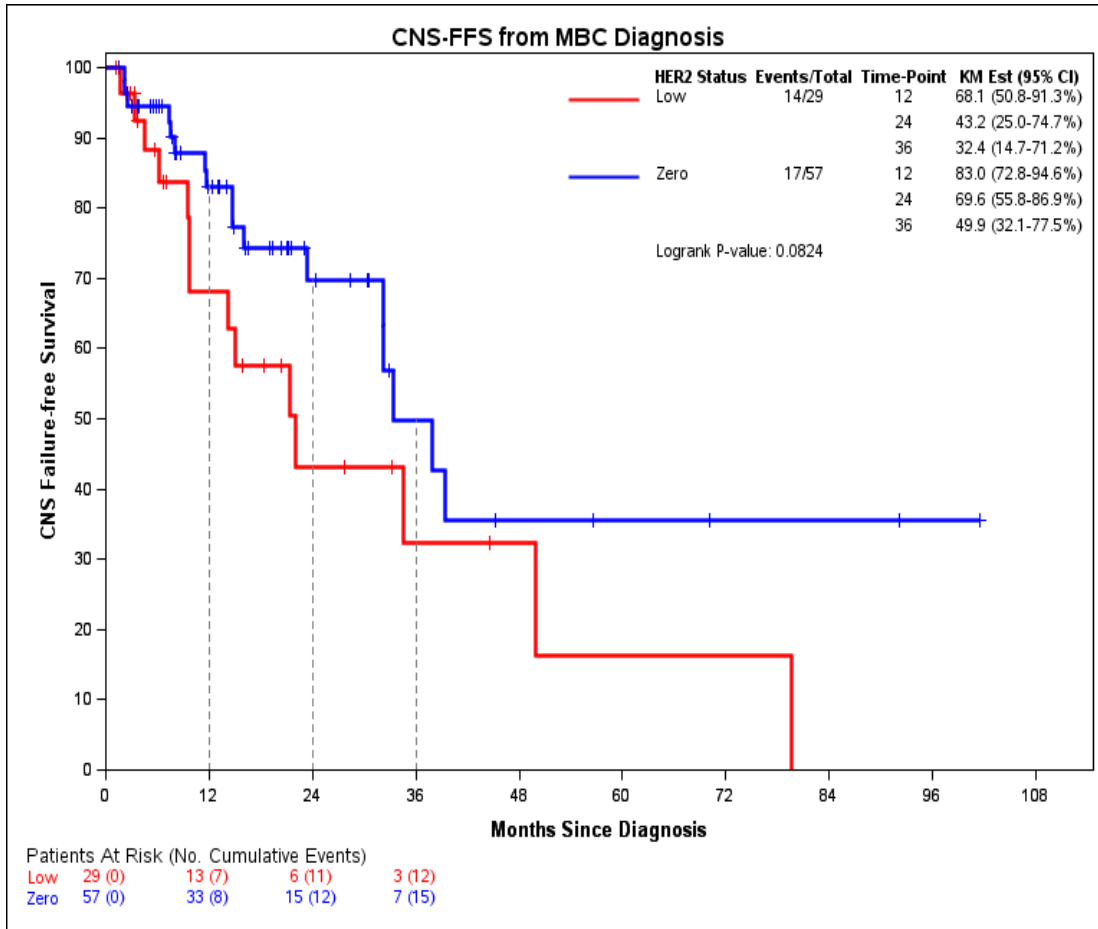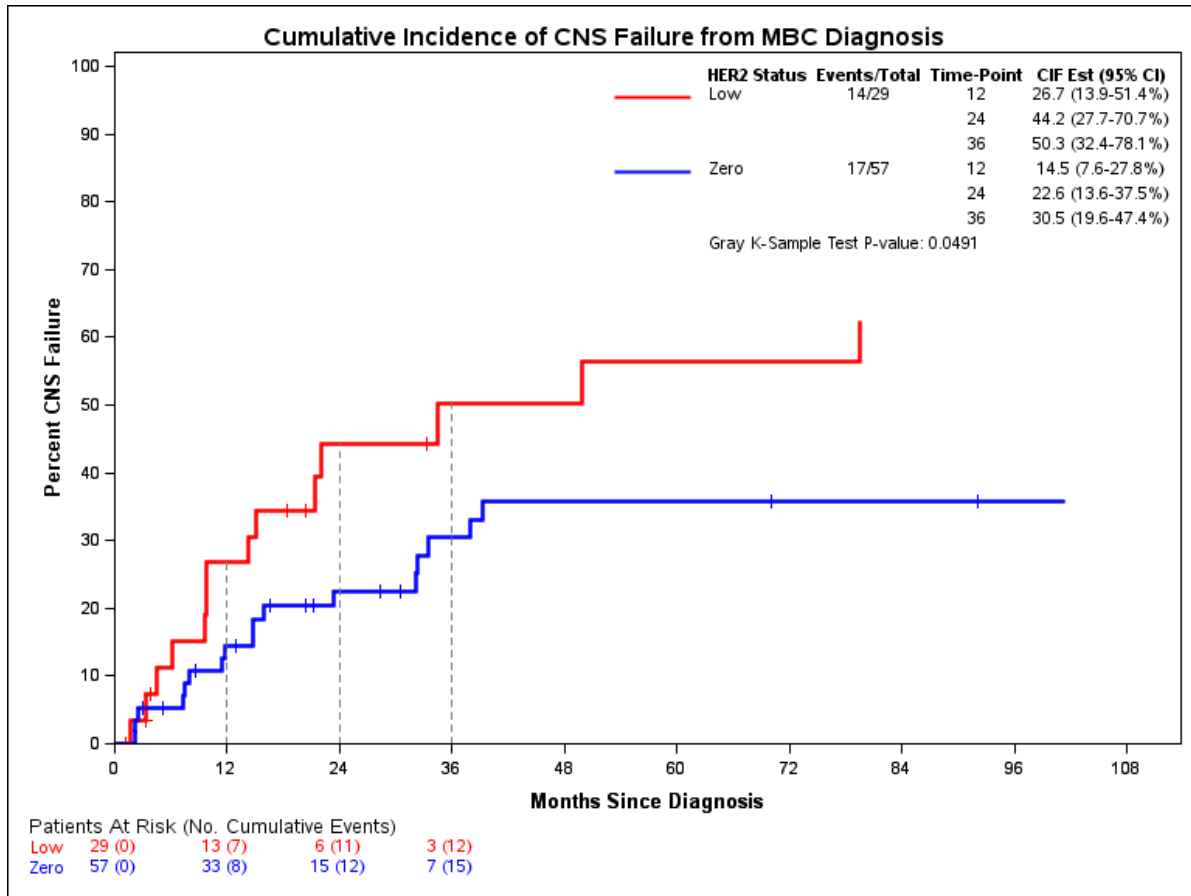Figure 3:

Cumulative Incidence of CNS Failure from MBC Diagnosis
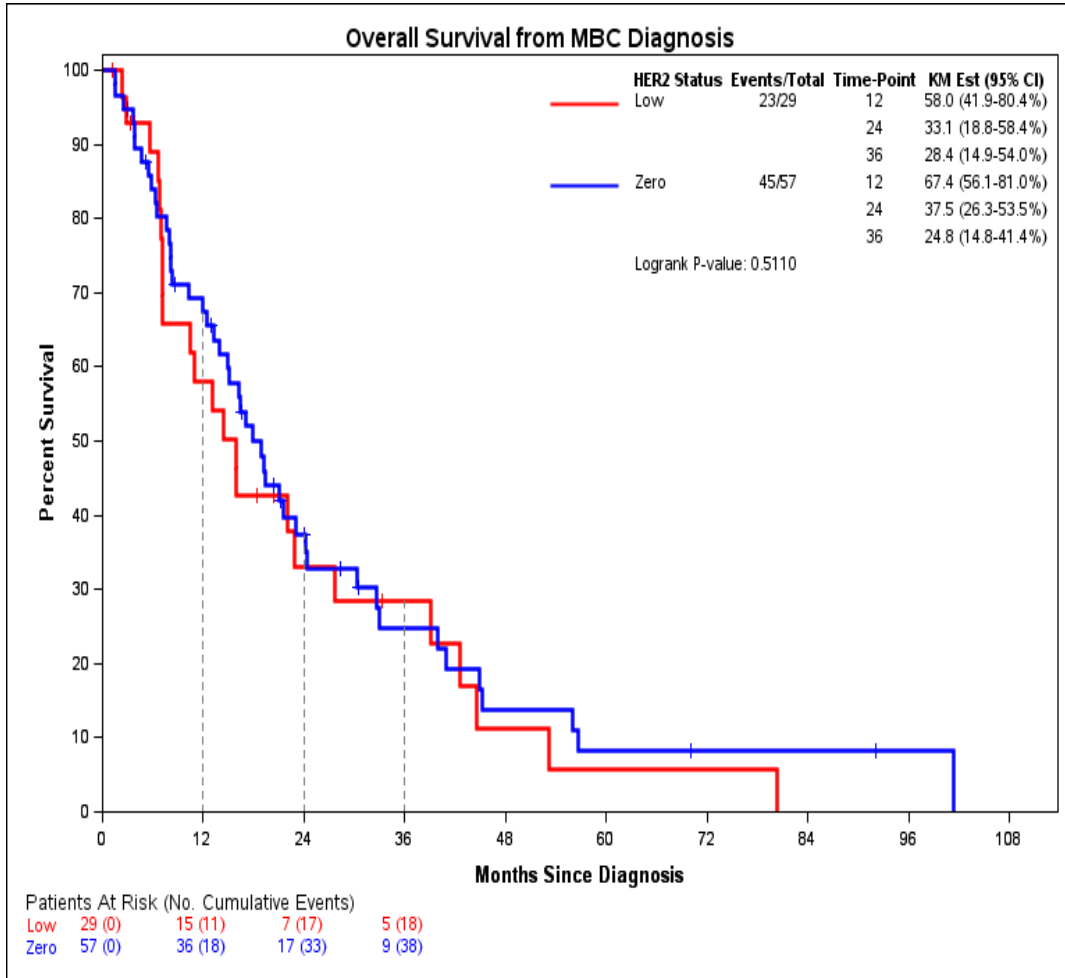
**Kalese Goodwin**
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**Understanding The Perspectives of Lung Cancer Screening Uptake Among Latinos Who Smoke via The Health Belief Model**

**Introduction**

Lung cancer is the leading cause of cancer death in the United States (U.S.) among men and women. Incidence and mortality rates vary by race, ethnicity, sex, and socioeconomic status, with Latinos bearing one of the highest burdens of lung cancer incidence and mortality.[1-2] Latinos are the largest minority group in the US. However, despite their large representation, Latinos remain one of the most underserved populations and continue to face enormous disadvantages in access to healthcare and screening.[3-8] Our project focused on understanding the individual perspectives of high-risk Latinos with regards to lung cancer screening. This will improve our understanding of why lung cancer screening is disproportionately low among Latinos. Moreover, our project aimed to move away from solely studying the barriers of lung cancer screening but also applying the Health Belief Model to shine light on the perceived benefits, perceived susceptibility, cues to action, and self-efficacy of lung cancer screening.[9] This comprehensive approach has the potential to serve as the foundation to develop innovative, accessible, and culturally appropriate solutions to increase uptake of lung cancer screening among Latinos. Addressing equity in lung cancer screening among Latinos is a public health priority and this project will serve as the foundation for a culturally competent solution.

**Objective**

To understand the perspectives of Latinos who smoke on lung cancer screening via the Health Belief Model. This understanding will guide the development of an intervention to increase lung cancer screening among Latinos.

**Methods**

In this qualitative study, participants were recruited in partnership with community-based organizations and the UR Medicine Lung Cancer Screening Program. The interviews were conducted in both Spanish and English and all interviews were audio-taped and subsequently transcribed verbatim The interview will explore participants' perceived benefits, susceptibility, barriers, cues to action, and self-efficacy in undergoing lung cancer screening. The Health Belief Model was used as a framework for interview guide development. All participants who report current tobacco use will be referred to Wilmot's Tobacco Cessation Center.

**Results**

We identified perceived susceptibility (e.g., Anybody can get lung cancer, second-hand smoke, exposure to environment/chemicals), severity (e.g., family burden, psychological impact, physical burden), benefits (e.g., early detection, prevention, quit smoking/reducing smoking), and barriers (e.g., lack of knowledge on the procedure, doctors did not discuss lung cancer screening, transportation), to lung cancer screenings in our population of interviewees. The interviews indicated cues to actions (e.g., self-motivation, learning about lung cancer screening through different avenues, influences to get screened, symptoms) that will encourage lung cancer screenings.

**Conclusion**

Multiple factors were displayed via the Health Belief model that played a role in accessibility and understanding the importance of lung cancer screening in the Latino Community. These factors identified why lung cancer screening is disproportionately low among the Latino community. Future research is needed to integrate these perspectives from the model to increase the amount of Latinos getting lung cancer screenings.

**References**

1. Siegel RL, Miller KD, Jemal A. Cancer statistics, 2022. CA Cancer J Clin. 2022; 72:7-33.

2. Miller KD, Goding Sauer A, Ortiz AP, Fedewa SA, Pinheiro PS, Tortolero-Luna G, Martinez-Tyson D, Jemal A, Siegel RL. Cancer statistics for Hispanics/Latinos, 2018. CA Cancer J Clin. 2018; 68(6):425-445.

3. U.S. Census Bureau. Race and ethnicity 2010, U.S. Accessed 07-14-2022. Available from www.census.gov/quickfacts/fact/table/US/PST045219

4. U.S. Census Bureau. Berchick ER, Hood E, Barnett JC. Health insurance coverage in the United Stated: 2017. Accessed 07-14-2022. Available from https://www.census.gov/content/dam/Census/library/publications/2018/demo/p60-264.pdf

5. U.S. Department of Agriculture. Rabbit MP, Smith MD, Coleman-Jenses A. Food security among Hispanic adults in the United States, 2011-2014. Accessed 07-14-2022. Available from https://www.ers.usda.gov/webdocs/publications/44080/59326_eib-153.pdf

6. Jens Manuel Krogstad. 5 facts about Latinos and education. Pew Research Center. 2016. Accessed 07-14-2022. Available from https://www.pewresearch.org/fact-tank/2016/07/28/5-facts-about-latinos-and-education/

7. Garcini LM, Renzaho AMN, Molina M, Ayala GX. Health-related quality of life among Mexican-origin Latinos: The role of immigration legal status. Ethn Health. 2018; 23(5):566-581.

8. Arbona C, Olvera N, Rodriguez N, Hagan J, Linares A, Margit W. Acculturative stress among documented and undocumented Latino immigrants in the United States. Hisp J Behav Sci. 2010; 32(3):362-384.

9. Rosenstock IM, Strecher VJ, Becker MH. Social learning theory and the Health Belief

Model. Health Educ Q. 1988; 15(2):175-83.

## Low English Proficiency as a Barrier to Care in Patients with Ventricular Assist Device

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### Purpose
Prior research has shown patients with low-English proficiency are more likely to experience complications during the course of treatment for chronic conditions.[1-4] This study aims to identify disparities in patients utilizing interpretative services after implantation of a left ventricular assist device (LVAD) and examines differences in anticoagulation and mortality outcomes.

### Methods
454 patients received an LVAD between 10/18/2012-5/10/2023 at University of Rochester Medical Center (URMC), with 14 (3.08%) requiring interpretative services (country/territory of origin: Puerto Rico (n=7), Dominican Republic, Bangladesh, Guatemala, Iraq, Jordan, Pakistan, and United States (ASL) (n=1)) (see fig. 1). Controls without the need for interpretive services were matched for gender, surgical approach, age, and concomitant procedures 2:1 (30 controls total). International normalized ratio (INR), days spent re-admitted, and mortality were measured 1 year after discharge. Demographics included distance from patient home to URMC, disability status, education, BMI, age, Intermacs profile, smoking status, etc. Patient-initiated appointment cancellations and no-show appointments were also counted. INR values were graphed showing values outside of the patient's goal INR (typically 2-3) (see fig. 2). Means were compared with a T-Test, categories compared with a chi-squared test, and variances compared with F-tests.

### Results
14 patients of a 2:1 matched cohort of 42 required at least some language interpretation to complete their LVAD education and care. The duration of the initial hospital stay was prolonged for those who used an interpreter, but Intermacs profile did not vary between cohorts. We also examined patient canceled or no-show follow-up appointments and found no difference between cohorts (p = 0.275, p = 0.737 respectively), showing equivalent follow-up between cohorts. Patient travel distance to the hospital was not different, suggesting distance is not a

differential barrier in these cohorts. Time in the therapeutic range (TTR) of anticoagulation over the first year after discharge did not vary between cohorts (45.84% vs 47.06%; p = 0.639). However, patients who required an interpreter had a greater variance in INR values during the first year after discharge home (p <0.001), and greater variance while outside the therapeutic window (p <0.001). The number of days readmitted during the first-year post-discharge did not vary between groups, supporting that this difference may be due to outpatient management of anticoagulation. Mortality at one year from discharge did not vary between cohorts.

### Conclusions

These results suggest that there may be unmeasured barriers to anticoagulation management for LVAD recipients who require interpreter services. Additionally, it is not clear from these data if the increased duration of initial hospital stay in this cohort is related to in-hospital difficulties in care delivery, or other perioperative factors. Teams should seek to ensure that adequate interpretation services are available to patients while hospitalized, at lab facilities, and digitally through electronic health record communications to ensure close continuity of care. Future research should examine the efficacy of different techniques to improve the quality of care for this unique cohort.

### Citations

1. Rawal, S., et al., Association Between Limited English Proficiency and Revisits and Readmissions After Hospitalization for Patients With Acute and Chronic Conditions in Toronto, Ontario, Canada. Jama, 2019. 322(16): p. 1605-1607.
2. Mukherjee, A., et al., Outcomes after hematopoietic cell transplantation among non-English- compared to English-speaking recipients. Bone Marrow Transplantation, 2022. 57(3): p. 440-444.
3. Wilson, E., et al., Effects of limited English proficiency and physician language on health care comprehension. J Gen Intern Med, 2005. 20(9): p. 800-6.
4. Pandey, M., et al., Impacts of English language proficiency on healthcare access, use, and outcomes among immigrants: a qualitative study. BMC Health Services Research, 2021. 21(1): p. 741.

| Table 1: Summary Statistics | Interpreter Users | No Interpreter Use | p value |
|---|---|---|---|
| n | 14 | 28 | |
| **Demographics** | | | |
| Age | 55.93 +/-9.6 | 56.11 +/-9.63 | p = 0.955 |
| Sex | | | |
|    Female | 2 | 5 | |
|    Male | 12 | 23 | p = 0.77 |
| BMI | 29.33 +/-7.4 | 32.68 +/-5.55 | p = 0.168 |
| Smoking Status | | | |
|    Current | 3 | 6 | |
|    Former | 5 | 12 | |
|    Never | 6 | 10 | p = 0.886 |
| Intermacs Profile | | | |
|    Profile 1 | 7 | 12 | |
|    Profile 2 | 0 | 2 | |
|    Profile 3 | 4 | 12 | |
|    Profile 4 | 1 | 2 | p = 0.829 |
| **Hospitalization Variables** | | | |
| Length of Hospital Stay | 55.6 +/- 23.5 | 26 +/- 12.5 | p = 0.004 |
| **Psychosocial Variables** | | | |
| Distance from home to hospital (mi) | 65.6 +/- 41.9 | 87 +/- 60.2 | p = 0.188 |
| Employment Status | | | |
|    Full Time | 1 | 8 | |
|    Part Time | 1 | 3 | |
|    On Disability | 9 | 9 | |
|    Retired | 1 | 7 | |
|    Unemployed | 2 | 1 | p = 0.104 |
| Spouse Employment Status | | | |
|    Full Time | 3 | 6 | |
|    Part Time | 0 | 3 | |
|    On Disability | 3 | 2 | |
|    Retired | 2 | 3 | |
|    Unemployed | 3 | 3 | |
|    Unmarried | 2 | 11 | p = 0.418 |

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| Outcomes | | | |
|---|---|---|---|
| Variance of all INR | 0.943 | 0.602 | **p <0.001** |
| Variance of INR Outside Therapeutic range | 0.552 | 0.248 | **p < 0.001** |
| Time in Therapeutic Range | 47.06% | 45.84% | p = 0.639 |
| 30 day readmission rate | 0 (0%) | 5 (17.9%) | **p= 0.304** |
| Readmitted Days During First Year After Discharge | 12.4 +/- 15.2 | 6.8 +/- 13.3 | p = 0.229 |
| One Year Mortality | 0 (0%) | 1 (6.7%) | p= 0.24 |
| No-Show Follow Ups | 1.5 +/- 2.1 | 1.8 +/- 3.2 | p = 0.737 |
| Patient Canceled Follow ups | 7.2 +/- 11.2 | 3.6 +/- 3.3 | p = 0.275 |
| | | | |

| Education | | | |
|---|---|---|---|
| Bachelors Degree | 1 | 8 | |
| Some College | 1 | 2 | |
| High School | 7 | 12 | |
| Some High School | 3 | 4 | |
| Middle School | 1 | 1 | |
| Less Than Middle School | 1 | 1 | p = 0.717 |

**Predictors of Left Inframammary Thoracotomy Infection After Left Ventricular Assist Device Implantation**

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**Purpose**

Bilateral thoracotomy and conventional sternotomy approaches to left ventricular assist device (LVAD) implantation share comparable rates of infection. Unique features of a thoracotomy approach may cause distinct factors to elevate the risk of thoracotomy wound infection from LVAD implantation. We sought to identify predictors of thoracotomy infection following LVAD implantation.

**Methods**

We conducted a single-institution retrospective study in which we reviewed all adult patients that received an LVAD implant via bilateral thoracotomy or combined left thoracotomy and hemi-sternotomy between February 12, 2018, to May 15, 2023, at the University of Rochester Medical Center (URMC). We utilized an existing internal database of LVAD recipients and supplemented these data with additional variables from electronic medical records. A total of 341 patients met the inclusion criteria. Cases were defined as a positive bacterial culture from a thoracotomy site and/or device pocket; controls either had no culture or a negative culture from this site. Notably, ascending driveline infections or infections originating from a site other than the thoracotomy site or device pocket were labeled as controls. We conducted univariate analysis with t-tests and chi-squared tests to investigate correlations between preoperative biomarkers, predictive demographic variables, and the development of an LVAD surgical site infection.

**Results**

Twenty-four patients had culture-confirmed infection of their left inframammary incision. Those with infection had a higher proportion of female patients (p = 0.046) and lower preoperative serum albumin (p = 0.007) than those without infection. The most common bacteria isolated included Staph Aureus, Klebsiella species, and Enterobacter species. Resistance patterns were variable, but most commonly resistance to penicillins and cephalosporins was found, with piperacillin/tazobactam resistance present in

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six of the 24 cases and vancomycin resistance in three of the 24 cases. Prevalence of smoking, diabetes, peripheral artery disease, and autoimmune disease were equivalent between groups. Eleven patients who had no surgical site culture growth required surgical debridement of the thoracotomy for presumed infection or readmission for presumed surgical site infection. When these patients were included in the analysis, patients with culture-confirmed or presumed infection were more likely to be female ($p = 0.017$), had a higher body-mass index (BMI; $p = 0.037$), and had lower preoperative serum albumin ($p = 0.028$).

**Conclusions**

These findings suggest that protein stores, such as albumin, may related to surgical site infection. The higher proportion of women in the infection cohort, as well as elevated BMI when presumed infections were included, suggest that breast tissue may increase risk of infection. Lastly, speciation of culture-negative, presumed infections will be pivotal for tailoring antibiotic prophylaxis in high-risk cases. Further research should examine how to effectively mitigate these risks in the perioperative setting.

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**Location**

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# Effectiveness and Reception of Mobile Simulation-based Trauma Education for Pre-hospital Providers

**Background**

A key component of standards trauma center verification is professional and community outreach and education for residents, nurses, prehospital personnel (including EMS and other first responders), and the public. One new aspect of this field is the use of high-fidelity simulation equipment to augment traditional forms of education. The use of mobile simulation-based education to supplement pre-hospital provider education, especially considering the out-of- hospital practice setting, relatively finite resources and lack of standardized academic curricula, may be especially valuable to these professions. Some of the advantages of mobile simulation education include the ability to provide education in transitive location settings, increased flexibility in learner accessibility, capacity for interdisciplinary training, and promotion of continuity of care.[1] To our knowledge, this is the pilot study regarding the utility of high-fidelity simulation of trauma management targeting prehospital providers is the first of its kind in the United States.

**Methods**

A series of educational sessions using high-fidelity simulation equipment was conducted over a time period of six months. The sessions were conducted by a dedicated educational team consisting of trained nurses. The target audience included pre-hospital providers employed by a number of emergency medical services, fire departments, and other first responder organizations. The specific educational content of the sessions varied, but each session included the use of high-fidelity simulation equipment such as mannequins and life-size models for hemorrhage and trauma for demonstrations and training scenarios.

At the beginning of each session, attendees were asked to complete a pre-intervention questionnaire. At the conclusion of each session, the attendees were asked to complete a post-intervention questionnaire. Responses to the questions were graded on a Likert scale from 1 to 5, with lower values indicating disagreement and higher values indicating agreement. Changes in responses were analyzed with chi squared tests and fisher tests using R Statistical Software. Statistical significance was defined as p-value $< 0.05$.

**Results**

A total of 42 responses have been captured so far.

In terms of objective measures, learners reported statistically significant increases in comfort level in managing adult trauma, pediatric trauma, geriatric trauma, airway trauma, traumatic brain injury (TBI), and hospital handoff. Other measures, such as managing hemorrhage or traumatic hypotension, did not have statistically significant changes between the intervention.
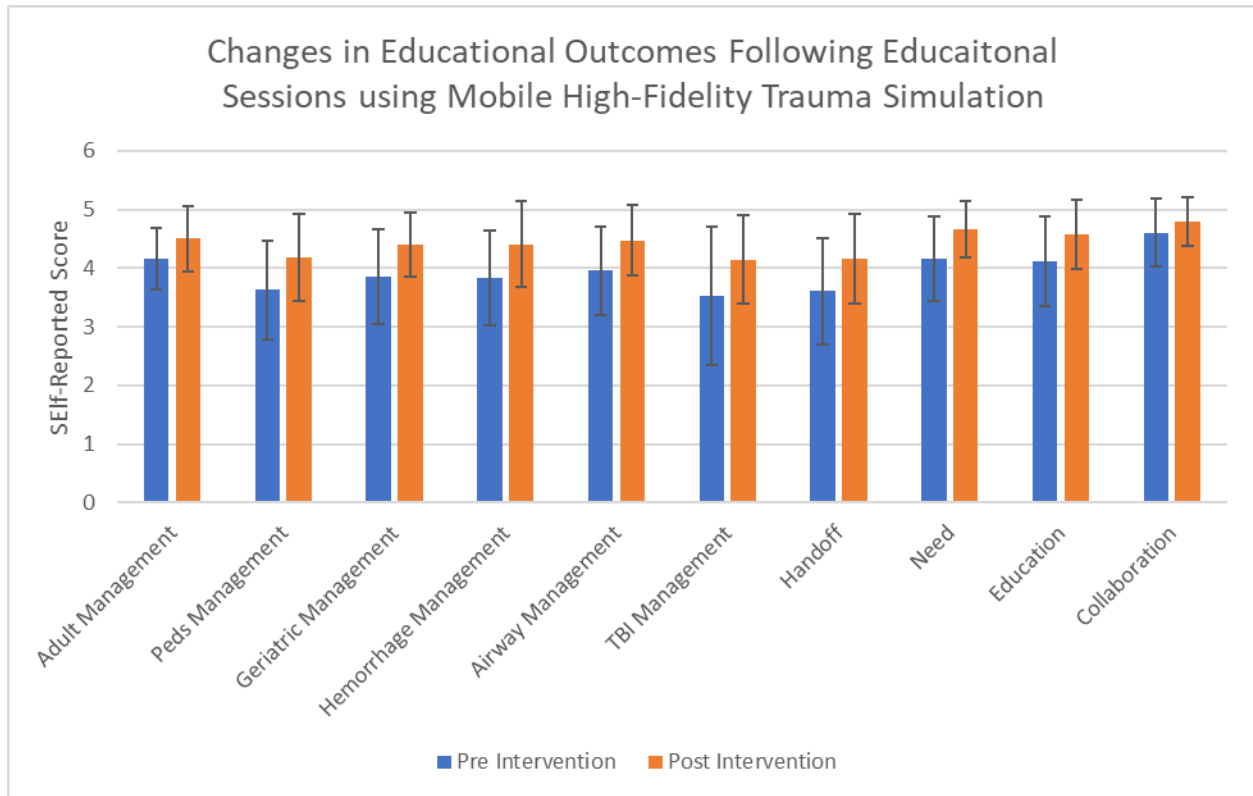
**Figure 1. Clustered column chart demonstrating average response values of major trauma management educational objectives evaluated with the study questionnaire.**

**Conclusion**

      High-fidelity medical simulation has been shown to be an effective tool for assessment and educational intervention in the hospital context. Improvements in participants' learning satisfaction, self-confidence, performance, and self-efficacy were documented in a study of in situ simulation medical training in a trauma center. Among other key points, simulation-based training was characterized as a valuable opportunity for emergency medical professionals to perform hands-on, realistic clinical activities that fall under their scope of practice in an informed, encouraging, and supportive learning environment.

As a preliminary study, this study shows that further research into the field of high-fidelity simulation for pre-hospital provider education is warranted. A quantitative standardized assessment of pre-hospital provider skills might be warranted. Additionally, further expansion of the mobile simulation education team will allow for development of simulation-based curricula targeting more specific aspects of pre-hospital care.

1. Wehbi NK, Wani R, Yang Y, et al. A needs assessment for simulation-based training of emergency medical providers in Nebraska, USA. *Adv Simul (Lond)*. 2018;3:22. doi:10.1186/s41077-018-0081-6

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**Characterizing Imaging of Childhood Cancers Associated with Rhabdoid Tumor Predisposition Syndrome with Pathologic Correlation**

**Objective:**

To review multimodality imaging findings and perform radiologic-pathologic correlation in solid neoplasms associated with Rhabdoid Tumor Predisposition Syndrome (RTPS) among children, adolescents, and young adults with the goal of improving the quality of radiologic interpretation.

**Abstract:**

For the first time since its inception, the fifth edition of the WHO tumor classification covers pediatric tumors in a separate volume. Pediatric tumors fundamentally differ from adult tumors in terms of their histopathology, molecular subtypes, and prognosis. One type of pediatric tumor, rhabdoid tumors are rare aggressive tumors that commonly localize in the kidneys, central nervous system, and other soft tissues. Patients with the cancer predisposition syndrome, rhabdoid tumor predisposition syndrome (RTPS) have an elevated risk of developing these tumors. Rhabdoid tumors arise due to germline or somatic mutations in *SMARCB1* and *SMARCA4*, which are subunits of the SWI/SNF chromatic remodeling complex responsible for activating and repressing gene transcription.

For individuals with the disease-associated germline, regular ultrasound and MRI imaging is recommended as surveillance. Since these tumors are often first identified on imaging, early and precise radiologic diagnosis can have important implications for genetic testing and continued surveillance of affected individuals. In this study, the Radiology PACS was searched to assess tumors associated with

rhabdoid tumor predisposition syndrome at URMC as well as collaborating medical centers. Patient clinical information, imaging findings, and pathology reports were obtained to analyze tumor location, sites of involvement, contrast enhancement, metabolic characteristics, and presence of metastases. In patients with malignant rhabdoid tumors of the kidney, there was associated hypercalcemia, disseminated disease, and the growth of atypical teratoid/rhabdoid tumors (ATRT) in the brain. On imaging, lesions can be intensely FDG-avid and hypermetabolic, demonstrating the importance of PET/CT-MR, especially for lesions undetectable on conventional CT or MRI. Through evaluating radiologic-pathologic correlation, diagnosis of these rare pediatric tumors can be improved across imaging modalities.

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# Validation of a 3-D Printed Model for Intracranial Vascular Anastomosis Practice and the Rochester Bypass Training Score

**Introduction:**

Surgical simulation models in cranial neurosurgery are needed to promote affordable, accessible, and validated practice in resident education. In bypass anastomosis practice, only simple tube tying or complex multi-tissue 3D models have been previously described.

**Objective:** To design and validate a simple 3-D printed model for intracranial anastomosis training and to develop the Rochester Bypass Training Score for assessment.

**Methods:**

A computer aided design (CAD) generic skull was uploaded into Meshmixer (v.3.5) and a 55 mm opening was created on the right-side to mimic a standard orbitozygomatic craniotomy. The model was rotated 20º upward and 35º left, before a 10 mm square frame was added 80 mm deep to the right orbit. The CAD model was uploaded to GrabCAD and printed using a J750 PolyJet 3D printer before being paired with a vascular anastomosis kit. (Figure 1) The model was validated with standardized assessments of residents and attending by simulating the deep part of an "M2-radial artery graft (RAG)-P2" bypass.

The Rochester Bypass Training Score (RBTS) was created to assess bypass patency, backwall suturing, and suture quality. (Figure 2) Post-simulation survey data regarding the realism and usefulness of the simulation were also collected.

**Results:**

5 junior residents (PGY1-4), 3 senior residents (PGY5-7), and 2 attendings participated. Mean operative time in minutes was: junior residents: 78, senior residents: 33, attendings: 50. The RBTS means were: junior residents 2.4, senior residents 4.0, and 5.0 attendings. A larger sample would be needed to assess significance (Table 1). Participants agreed the model was realistic, useful for improving operative technique, and would increase comfort in bypass procedures. Cost per re-useable polylactic acid (PLA) model was $17.27.

**Conclusion:**

This study presents an affordable, realistic and education intracranial vascular anastomosis simulator and introduces and RBTS for assessment.
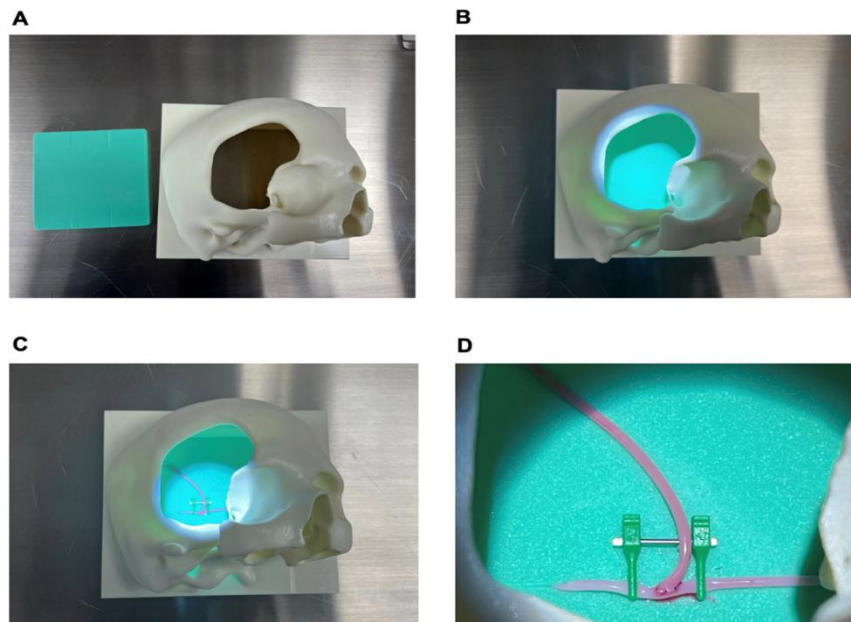


**Figure 1: Bypass Simulation Model:** A. Model disassembled with stage and 3-D printed Skull. B. Model with stage inserted. C. Zoomed out view of assembled model. D. Zoomed in view of assembled model.

**Table 1: Rochester Bypass Training Score and Scored Bypasses**

| Sample | Level | Patent (0 = no, 1 = yes but stenotic, 2 = fully patent) | No Backwall Suture? (0 = no, 1 = yes) | Suture Quality* (0 = >75% of sutures poor, 1 = 25-75% of sutures poor, 2 = <25% of sutures poor) | Total |
|--------|-------|------|------|------|------|
| 1 | Attending | 2 | 1 | 2 | 5 |
| 2 | Junior Resident | 1 | 0 | 1 | 2 |
| 3 | Attending | 2 | 1 | 2 | 5 |
| 4 | Senior Resident | 2 | 1 | 2 | 5 |
| 5 | Senior Resident | 1 | 0 | 2 | 3 |
| 6 | Junior Resident | 2 | 1 | 2 | 5 |
| 7 | Junior Resident | 2 | 1 | 2 | 5 |
| 8 | Junior Resident | 0 | 0 | 0 | 0 |
| 9 | Senior Resident | 2 | 1 | 1 | 4 |
| 10 | Junior Resident | 0 | 0 | 0 | 0 |

Legend
* = suture alignment, distance (from edges) and frequency (distance apart)



Bypass Receiving a 0/5 Score

Bypass Receiving a 5/5 Score
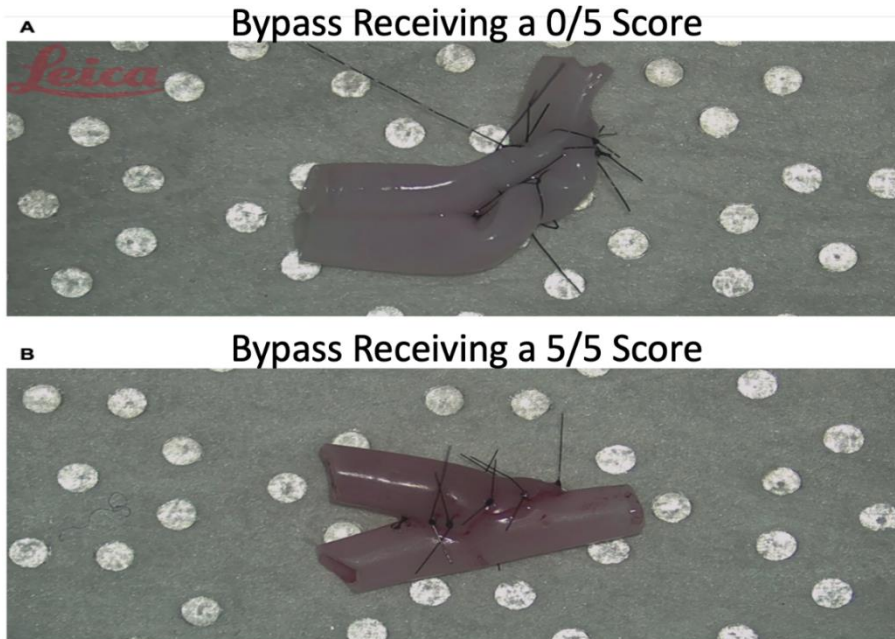
# Patient Reported Quality of Knee and Hip Osteoarthritis Care

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Benjamin F. Ricciardi, MD[2], Caroline P. Thirukumaran, MBBS, MHA, PhD[2], Kathryn A. Miller, MD[3], Courtney Jones PhD, MPH[4] Katherine H. Rizzone, MD, MPH[2] [1]University of Rochester School of Medicine and Dentistry, Rochester, NY,  [2]University of Rochester Medical Center, Department of Orthopaedics and Physical Performance, Rochester, NY, [3]Division of General Internal Medicine, Department of Medicine, University of Wisconsin School of Medicine and Public Health, Madison, WI, [4]Department of Public Health Sciences, University of Rochester School of Medicine and Dentistry, Rochester, NY,  Email of Presenting Author: jane_jurayj@URMC.rochester.edu

**INTRODUCTION**: Osteoarthritis (OA) is a degenerative joint disease responsible for significant pain and disability worldwide. International guidelines exist for the treatment of knee and hip OA, but despite these recommendations, discrepancies exist in adherence to these OA clinical guidelines. There are significant gender and racial disparities in OA care. For instance, females, Black Americans, and patients residing in areas with greater socioeconomic disadvantage have higher rates of OA, but they may receive reduced quality of OA care.  The purpose of this study was to assess patient-reported quality of arthritis care using the OsteoArthritis Quality Indicator (OA-QI) and to explore clinical and demographic variables associated with greater reported quality of care. We hypothesized that OA management program recommendations for education, and non-surgical management such as weight loss, physical activity counseling, nutrition counseling, and medication counseling are not fully implemented in our patient sample as reported in the OA-QI. In addition, we hypothesize that disparities exist in patient-reported quality of OA care, with female and BIPOC patients achieving lower QI pass rates compared to white males.

**METHODS**: This was a cross-sectional study conducted in an academic orthopaedic clinic setting. Eligible participants were adults >22 years with hip or knee arthritis presenting to the department of orthopaedic surgery for evaluation, who had not received joint replacement in the affected joint. Participants completed the OA-QI v2 in clinic. The OA-QI is a validated 17-item survey with a score range of 0-100 (100 = top score), that assesses patient-reported quality of OA care. Chart extraction included participants' demographic information, number of visits in the last 12 months, smoking status, diabetes status, BMI, surgical referral, and Charlson Comorbidity Index (CCI). State and national ADI were calculated. The primary outcome was total OA-QI score, which was calculated as the percent of QI measures achieved based on the total eligible QI measures for an individual. At the group level, an item pass rate was determined by the number of participants that achieved that QI measure (checked 'yes') divided by the total number of eligible participants (checked 'yes' or 'no'). Analyses was conducted using SAS and differences in means and frequencies were calculated using t-tests, chi-square, ANOVA and linear regression

**RESULTS SECTION:** The study cohort consisted of 107 participants, the majority of whom were female (65.4%), white (88.8%) and visit was in regards to their knee OA (85%). The mean OA-QI score for hip arthritis patients was 70.95 (SD = 16.04) compared to 73.55 (SD = 15.38) for knee arthritis patients. OA-QI scores for new patients (M = 60.6, SD = 22.06) were significantly lower than OA-QI scores for returning patients (M = 74.03, SD = 14.61) (p = 0.03). OA-QI scores were significantly lower in participants that were referred to surgery (M = 68.0, SD = 17.93) than participants who were not referred (M = 75.2, SD = 13.87 )(p = 0.05). Two sample t-tests comparing mean OA-QI scores did not show significant differences in means when examined by gender, race, ethnicity, previous injury to the joint or surgery to the joint. OA-QI scores did not vary by the ADI. Referral to a professional for help with weight loss and prescription of narcotic pain killers had the lowest pass rates, 12.15% and 25.23% respectively. When asked about the perceived next step in their OA care (N=68), 54.4% of patients identified injections, 45.6% identified joint replacement, 33.8% identified weight loss, and 17.6% identified physical therapy. Both BMI and new patient status were independent predictors of OA-QI score after adjustment for age and CCI. For every one-point increase in BMI, the OA-QI score increased by 0.422 (p=0.04), and being a new patient was associated with a 13.21 decrease in OA-QI score compared to being a return patient (p=0.02) after controlling for age and CCI.

**DISCUSSION**: We did not find a relationship between overall OA-QI score and demographic variables such as biological sex, race, age, or ADI score, suggesting that patient reported quality of information delivered was similar across a wide cross-section of osteoarthritis patients in a tertiary referral, academic setting. Consistent with prior work, the lowest pass rate for any of the QI items was referral for help with weight loss. Given the high prevalence of obesity in our sample, and the clear link between excess body weight and OA symptoms, provision of support with weight loss should remain a priority. It is possible that the link between elevated BMI and higher pass rate reflects the increased education and guidance of overweight and obese patients around weight loss, physical activity, and lifestyle changes. While the lower pass rates in new patients can be explained by fewer opportunities to receive OA education and care, they point to a need to cover basic principles of OA progression and care during new patient visits.

**SIGNIFICANCE/CLINICAL RELEVANCE**: The findings of this study indicate that despite existing guidelines for non-surgical management of knee and hip OA, patient reported quality of the information received was variable, and subpopulations of patients still receive substandard care for their OA. Future steps need to continue to examine and address these clinical care disparities.

Title: Preliminary Validation of Apple AirPods Pro IMU Sensors for Head Motion Tracking during Gait in Patients with Visual Impairments

Mentors/Preceptors:  John-Ross Rizzo, MD; Gaurav Seth, PhD candidate

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URMC Sponsor: Kurt Hauber, MD

**Hisaaki Kawabata**

**URSMD Class of 2026**

Abstract:

Changes in gait are well-documented in individuals with visual impairments, including increased head flexion, attributed to anticipatory mechanisms for obstacle avoidance. Existing literature primarily employs costly optical motion capture systems in laboratory settings, limiting generalizability. This study explores the potential of Apple's AirPods Pro, equipped with built-in inertial motion unit (IMU) sensors, as a cost-effective alternative for head motion tracking during gait. We aim to validate the accuracy and resolution of AirPods Pro IMU sensors against established IMU-based systems, ultimately enhancing the applicability of head posture observation in real-world settings and improving rehabilitation protocols for patients with visual impairments. Head posture during gait was simultaneously tracked using multiple motion capture systems, including AirPods Pro IMU sensors, in two adult subjects — one with visual impairment and one without. The experiments were conducted on a straight, single-level walkway under varying lighting conditions. Data from the AirPods Pro motion sampler app and other motion capture systems were processed and analyzed using Python. Preliminary results indicate that AirPods Pro IMU sensors effectively track head motion during gait with a high degree of accuracy and resolution. The data

obtained from the AirPods Pro system closely aligns with the established IMU-based motion tracking

systems. This study demonstrates the feasibility of using Apple's AirPods Pro as a reliable tool for head

motion tracking during gait. If proven robust in larger trials, these sensors hold promise for non-invasive

monitoring of head posture in patients with visual impairments during real-world, dynamic activities. The

low cost, ease of use, and widespread availability of AirPods Pro make them an attractive option for

future research and potential clinical applications, including early detection of vision loss and improved

rehabilitation protocols for patients with blindness or low vision.

# Fluoroscopic vs Ultrasound Geniculate Nerve Diagnostic Blocks: Outcomes for Patients with Knee Osteoarthritis

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## Background

Radiofrequency ablation of genicular nerves has been shown to have a significant impact in receiving knee pain (Hong, 2019). This treatment is advantageous due to its minimal invasiveness, rapid recovery rate, and low risk of adverse events (Hong, 2019). Furthermore, the long-term cost-effectiveness of radiofrequency ablation is significantly greater than other similarly less invasive treatment options such as intra-articular steroid injections (Desai, 2019). Two common methods for imagine are ultrasound guided ablations and fluoroscopy guided ablations. Both methods have been shown to decrease pain significantly in both short-term and long-term periods (Sari, 2017).

## Purpose

The purpose of this study is to compare outcomes and demographics between patients who received fluoroscopy guided geniculate nerve blocks in comparison to patients who received ultrasound guided nerve blocks. Due to the significantly high prevalence and cost burden of knee osteoarthritis, an effective pain management treatment is essential for millions of patients, their families and support networks, and the larger healthcare system. Increasing the efficiency of this procedure through image-guided injection that enable further accuracy and risk reduction is key to the use of this procedure for long-term pain management.

## Methods

The study was a retrospective chart review at the University of Rochester Medical Center. Inclusive criteria for study participants was based on the CPT code for Under Introduction/Injection of Anesthetic Agent (Nerve Block), Diagnostic or Therapeutic Procedures on the Somatic Nerve (64454), between January 1st, 2020, and July 1st, 2023. Demographic information included gender, age, race, ethnicity, insurance payer, and body mass index. Variables related to the diagnostic block procedure included the Visual Analog Scale pain score, imaging guidance used, laterality of the procedure, the type of anesthetic, and the percent improvement after the procedure. Medical histories were reviewed to analyze diabetes, smoking status, thyroid or parathyroid issues, Kellgren-Lawrence score, localization of the knee pain, and rheumatological conditions.

**Results and Data Analysis**
Of the 218 patients analyzed, 87.2% had a fluoroscopy-guided procedure while 12.8% of patients had ultrasound-guided procedure. 69.3% of patients studied identified as Female and 82.1% of patients were White. Patients experienced $82.15 \pm 27.39$ percent pain improvement as a result of the procedure. Thyroid and Parathyroid issues were the most common past medical condition in patients with 39.4% of patients affected, while Medial Joint Line pain was the most common physical exam finding with 74.3% of patients presenting with pain to palpation. Further statistical analysis will be performed with the Analysis of Covariance model (ANCOVA) to determine differences in mean percentage improvement. Differences in age, BMI, and Kellgren Lawrence Stage of Osteoarthritis will be controlled for.

References

Desai M, Bentley A, Keck WA, Haag T, Taylor RS, Dakin H. Cooled radiofrequency ablation of the genicular nerves for chronic pain due to osteoarthritis of the knee: a cost-effectiveness analysis based on trial data. BMC Musculoskelet Disord. 2019 Jun 26;20(1):302. doi: 10.1186/s12891-019-2681-2. PMID: 31238925; PMCID: PMC6593544.

Hong T, Wang H, Li G, Yao P, Ding Y. Systematic Review and Meta-Analysis of 12 Randomized Controlled Trials Evaluating the Efficacy of Invasive Radiofrequency Treatment for Knee Pain and Function. Biomed Res Int. 2019 Jun 26;2019:9037510. doi: 10.1155/2019/9037510. PMID: 31346525; PMCID: PMC6617930.

Sarı S, Aydın ON, Turan Y, et al. Which imaging method should be used for genicular nerve radio frequency thermocoagulation in chronic knee osteoarthritis? Journal of Clinical Monitoring and Computing. 2016;31(4):797-803. doi:10.1007/s10877-016-9886-9

**Camila Lage**

Preceptors: Dr. Christoph Proschel, Dr. Margot Mayer-Proschel, Dr Mark Noble.

### The Role of the Human Herpesvirus (HHV6A) Latency Associated Protein U94 in Alzheimer's Disease Pathology

Alzheimer's Disease (AD), is a neurodegenerative disorder that is the most common cause of dementia. Molecularly, it's a protein-misfolding disease defined by the accumulation of amyloid-beta plaques and neurofibrillary tangles. As a multifactorial disease, many factors lead to worsening AD pathology. One of those factors is the latent form Human Herpesvirus (HHV6A), whose transcripts have been found to be enriched in AD patient's brains. U94 is a protein required for maintenance of HHV6A latency, which has been linked to the inhibition of motility of glial progenitor cells. Thus, the purpose of this study was to test whether U94A expression can exacerbate AD associated pathologies by impairing normal neural cell function, making these cells vulnerable to additional insults. Our hypothesis is that HHV6A latency associated protein U94A increases the vulnerability of neural cells to Alzheimer's Disease (AD) associated risk factors and thus worsens AD pathology. To quantify the effect of U94 if the amyloidogenic pathway, brains from previously generated transgenic male mice with the double knock-in of U94 and the AD mouse model of APPKI  (U94/APPKI) were harvested at 4 months and 6 months of age. Brains from individual mutant lines and WT mice were also harvested at the same timepoint as a control. The extent of amyloid deposition is being determined by immunofluorescence (IF) staining in the hippocampal cortex by human A$\beta$ specific 6E10 antibody. Astrocyte localization and microglial activation is being studied by staining with GFAP and Iba-1 respectively. Colocalization of plaque-induced genes SerpineA3 and LGALS is also being studied. While experiment optimization and data analysis is still ongoing, preliminary and concurrent findings from behavioral analysis in the group suggest worse AD pathology in the U94/APPKI mice. The results may identify U94 as a disease modifying agent and thus a new possible therapeutic target for AD pathology.

Building a Project Advisory Committee for Incarcerated Fatherhood Project in Monroe County, New York

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The over-incarceration of Black persons resulting from racially based inequities in the justice system have detrimental effects on all facets of Black families' lives, including social, economic and health outcomes. The effects are also intergenerational, and have been shown to negatively impact psychosocial and behavioral development, academic performance and health outcomes of children of incarcerated parents. This project is the initial step to a study that has an aim of adapting and testing an intervention aimed at improving father-child relationship and strengthening fatherhood skills for Black males incarcerated in Monroe County, New York. The project's aim was to build a project advisory committee. Members were to be of diverse backgrounds, have extensive knowledge about and experience with individuals who have been incarcerated, and/or be formerly incarcerated Black fathers. Each member invited was interviewed. They were asked to describe the work that they have been engaged in, to discuss barriers for incarcerated fathers they have witnessed, to provide overall thoughts about study strategies and potential challenges and solutions to implementation, and to suggest potential members. Results of key informant interviews revealed the many financial, policy and social stressor that fathers face during and after incarceration, and the strained relationships with their children and partners. These discussions provided insight about project design, methods, study subjects, recruitment and retention strategies. This project serves as the foundation for the engagement of community stakeholders and provides important strategies to help ensure the success of the intervention to provide parenting skills and knowledge for Black fathers incarcerated.

# Outcomes of vascular graft infections treated with bioabsorbable, antibiotic beads are similar to less severe inguinal vascular surgical site infections

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**Objective:** Vascular surgical site infections (VSSI) and infected grafts remain a critical problem in vascular surgery. Prior clinical reports suggest antibiotic-impregnated beads can be used to attempt salvage of the graft and improve outcomes, especially if explant would result in major morbidity or mortality. Described is our institutional experience managing groin VSSI using bio-absorbable, antibiotic-impregnated beads compared to groin VSSI managed with debridement alone.

**Methods:** Patients with VSSIs after lower-extremity procedures were identified through the institutional database and departmental registries from 2014-2023. Cases were excluded if they did not involve an inguinal incision infection or an operation for VSSI management. Outcomes, including amputation-free survival, reinfection, and re-operation for infection were recorded, along with microbial isolates. Basic descriptive statistics, Kaplan-Meier, and Multiple variable cox proportional hazards analyses were performed.

**Results:** There were 43 patients identified (20 treated with antibiotic beads, 23 with debridement alone). The two groups differed significantly in their Szilagyi classification, with thirteen patients (65%) with class III infections in the antibiotic bead group compared with one (7%) in the debridement alone group. There was no significant difference in amputation-free survival for those cases that received antibiotic beads versus debridement alone (p=0.20) or amputation-free survival between Szilagyi classifications (p = 0.47) despite a higher representation of Szilagyi III cases in the antibiotic bead group (p = 0.0001). Overall, when controlled for fungal infections, patients with graft infections treated with beads experienced similar survival outcomes to patients with subcutaneous infections treated with debridement alone (p=0.21) (Figure 1). Vascular grafts infected with Candida albicans significantly increased the hazard ratio of ipsilateral lower extremity amputation (HR: 7.1(1.5-34.1), p=0.014).

**Conclusion:** The efficacy of bioabsorbable antibiotic beads in VSSIs remains controversial. While this cohort study demonstrated an increased risk of re-infection, this is confounded by the antibiotic bead group having a higher frequency of graft infections. Despite this, antibiotic bead appears to be safe for use in patients with vascular graft infections and may help achieve

outcomes similar to patients without graft involvement. Further studies with larger patient populations and similar infection severity between groups is needed.

**Figure 1**. Kaplan-Meier survival analysis of 1-year amputation-free survival in patients without fungal infections treated with calcium sulfate antibiotic-laden beads. A. 1-year amputation-free survival of patients who received antibiotic beads compared to those who did not receive bead placement. B. 1-year amputation-free survival of patients with Szilagyi Class I, II, and III infections in the entire cohort. C. 1-year amputation-free survival of patients with Szilagyi Class III infections who received antibiotic bead placement compared to Szilagyi Class II infections who did not receive antibiotic beads.



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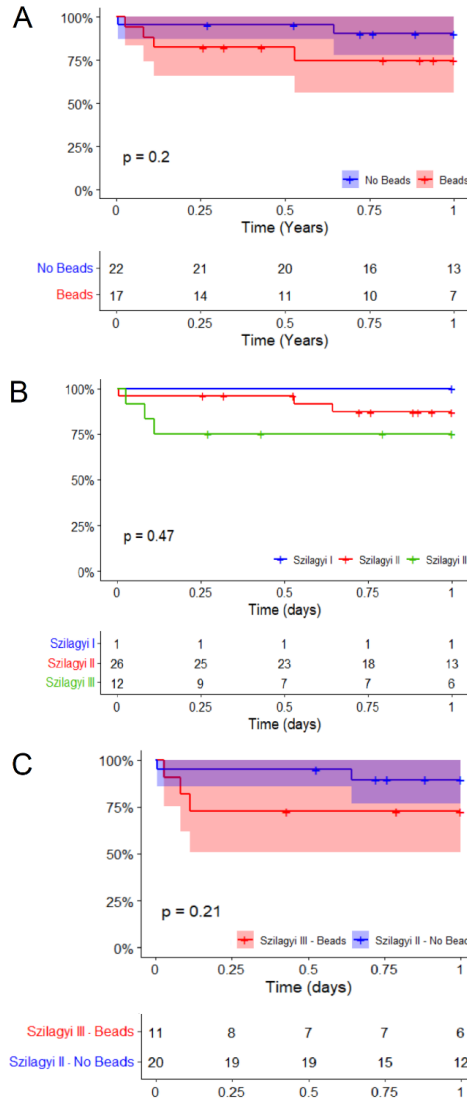
**Title**: Cytopenic complications within lymphoplasmacytic lymphoma patients

**Author: Catherine Liu**

**Mentors**: Dr. Clive Zent, Dr. William Archibald

**Location**: University of Rochester Medical Center

**Background:** Cytopenia is frequently seen in patients with indolent B-cell malignancies. They add to the complexity of treatment that is required for these patients and are often associated with poor prognosis. Specifically, the occurrence and treatment of cytopenia within lymphoplasmacytic lymphoma (LPL) patients has seldom been described. Classified as an extremely rare neoplasm, there are only 1000-1500 new cases of LPL per year in the US. Novel agents such as ibrutinib, a Bruton's Tyrosine Kinase inhibitor (BTKi), have improved the prognosis of patients with LPL, but the response of cytopenias to these agents have not yet been assessed. Although rare, it is important to study cytopenic complications within the LPL population to improve our standards of care. We also sought to understand how patients with LPL present to hematologic care. Here, we provide a comprehensive analysis and description of cytopenic complications in LPL patients and reason for presentation to hematologic care within the University of Rochester Medical Center.

**Methods**: We performed an observational, retrospective chart-review study on all patients diagnosed with LPL within the University of Rochester Medical Center's lymphoma database between May 1$^{st}$ 2000 to March 1$^{st}$ 2023

**Results**: Our study cohort consisted of 124 LPL patients (44% women, 56% men), 120 (97%) of which had a bone marrow biopsy confirming their diagnosis. The median age at the initial visit with hematology was 71. At the initial visit with hematology, 46 (37%) patients presented with abnormal complete blood count, 37 (30%) with a paraprotein, 17 (14%) with neuropathy, 7 (6%) with fatigue, 5 (4%) with lymphadenopathy and 12 (10%) with unknown reasons. 99 (80%) patients received treatment with the median number of treatment lines being 2, and 25 (20%) never required treatment at the time of study. The top choices for first line of treatment were BTKi alone (43%), rituximab plus a chemotherapy agent (30%), rituximab alone (14%), and rituximab plus BTKi (7%). There was a total of 83 (67%) patients who experienced at least one cytopenia. 58 patients had a cytopenia before or at the time of diagnosis, whereas 21 patients had a cytopenia occur during their disease progression, with a median onset of 175 days after diagnosis. Of those with cytopenia, 79 (95%) had anemia, 33 (40%) had thrombocytopenia, and 5 (6%) had leukopenia. Regarding the etiology of the cytopenia, 67 (81%) were caused by bone marrow failure, 7 (8%) were caused by an autoimmune reaction, and 9 (11%) were unclear.

**Conclusion**: This study confirms that cytopenic complications are present in the vast majority LPL patients, with anemia and thrombocytopenia being the most common subtypes. These findings highlight the importance studying our management of such LPL patients. Since we see that BTK inhibitors and rituximab are the choice drug for initial treatment, future studies should investigate their efficacy on this population.

**Malin, Michaela**

<u>The disparities in clinic visit "no-show rates" in sports medicine orthopedic care</u>

<u>Preceptor:</u>
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Co-Investigators:
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Background:

Outpatient clinic "no-shows" are defined as visits that a patient does not attend without advanced notice, and not due to physician or clinic cancellations. These include both in-person and telehome visits. The "no-show rate" is the number of no-shows a given clinician has out of the total visits scheduled in a given time period. Telehome visits may decrease this no-show rate, especially phone call visits, which utilize widely available technology and do not require internet access. The present study aims to evaluate the sociodemographic factors associated with no show rates and whether this rate varies with in-person or telehome modalities.

Methods:

Retrospective analysis included 1,999 patients seen by a single surgeon during a 6-month period from 9/5/22 to 3/27/23. The inclusion criteria were all patients seen either in person or via telehealth during this period, and exclusion criteria were any patients not seen in a clinic visit during this time. Patients were identified using electronic medical records. Relevant data was collected, including: date of visit, sex, race, ethnicity, age, smoking status, address of primary residence, reason for visit, laterality of injury, whether surgery was performed, date of surgery, procedures conducted, and date of follow-up visit. Descriptive statistical and regression analyses were conducted with chi-squared tests for categorical variables and Kruskal-Wallis for continuous variables.

Results:

A total of 1,797 in-person visits, and 202 telehome visits were included in the analysis. Comparisons between the two groups showed no significant difference in any of the demographic variables between the two groups. The no-show rate was 5.06% in the in-person cohort, and 5.45% in the telehome cohort. The no-show rate varied across racial groups in both visit types, with black patients having a 3.7% (p=0.034) higher rate of not arriving for their appointment compared to white patients. Medicaid patients did not arrive at a 9.5% (p < 0.001) higher rate compared to patients covered by commercial insurance. Patients who ultimately received surgical intervention were 7% (p<0.001) less

likely to be a "no-show" compared to those who did not receive surgery. All other variables were not significantly different between no-show and completed clinic visits.

Conclusion:

Discontinuous care is harmful in post-operative recovery and negatively impacts non-surgical interventions and follow-up. Medicaid coverage is used as a proxy for lower socioeconomic status in this study. The higher no-show rate in this subgroup may be indicative of difficulty accessing transportation, childcare, or time off from work, which can all be disproportionate barriers to care for people with lower socioeconomic status. These findings also suggest that no-show rates are consistent across telehome and in-person visits. Future research would be beneficial into the difference in demographic variables between in person and tehehome groups to determine if different factors may be influencing these rates. No-show rates are impactful on patient access to orthopaedic care and important for clinicians to identify methods to minimize them.

References:

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1. Cohen-Yatziv L, Cohen MJ, Halevy J, Kaliner E. No-shows in ambulatory clinics and non-utilized appointments for elective operations in selected surgical departments at a tertiary hospital in Israel. *Isr J Health Policy Res.* 2019;8(1):64.

2. Gudlavalleti ASV, Elliott JO, Asadi R. Factors Associated With No-Show to Ambulatory Tele-Video Neurology Visits. *Cureus.* 2023;15(5):e38947.

3. Jones MK, O'Connell NS, Skelton JA, Halvorson EE. Patient Characteristics Associated With Missed Appointments in Pediatric Subspecialty Clinics. *J Healthc Qual.* 2022;44(4):230-239.

4. Liu JKC, Kang R, Bilenkin A, et al. Patient satisfaction and cost savings analysis of the telemedicine program within a neuro-oncology department. *J Neurooncol.* 2022;160(2):517-525.

5. Xiong G, Greene NE, Lightsey HMt, et al. Telemedicine Use in Orthopaedic Surgery Varies by Race, Ethnicity, Primary Language, and Insurance Status. *Clin Orthop Relat Res.* 2021;479(7):1417-1425.

**TITLE:** Operative Time and Infection Risk in Conversation Total Hip Arthroplasty: Should there be a time limit for hardware removal?

**AUTHORS: Sophie Moody BA**, Matthew Sherman BS, Chad Krueger M

**INSTITUTION**: Rothman Institute, Philadelphia, PA

**ABSTRACT:**

**Background**: While it has been well established that longer operative times in primary total hip arthroplasty (THA) are associated with higher rates of complications, this has yet to be explored in conversion THA. The purpose of this study is to investigate this relationship between operative time and complications in the setting of conversion THA with hardware removal. We also aim to establish a maximum length of surgery after which complications are increased.

**Methods**: This was a retrospective study conducted at a single institution. A total of 263 conversion THAs performed between 2015-2021 that met criteria were included. An AUC curve was constructed to determine a cutoff for surgery time that increased the likelihood of complications. Logistic regressions were ran to determine predictors for operative times longer than the time cutoff as well as predictors of complications.

**Results**: The overall complication rate of conversion THA involving hardware removal was 26.3% (69 patients). An analysis of our AUC revealed an operative time of 136 minutes to be an appropriate predictor of complications (95% CI: 0.634 – 0.774), with complications 4 times as likely in cases over 136 minutes (40.5% vs. 16%, p<0.001). Regression analysis revealed that index hardware of cephalomedullary nails (p<0.001, OR:14.00), DHS plates (p<0.001, OR: 6.49), and intramedullary nails (p=0.009, OR: 6.7) were significant predictors of operative times over 136 minutes along with higher BMI (p=0.001, OR:1.12). Larger BMI and operative times greater than 136 minutes were also found to be predictors of complications (p<0.01, OR: 0.92; P<0.001, 3.98).

**Conclusion**: Conversion THA cases involving hardware removal that are longer than 136 minutes are associated with higher complication rates. This information can be used for pre-operative surgical planning and counseling of patients.

**Timothy Olsen, MBA**
**Preceptor** Jonathan Leckenby, MBBS, PhD

# Standardizing an Experimental Model for Triple Negative Breast Cancer: Preliminary Surgery and Adjuvant Chemotherapy Protocol

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## Introduction

Breast cancer poses a significant global health challenge, particularly with the aggressive triple-negative breast cancer (TNBC) subtype. To advance treatment outcomes and pathophysiologic understanding of TNBC, it is necessary to improve upon commonly used experimental tumor models, such as patient-derived xenografts (PDXs), which fall short in recapitulating tumor-immune interactions due to their reliance on immunosuppression. To overcome this limitation, our study sought to establish a standardized treatment protocol for the widely adopted immunocompetent E0771 TNBC murine model by evaluating the efficacy of various adjuvant and non-adjuvant chemotherapy regimens in this context.

## Methods

16-week-old female C57BL/6 mice received hormone-resistant syngeneic murine breast cancer cells (E0771, ATCC®) in the right mammary fat pad. Surgical excision and/or intraperitoneal (i.p.) injections of Paclitaxel (PTX), Cisplatin (CP), or Vincristine (VCT) began upon tumor detection (Figure 1). Mice were grouped into five treatment arms: 1) Control (saline, n=3), 2) VCT (1.5mg/kg, 2 days/week, n=3), 3) PTX/CP (7.5mg/kg PTX, 5 days/week; 2.5 mg/kg CP, 1 day/week, n=5), 4) Surgery+PTX/CP (tumor excision followed by PTX/CP, n=2), and 5) Surgery (tumor excision without chemotherapy, n=2). In vitro dose-response curves confirmed E0771 sensitivity to PTX, CP, and VCT. Tumor growth rates were modeled via linear regression. Survival time (inoculation to death) was assessed using Kaplan-Meier curves with Log-Rank comparisons. Metastatic disease was evaluated via Fisher's Exact Test. $P<.05$ represents significance.

## Results

PTX/CP, VCT, and saline treatments exhibited 37.1, 18.0, and 32.5 mm$^3$/day faster tumor growth than surgery alone, and 41.3, 22.2, and 36.7 mm$^3$/day increases compared to

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surgery+PTX/CP, respectively ($p$=<.001, .002, .006, <.001, <.001, .002) (Figure 2). VCT-treated mice showed 19.1 mm3/day slower tumor growth than PTX/CP ($p$=.016). Surgery+PTX/CP had a numerically lower tumor growth rate (4.2 mm3/day) compared to surgery alone ($p$=.237). Survival times were similar between surgery groups ($p$=.808), but surgical intervention correlated with prolonged survival compared to PTX/CP, VCT, and saline ($p$=.027, .036, .048). Overall, survival differed significantly among the five groups ($p$<.001) (Figure 3), while metastatic disease did not ($p$=.820).

## Conclusion

Among the treatment groups, surgery before Paclitaxel and Cisplatin (surgery+PTX/CP) demonstrated the slowest tumor growth and significantly lengthened survival compared to non-adjuvant treatments, suggesting its potential as a starting point for developing an adjuvant chemotherapy regimen for the E0771 model. While promising, our findings warrant future investigation with larger samples and additional adjuvant treatment combinations.

**Figure 1.** Surgical excision procedure

**Figure 2.** Modeling tumor growth via linear regression



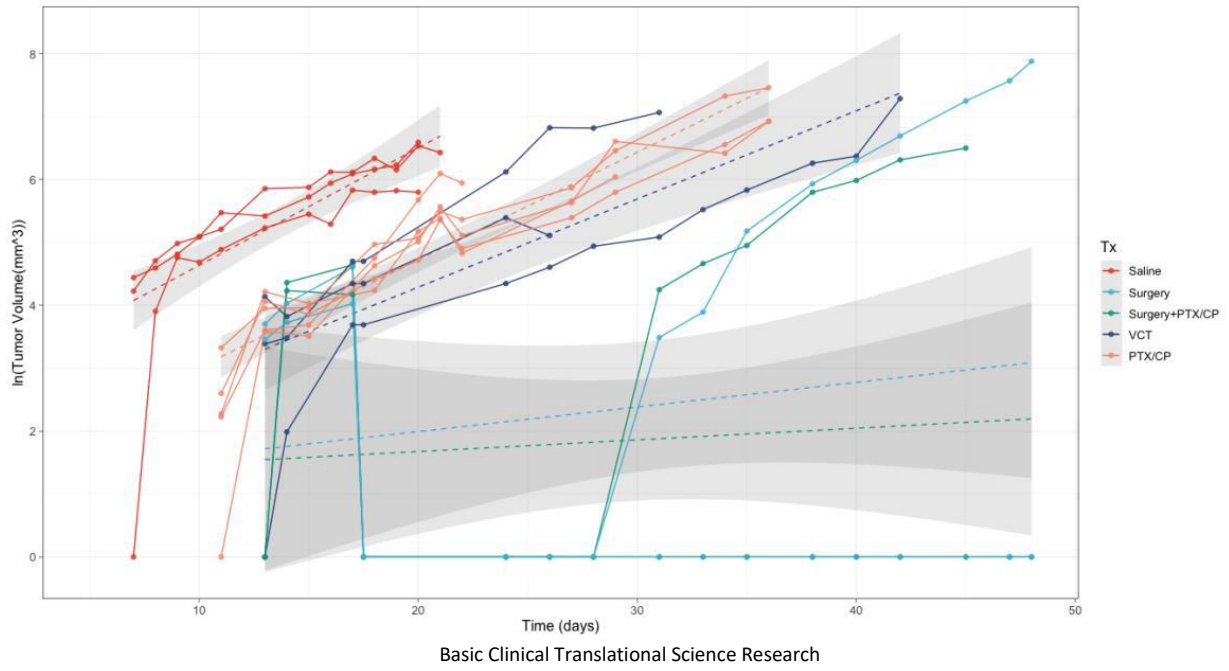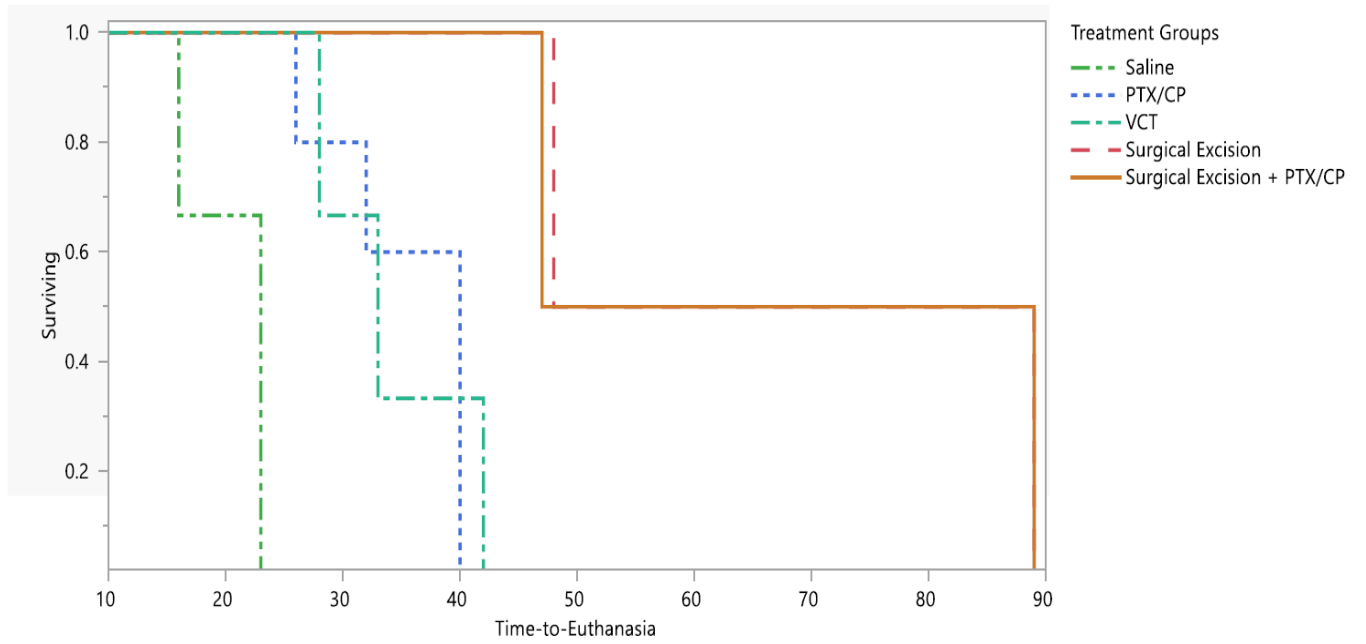Basic Clinical Translational Science Research

**Figure 3.** Kaplan-Meier curve and log-rank comparison ($p<.001$)

**Anthony Pamatmat**

Preceptors:
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Department of Urology

**Title**: Clinical Insights into Robotic-Assisted Simple Prostatectomy and Holmium Laser Enucleation in Treating Benign Prostatic Hyperplasia: A Single-Center Perspective

**Background**

Benign prostatic hyperplasia (BPH) is the nonmalignant overgrowth of prostatic tissue surrounding the urethra and is present in more than 50% of men over the age of 60. The resultant lower urinary tract symptoms, including urgency, frequency, and nocturia, significantly diminish the quality of life. Left untreated, BPH can lead to more severe complications, such as renal insufficiency, urinary tract infections (UTIs), and bladder stones.

Traditionally, BPH treatment for prostates larger than 80 cc involved open prostatectomy. However, over the past decade, holmium laser enucleation of the prostate (HoLEP) has emerged as a superior option, boasting reduced catheterization time, diminished blood loss, and shorter hospital stays. Alternatively, robotic-assisted simple prostatectomy (RASP), utilizing the da Vinci surgical system, offers an easier learning curve for those skilled in robotics. It also allows for concomitant abdominal procedures. The most prevalent type is the multiport da Vinci Xi (MP-RASP), featuring four robotic trocars and two additional assistant ports. A newer option, the single-port da Vinci (SP-RASP), involves only one incision while providing control of three arms within the abdominal cavity. Although SP-RASP has the potential for less invasiveness, comparative studies between the two are limited, and no studies have yet compared SP-RASP to HoLEP.

**Methods**

Data was retrospectively obtained through manual chart review from patients with large prostate (80 > cc) that underwent either SP-RASP or MP-RASP between January 2022 to March 2023 performed at URMC. HOLEP data was gathered from a prospectively maintained database from the same timeline. Count data were presented as proportions, while continuous variables were analyzed nonparametrically, using median and interquartile range. Chi-square tests were employed for count data comparisons of preoperative measures and postoperative outcomes between RASP and HoLEP, and Kruskal-Wallis tests were used for continuous variables. Linear regression was performed to calculate unadjusted and adjusted mean differences, factoring in Charlson comorbidity index and prostate size. P-

values were reported for significance at the 0.05 level, and statistical analysis was conducted using R version 4.2.2.

**Results**

This study included 74 patients who underwent HoLEP and 59 patients that underwent RASP for treatment of BPH. Of the 59 RASP patients, 43 were MP-RASP while 16 were SP-RASP. Comparison of baseline characteristics revealed RASP tends to operate on larger prostate sizes in comparison to HoLEP. Outcome measures tend to favor HoLEP in operative time, catheter duration, and post operative hematuria. Catheter duration and operative time were significantly lower for unadjusted and adjusted linear regression.

**Conclusion**

This study contributes to existing literature comparing HoLEP with RASP and is one of the first studies to compare HoLEP in SPRASP. Overall, outcomes for all procedure types were favorable, but HoLEP had better outcomes for operation time, catheter duration, and post operative hematuria. Further research will need to be conducted to compare post operative urinary retention and sexual function, as well as direct comparison between SP-RASP to MP-RASP.

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**Title:** Enterocutaneous Fistulas: A Single Plastic Surgery Center's Involvement in Care and Outcomes

**Introduction:** Enterocutaneous fistulas (ECF) pose a significant chronic challenge due to their considerable morbidity and mortality. ECF management necessitates a multidisciplinary and individualized approach including consideration of sepsis control, wound care, electrolyte and nutritional support, and overall optimization of the patient's condition. While ECF management is often done by the Colorectal service, Plastic Surgery can be consulted for assistance with more challenging surgical cases involving abdominal wall reconstruction. The purpose of this study is to provide a descriptive analysis of a single plastic surgery center's involvement in the care of ECF patients eligible for abdominal wall reconstruction (AWR).

**Methods:** An IRB-approved retrospective study was performed on adult ECF patients who underwent AWR and surgical treatment in conjunction with plastic surgery at a tertiary academic medical center. Data was consolidated from two databases: one encompassing ECF patients across three hospitals (2011-2023) and another on AWR cases performed by plastic and reconstructive surgeons. Clinical information was extracted from electronic medical records, followed by descriptive statistical analyses.

**Results:** Of 1,017 ECF patients, 44 underwent AWR with the division of plastic surgery as a part of their treatment. The median age of these 44 patients was 58 years, and the median body mass index was 30.8 kg/m$^2$. 54.5% reported a tobacco use history, and 25% were on immunosuppression. Etiologies included inflammatory bowel disease (13.6%), trauma (2.3%), emergency surgery (22.7%, often perforated diverticulitis), cancer-related (10%), iatrogenic injury (45.4%, frequently missed enterotomy), and 3 cases of unknown origin. Of the 44 patients that underwent plastic surgery intervention, 77.8% underwent bilateral component separation (CS), 11.1% unilateral CS, 6.7% complex multilayered closure, and 4.4% split-thickness skin grafting. Perforator preservation occurred in 75% of CS patients; complications were higher in CS without preserved perforators (p=0.012). As for mesh usage: biologic mesh in 34 patients, synthetic mesh in 4 patients, Vicryl™ in 2 patients, and no mesh placed in 4 patients. Smoking status increased length of stay in CS (p=.043). Age >65 and BMI >30 correlated with higher 90-day complications (p=.028, .036). Older age delayed CS wound healing (p=.026). Only 2 Basic

patients had a recurrence of ECF after plastic surgery involvement, both with a history of Crohn's disease. Two patients died a median of 790 days post-reconstruction: one from a UTI, the other an unknown.

**Conclusion:** Enterocutaneous fistulas pose a formidable challenge from both technical and clinical management perspectives and require a multidisciplinary approach. For large enterocutaneous fistulas that are recalcitrant to basic resection procedures, there may be a role for larger resections with abdominal wall reconstruction or transplant performed by plastic surgery. Future studies should investigate ECF care prospectively in patients with and without plastic surgery involvement to compare indications and outcomes.

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# *ZC4H2*-Associated Rare Disorder (ZARD) Natural History Study: Inheritance and Phenotypic Differences Between Males and Females

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**Purpose:** *ZC4H2*-Associated Rare Disorder (ZARD) is a rare condition caused by a mutation of the *ZC4H2* gene on the X-chromosome. This gene codes for a zinc-finger protein that plays an important role in nervous system development.[1,2] ZARD is characterized by highly variable symptoms, potentially influenced by a patient's sex.[1,3–8] In this study, we analyze mutation inheritance and phenotypic differences in male and female children with ZARD using data gathered from visits with 38 participants, the largest ZARD cohort to be studied thus far.

  **Methods:** We interviewed parents about their child's symptoms and conducted virtual physical and
  neurological examinations. The parent- and physician-reported features prevalent in our participants

were compared on the basis of sex. Fisher's exact, maximum likelihood $\chi^2$, and Cramer's V tests were utilized in our analysis.

**Results:** Inheritance of *ZC4H2* mutations differed between sexes: males tended to have maternally-inherited mutations, while females tended to have de novo mutations. Female participants were significantly more likely to have contractures at birth, a diagnosis of arthrogryposis multiplex congenita, lower limb muscle atrophy, and pyramidal signs on exam. On the other hand, the following features were statistically more common in male participants than female participants: seizures, difficulty staying asleep, difficulty with pain or irritability (and more specifically, experiencing intermittent periods of pain), severe visual impairment, and a generalized distribution of muscle atrophy.

**Conclusion:** Our study suggests that not only can female children with ZARD experience a similar breadth of clinical features as males, but there are also several symptoms that are more common in one sex compared to the other. Further analysis is needed to analyze the role that mutation type may play in phenotypic expression.

**References:**

1. Hirata H, Nanda I, van Riesen A, et al. ZC4H2 Mutations Are Associated with Arthrogryposis Multiplex Congenita and Intellectual Disability through Impairment of Central and Peripheral Synaptic Plasticity. *Am J Hum Genet*. 2013;92(5):681-695. doi:10.1016/j.ajhg.2013.03.021

2. May M, Hwang KS, Miles J, et al. ZC4H2, an XLID gene, is required for the generation of a specific subset of CNS interneurons. *Hum Mol Genet*. 2015;24(17):4848-4861. doi:10.1093/hmg/ddv208

3. Ahn JY, Kim SY, Lim BC, Kim KJ, Chae JH. Variable Phenotypes of *ZC4H2*-Associated Rare Disease in Six Patients. *Ann Child Neurol*. 2022;30(3):120-126. doi:10.26815/acn.2022.00129

4.      Frints SGM, Hennig F, Colombo R, et al. Deleterious de novo variants of X-linked ZC4H2 in females cause a variable phenotype with neurogenic arthrogryposis multiplex congenita. *Hum Mutat*. 2019;40(12):2270-2285. doi:10.1002/humu.23841

5.      Comlekoglu T, Kumar V, King K, Al Saif H, Li R, Couser N. Ophthalmic abnormalities in Wieacker-Wolff syndrome. *J Am Assoc Pediatr Ophthalmol Strabismus*. 2022;26(2):91-93. doi:10.1016/j.jaapos.2021.10.010

6.      Godfrey D, Torres A, Heidary G, et al. A 7-year old female with arthrogryposis multiplex congenita, Duane retraction syndrome, and Marcus Gunn phenomenon due to a ZC4H2 gene mutation: a clinical presentation of the Wieacker-Wolff syndrome. *Ophthalmic Genet*. 2021;42(5):612-614. doi:10.1080/13816810.2021.1923040

7.      Godfrey ND, Dowlatshahi S, Martin MM, Rothkopf DM. Wieacker–Wolff syndrome with associated cleft palate in a female case. *Am J Med Genet A*. 2018;176(1):167-170. doi:10.1002/ajmg.a.38527

8.      Piccolo G, d'Annunzio G, Amadori E, et al. Neuromuscular and Neuroendocrinological Features Associated With ZC4H2-Related Arthrogryposis Multiplex Congenita in a Sicilian Family: A Case Report. *Front Neurol*. 2021;12. Accessed December 12, 2022. https://www.frontiersin.org/articles/10.3389/fneur.2021.704747

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**Title:** Dry Needling Management of Hamstring Injuries: A Retrospective Chart Review

**Background:** Dry needling (DN) is a minimally invasive treatment modality that was originally used for it's potential benefits in reducing spasticity in both upper and lower limbs in patients with neurologic disease[1]. Research on the topic has also examined the effects of DN on musculoskeletal pain (MskP)[2,3], and it has been shown to have beneficial effects on patients' range of motion, physical functioning, and muscle strength in both the lower and upper extremities[2,3]. Its therapeutic effects have been attributed to the impact DN has on myofascial trigger points (MTrP), which is a sensitive area of tight muscle that occurs after injury or overuse[4]. MTrPs can cause pain and limit motion and function. Minimal research has focused on how DN impacts specific populations of patients, such as athletes[5]. Hamstring injuries are often difficult to treat, require a prolonged return to sport, and are commonly re-injured without proper treatment[9]. Dry needling therapy has been used to manage hamstring injuries by enhancing range of motion, reducing pain, and increasing strength and power[6,7], with the overall goal of facilitating a return to sport or activity. The aim of our study was to evaluate how dry needling impacts pain, return to play, and other patient-reported outcomes in athletes with hamstring injuries.

**Design:** Retrospective Chart Review

**Setting:** University of Rochester Medical Center Orthopaedic Sports Medicine Clinic

**Independent Variable:** Received Dry Needling, Hamstring Injury, Demographic Information

**Methods**: Potential participants were identified through the keyword "Dry needling" in patients notes and charts were then reviewed for inclusion criteria. Electronic medical records of patients above the age of 13 who received dry needling after a hamstring injury between 2010-present were included in the cohort. They needed to be diagnosed with a hamstring injury, such as a non-specific hamstring injury, hamstring tendinitis, or hamstring strain. These hamstring injuries hindered their ability to participate in their respective sport or activity. Chart abstraction components included demographic characteristics, course of management of the diagnosis and patient-reported outcomes.

**Outcome Measures**: Changes in Patient Reported Outcome Measure Information System (PROMIS) scores, visual analog survey (VAS) pain scores, subjective improvement by patient, and return to sport if applicable.

**Results:** Our cohort consisted of 49 participants with a mean age of 31.71 years. Participants were almost evenly divided by gender (53% female) and the majority were white (81.6%). Most participants had private insurance (85.8%), while the rest had public insurance (12.2%) or were uninsured (2.0%). The average count of dry needling sessions within the cohort was 1.84. Most participants participated in sports (85.7%). Of those who participated in sports, all pediatric patients were high school athletes, with running being the most prevalent sport. Of the adult patients, 33.3% were collegiate athletes, 30.6% were recreational athletes, and 13.9% participated in active competitions for their sport (i.e marathon). The most common medical diagnosis using ICD-codes were non-specific hamstring injury (26.5%), hamstring tendinitis (28.5%), and hamstring strains (24.4%). 69.4% of patients reported improvement in symptoms, such as reduced hamstring pain and greater mobility, after at least one dry needling session. 59.2% of patients returned to sport/activity after dry needling treatment. PROMIS depression and physical function scores existed for 28 participants at baseline visit, whereas PROMIS pain interference scores existed for 29 participants at the baseline visit, which is defined as the initial encounter when the patient was seen for a hamstring injury. At the 1st visit, defined as the visit when the patient received dry needling if they hadn't at the baseline visit, 26 participants had available PROMIS depression scores, 28 participants had available PROMIS physical function scores, and 27 participants had available PROMIS pain interference scores. Only eight PROMIS depression, physical function, and pain interference scores were available for patients who received dry needling at a 2nd visit, defined as the visit whereby the patient received a second dry needling treatment. Only three PROMIS depression, physical function, and pain interference scores were available for patients who received dry needling at a 3rd visit, defined as the visit whereby the patient received a third dry needling treatment. VAS scores existed for all 49 participants at baseline and 1st visit, 27 participants at the 2nd visit, and 10 participants at the 3rd visit.

**Discussion**: There is limited existing research on the impact of dry needling on hamstring injuries. One case report highlights improvement in pain and dysfunction of an 18-year-old collegiate pole vaulter with an acute hamstring strain[8]. This improvement in pain and dysfunction is consistent with the majority of participant-reported improvement in symptoms found in our study.
This retrospective chart review was limited by the incomplete and missing data present with our given sample, such as the lack of available PROMIS scores and indications of return to sport. This led to the exclusion of some records and contributed to selection bias. Most of the participants were white and privately insured, limiting the generalizability to the broader population. Given the structure of the retrospective study, there was a lack of a control group, making it difficult to determine if there were other factors accounting for the improvement in symptoms besides the dry needling therapy itself.

**Conclusion:** Overall, dry needling was helpful for the majority of the participants that received this therapy, as 69.4% of the participants included in this study reported an improvement in their hamstring injury symptoms, and 59.2% of patients returned to their respective sport or activity after treatment. As hamstring injuries often lead to loss of function and hamper return to sport with existing treatment options, novel therapies should be explored. Due to the limitations of this descriptive retrospective study, the next steps for our research include conducting a prospective cohort study evaluating the effects of dry needling on patient-reported outcomes such as pain and physical function in hamstring and other lower-extremity injuries in an endurance athlete population.

**Sources:**

1.   Ghannadi S, Shariat A, Ansari NN, Tavakol Z, Honarpishe R, Dommerholt J, Noormohammadpour P, Ingle L. The Effect of Dry Needling on Lower Limb Dysfunction in Poststroke Survivors. J Stroke Cerebrovasc Dis. 2020 Jun;29(6):104814. doi: 10.1016/j.jstrokecerebrovasdis.2020.104814. Epub 2020 Apr 21. PMID: 32327366.
2.   Sánchez-Infante J, Navarro-Santana MJ, Bravo-Sánchez A, Jiménez-Diaz F, Abián-Vicén J. Is Dry Needling Applied by Physical Therapists Effective for Pain in Musculoskeletal Conditions? A Systematic Review and Meta-Analysis. Phys Ther. 2021 Mar 3;101(3):pzab070. doi: 10.1093/ptj/pzab070. PMID: 33609356.
3.   Chys M, De Meulemeester K, De Greef I, Murillo C, Kindt W, Kouzouz Y, Lescroart B, Cagnie B. Clinical Effectiveness of Dry Needling in Patients with Musculoskeletal Pain-An Umbrella Review. J Clin Med. 2023 Feb 2;12(3):1205. doi: 10.3390/jcm12031205. PMID: 36769852; PMCID: PMC9917679.
4.   Lavelle ED, Lavelle W, Smith HS. Myofascial trigger points. Anesthesiol Clin. 2007 Dec;25(4):841-51, vii-iii. doi: 10.1016/j.anclin.2007.07.003. PMID: 18054148.
5.   Brewster BD, Snyder Valier AR, Falsone S. A Systematic Dry-Needling Treatment to Support Recovery Posttraining for Division I Ice Hockey Athletes: An Exploration Case Series. J Athl Train. 2022 Aug 1;57(8):788-794. doi: 10.4085/1062-6050-0096.21. PMID: 36356615; PMCID: PMC9661933.
6.   Gattie E, Cleland JA, Snodgrass S. The Effectiveness of Trigger Point Dry Needling for Musculoskeletal Conditions by Physical Therapists: A Systematic Review and Meta-analysis. J Orthop Sports Phys Ther. 2017 Mar;47(3):133-149. doi: 10.2519/jospt.2017.7096. Epub 2017 Feb 3. PMID: 28158962.
7.   Gregory TJ, Rauchwarter SA, Feldman MD. Clinical Commentary: Rehabilitation Using Acute Dry Needling for Injured Athletes Returning to Sport and Improving Performance. Arthrosc Sports Med Rehabil. 2022 Jan 28;4(1):e209-e213. doi: 10.1016/j.asmr.2021.09.035. PMID: 35141553; PMCID: PMC8811490.
8.   Dembowski SC, Westrick RB, Zylstra E, Johnson MR. Treatment of hamstring strain in a collegiate pole-vaulter integrating dry needling with an eccentric training program: a

resident's case report. Int J Sports Phys Ther. 2013 Jun;8(3):328-39. PMID: 23772348; PMCID: PMC3679638.

9.   Erickson LN, Sherry MA. Rehabilitation and return to sport after hamstring strain injury. J Sport Health Sci. 2017 Sep;6(3):262-270. doi: 10.1016/j.jshs.2017.04.001. Epub 2017 Apr 10. PMID: 30356646; PMCID: PMC6189266.

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**Title**: Enhancing Sensitivity Assessment in CIPN Clinical Trials: A Comparative Analysis of Daily Diary vs. Weekly Recall for Symptom Evaluation

**Introduction:** Treating chemotherapy-induced peripheral neuropathy (CIPN) and general neuropathy is difficult due to the lack of targeted drugs and complicated pathophysiology. Moreover, patients exhibit diverse symptoms, making it challenging to establish an assay sensitive composite measure. Other studies have explored how different outcome measures may contribute to increased assay sensitivity in pain trials (1, 2), but to our knowledge this is the first study to assess these factors within CIPN trials specifically. The goal of this secondary analysis is to examine the sensitivity of daily diary compared to week recall in assessing individual symptoms: hot/burning pain, sharp/shooting pain, cramping, tingling, and numbness during clinical trial of a transcutaneous electrical nerve stimulation (TENS) device for chronic CIPN.

**Methods:** This study is a secondary analysis of data collected during a randomized clinical trial of a TENS device for chronic CIPN. The study included a week-long baseline period in which all participants were asked to think of the worst their legs and feet have felt over the past 24 hours when rating each of the 5 CIPN symptoms daily (i.e., daily diary) on 0-10 NRS [0 = None; 10 = As bad as you can imagine]. At the study visit at the end of that week participants were asked to rate these symptoms over the past week (i.e., week recall). The same outcomes were completed the week prior to the end of the study (i.e., week 6) and at the 6-week visit.

The sizes of these subgroups were different depending on whether the mean daily diary scores or week recall scores were used to define the subgroups (i.e., groups with ≥ at baseline in the symptom). Considering sample size plays a factor in calculating treatment effects, analyses were performed with both outcomes (i.e., mean diary scores and week recall scores) on the subgroups that were defined using

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both the daily diary and week recall scores. Thus, these analyses allow for comparison between the potential assay sensitivity of a clinical trial that defines the minimum symptom severity entry criteria using the mean of daily symptom scores vs. a week recall-based assessment and subsequently uses the mean of daily diary scores or week recall scores as the outcome variable.

**Results:** The daily diary within-subject standard deviation showed reduced variability at follow-up compared to baseline for all five CIPN symptoms. This reduction was more pronounced in individuals experiencing painful symptoms, hot/burning pain (0.4), sharp/shooting pain (0.38), and cramping (0.37) in comparison to those with nonpainful symptoms, tingling (0.04) and numbness (0.19).

Participants rated baseline symptoms higher on the week recall compared to the daily diary, regardless of the symptom or subgroup. For instance, baseline mean for hot/burning, week recall subgroup was 7.23 for outcome week recall compared to baseline mean of 5.70 for outcome daily diary. Therefore, regardless of CIPN symptoms, daily dairy subgroups had a smaller sample size compared to week recall subgroups. Despite the smaller sample size, the use of daily diary as the subgroup and outcome had the lowest pooled variation (denominator of Cohen's D), except for numbness. In the case of sharp/shooting pain and numbness, the most favorable Cohen's D was attained by using the week recall for defining the sample and the outcome. In sharp/shooting pain, the difference between baseline mean and follow-up mean (numerator of Cohen's D) were greater using week recall as the subgroup and outcome compared to the daily diary as the subgroup and outcome (3.53 vs 2.71). Hot/burning pain, cramping, and tingling symptoms showed the highest Cohen's D when the daily diary was utilized for both defining the sample and determining the outcome.

Similarly, to effect size from baseline, the greatest Cohen's D values were observed for hot/burning and cramping symptoms, 0.51 and 0.50, respectively, when the daily diary was used both as the subgroup and the outcome. The greatest Cohen's D value for sharp/shooting pain was achieved, 0.60, when *daily diary* was used as the subgroup and *week recall* as the outcome. Sample size estimations were computed using Cohen's D. In comparison to sample size estimates derived from week recall alone, using only the daily diary resulted in notably reduced estimates for hot/burning (61 vs. 195) and cramping (64 vs. 249), and a slight increase was observed for sharp shooting (68 vs. 54).

**Discussion:** The daily diary appears to be more effective for assessing painful symptoms, as it substantially decreased variability in follow-up measurements when compared to baseline. This effect may be attributed to a larger reduction in the rating of painful symptoms during follow-up. This observation aligns with the understanding that higher NRS scores typically exhibit greater variability compared to lower NRS scores. In terms of assay sensitivity, relying solely on the daily diary yields results that are either superior or only marginally inferior to those obtained from using week recall alone. In this study, participants were asked to rate their worst pain (vs average pain), which may account for the more pronounced disparities observed between week recall and 7-day means in comparison to findings

from other studies(1, 3). The noteworthy reduction in sample size estimates plays an important role for researchers, especially considering the cost and time of enrolling participants in large-scale clinical trials.

**References**

1.      Jensen MP, Hu X, Potts SL, Gould EM. Single vs composite measures of pain intensity: relative sensitivity for detecting treatment effects. Pain. 2013;154(4):534-8.

2.      Schaffer EM, Basch EM, Schwab GM, Bennett AV. Comparison of weekly and daily recall of pain as an endpoint in a randomized phase 3 trial of cabozantinib for metastatic castration-resistant prostate cancer. Clin Trials. 2021;18(4):408-16.

3.      Smith SM, Jensen MP, He H, Kitt R, Koch J, Pan A, et al. A Comparison of the Assay Sensitivity of Average and Worst Pain Intensity in Pharmacologic Trials: An ACTTION Systematic Review and Meta-Analysis. J Pain. 2018;19(9):953-60.

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**Title:** Pattern of Electronic Cigarette Use and its Impact on Patients with Inflammatory Bowel Disease

**Background:**

The relationship between cigarette use and inflammatory bowel disease (IBD) activity has been well documented in the literature. Electronic cigarettes (e-cigarettes) are relatively new to the market, and their effects on IBD activity have not yet been characterized. We set out to determine the pattern of e-cigarette use amongst our patient population and evaluate the impact of e-cigarette use on several disease-related outcomes.

**Methods:**

Adult patients with Crohn's disease (CD), Ulcerative Colitis (UC), or Indeterminate Colitis (IBD-U) attending IBD clinics at the University of Rochester were invited to complete a brief questionnaire about their use of e-cigarettes and other tobacco products. Following this, we performed chart reviews to determine their disease-related outcomes including changes in medications, steroid use, IBD-related ED visits, and IBD-related hospitalizations – all within 1 year of their entry into the study – and ever having had an IBD-related surgery.

**Results:**

A total of 203 patients were included in our study, of whom 174 (85.7%) were never e-cigarette users (NUs), and 29 (14.3%) were current or former e-cigarette users (EUs). Compared to NUs, the E-cigarette users were younger (average age of 31 vs. 52, for EUs and NUs, respectively, p <0.001) and were more

likely to be current or former smokers (69% vs. 33%, for EUs and NUs, respectively, p <0.001). The two groups were comparable regarding other demographic and disease-related characteristics (Table 1).

When looking at e-cigarette use behavior amongst our subjects, we found that most of our patients started using e-cigarettes before the age of 30 (18/29, 62%). More patients used E-cigarettes multiple

times per day (16/29, 55.2%), with 27.6% using within 5-10 minutes after wakening up. A common reason patients gave for using e-cigarettes was to attempt to quit smoking (13/29, 44.8%), so unsurprisingly, most patients used only nicotine e-liquid (22/29, 75.8%). A minority of our subjects used cannabis e-liquid (N = 3, 10.3%) or both nicotine and cannabis (N = 3, 10.3%). All the patients who used cannabis e-liquid chose a variety that contained THC.

In univariate and multivariate analyses adjusting for age, gender, cigarette smoking status, disease type, disease severity (complicated phenotypes), and level of medical therapy, E-cigarette use had no significant impact on any of the five disease outcomes of interest; changes in medications, steroid use, IBD-related ED visits, and IBD-related hospitalizations – all within 1 year of their entry into the study – and ever having had an IBD-related surgery.

**Conclusions:**

In this single-center IBD population, E-cigarette use was common (14.3%), especially in younger patients who are current or former smokers.  Nonetheless, E-cigarette use had no significant impact on disease-related outcomes including changes in medications, steroid use, ED visits, and hospitalizations – all within 1 year of their entry into the study – and ever having had an IBD relates surgery. Larger population-based studies are needed to verify these findings.

**Table 1: Patient Characteristics by E-cigarette Use**

| Variable | Never User | User | p-value |
|---|---|---|---|
| | N=174 | N=29 | |
| **Age in years, Median (IQR)** | 52.0 (33.0 : 65.0) | 31.0 (24.0 : 43.0) | <0.001 |
| **Gender** | | | 0.51 |
| Male | 75 (43.1%) | 15 (51.7%) | |
| Female | 99 (56.9%) | 14 (48.3%) | |
| **Race** | | | 0.71 |
| White or Caucasian | 151 (86.8%) | 27 (93.1%) | |
| Black or African A | 11 (6.3%) | 0 (0.0%) | |
| Other | 12 (6.9%) | 2 (6.9%) | |
| **Smoking status** | | | <0.001 |
| Never User | 116 (66.7%) | 9 (31.0%) | |
| Former User | 51 (29.3%) | 14 (48.3%) | |
| Current User | 7 (4.0%) | 6 (20.7%) | |
| **Disease Type** | | | 0.17 |
| Crohn's | 105 (60.3%) | 23 (79.3%) | |
| Ulcerative Colitis | 65 (37.4%) | 6 (20.7%) | |
| IBD-Unclassified | 4 (2.3%) | 0 (0.0%) | |
| **Disease Severity** | | | 0.55 |
| Not complex | 84 (48.3%) | 16 (55.2%) | |
| Complex | 90 (51.7%) | 13 (44.8%) | |
| **Current Medication** | | | 0.29 |
| Not advanced therapy | 60 (34.5%) | 7 (24.1%) | |
| Advanced therapy | 114 (65.5%) | 22 (75.9%) | |

Legend:

Disease severity:

- Not complex: Crohn's Disease (B1); Ulcerative Colitis (E1, E2)
- Complex: Crohn's Disease (B2, B3, p); Ulcerative Colitis (E3)

Current Medication:

- Not advanced therapy: no therapy, mesalamine, azathioprine, 6-MP, methotrexate.

Advanced therapy: adalimumab, infliximab, certolizumab, golimumab, vedolizumab, ustakinumab, Risankizumab, tofacitinib, ozanimod.

**Emerging Adults and Their Hospital Experience**
Student researcher: **Hannah Schneider**
Principal Investigator: Ashley Jenkins MD, MSc

**Background**
Emerging adults, people ages 18 to 25 years, are at a unique developmental phase between adolescence and adulthood. Compared to older adults, emerging adults consistently report worse patient experiences during hospitalization on national patient satisfaction surveys. This is alarming as poor patient experience correlates with increased odds of hospital readmission and mortality during hospitalization. Available evidence on patient experience for hospitalized emerging adults is limited to de-identified survey data. Interactions with providers appear to account for the largest decline in patient experience scores for hospitalized emerging adults; yet, it remains unknown how these interactions and other components of hospital care differ for this population compared to other adult-aged patients.

**Objective**
To understand emerging adults' hospital experience at adult care facilities.

**Methods**
We are conducting a multi-site qualitative research study using a phenomenological qualitative approach. To more comprehensively understand the hospital experience of emerging adults, we are collaborating with the University of Texas Southwestern (UTSW) to recruit participants from four hospitals in community or tertiary university-based settings. Participant inclusion and exclusion criteria are highlighted in Table 1. To ensure diversity of recruited participants, we are administering a demographic survey to include characteristics such as presence of a chronic condition, past admission to a pediatric hospital, and insurance status. We are conducting interviews either during hospitalization at the bedside or via virtual platform within one year of hospital discharge. We are using a framework-supported interview guide while conducting the interview. The interviews are recorded, transcribed, de-identified, and checked for accuracy by a member of the research team. When sufficient interviews have been conducted, we will then use a hybrid inductive and deductive thematic analysis approach to identify actionable themes relevant to improving the hospital experience of emerging adults.

Table 1 Inclusion/exclusion criteria

| Inclusion | Exclusion |
|---|---|
| Aged 18-25 years at the time of hospitalization | Admitted primary to a non-medical or non-surgical team (e.g. psychiatry or obstetrics/gynecology) |
| Hospitalized in the 365 days prior to recruitment | Not admitted to hospital (e.g. seen for acute care visit in ED or admitted for observation in the ED) |
| Hospitalized for a medical admission | |
| English speaking | |

## Results

We developed an interview guide based on the Press Ganey Patient Satisfaction survey categories. Some of the categories include hospital experience; interactions with nurses, physicians, and other clinical staff; hospital environment; and satisfaction with the level of self-involvement patients undertook in their care. Refer to Table 2 for a full list of topics and examples of detailed questions associated with each category. We aim to interview a total of 40 participants across the hospital sites with maximal variation in reasons for hospitalization (one-time acute event versus exacerbation of a chronic condition) and past pediatric hospital use.

Table 2 Summary of interview guide categories with an associated question

| Topic | Example question or prompt |
|---|---|
| How patient made decision to seek care at specific hospital | What factors lead you to seek care at [hospital]? |
| Overall hospital experience | What aspects of the hospital stay did you like or dislike? |
| Interactions with nurses | What could your nurses have done to improve your care? |
| Interactions with physicians | What could your physicians have done to improve your care? |
| Impressions of hospital environment | How was your experience with the food provided? |
| Needs met | Did you feel that your needs were met during your stay? |
| Discharge | What barriers to discharge did you experience, if any? |
| Previous adult hospitalizations | If you were previously hospitalized in an adult hospital, how did your most recent experience compare to your past experiences? |
| Previous pediatric hospitalizations | If you were previously hospitalized in a pediatric hospital, how did your most recent experience in an adult hospital compare to your experience in a pediatric hospital? |
| Involvement in care | Did your physician discuss your diagnosis and care plan with you? |
| Comparison of care across age groups | What do you feel may be contributing to worse hospitalization experiences among 18–25-year-old patients? |

**Discussion**

Four patients have been recruited for the study thus far with two interviews completed. Qualitative analysis will occur iteratively as we complete more interviews to inform subsequent patient recruitment (e.g., presence of a chronic illness, location of care, etc.) to ensure we are capturing diverse perspectives.

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### Medical Student Attitudes Toward Medical Decision-Making Augmentation Tools

**Background**: There is growing evidence that diagnostic errors could easily be the most significant safety and medical malpractice problem in the United States. The blame nor the onus to improve diagnosis rests solely on the shoulders of individual physicians; system-wide efforts need to be put in place to reduce diagnostic errors. A paper published in *Diagnosis* in July 2019 that reviewed 25 years of United States malpractice claims revealed that inaccurate or delayed diagnoses were cited in 34% of medical malpractice claims where the patient died or was seriously disabled. The study confirmed that incorrect or delayed diagnosis remains the most common, catastrophic, and costly medical error in closed malpractice claims. It was found that more diagnostic error claims were rooted in outpatient care than inpatient care (68.8 versus 31.2 percent). The malpractice claims caused by diagnosis errors comprised 28% of all the payouts. Inaccurate and delayed diagnosis remains the most catastrophic and costly of all medical errors. The breadth and depth of knowledge that medical students are expected to memorize and then mobilize in clinical care years later often exceeds what is humanly possible. We intend to show medical student attitudes toward medical decision-making augmentation tools and how these tools can potentially play a role in medical education.

**Methods**: 40 students participated in a survey-based study reflecting on their attitudes and experiences using artificial intelligence in the context of medical decision making. 10 students engaged in a case-based activity involving the use of standardized cases and VisualDx. Each student was presented with a set of cases. They entered the information they deemed clinically relevant along with their predicted differential diagnosis into a Red Cap survey. Students then entered this data into VisualDx to develop a software generated differential diagnosis. Participants were then reinstructed to reenter their top diagnosis and two alternative diagnoses. At the end of the survey, students answered questions reflecting on their experience using their differential diagnosis tool and how it may be used in their future medical education.

**Results**: 9 students (23%) felt they had sufficiently educated on the use of information technology (UpToDate, MDCalc, VisualDx, DynaMed, Epocrates, Glass AI, ChatGPT etc.) in the context of clinical decision making and to inform diagnosis, testing and treatment. 4 participants (10%) reported that they felt it was neither appropriate nor desirable to use

diagnostic, testing and therapy support technology in the exam room in front of the patient. 85% of students (n=34) reported feeling AI would enhance their clinical decision-making ability in the exam room. Regarding diminishing their role as a physician, 8 participants felt that AI may interfere (20%).

**Conclusion**:

Overall, attitudes toward AI among medical students are shaped by a combination of factors, including their exposure to AI, education, personal values, and experiences seeing its implications in clinical practice. It is important for medical educators and institutions to provide students with a well-rounded understanding of AI's potential benefits and challenges to help them make informed decisions as future healthcare professionals. AI holds immense promise in medical education, it is essential to acknowledge and address potential challenges, including issues related to data privacy, bias in AI algorithms, and the need for ongoing human oversight and training. Integrating AI responsibly and ethically into clinical practice and medical education is crucial to realizing its full potential. As AI continues to advance, it has the potential to revolutionize healthcare delivery and medical training, ultimately improving patient outcomes and the quality of medical education.

## Bacterial Keratitis: Associations Among Virulence Factors and Patient Outcomes

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### Purpose

*Staphylococcus aureus* is the leading Gram-positive pathogen responsible for bacterial keratitis, a devastating eye disease that can result in scarring, corneal perforation, endophthalmitis, and, ultimately, blindness. With increasing rates of resistance and the ability of *S. aureus* to establish diverse infections, it is important to study and understand the key bacterial drivers of infection. It has been established that specific *S. aureus* virulence factors have a higher prevalence among ocular *S. aureus* isolates compared to strains causing non-ocular disease, and these bacterial factors are particularly important in ocular disease severity. Thus, it is possible that patient outcomes of bacterial keratitis may correlate with the presence of specific bacterial virulence factors. Here, for the first time, specific bacterial factors associated with clinical disease variables and outcomes are defined.

### Methods

Real-world cases of *S. aureus* bacterial keratitis were collected at the University of Michigan Kellogg Eye Center and specimens transported to the University of Rochester Flaum Eye Institute, where they underwent whole genome sequencing (WGS). Each isolate was queried for strain markers such as multi-locus sequence type (MLST), *agr* type, *spa* type, and MSSA/MRSA status, as well as 232 unique *S. aureus* virulence factors using an established *in silico* pipeline. Data generated was analyzed and directly correlated with patient clinical outcomes in *S. aureus* keratitis including infiltrate size, visual acuity, and corneal perforation to identify those factors important in bacterial keratitis pathogenesis. Corresponding patient outcomes were scaled and analyzed against virulence factors. Visual acuity was divided into three bins: $\geq 20/60=1$, $\geq 20/200=2$, $<20/200=3$. Infiltrate size (mm) was divided into four bins: $0=0$, $0 \leq 1=1$, $1 \leq 2=2$, $2 \leq 4=3$, $>4=4$. Corneal perforation was divided based on its presence or lack thereof.

### Results

11 *S. aureus* strains underwent WGS. MLST 5 was the most common with 4 samples (36%) falling under this sequence type. Other MLSTs included 1, 8, 13, 30, 72, 87, and 3989, each of which

represented 1 sample. For *agr* type, 3 samples (27%) were *agr I*, 5 samples (45%) were *agr II*, 2 samples (18%) were *agr III*, and 1 sample (9%) was *agr IV*. *spa* type was very diverse with 9 different types identified: t2, t242, t273, t338, t3609, t548, t6509, t688, t8, t95. For methicillin susceptibility, 9 samples (82%) were MSSA, while 2 samples (18%) were MRSA.

All 11 samples were queried for 232 virulence factors. 11 virulence factors were found in none of the samples and 153 were found in all samples. The remaining 68 virulence factors were identified as potentially impactful for disease severity. Following initial analysis, certain subsets of enterotoxins, serine proteases, and pseudo-enterotoxins seem to be associated with more severe disease. For example, 8 of the 11 samples carried the enterotoxins SEG, SEI, SEM, SEN, and SEO. On average, these 8 patients presented with larger infiltrates (mean=2.0) compared to those without the enterotoxins (mean=1.5). These 8 patients also presented with worse final VA (mean=2.7) compared to the other 3 patients (mean=2.3).

9 of the 11 samples were found with the serine proteases SplC, SplD, SplE, and SplF. This group of 9 patients had larger infiltrates (mean=2.2) than the samples without the serine proteases (mean=1.0). These 9 samples also had more severe presenting VA (mean=2.8) and final VA (mean=2.8) compared to the 2 samples without the serine proteases (presenting VA mean=2.0, final VA mean=1.0).

The pseudo-enterotoxins YENT1 and YENT2 were found in 5 of the 11 samples. Patients with strains carrying these pseudo-enterotoxins experienced a corneal perforation 60% of the time (3/5), while patients with strains that did not have them experienced no corneal perforations (0/6).

**Conclusion**
Given the significant morbidity and potential for vision loss associated with bacterial keratitis, it is imperative to investigate this disease and potential means to reduce patients' risk. Here, we present initial results showing potential associations among certain enterotoxins, serine proteases, and pseudo-enterotoxins with more severe infiltrate size, visual acuity, and corneal perforation. Further statistical analysis will be required to prove these associations among virulence factors and patient outcomes, but initial analysis suggests correlations between the two. As this relationship has never been previously defined, active utilization of this knowledge may improve our ability to diagnose, prognose, and ultimately treat this blinding disease.

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Understanding the Impact of HPV/Oropharyngeal Cancer Screening on Participants of the MOUTH study (Men and women Offering Understanding of Throat HPV)

Background

Human papillomavirus (HPV) is the most common sexually transmitted infection in the United States. The MOUTH study (Men and women Offering Understanding of Throat HPV) aims to elucidate how biomarkers can offer insight into future risk of HPV-related oropharyngeal cancer. The study also aims to better understand the impact of cancer screening on at-risk patients. A systematic review in 2017 examined the psychological distress related to cancer screenings (including breast, colorectal, prostate, lung, and cervical cancers), but the reviewers ultimately concluded that further studies are needed to evaluate the impact of psychological distress from cancer screenings. They also noted the importance this information can be in improving national cancer screening adherence. This project aims to address this knowledge gap by using a semi-structured qualitative interview to gauge participants' thoughts and concerns about engaging in oropharyngeal cancer screening.

Methods

Participants who completed the MOUTH study will be invited to participate in an optional qualitative interview. Enrolled participants will complete a one-time semi-structured interview and two self-reported assessment tools: The Patient Depression Questionnaire-9 (PHQ-9) and State-Trait Anxiety Inventory (STAI). Interviews will be recorded, and notes will be taken by trained study team members. Data will be coded using thematic analysis to identify major themes.

Results

Thirteen participants were interviewed in the summer of 2023. Participants highlighted several recurring themes. Some motivations for participating in cancer research include receiving a clean bill of health, peace of mind, curiosity about one's HPV status, and desire to engage in research activities. Participants identified several benefits to participating in research such as giving back to science or humanity, learning about HPV and one's HPV status, and the opportunity to receive high-quality medical care for free. Barriers to research include finding the time to attend research activities, traveling to Baltimore, and concerns regarding research data confidentiality. Participants spoke at length about facilitators to participation such as flexibility in scheduling activities, coordinated care, and clear communication. Conversely, some barriers to participation included difficulty tolerating the head and neck examinations. Some participants spoke about their anxiety and trepidation about participating in cancer research. Overall, participants were glad they participated in the MOUTH study. Many remarked about how their participation increased their awareness of HPV and may have contributed to behavioral changes.

Discussion

The preliminary results of the qualitative interviews provide a framework upon which to analyze participants' thoughts and concerns around participating in oropharyngeal cancer screening. In general, participants were happy they participated in the study. They highlighted personal motivators for returning year-after-year to complete study activities. Many have been participants for over half a decade. Their commentary provided key insight into best practices for engaging and retaining participants in a longitudinal cancer screening study. They also spoke about barriers to completing study activities. Most importantly, they shared thoughts about how their participation either contributed to or reduced their anxiety with novel screening procedures. While more interviews will be needed to ascertain all primary domains and achieve thematic saturation, this cohort of participants has elucidated key details surrounding participation in and feasibility of oropharyngeal screening.

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## Development of a vaping cessation text messaging intervention for Latino young adults: A participatory research approach

**Background:** E-cigarettes (including vapes) are increasingly popular amongst young adults. Latino young adults may be at increased risk for the harmful effects of vaping because of higher susceptibility for vaping among Latino youths and disproportionate targeting by tobacco and e-cigarette industry practices. There are few, if any, vaping cessation resources specific for the Latino population or for those who prefer to speak Spanish. *Decídetexto* is text message-based intervention for smoking, designed for the Latino community, and rooted in social cognitive theory. It has been associated with significant smoking cessation rates amongst Latino adults.

**Objective:** To describe the participatory research procedures of developing *Kick Vaping*, a text message based vaping cessation intervention for Latino young adults, available in English and Spanish.

**Methods:** The two aims of this project were: 1) adaptation of *Decídetexto* for use as a vaping cessation tool, and 2) translation of the text messages to Spanish. A Community Advisory Board (CAB) of eight Latino young adults (aged 18-25) was formed to adapt *Decídetexto* for vaping cessation. The CAB met at regular intervals to review *Decídetexto* messages in English and adapt the messages to vaping cessation. Two bilingual Latino medical students then independently translated the messages to Spanish, and a supervised, iterative process was used to facilitate unanimous agreement. Readability assessments were used to evaluate the comprehensibility of the text messages both in English and Spanish. The Fernandez Huerta (FH) and INFLESZ readability indices were used to assess the Spanish language text messages and the Flesch-Kincaid Grade Level (FKGL) & Simple Measure of Gobbledygook (SMOG) Grading were used to assess English language text messages.

**Results:** The final product of the CAB was *Kick Vaping*, a text message based vaping cessation intervention offered in both English and Spanish. The final iteration of *Kick Vaping* includes 208 text

messages per library (one in English, one in Spanish for men, one in Spanish for women, and one in Spanish for non-binary individuals). Final readability scores of the text messages in English were 4.0 and 5.5 according to FKGL and SMOG, respectively. These indicate reading levels of 4th and 5th grade respectively, which are aligned with the American Medical Association recommendation that health materials be targeted to the sixth-grade reading level or below. Final readability scores of the text messages in Spanish were 83.3 according to FH and 79.0 according to INFLESZ, which indicate reading levels of "easy" and "somewhat easy" respectively.

**Conclusions:** Engaging in participatory research with Latino young adults to create a text message based vaping intervention for the Latino young adult community is both practical and workable. The next step of this process is to assess the feasibility, acceptability, and preliminary impact of the Kick Vaping text message intervention for Latino young adults.

# Double Crush Syndrome in the Lower Extremity: Evidence for an Unfamiliar Clinical Entity

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*Introduction*

Double crush syndrome (DCS) is classically defined as multiple sites of compression along a single nerve. The combination of a compressive proximal lesion in the lumbar spine and a distal common peroneal nerve entrapment may result in compound nerve dysfunction. The two injuries may occur together or separately, and little is known about the possible pathophysiological implications of one injury on the other. We present a series of DCS patients with both active L5 radiculopathy and active peroneal mononeuropathy as found on electromyography (EMG) studies.

*Materials and Methods*

A retrospective analysis of 101 consecutive patients who underwent peroneal release and had a diagnosis of L5 radiculopathy between January 2000 and April 2023 at two quaternary academic institutions was performed. Patients were included if they had both an active L5 radiculopathy and active peroneal mononeuropathy on EMG findings, as well as pre- and post-peroneal release physical exam findings. Of the 101 patients identified with both diseases, 7 patients had a "pure" DCS of the lower extremity, meaning the co-occurrence of both active diseases based on EMG, and had the relevant pre- and post-operative data. Descriptive statistics of patient demographics, clinical presentation, surgical details and outcomes were performed.

*Results*

The mean age of patients was 62.00 years old, ranging from 47 to 80 years. 4 of the 7 patients were female (57.14%). All 7 patients included in this analysis underwent peroneal release, and 1 of the patients underwent lumbar spine surgery to address their L5 radiculopathy less than 3 years prior to their peroneal release. 1 of the patients had an intraneural ganglion cyst of the peroneal nerve. The average dorsiflexion strength on presentation of this cohort was 2.1 out of 5, while the average dorsiflexion strength following peroneal release was 2.9. 5 of the 7 patients (71.42%) presented with pain or numbness, or both, in the lateral leg/dorsal foot. 4 of these patients (57.14%) continued to have these symptoms following peroneal release. The mean follow-up time for this cohort was 8.05 months.

*Conclusions*

This is the first series to report double crush syndrome with two active points of compression in the lumbar spine and lower extremity based on EMG findings. Peroneal release was found to improve average dorsiflexion strength (reduce footdrop) and should be considered along with spinal interventions by neurosurgeons.

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*Background and Objective*

Psoriasis (PsO) is an autoimmune mediated skin condition and in 30% of cases progress into Psoriatic Arthritis (PsA)[1]. Currently PsO affects roughly 3% of the United States[2], and PsA's incidence ranges from 0.06-0.25% of the U.S. population[3]. The disease can present in a wide range of phenotypes and in several degrees of severity, covering anywhere from 1-100% of Body Surface Area (BSA). While therapies have been developed targeting known key cytokines such as TNF-Alpha, IL-17, and IL-23, there is also a significant rate of drug resistance developing in both PsO and PsA patients[4]. Because of this, significant effort has been put forth to try to reduce the current gap in understanding of the underlying pathology of PsO and PsA. In the AMP-AIM study, patients of varying phenotypes of PsO and PsA are being recruited to have skin, blood, and synovial samples taken to analyze the molecular and cellular markers which sustain the disease process to elucidate the development of the diseases, mechanism of drug resistance, and potential new molecular targets for therapy.

*Methods*

AMP-AIM is a national exploratory program which seeks to address the current gap in knowledge regarding the diversity in disease phenotypes and molecular markers in both PsO and PsA. The study is composed of 3 cohorts:

•        • Cohort 1: Patients with no systemic medications with established PsO(1a) or PsA(1b) in order to collect skin and synovial biopsies, respectively.

•        • Cohort 2: Patients naïve to systemic medications that are starting medication for their PsO(2a) or PsA(2b) collecting skin or synovial biopsies, respectively.

•        • Cohort 3: Patients with PsO at high risk of developing PsA due to genetic risk and severe disease expression

Along with meeting these requirements, enrollees would be excluded if they met any of the following criteria:

1. Possessing other Auto-immune conditions
2. Medication use that would interfere with disease presentation
3. Active Malignancy or Infection

4. Unable to provide consent or undergo procedure

5. Patient had not seen medical provider in past 2 years

If patients were found eligible in chart review their doctor was contacted and assessment appointment was made. In this assessment it would be determined if the patient as fit to undergo biopsy and what kind and from where.

*Results*

Over the course of the summer 562 potential enrollees were screened with 22.4% of patients having just PsO and 76.6% having both PsO and PsA. Upon Screening for medications, comorbidity, and other exclusion criteria, only 15 (2.7%) potential enrollees remained. After consulting with their physician during a clinic visit only 2 of the 15 patients decide to enroll in the study and were sorted into their proper cohorts.

*Discussion and Conclusions*

While no conclusive data can be drawn from the small sample size of patient samples obtained, this experience illuminated the logistical and ethical difficulty in conducting exploratory studies into the pathology of diseases that require withholding use of available medications. The AMP AIM study will continue to work with its national network of sites to recruit more participants into the study to further explore the underlying mechanism of both PsO and PsA.

References

1) Ritchlin CT, Colbert RA, Gladman DD. Psoriatic Arthritis. *The New England journal of medicine.* 2017;376(10):957-970. doi:https://doi.org/10.1056/NEJMra1505557

2) Armstrong AW, Mehta MD, Schupp CW, Gondo GC, Bell SJ, Griffiths CEM. Psoriasis Prevalence in Adults in the United States. *JAMA Dermatol.* 2021;157(8):940-946. doi:10.1001/jamadermatol.2021.2007

3) Ogdie A, Weiss P. The Epidemiology of Psoriatic Arthritis. *Rheum Dis Clin North Am.* 2015;41(4):545-568. doi:10.1016/j.rdc.2015.07.001

4) Lowes MA, Suárez-Fariñas M, Krueger JG. Immunology of Psoriasis. *Annual Review of Immunology.* 2014;32(1):227-255. doi:https://doi.org/10.1146/annurev-immunol-032713-120225

**Neighborhood social vulnerability is correlated with worse quality of life in kidney stone patients**

*David Song*

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INTRODUCTION AND OBJECTIVE: Socioeconomic factors contribute to kidney stone prevalence, impacting the quality of life of affected individuals. The Social Vulnerability Index (SVI), developed by the CDC using US census data, assesses various socioeconomic factors to determine the level of vulnerability within a particular community. This study aims to explore the association between social vulnerability and patient-reported quality of life in kidney stone patients, utilizing the Wisconsin Stone Quality of Life Questionnaire (WISQOL), a validated disease-specific questionnaire.

METHODS: A retrospective review was conducted for new urolithiasis patients who completed the WISQOL questionnaire upon their initial visit to a kidney stone clinic between 1/16/2019, and 4/13/2023. Patients were categorized into quartiles based on their census tract SVI scores, representing varying levels of vulnerability (quartile 1: least vulnerable, quartile 4: most vulnerable). Statistical analysis using the one-way ANOVA test in Python3 was performed to assess the disparity in WISQOL total score and subscores.

RESULTS: The study included a total of 1696 patients, distributed across quartiles 1-4 as follows: 662 (39%), 639 (38%), 291 (17%), and 104 (6%). WISQOL total scores decreased (indicating worsening QOL) as social vulnerability increased, with a statistically significant difference observed among the SVI quartiles ($p < 0.001$). Several SVI sub-scores showed negative correlations with lower WISQOL scores, including socioeconomic factors ($p < 0.001$), minority status and language ($p < 0.01$), housing type and transportation ($p < 0.05$), and household composition and disability ($p < 0.01$). Furthermore, significant differences were noted in all WISQOL subdomains between the SVI quartiles, encompassing social impact, emotional impact, disease impact, and impact on vitality ($p < 0.01$).

CONCLUSIONS: Our findings highlight the association between neighborhood-level socioeconomic vulnerability and diminished quality of life among new kidney stone patients attending a kidney stone clinic. The incorporation of SVI measures may prove valuable for clinicians and researchers in identifying patients who are most likely to benefit from preventive and clinical interventions.
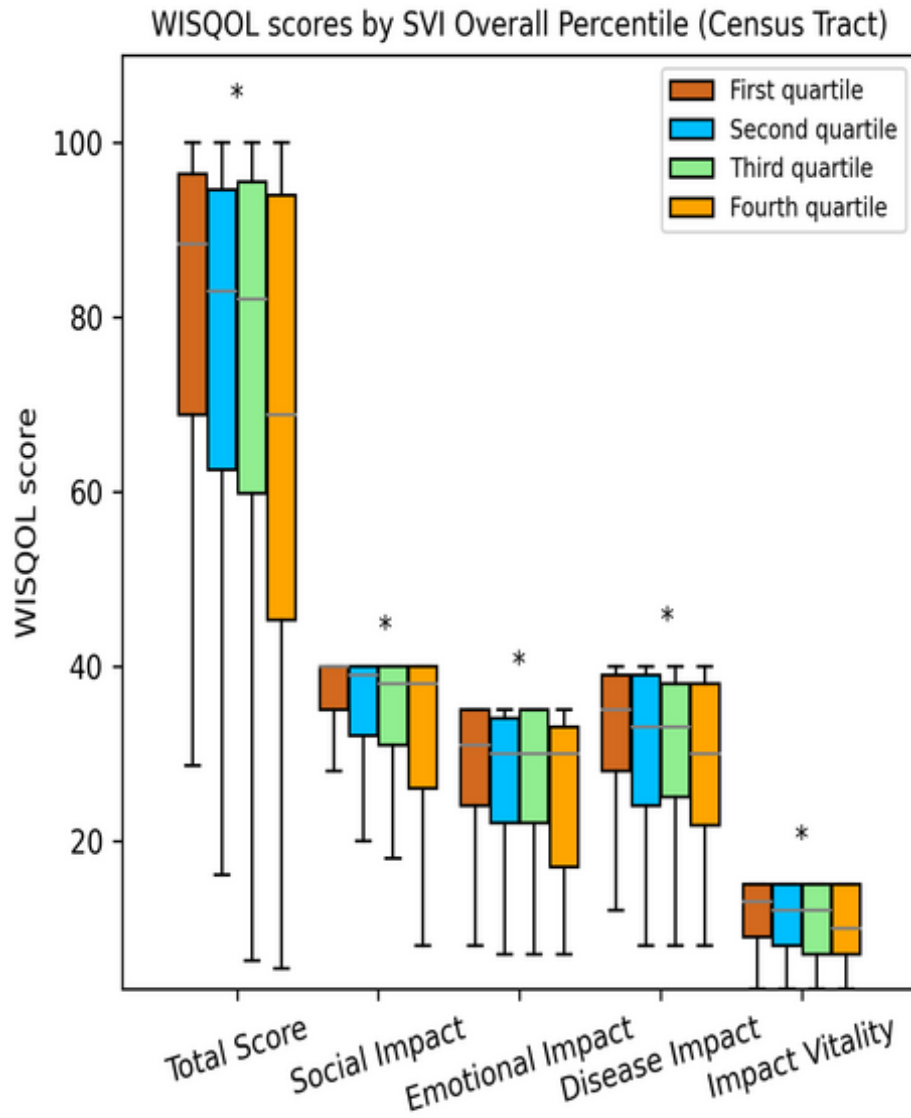
Figure 1. WISQOL scores between q1 (n=662), q2 (n=639), q3 (n=291), q4 (n=104); * p < 0.001 with ANOVA

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## Changes in Brain White Matter Integrity Associated with Head Impacts and Physical Exertion in Football Athletes

### Background:

Repetitive head impacts (RHIs) below the level of concussion may be a significant cause of neurologic damage in contact athletes. Since these hits are clinically silent and are often left untreated, athletes may be at risk long term for depression, dementia, and chronic encephalopathy. Blood-based biomarkers (BBMs), proteins, or other smaller molecules found in blood or cerebrospinal fluid, have been studies as sideline markers indicating neuronal traumatic injury. A recent study showed that changes in two BBMs, Glial Fibrillary Acidic Protein (GFAP) and UCHL1, measured immediately after a football game may correlate with reductions in white matter integrity on diffusion tensor imaging (DTI), which is considered a reference standard for brain injury after trauma. This project aimed to dichotomize the measure of white matter changes into an injured category and non-injured category, to determine clinically useful BBM cutoffs for identifying athletes at risk for reduced white matter after a single football game.

## Methods:

DTI data were collected from three groups pre- and post-intervention: collegiate football players before and after a game, the same football players before and after exercise, and collegiate non-contact athlete controls before and after inactivity. Brain imaging was segmented into 39 regions of interest which were each included in this analysis. The DTI metrics analyzed in this study to assess white matter changes were fractional anisotropy (FA), Mean Diffusivity (MD), Axial Diffusivity (AD), and Radial Diffusivity (RD). In the literature, increased FA and/or decreased MD and RD is associated with traumatic axonal swelling, and decreased FA and/or increased MD and RD is associated with axonal loss. Parametric and nonparametric tests were conducted to compare the differences in pre-post DTI changes in 39 brain regions among these three groups.

## Results:

When comparing pre-post DTI changes in football game players vs non-contact controls, there was a significant difference in FA change for 9 regions, in MD change for 4 regions, and in RD change for 4 regions. When comparing pre-post DTI changes in football players after a game vs after exercise, there was a significant difference in FA change for 4 regions, in MD change for 1 region, and RD change for 5 regions. When comparing pre-post DTI changes in the football exercise group vs non-contact controls, there was a significant difference in FA change for 6 regions and in RD change for 2 regions. Differences in AD change were only significant for 1 region among the three comparisons.

## Conclusion:

The initial results from this study suggest significant differences in DTI change for FA, MD, and RD in football players before and after a single game, compared to DTI changes in the same players before and after exercise and when compared to DTI changes in non-contact athlete controls before and after inactivity. Our results may also suggest that significant differences may not be seen when comparing changes in AD among the three groups. Additional ongoing analyses will provide more information to develop a dichotomized DTI measure to assess injury status that can be correlated to BBM measurements.

## Abortion Care in Rochester NY in the Post-Dobbs Era

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**Purpose:**

On June 24, 2022, the US Supreme Court issued the Dobbs v. Jackson Women's Health Organization ruling, stating that there is no constitutional right to abortion and overturning the landmark Roe v. Wade. This decision turned the rights surrounding abortion over to the state's control, creating a patchwork of abortion access across the nation in the following months. Despite the fact that 30% of women in the United States obtain an abortion by age 30, the availability of abortion providers remains limited. Restrictive abortion laws pose challenges to safe, legal access and lead to potentially hazardous alternatives which disproportionately affect marginalized communities. This research project endeavors to investigate the landscape of abortion care access in Rochester, NY by examining abortion care utilization during the 3-year period leading up to the pivotal Dobbs v. Jackson decision and subsequently contrasting it with the following 3 years. The aim is to discern shifts in abortion care utilization and accessibility in order to determine potential ramifications on reproductive health outcomes and healthcare equity. Given the volume of abortions provided and its proximity to other state borders, Strong Memorial Hospital is an ideal location to examine these trends in abortion care. We hypothesize that with more limited access, women will be required to travel further distances for abortion care, and this geographical barrier will cause them to seek abortions later in their pregnancy than they desire.

**Methods:**

This is a cross-sectional study that analyzes data from all patients who underwent a medical or surgical termination of pregnancy at URMC's Gender Wellness, Obstetrics, & Gynecology Family Planning Clinic during the 3 years before Dobbs v. Jackson Women's Health Organization and the 3 years after (6/24/2019-6/24/2025). Patients who were seen in the Family Planning clinic but did not undergo an abortion at our institution were excluded. Data was collected in two phases. Phase one employed a retrospective chart review from all women who already received treatment. Phase two is ongoing and includes prospectively collected data from women who will be completing care with URMC up until 6/24/2025. In phase two, data is entered at the end of every month for those patients that completed treatment in that month. All patient data was de-identified and the study protocol was approved by the URMC Institutional Review Board. Patient demographics for age, race, ethnicity, zip code, insurance type, and highest level of education were collected, as well as clinical information at the time of their visit including gravida and parity status, gestational age at time of abortion, trimester of abortion (first vs. second), and type of abortion (medical vs. surgical). The mean distance traveled and gestational age were calculated with sub-analyses of gestational age (<9,

9 to 13, 13 to 20, and >20 weeks), and statistical analyses were performed to assess the association between these two variables during the months of April, May, and June across the years 2020, 2021, 2022, and 2023.

**Results:**

To date, data has been collected from a total of 2252 patients, and 618 have been analyzed (202 from April, 206 from May, and 210 from June). Analysis of April showed a mean distance traveled (D) of 32.3 miles and gestational age (GA) of 14 weeks and 4 days in 2020, D of 31.9 miles and GA of 13 weeks and 3 days in 2021, D of 22.4 miles and GA of 13 weeks and 4 days in 2022, and D of 25.0 miles and GA of 13 weeks and 3 days in 2023. Spearman's rank correlation coefficient (ρ) was ρ=0.4145 with p-value=0 for April 2020-2022, and ρ=0.4819 with p-value=0.0006 for April 2023. Gestational age sub-analyses showed that in April 2020, 21% of patients received abortions at <9 weeks of gestation, 10% at 9 to 13 weeks, 56% at 13 to 20 weeks, and 13% at >20 weeks. April 2021 showed 34% at <9 weeks of gestation, 9% at 9 to 13 weeks, 41% at 13 to 20 weeks, and 16% at >20 weeks. April 2022 showed 29% at <9 weeks of gestation, 15% at 9 to 13 weeks, 38% at 13 to 20 weeks, and 18% at >20 weeks. April 2023 showed 30% at <9 weeks of gestation, 13% at 9 to 13 weeks, 39% at 13 to 20 weeks, and 17% at >20 weeks. Analysis of May demonstrated D of 40.0 miles and GA of 15 weeks and 1 day in 2020, D of 36.3 miles and GA of 13 weeks and 1 day in 2021, D of 31.5 miles and GA of 13 weeks and 6 days in 2022, and D of 25.2 miles and GA of 13 weeks and 6 days in 2023. ρ was calculated as ρ=0.4297 with p-value=0 for May 2020-2022, and ρ=0.2891 with p-value=0.0376 for May 2023.

Gestational age sub-analyses showed that in May 2020, 26% of patients received abortions at <9 weeks of gestation, 7% at 9 to 13 weeks, 46% at 13 to 20 weeks, and 21% at >20 weeks. May 2021 showed 43% at <9 weeks of gestation, 11% at 9 to 13 weeks, 26% at 13 to 20 weeks, and 20% at >20 weeks. May 2022 showed 23% at <9 weeks of gestation, 20% at 9 to 13 weeks, 43% at 13 to 20 weeks, and 15% at >20 weeks. May 2023 showed 21% at <9 weeks of gestation, 21% at 9 to 13 weeks, 37% at 13 to 20 weeks, and 21% at >20 weeks.

Analysis of June demonstrated D of 28.6 miles and GA of 14 weeks in 2020, D of 28.7 miles and GA of 13 weeks and 6 days in 2021, D of 15.4 miles and GA of 13 weeks and 1 day in 2022, and D of 30.3 miles and GA of 13 weeks and 5 days in 2023. ρ was calculated as ρ=0.4297 with p-value=0 for June 2020-2022, and ρ=0.2891 with p-value=0.0376 for June 2023.

Gestational age sub-analyses showed that in June 2020, 25% of patients received abortions at <9 weeks of gestation, 19% at 9 to 13 weeks, 39% at 13 to 20 weeks, and 17% at >20 weeks. June 2021 showed 30% at <9 weeks of gestation, 9% at 9 to 13 weeks, 49% at 13 to 20 weeks, and 11% at >20 weeks. June 2022 showed 26% at <9 weeks of gestation, 25% at 9 to 13 weeks, 34% at 13 to 20 weeks, and 15% at >20 weeks. June 2023 showed 28% at <9 weeks of gestation, 17% at 9 to 13 weeks, 40% at 13 to 20 weeks, and 15% at >20 weeks.

**Discussion:**

Our results showed that for both the 3-year period prior to Dobbs v. Jack and the 1-year period since the ruling, there exists a statistically significant positive association between the distance patients

traveled to URMC and the gestational age at which they received abortion care. During the months of April and May across the years, the percentage of abortions at >20 weeks gestational age has increased slightly, although June noted a modest overall decrease.

Conversely, the mean distance traveled during April and May has decreased over the years, suggesting that patients are utilizing abortion care services closer to their communities than we had predicted. However, a comparison of June 2022 to June 2023 showed a sudden increase from 15.4 miles to 30.3 miles for mean distance traveled, indicating that this relationship remains in flux. Further data collection and statistical analyses will be required to comprehensively compare the three-year period leading up to Dobbs v. Jackson to the three-year period afterwards, but initial analysis suggests correlation between gestational age and distance traveled for abortion care, as well as early variations in these factors as abortion access transforms. Multivariate analysis will be performed to assess differences in the association between these two factors for each month of the year to account for seasonal differences in abortion rates. Since a statistically significant association between distance traveled and gestational age was noted, we also plan to assess for an association between distance traveled and rate of complications. As the topography of abortion care legislation continues to change, it is essential to address the geographical disparities in abortion care access to uphold the principles of bodily autonomy and reproductive equity.

**Kismat Touhid**

## Area Deprivation Index (ADI) as a Predictor of Patient-Reported Outcomes (PROMIS) Following Reverse Total Shoulder Arthroplasty

Principal Investigator:

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Co-Investigators:

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### 1. Background

Over the past several years, reverse total shoulder arthroplasty (rTSA) has become the dominant shoulder arthroplasty procedure and offers the promise of immense functional improvements to an aging population. Despite this fact, perceived patient benefit may not be equally distributed among those experiencing divergent levels of socioeconomic stress, as a nascent yet growing body of orthopedic literature suggests. Unfortunately, there exists a paucity of research elucidating the relationship between social determinants of health (SDOH) on rTSA outcomes. This study sought to explore this area by utilizing Area Deprivation Index (ADI) as a surrogate for SDOH and its impact on patient-reported outcomes collected by Patient-Reported Outcomes Measurement Information System (PROMIS). Defining such relationships may be useful in refining how vulnerable patient populations are identified and in informing future efforts to improve equitable patient outcomes.

### 2. Methods

This was a retrospective review of 207 patients who had undergone rTSA for non-traumatic, non-bilateral, non-revision and non-tumor related indications between 1/1/2015-3/1/2023. The most recent pre-op PROMIS survey responses (at most 6 months prior to surgery) and the latest post-op PROMIS survey responses between 6 months to 2 years were compiled along with patient demographic data, insurance, smoking history, and BMI. Achievement of minimal clinically important difference, or MCID, was determined if patients' PROMIS delta outcomes met or exceeded at least half the standard deviation of pre-op PROMIS domain outcomes in the appropriate direction (higher physical function and upper extremity values demonstrate desirable outcomes while higher pain interference and depression values actually demonstrate worse outcomes). ADI values were obtained by geocoding patient addresses into census blocks into R Studio 4.13 and deriving the corresponding

12-digit FIPS codes needed to retrieve ADI from University of Wisconsin's Neighborhood Atlas database. Data was stratified into 6m-12m, 12m-18m, and 18m-24m cohorts in order to detect any significant differences in PROMIS outcomes dependent on follow-up time using chi-square for MCID achievement and Kruskal-Wallis for post-op outcomes. Within each discrete follow-up period, patient data were ranked by ADI quartiles and thirds in order to compare outcomes between the least socially deprived cohorts (lowest quartile and tertile) and most socially deprived cohorts (highest quartile and tertile) via ANOVA. Tukey HSD is used to identify intra-group differences. Linear regression was used to determine relationships between ADI and demographic variables with PROMIS outcomes, and multivariable regression analysis was used to determine the individual impact of each demographic variable on PROMIS outcomes while adjusting for other variables. Logistic regression was used to identify potential relationships between patient background variables, including ADI, with achievement of MCID.

## 3. Results

Descriptive statistics revealed n=95 for the 6m-12m cohort with a mean follow-up of approximately 9 months, n=59 for the 12m-18m cohort with a mean follow-up of approximately 15 months, and n=54 for the 18m-24m cohort with a mean follow-up of approximately 21 months. Kruskal-Wallis tests show statistically significant differences in final physical function (p=0.047) and pain interference (p=0.018) values between the cohorts. Chi-square tests reveal statistically significant differences in achieving MCID for physical function (p=0.0016) and nearly significant differences in achieving MCID for pain interference (p=0.0627) and upper extremity (p=0.0852). Additionally, Kruskal-Wallis and Chi-Square tests reveal no significant differences between outcomes in the 12m-18m and 18m-24m cohort. Further SDOH analysis for data points within the 6m-12m period are isolated from the remaining data to avoid the confounding effect of follow-up period on ADI/other social determinants on PROMIS outcomes.

ANOVA testing of ADI quartiles on the PROMIS domain outcomes reveal a statistically significant correlation between ADI and pre-op pain interference (PI) scores (p=0.012) as well as post-op upper extremity (UE) scores (p=0.006), and nearly significant relationship with post-op pain interference (p=0.085). Tukey HSD reveals a mean difference of about 5.84 between the least and most socially deprived quartiles for pre-op PI and a mean difference of 5.81 between the least and most socially deprived quartiles, as well as large mean difference of 10.1 for post-op UE between the least and most socially deprived quartiles. Tertile analysis also revealed similar statistically significant relationships. However, chi-square tests showed no statistically significant differences in ADI cohort and rates of achieving MCID.

Unadjusted linear regression analysis of non-ADI variables shows statistically significant negative correlations with BMI and final physical function (PF) (p=0.0209, slope= -0.358, r^2=0.058) and upper extremity scores (p=0.043, slope= -0.452, r^2=0.0843). Also, gender was correlated with multiple PROMIS outcomes including pre- and post-op PF outcomes as well as pre-op PI outcomes. Race and insurance were variables that showed no statistically significant relationship with any of the PROMIS outcomes and were thus not used in multivariable regression analysis nor logistic regression analysis for MCID achievement. Multivariable regression showed gender is a significant predictor of pre-op PF, smoking history, age and ADI are independent predictors of pre-op PI, smoking history, gender and BMI are independent predictors of post-op PF, and that ADI is the only significant independent predictor of post-op PI. Logistic regression analysis with these same independent variables demonstrates no statistically significant impact on achievement of MCID for all four domains.

Analysis of the other 12m-18m and 18m-24m time periods is still ongoing.

**4. Discussion**

Previous research on PROMIS outcomes for orthopedic shoulder procedures, including rTSA, shows that patients report maximal changes around 1 year, and the findings of this investigation corroborate this. For the 6m-1yr cohort, multiple different analyses support the idea that ADI is either correlated or a predictor of PROMIS outcomes, particularly for pain interference and upper extremity function. More specifically, patients who reside in areas of higher social deprivation report worse post-operative pain interference and upper extremity function. While ADI did not predict pre-op PI, it was the only variable that independently predicted post-op PI. In fact, it was the only variable that had independent predictive power for a

post-operative PROMIS outcome where no other variable, highlighting its potential utility in identifying patients who may experience barriers to care or recovery that results in poorer outcomes. More investigation is needed as to the mechanisms behind higher pain and relatively worse upper extremity outcomes in patients from higher ADI locations. Interestingly, there was no relationship found between achievement of MCID and any of the patient background variables, including ADI, suggesting that achievement of MCID is likely a stable outcome of rTSA or that other variables play a much more significant role in influencing achievement of MCID than those analyzed in this study. So, while the absolute scores for post-op UE and PI seem to be worse among those from higher ADI census blocks, patients still achieve a clinical benefit from rTSA regardless of patient background. Limitations in this study include poor response rates for upper extremity surveys and lack of racial and insurance diversity, possibly underpowering the regression analyses for these variables. Establishing a link between disparities in SDOH with rTSA outcomes and highlighting the utility of ADI in this hopefully informs future actions to correct for these outcome discrepancies.

## 5. Figures

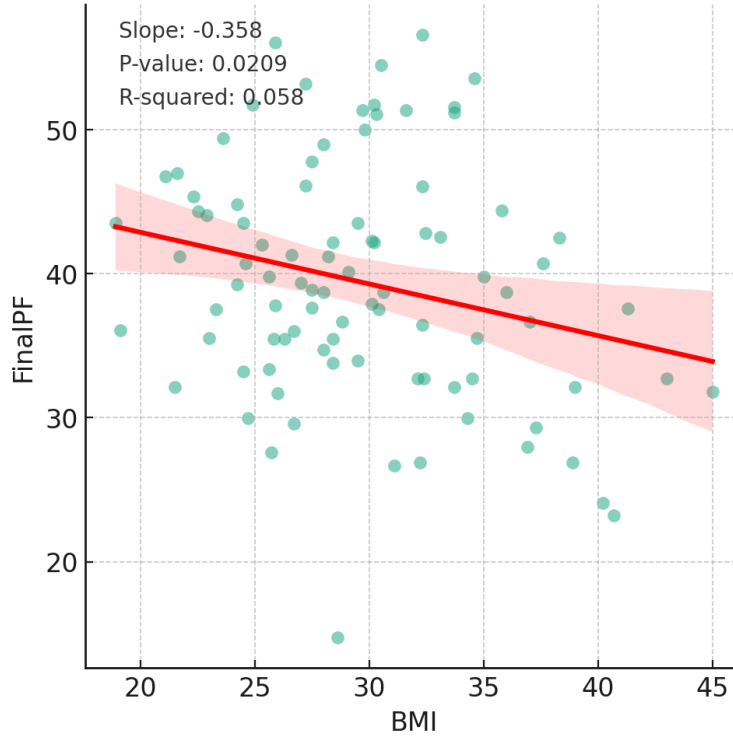**Descriptive Statistics For 6m-12m Cohort**

| | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| Age | 95 | 51 | 85 | 71.46 | 7.387 |
| BMI | 91 | 18.90 | 45.00 | 29.6367 | 5.52106 |
| ADI | 95 | 17 | 99 | 63.15 | 18.342 |
| Pre-Op Delta | 95 | -179 | 0 | -35.84 | 45.557 |
| Post-Op Delta | 95 | 184 | 366 | 268.08 | 57.640 |
| Pre-Op PF | 94 | 22.64266456 | 54.32183527 | 36.0744373613 | 6.68595168692 |
| Final PF | 95 | 14.719776150000000 | 58.146926880000000 | 39.430423520210525 | 8.397635122999398 |
| Delta PF | 94 | -17.696598060000000 | 21.319705960000000 | 3.357854492978723 | 6.801874379695254 |
| Pre-Op Dep | 86 | 34.1674981234214 | 76.8812157254130 | 51.951294814039660 | 9.898156892494612 |
| Final Dep | 85 | 34.1674981234214 | 69.4527282714844 | 50.098572436508340 | 9.577111390004000 |
| Delta Dep | 76 | -28.704021666198500 | 16.479785919189400 | -1.195361760207958 | 7.598162933835567 |
| Pre-Op UE | 54 | 20.3111457824707 | 45.7186393737793 | 28.724988739824060 | 6.086053915067824 |
| Final UE | 51 | 14.6524314880371 | 60.7018051147461 | 34.646855280551000 | 8.674308835952328 |
| Delta UE | 37 | -5.721286773681697 | 38.410396575927710 | 6.768061748866968 | 8.672135881392396 |
| MCID_PF | 95 | 3.24763257362268 | 3.24763257362268 | 3.247632573622680 | .000000000000000 |
| MCID_Dep | 95 | -4.93010378337072 | -4.93010378337072 | -4.930103783370720 | .000000000000000 |
| MCID_UE | 95 | 3.12143652342042 | 3.12143652342042 | 3.121436523420420 | .000000000000000 |

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| | | | | | |
|---|---|---|---|---|---|
| Pre-Op PI | 91 | 50.1232528686 523 | 76.4481735229 492 | 62.7830488200 57410 | 6.01316913369 1794 |
| Final PI | 93 | 38.6715964471 728 | 73.7037238442 168 | 57.6730102257 15910 | 8.39952851927 3094 |
| | | | | | |
| Delta PI | 89 | - 25.9814872741 69910 | 9.14455413818 3594 | - 4.75653354857 2502 | 7.52574778356 6417 |
| MCID_PI | 95 | - 3.12525746902 413 | - 3.12525746902 413 | - 3.12525746902 4130 | .000000000000 000 |
| Valid N (listwise) | 35 | | | | |

Figure 1

Relationship between BMI and FinalPF

Slope: -0.358
P-value: 0.0209
R-squared: 0.058



Relationship between ADI and FinalUE

Slope: -0.161
P-value: 0.0099
R-squared: 0.128

Relationship between ADI and FinalPI

Slope: 0.118
P-value: 0.0123
R-squared: 0.067
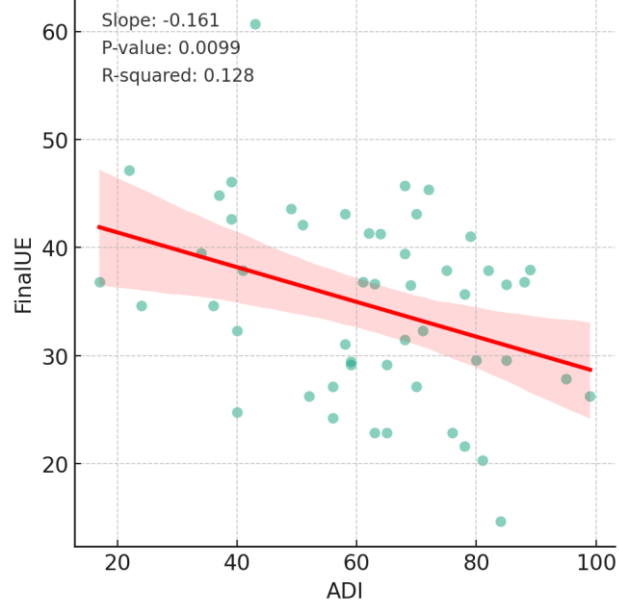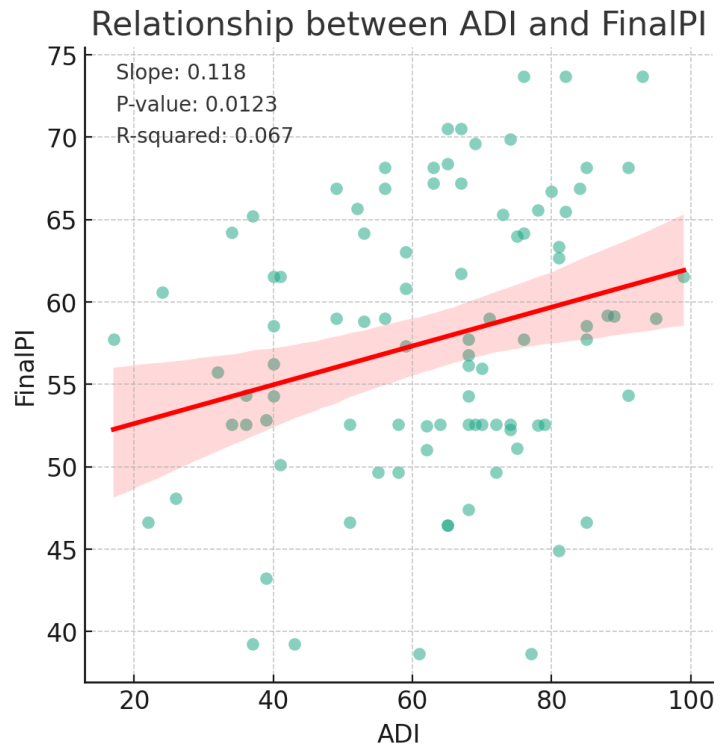
**Tran, Janet**

## Impact of Social Deprivation on Cubital Tunnel Syndrome

**Purpose:** Cubital tunnel syndrome (CuTS) is the second most common peripheral nerve compression syndrome in the upper extremity. The Area Deprivation Index (ADI) measures social deprivation using several domains such as education, income/employment, and housing environment based on zip codes. The aim of this study is to investigate the impact of social deprivation on the presenting electrodiagnostic severity of CuTS and on the treatment timeline of CuTS patients undergoing surgery.

**Methods:** This is a retrospective study evaluating patients presenting to an academic institution who were diagnosed with CuTS and underwent surgical intervention in a 6-year period. Variables including age, gender, BMI, ADI, electrodiagnostic severity classification, and time elapsed between several treatment milestones were obtained from 277 cases. Treatment milestones included referral to and initial evaluation by hand surgery, date of electrodiagnostic studies, surgical decision date, and surgical date. Study inclusion criteria include a ICD-10 code for cubital tunnel syndrome or a CPT code for ulnar nerve decompression and a valid 9-digit zip code. Patients treated in the setting of trauma, ipsilateral revision, or second contralateral diagnosis were excluded. Patients who obtained EDX studies prior to presentation were excluded in analysis of time elapsed between EDX studies and treatment milestones. Patients were grouped into thirds of ADI national percentiles. Higher ADI percentiles indicate a greater degree of deprivation.

**Results:** Current data included 383 patients divided by ADI national percentiles from least to most deprived thirds: low (n=30), middle (n=152), and upper (n=201) Patients in the lowest third had significantly shorter time between initial presentation to date of surgery compared to the middle third (116 vs. 196 days, p=0.02) and upper third (116 vs. 204 days, p=0.01) of percentiles. Additionally, patients in the lowest third compared to the highest third of percentiles had significantly shorter time between initial presentation to date of EDX studies (41 vs. 70 days, p=0.02) and surgical decision (47 vs. 107 days, p=0.01). The proportion of electrodiagnostically severe CuTS exhibits a trend of increasing with increasing social deprivation. This does not meet statistical significance at the current sample sizes.

**Conclusions**: Increasing social deprivation correlates with a prolonged time from presentation to the surgery. Delays in completing different treatment milestones may contribute to this in an additive fashion. We also note a trend towards more advanced disease in the more socially deprived groups. Defining and acting on factors that result in this delayed care represents an area of improvement for healthcare systems.

**Sarah Wegman**

Preceptors: Peter Juviler, MD; Derek Wakeman, MD

## Qualitative Analysis of a Novel Peer Support Intervention for Pediatric Gastrostomy

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**Introduction:** Gastrostomy tube (G-tube) insertion is a common pediatric procedure associated with high rates of healthcare resource utilization. We developed a peer support program for caregivers of children with new G-tubes aimed at increasing caregiver self-efficacy and decreasing health system utilization. During the initial pilot, we offered peer support to children thought to be at highest risk for poor outcomes – single caregiver, neonatal intensive care unit admission, living in a home in an area deprivation index > 80. In this study, we aimed to systematically explore mentor experiences to understand their perspective on program feasibility, acceptance, and efficacy.

**Methods:** Five of seven mentors from the G-tube peer support program between April 2022 and December 2022 participated in a semi-structured focus group (one group of 2 participants and one group of 3) via recorded video conference. Transcripts were coded using Dedoose via inductive and deductive analyses (informed by an existing peer support conceptual framework).

**Results:** Five major themes emerged: mentor perception of the program (goals and efficacy); peer support relationship dynamics; mentor-specific factors (capability, motivation, and opportunity); determinants of program success; and suggestions for program improvement. Mentors perceived the program as a valuable source of support and comfort for caregivers that complements and expands the reach of support they receive from clinical providers. Mentor-mentee relationships primarily included assistance in daily G-tube management, social and emotional support, and linkage to additional resources. Relationship success was improved by making initial contact 3-4 days post-discharge and establishing a trusting relationship with clear expectations early. Mentors suggested that while financial compensation is appreciated, recognition of their contribution and impact by the clinical team may be a more important motivation. Lastly, mentors prioritized program diversity, equity, and inclusion by advocating for program mechanisms to enroll foster parents receiving a foster child with a G-tube and recruitment of mentors qualified to support non-English-speaking mentees.

# Risk Factors for Infection Control after Treatment of Prosthetic Knee Infection at a Western New York Tertiary Referral Center

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## Introduction

Prosthetic joint infections (PJI) are common complications associated with total knee arthroplasties (TKA) and one of the leading causes of TKA failure. Although the incidence rate for PJIs remain at 1-2%, PJIs are associated with significant increases in mortality and morbidity, as well as prolonged hospitalizations and intensive medical care. In addition to the impacts on patients, PJIs also increase healthcare costs and place a heavy economic burden on the healthcare system with costs expected to exceed $1.8 billion annually by 2030. Coupled with an aging population in the United States, the demand for TKA is projected to skyrocket in the next few decades, with some estimates projecting a 4.5-fold increase by 2060. As such, identification of optimal treatment strategies and prevention of PJIs are of great importance. During TKA revisions, spacers can be implanted in order to maintain joint stability and provide intra-articular antibiotics. However, there remains no consensus on which spacer types are optimal for infection control. In this study, we will examine the relationship between spacer types and post-operative complications and identify risk factors for PJI.

## Methods

In this retrospective study, patients with confirmed prosthetic knee infections who underwent revision TKAs at a single institution between 2015-2023 were identified. Subjects, ages 18-90, were classified into comparison groups based on the type of prosthetic spacer implanted. Post-operative complication rates and same joint reoperation rates were compared between groups. Post-operative complications included deep vein thrombosis, cardiovascular complications, pulmonary complications, strokes, urinary tract infections, and reinfection. Risk factors, such as age, gender, body mass index, diabetes status, insurance status, lab values, microbial cultures, and prior surgical history were also identified.

## Results

In total, 49 patient charts were reviewed. The average subject age was 68.8 and the average length of follow-up was 19.2 months. The most prevalent knee infection species were staphylococcus aureus (14.3%), staphylococcus epidermidis (10.2%), and enterococcus (4.1%). 14.3% of subjects had static spacers while the remaining 83.7% of subjects had articulating spacers. Real implant spacers were the majority subtype of articulating spacers (63.3%), followed by biomet stage 1 and osteoremedies spacers (16.3%). Among subjects with static spacers, the 1-month and 12-month complication rates were 14.3% and 14.3%, respectively. Although subjects with articulating spacers had a lower 1-month complication

rate (11.9%), their 12-month complication rate was higher (21.3%). When comparing articulating spacer subtypes, biomet stage 1 and osteoremedies spacers had lower 1-month (0.0%) and 12-month (12.5%) complication rates relative to real implant spacers (12.9% and 22.6%, respectively). The most common post-operative complications were surgical site infections requiring further surgery (28.6%), antibiotic complications (21.4%), sepsis (21.4%), and UTIs (14.3%). Within the entire patient sample, 28 out of 49 patients (57.1%) underwent reoperations on the same joint.

## Conclusion

There remains a high rate of complications following revision TKAs among subjects with articulating and static spacers. Sepsis, surgical site infections requiring further surgery, and antibiotic complications were the leading complications within the study population. Over half of the subjects reported reoperations on the same joint. These reoperations not only represent a significant decrease in mortality and morbidity but also greatly increase healthcare cost.

## Concordance of patient perceived sports bra size with objective measurement

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Bianca Edison5, Courtney Jones1,6

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### Introduction

Sports bras are an essential piece of sporting equipment for women to be able to participate comfortably in activity. The breasts sit atop of the chest with minimal anatomical support and move with multidirectional forces [1]. This motion can lead to breast pain during activity, which is a commonly reported obstacle to physical activity for women [1,2]. Dampening of these motions with suitable support for the breasts can enable women to participate in sport. However, in the limited data that exists on sports bra fit, it has been found that women wear ill-fitting bras more often than well-fitting bras [3,4]. Furthermore, bra fit appropriateness has not been previously studied in an American cohort or in an adolescent population. Improved awareness of bra fit and sizing is essential to ensure appropriate development can be made for support apparel. Our hypothesis was that most women are not wearing appropriately fitting bras.

### Methods

This was a cross-sectional study of girls and women participants who were seen in the University of Rochester Medical Center (URMC) Orthopaedics sports medicine clinics for a musculoskeletal complaint. Women and girls ages 11-64 years old were eligible for recruitment. All subjects gave informed consent for inclusion before their participation in the study and the study protocol was approved by the URMC Institutional Review Board. Participant demographics, sports bra characteristics and history of sport bra usage were collected from each participant, in addition to their self-reported bra size. Bra size was objectively measured by study staff using a uniform

method of measuring band and bust size (Figure 1). Cup size was calculated from these measurements. Statistical analyses were performed to assess for differences and concordance using SAS, version 9.4 (Cary, NC).
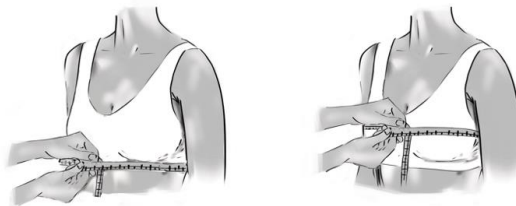


## Results

There were 69 women and girls in the cohort. Mean age was 22.5 +/-12.4 years and 88.4% were white. Most commonly self-reported band size was 34 (n=21), cup size B (n=19) and the most commonly reported comprehensive bra size was 34A (n=8). Most commonly measured band size was 34 (n=26), cup size was C (n=17) and comprehensive bra size was 34B (n=12). Of the 58 reported band sizes, 56.9% did not match the objectively measured band size, with the vast majority of discordance being underestimations (87.9%). Of the 59 reported cup sizes, 44.1% did not match the objectively measured cup sizes, with the majority of the discordance being overestimations (61.5%). Examining both components (cup and band size), there was 58.1% discordance between self-reported and objectively determined measurements. Concordance did not significantly differ based on breast asymmetry, breast pain/discomfort with activity, previous professional bra fitting, bra cup size, body mass index, or Area Deprivation Index. Women who could correctly identify their cup size were older (25.6+/-14.27) than patients who could not (19.7+/-9.8) (p=0.054). While the majority of participants (69.6%) were satisfied/very satisfied with the fit of their sports bra, only a third (34.8%) reported they had previously had a professional bra fitting and 39.1% reported that they felt their breast size had increased in the past year. The top feature for selecting a sports bra was the amount of support it provided (62.3%).

**Conclusions**

Our results show that there is a large discordance between perceived and objectively measured sports bra size. Improper bra fit may be a significant contributor to women being inactive or prevent them from comfortably participating in sports. Important next steps from this pilot project are to purposeful recruit a more representative cohort to better reflect the demographics

of American women, in addition to comparing data in athletes versus non-athletes and obese and non-obese women. These findings indicate that sports bras are key to engagement in exercise, with more investigation needed to define what impacts and influences "support" as a primary choice factor for women when purchasing sports bras.

**References**

1 Mason BR, Page KA, Fallon K (1999) An analysis of movement and discomfort of the female breast during exercise and the effects of breast support in three cases. J Sci Med Sport 2:134-144. https://doi.org/10.1016/s1440-2440(99)80193-5

2 Burnett E, White J, Scurr J (2015) The influence of the breast on physical activity participation in females. J Phys Act Health 12:588-594. https://doi.org/10.1123/jpah.2013-0236

3 Greenbaum A, Heslop T, Morris J, Dunn, K (2003) An investigation of the suitability of bra fit in women referred for reduction mammaplasty. Br J Plast Surg 56:230-236. https://doi.org/10.1016/s0007-1226(03)00122-x

4 Greenbaum A, Heslop T, Morris J, Dunn, K (2003) An investigation of the suitability of bra fit in women referred for reduction mammaplasty. Br J Plast Surg 56:230-236. https://doi.org/10.1016/s0007-1226(03)00122-x

**Dry Needling Management of Hamstring Injuries: A Retrospective Chart Review**
**K. Yoon, A. Rana, K. Rizzone**

**Intro:** Dry needling (DN) is a minimally invasive treatment modality that was originally used for it's potential benefits in reducing spasticity in both upper and lower limbs in patients with neurologic disease[1]. Research on the topic has also examined the effects of DN on musculoskeletal pain (MskP)[2,3], and it has been shown to have beneficial effects on patients' range of motion, physical functioning, and muscle strength in both the lower and upper extremities[2,3]. Its therapeutic effects have been attributed to the impact DN has on myofascial trigger points (MTrP), which is a sensitive area of tight muscle that occurs after injury or overuse[4]. MTrPs can cause pain and limit motion and function. Minimal research has focused on how DN impacts specific populations of patients, such as athletes[5]. Hamstring injuries are often difficult to treat, require a prolonged return to sport, and are commonly reinjured without proper treatment[9]. The aim of our study was to evaluate how dry needling impacts pain, return to play, and other patient-reported outcomes in athletes with hamstring injuries.

**Design:** Retrospective Chart Review

**Setting:** University of Rochester Medical Center Orthopaedic Sports Medicine Clinic

**Independent Variable:** Received Dry Needling, Hamstring Injury, Demographic information
Methods: Participants were identified through the keyword "Dry needling" in patients notes and charts were then reviewed for inclusion criteria. Electronic medical records of patients above the age of 13 who received dry needling after a hamstring injury between 2010-present were included in the cohort. Chart abstraction components included demographic characteristics, course of management of the diagnosis and patient-reported outcomes.

**Outcome Measures**: Changes in Patient Reported Outcome Measure Information System (PROMIS) scores, visual analog survey (VAS) pain scores, subjective improvement by patient, and return to sport if applicable.

**Results:** Our cohort consisted of 49 participants with a mean age of 31.71 years. Participants were almost evenly divided by gender (53% female) and the majority were white (81.6%). Most participants had private insurance (85.8%), while the rest had public insurance (12.2%) or were uninsured (2.0%). The average count of dry needling sessions within the cohort was 1.84. Most participants participated in sports (85.7%). Of those who participated in sports, all pediatric patients were high school athletes, with running being the most prevalent sport. Of the adult patients, 33.3% were collegiate athletes, 30.6% were recreational athletes, and 13.9% participated in active competitions for their sport (i.e marathon). The most common

medical diagnosis using ICD-codes were non-specific hamstring injury (26.5%), hamstring tendinitis (28.5%), and hamstring strains (24.4%). 69.4% of patients reported improvement in symptoms, such as reduced hamstring pain and greater mobility, after at least one dry needling session. 59.2% of patients returned to sport/activity after dry needling treatment. PROMIS depression and physical function scores existed for 28 participants at baseline visit, whereas PROMIS pain interference scores existed for 29 participants at the baseline visit, which is defined as the initial encounter when the patient was seen for a hamstring injury. At the 1st visit, defined as the visit when the patient received dry needling if they hadn't at the baseline visit, 26 participants had available PROMIS depression scores, 28 participants had available PROMIS physical function scores, and 27 participants had available PROMIS pain interference scores. Only 8 PROMIS depression, physical function, and pain interference scores were available for patients who received dry needling at a 2nd visit, defined as the visit whereby the patient received a second dry needling treatment. Only 3 PROMIS depression, physical function, and pain interference scores were available for patients who received dry needling at a 3rd visit, defined as the visit whereby the patient received a third dry needling treatment. VAS scores existed for all 49 participants at baseline and 1st visit, 27 participants at the 2nd visit, and 10 participants at the 3rd visit.

All participants, a majority of whom were athletes, received dry needling because of a hamstring injury, such as a non-specific hamstring injury, hamstring tendinitis, or hamstring strain. These hamstring injuries hindered their ability to participate in their respective sport or activity. Therefore, dry needling therapy was used to improve symptoms of the participants by enhancing range of motion, reducing pain, and increasing strength and power[6,7], with the overall goal of facilitating a return to sport or activity. Consistent with the literature highlighting the expected benefits of dry needling on musculoskeletal injuries, most of the participants in this sample reported an improvement in hamstring injury symptoms and subsequently returned to their respective sport/activity.

**Discussion:**
There is limited existing research on the impact of dry needling on hamstring injuries. One case report highlights improvement in pain and dysfunction of an 18-year-old collegiate pole vaulter with an acute hamstring strain[8]. This improvement in pain and dysfunction is consistent with the majority of participant-reported improvement in symptoms found in our study.

This retrospective chart review was limited by the incomplete and missing data present with our given sample, such as the lack of available PROMIS scores and indications of return to sport. This led to the exclusion of some records and contributed to selection bias. Most of the participants were white and privately insured, limiting the generalizability to the broader population. Given the structure of the retrospective study, there was a lack of a control group, making it difficult to determine if there were other factors accounting for the

improvement in symptoms besides the dry needling therapy itself.

**Conclusion:**
Overall, dry needling was helpful for the majority of the participants that received this therapy, as 69.4% of the participants included in this study reported an improvement in their hamstring injury symptoms, and 59.2% of patients returned to their respective sport or activity after treatment. As hamstring injuries often lead to loss of function and hamper return to sport with existing treatment options, novel therapies should be explored. Due to the limitations of this descriptive retrospective study, the next steps for our research include conducting a prospective cohort study evaluating the effects of dry needling on patientreported outcomes such as pain and physical function in hamstring and other lower-extremity injuries in an endurance athlete population.

**Sources:**

1. Ghannadi S, Shariat A, Ansari NN, Tavakol Z, Honarpishe R, Dommerholt J, Noormohammadpour P, Ingle L. The Effect of Dry Needling on Lower Limb Dysfunction in Poststroke Survivors. J Stroke Cerebrovasc Dis. 2020 Jun;29(6):104814. doi: 10.1016/j.jstrokecerebrovasdis.2020.104814. Epub 2020 Apr 21. PMID: 32327366.

2. Sánchez-Infante J, Navarro-Santana MJ, Bravo-Sánchez A, Jiménez-Diaz F, Abián-Vicén J. Is Dry Needling Applied by Physical Therapists Effective for Pain in Musculoskeletal Conditions? A Systematic Review and Meta-Analysis. Phys Ther. 2021 Mar 3;101(3):pzab070. doi: 10.1093/ptj/pzab070. PMID: 33609356.

3. Chys M, De Meulemeester K, De Greef I, Murillo C, Kindt W, Kouzouz Y, Lescroart B, Cagnie B. Clinical Effectiveness of Dry Needling in Patients with Musculoskeletal Pain-An Umbrella Review. J Clin Med. 2023 Feb 2;12(3):1205. doi: 10.3390/jcm12031205. PMID: 36769852; PMCID: PMC9917679.

4. Lavelle ED, Lavelle W, Smith HS. Myofascial trigger points. Anesthesiol Clin. 2007 Dec;25(4):841-51, vii-iii. doi: 10.1016/j.anclin.2007.07.003. PMID: 18054148.

5. Brewster BD, Snyder Valier AR, Falsone S. A Systematic Dry-Needling Treatment to Support Recovery Posttraining for Division I Ice Hockey Athletes: An Exploration Case Series. J Athl Train. 2022 Aug 1;57(8):788-794. doi: 10.4085/1062-6050-0096.21. PMID: 36356615; PMCID: PMC9661933.

6. Gattie E, Cleland JA, Snodgrass S. The Effectiveness of Trigger Point Dry Needling for Musculoskeletal Conditions by Physical Therapists: A Systematic Review and Meta-analysis. J Orthop Sports Phys Ther. 2017 Mar;47(3):133-149. doi: 10.2519/jospt.2017.7096. Epub 2017 Feb 3. PMID: 28158962.

7. Gregory TJ, Rauchwarter SA, Feldman MD. Clinical Commentary: Rehabilitation Using Acute Dry Needling for Injured Athletes Returning to Sport and Improving Performance. Arthrosc Sports Med Rehabil. 2022 Jan 28;4(1):e209-e213. doi: 10.1016/j.asmr.2021.09.035. PMID: 35141553; PMCID: PMC8811490.

8. Dembowski SC, Westrick RB, Zylstra E, Johnson MR. Treatment of hamstring strain in a collegiate pole-vaulter integrating dry needling with an eccentric training program: a resident's

case report. Int J Sports Phys Ther. 2013 Jun;8(3):328-39. PMID: 23772348; PMCID: PMC3679638.

9. Erickson LN, Sherry MA. Rehabilitation and return to sport after hamstring strain injury. J Sport Health Sci. 2017 Sep;6(3):262-270. doi: 10.1016/j.jshs.2017.04.001. Epub 2017 Apr 10. PMID: 30356646; PMCID: PMC6189266.

**Zappi, Isabella**

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Icahn School of Medicine at Mount Sinai

Adrenal Research Center

Title: The role of Lh/hCG receptor as a driver and therapeutic target in adrenal cortical cancer

Background: Adrenocortical carcinomas are a rare cancer (1-2/million) with a poor prognosis that present with varying steroid secretion excess, the most common being hypercortisolism (30-40%). Due to the lack of definitive prognostic markers and poor prognosis, it is imperative to further investigate adrenocortical carcinomas to look for important biomarkers and potential therapeutic targets. Embryologically, the adrenal glands and the gonads develop from the urogenital ridge with differential migration and differentiation. In adults, adrenal cortical cell growth and steroidogenesis are controlled by pituitary ACTH whereas gonadal cell growth and steroidogenesis are regulated by pituitary LH. However, there are multiple clinical examples of tumorigenesis in the gonads driven by high ACTH (in congenital adrenal hyperplasia) and adrenal cortical tumorigenesis driven by high LH/hCG levels (adrenal tumors in pregnant and postmenopausal females). Published and unpublished data demonstrate that LH/hCGR-R are expressed in normal adult adrenocortical progenitor cells located in the subcapsular area (SC), the same cells that express *Notch atypical ligand I Delta like homologue 1 (DLK1)*. In addition, small studies demonstrate protein expression of both LH/hCG-R and DLK1 in ACC. In contrast, *synaptophysin* is expressed in more differentiated adrenal cortical cells, particularly those secreting aldosterone and cortisol in benign adenomas. In this case report we describe the expression of LH/hCG-R, DLK1, synaptophysin, COX-2 (cyclooxygenase 2), CYP11B1, and CYP11B2 (aldosterone synthase) in ACC before and after treatment with mitotane. This report highlights the expression of *LH/HCG-R* both before and after mitotane treatment in an aggressive case of ACC and indicates that it might be targeted for therapy.

Hypothesis: LH/hCG receptor can serve as a driver and therapeutic target in adrenal cortical cancers, particularly in postmenopausal women who have elevated LH levels.

Methods: All steps for immunohistochemistry were carried out in a humidified chamber. Tissues were formalin-fixed and paraffin-embedded. Sections were deparaffinized, rinsed in graded alcohol, rinsed in water, and treated with 3% hydrogen peroxide in 100% methanol for 10 min. Sections were then rinsed in water and placed in an antigen retrieval solution (1% citrate buffer) for antigen retrieval, which was carried out in a pressure cooker. Following antigen retrieval, the sections were blocked for 30 minutes with normal goat serum. Sections were then incubated overnight at 4°C with rabbit polyclonal antibody to LH/hCG receptor (SC-25828, Santa Cruz

Biotechnology, Inc., Dallas, TX) at a 1:400 dilution, rabbit polyclonal antibody to COX-2 (AB179800, Abcam, Cambridge, MA) at a 1:1000 dilution, rabbit polyclonal antibody to GATA-6 (PA1-104, Invitrogen, Waltham MA) at a 1:200 dilution, rabbit polyclonal antibody to synaptophysin (36406, Cell Signaling, Danvers, MA) at 1:200 dilution, mouse polyclonal antibody to CYP11B2 (MABS1251, Millipore-Sigma, Burlington, MA) at a 1:1000 dilution, mouse polyclonal antibody to DLK-1 (SC-376755, Santa Cruz Biotechnology, Inc., Dallas, TX) at a 1:200 dilution, mouse polyclonal antibody to GATA-4 (SC-1237, Santa Cruz Biotechnology, Inc., Dallas, TX) at a 1:200 dilution, or rat polyclonal antibody to CYP11B1 (MABS502, Millipore-Sigma, Burlington, MA). After overnight incubation, the sections underwent 3 PBS washes. Sections were then incubated in biotinylated goat anti-rabbit (for COX-2, LH/hCGR, GATA6, and synaptophysin), anti-mouse (for CYP11B2, DLK-1, and GATA4), and anti-rat (for CYP11B1) for 30 minutes, followed by 3 PBS washes. Next, the sections were incubated with streptavidin-horseradish peroxidase for 30 minutes. Afterwards, the sections were washed in 0.5% Triton X 100 for 30 seconds followed by the application of the chromogen, diaminobenzidine (DAB), for 1-2 minutes in the dark. The sections were then counterstained with hematoxylin. Positive and negative controls were run in parallel with appropriate results.

Results: Pre-mitotane staining was congruent with clinical status as CYP11B2 was negative and was heterogeneously positive for LH/HCG-R, DLK1, COX2, SYP, and CYP11B1. Following treatment with mitotane two novel changes were found: (1) CYP11B1 and SYN activity decreased and (2) LH/HCG-R and DLK1 expression was more positive. Additionally, COX-2 expression was found to decrease after mitotane treatment.

Conclusion: The novel finding of LH/hCG-R expression in ACC and the interesting finding that it increased in expression after mitotane treatment possibly indicates its potential as a prognostic marker or therapeutic agent. The expression of LH/hCG-R in ACC also suggests that these tumors cells could be dedifferentiating to a more progenitor cell type stemming from the adrenal cortex's gonadal-adrenal origin. The expression of the markers investigated in this case need to be further studied in more cases of ACC to confirm the findings that were observed.

References:

1. Doroszko M, Chrusciel M, Stelmaszewska J, et al. GnRH antagonist treatment of malignant adrenocortical tumors. *Endocr Relat Cancer*. 2018;26(1):103-117. doi:10.1530/ERC-17-0399
2. Carlson HE. Human adrenal cortex hyperfunction due to LH/hCG. *Molecular and Cellular Endocrinology*. 2007;269(1-2):46-50. doi:10.1016/j.mce.2006.06.014

3. Korol P, Jaranowska M, Pawlikowski M. Immunohistochemical demonstration of LH/CG receptors in non-neoplastic human adrenal cortex and adrenocortical tumors. *Folia Histochemica et Cytobiologica*. 2019;57(1):23-27. doi:10.5603/FHC.a2019.0003

4. Bernichtein S, Alevizaki M, Huhtaniemi I. Is the adrenal cortex a target for gonadotropins? *Trends in Endocrinology & Metabolism*. 2008;19(7):231-238. doi:10.1016/j.tem.2008.06.003

Poster Title: The Impact of Social Deprivation on Carpal Tunnel
Author: **Callista Zaronias**
Mentors: Bilal Mahmood, MD; Thomas Carroll, MD; Akhil Dondapati, MD
Location where research was completed: University of Rochester, Rochester, NY

**Introduction:**
Carpal Tunnel Syndrome (CTS) is the most common peripheral nerve compression and is often managed surgically. The impacts of social determinants of health are recognized. The Area Deprivation Index (ADI) quantifies social deprivation domains including education, income/employment, and housing quality by zip-code. There is evidence that increased social deprivation is associated with worse outcomes in managing peripheral nerve compression. The purpose of this study is to determine whether patients who are diagnosed with CTS, undergo Carpal Tunnel Release (CTR), and who are more socially deprived as indicated by ADI, have greater wait times between referral to hand surgery, evaluation by a hand surgeon, electrodiagnostic studies (EDX), decision to and date of CTR, and whether they present with more advanced findings of CTS.

**Methods:** This is a retrospective study of patients who received a CTS diagnosis and underwent CTR over a 6-year period at an academic institution serving urban, suburban, and rural populations. Variables reviewed included history of diabetes, thyroid disease, smoking, ADI, severity of CTS by EDX, time elapsed between referral to and date of presentation to the Hand Surgery Division, date of initial evaluation by the surgeon, date of EDX, date that surgery was deemed necessary, and date of surgery. Patients who did not receive EDX or had EDX completed before presentation to hand surgery were excluded from analysis.

**Results:** Current data includes 380 patients divided into tertiles by ADI National Percentile: lower/least deprived (n=33), middle (n=178), and upper/most deprived (n=190). When considering time from referral to Hand Surgery division to presentation to Hand Surgery, patients of the middle deprivation tertile (57.45 days) had significantly greater wait times than those of the lower deprivation tertile (27.59 days) (p = 0.01). When considering time from EDX to surgical decision, patients of the middle tertile (143.28 days) had significantly greater wait times than patients of the lower tertile (62.32 days) (p = 0.03); patients of the upper deprivation tertile (223.43 days) also had significantly greater wait times than those of the lower tertile (62.32 days) (p = 0.00005). A final strong indicator of wait time for more socially deprived patients was the measure of time from EDX to surgery. Patients of the middle tertile (172.99 days) had greater wait times than those of the lower tertile (111.31 days) (p = 0.04); patients of the upper tertile (281.83 days) had significantly greater wait times than those of the middle tertile (172.99 days) (p = 0.01); patients of the upper tertile (281.83 days) had significantly greater wait

times than those of the lower tertile (111.31 days) (p = 0.0001). These measures demonstrate the increased wait times in CTS management for patients of more socially deprived backgrounds. Additionally, the data revealed that increasing social deprivation was correlated with more severe presentations of CTS. For both the middle and upper tertiles of ADI, significantly more patients presented with severe than moderate (p-value=0.01, p-value=0.02) or mild (pvalue=
0.01, p-value=0.001) EDX severity ratings.

## Conclusions:

Increasing social deprivation correlates with greater severity of CTS by EDX and prolonged time from referral to presentation to Hand Surgery, from EDX to surgical decision, and from EDX to surgery. Delays in reaching treatment milestones may contribute to this. These results indicate an area of improvement for equity of patient care.

Table 1: Comparison of Patient Demographics by ADI National Percentile Thirds. Significant PValues indicated in bold.

| | National ADI Thirds | | | | | | | | | T-Test P Values | | |
| | Least Deprived Third | | | Middle Third | | | Most Deprived Third | | | Comparing the following National Percentile Thirds | | |
| Patient Characteristics | Frequency or Avg | % or range | Sample Size | Frequency or Avg | % or Range | Sample Size | Frequency or Avg | % or Range | Sample Size | Lower vs Middle | Middle vs Upper | Lower vs Upper |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Δ First Mention of CTS/Referral | 1442.09 | (39378-0) | 32 | 790.37 | (42024--365) | 166 | 623.81 | (40568--674) | 177 | 0.61 | 0.69 | 0.52 |
| Δ Referral to Hand/Hand Presentation | 27.59 | (99-0) | 32 | 57.45 | (1017--69) | 166 | 43.64 | (1093--273) | 177 | **0.01** | 0.30 | 0.10 |
| Δ Presentation to Hand/EDX | 39.84 | (598--79) | 31 | 73.10 | (1008-1) | 101 | 90.74 | (1212-6) | 92 | 0.26 | 0.48 | 0.12 |
| Δ EDX/Surgical Decision | 62.32 | (366-2) | 31 | 143.28 | (4061-0) | 160 | 223.43 | (3266-0) | 180 | **0.03** | 0.09 | **0.00005** |
| Δ Presentation to Hand/Surgical Decision | 96.30 | (623-0) | 33 | 110.25 | (4095-0) | 178 | 105.25 | (1764-0) | 190 | 0.72 | 0.88 | 0.78 |
| Δ EDX/Surgery | 111.31 | (490-0) | 32 | 172.99 | (1288-0) | 166 | 281.83 | (3317-0) | 186 | **0.04** | **0.01** | **0.0001** |
| Δ Surgical Decision/Surgery | 53.82 | (454-0) | 33 | 39.20 | (985--3628) | 178 | 66.74 | (827--281) | 190 | 0.60 | 0.25 | 0.47 |
| Δ Presentation to Hand/Surgery | 150.12 | (626-20) | 33 | 149.45 | (1280--333) | 178 | 171.99 | (1787--11) | 190 | 0.98 | 0.39 | 0.53 |
| **For patients who presented to Hand PA or NP before hand surgeon** | | | | | | | | | | | | |
| Presentation to Hand/Presentation to Surgeo | 55.00 | (107-25) | 5 | 143.92 | (1280-2) | 26 | 167.14 | (1764-4) | 36 | 0.15 | 0.79 | 0.08 |
| **Laterality** | | | | | | | | | | | | |
| Bilateral | 19 | 59.375 | | 97 | 100 | | 98 | 51.85 | | | | |
| Right | 7 | 21.875 | | 0 | 0 | | 56 | 29.63 | | | | |
| Left | 6 | 18.75 | | 0 | 0 | | 35 | 18.52 | | | | |
| Hx of Diabetes | 5 | 15.15 | | 39 | 21.91 | | 51 | 26.84 | | | | |
| Hx of Thyroid Disease | 8 | 24.24 | | 35 | 19.66 | | 38 | 20.00 | | | | |

Figure 1: Proportion of EDX Severity Ratings per Third of National ADI Percentiles



% of EDX Ratings per Third of National ADI Percentiles
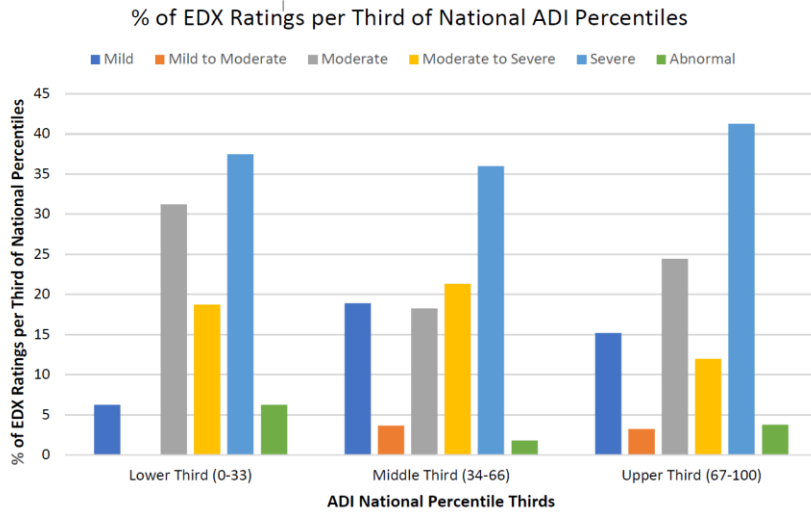
**Zhuang, William**

1. Objectives

The purpose of this study was to conduct a cross-sectional analysis on the diversity of academic sports medicine surgeons in the United States. We aimed to determine if the gender and race of sports medicine surgeons correlated with attainment of academic rank, leadership, and practice setting.

2. Methods

Surgeons were identified using the American Orthopedic Society for Sports Medicine (AOSSM) membership database, including individuals who had completed fellowship training and are practicing in academia. Demographic data (age and race), academic rank, leadership positions held, years in practice, practice setting (urban vs. rural), and work address were obtained from the AOSSM membership directory and publicly available profession profiles. Practice setting was defined as urban (population greater than 250,000) or rural (population less than 250,000). National area deprivation index (ADI) decile of work addresses as a measure of socioeconomic deprivation was subsequently calculated. Surgeons without a work address in the U.S. or who were still undergoing residency or fellowship training were excluded.

ADI scores were evaluated with linear regression, while years in practice were evaluated with negative binomial regression to account for the skew in distribution. Practice setting and leadership status were assessed using logistic regression. Academic rank was evaluated using ordered logistic regression.

No institutional review board approval was required for this survey study.

3. Results

Of the 554 surgeons who met the inclusion criteria, 86.28% were male and 13.72% were female. 82.67% were white, 11.19% were Asian, 4.69% were black, and 1.44% were Hispanic. 82.13% of surgeons held an academic rank. Of those who did, 0.54% were instructors, 31.95% were assistant professors, 22.02% were associate professors, 27.62% were professors. Under half of the surgeons included did not have at least one leadership position (43.68%). Over half of the surgeons evaluated practiced in an urban setting (57.94%). The average ADI of work addresses was 35.64%. The average years in practice following the completion of the highest level of training was 13.9 years.

Statistical analysis revealed that neither gender nor race significantly impacted the attainment of academic rank, leadership status, or whether they practiced in an area of higher or lower ADI. It was found that males had a higher probability of practicing in locations that had a higher ADI by an average of 5.71 points, however, this was not statistically significant (36.43 vs. 30.74, P = 0.072). Additionally, male surgeons were found to have a higher probability of practicing in a rural setting compared to their female counterparts (44.40 vs. 27.40, P = 0.002). Black and Hispanic surgeons had a 14.26% lower probability of

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practicing in a rural setting than their white counterparts, although this was not significant (-29.94, 1.41, P = 0.074). Race did not have a significant impact on the ADI of where surgeons practiced. Analysis further revealed that male surgeons on average had more years in practice compared to their female counterparts by 4.16 years (14.46 vs. 10.30, P < 0.001). Asian surgeons on average had 4.58 years less experience than their white counterparts (-7.02, -2.14, P<0.001).

## 4. Conclusion

The study reveals that academic orthopedic sports medicine is still largely lacking in diversity. The analysis demonstrates that female continue to be underrepresented despite recent increases in females entering the field of orthopedic surgery. White and Asian surgeons are overrepresented while black and Hispanic surgeons continue to be underrepresented. Despite female, black and Hispanic individuals being underrepresented in orthopedic sports medicine, this study's analysis found that there was no correlation between a surgeon's gender and their attainment of any level of academic rank. Further analysis is needed to elucidate the reasons behind this phenomenon. While there was no statistically significant difference in ADI scores between genders and races, these results, and findings that male surgeons are more likely to practice in rural areas, suggests that there may be confounding factors influencing the practice setting based on gender or race. Additional studies are needed to understand the opportunities and factors influencing a physician's decisions to enter urban or rural practice. Overall, the results suggest that there are still opportunities to increase the rates of females, black, and Hispanic individuals entering the field of orthopedic sports medicine. Increasing diversity within academic orthopedic sports medicine may also provide a more diverse pool of instructors and encourage more female and minority physicians to enter the field in a virtuous cycle. Such action is much needed as the population of patients in the U.S. continues to become more heterogenous, warranting a pool of physicians that must become equally diverse to meet its needs.

Community Health Research

## URWell Urology Clinic Cost Based Analysis: Empowering the Urban Underserved through Quality Care for Optimal Urological Health

**V. Driesman BS**, C. Wanderling MD, M. Ninomiya MD, K. Yuen MD, A. Steinmetz MD, D. Phan MD, H. Rashid, J. Cubillos MD

### Introduction:

• Substantial racial disparities are evident within the realm of urological care, with minority populations, notably African Americans, experiencing a disproportionate burden of urological diseases when compared to Caucasians. These disparities manifest across various facets of urology, encompassing disparities in cancer screening, treatment modalities, chronic kidney disease prevalence, and survival rates. Moreover, LatinX exhibit a higher prevalence of erectile dysfunction when contrasted with their Caucasian counterparts. (1)

• The City of Rochester has a large minority population. In fact, 63.4% of the City of Rochester's population identified as part of a minority population in 2018. Furthermore, 6.1% of Rochester's population (12,674 people) had no health insurance in 2018. (2)

• St. Joseph's Neighborhood Center (SJNC) is a Catholic-founded charity organization that provides primary health care, counseling, and social work services to the uninsured Rochester Community. They have been providing essential care services to those without Medicaid/Medicare or private health insurance for the past 30 years, serving thousands of patients per year.

• The University of Rochester Medical Center (URMC) has a long-standing partnership with SJNC through a student-volunteer-run primary care clinic, URWell. Together with the SJNC, University of Rochester Medical Center volunteers formed a URWell Urological Specialty Care bi-monthly clinic in 2021.

### Methods:

• The primary objective of this study is to evaluate the efficacy of delivering affordable essential urological healthcare services to the uninsured and underserved populations residing in Rochester, NY. The assessment will focus on gauging the impact and effectiveness of this initiative in improving the overall health outcomes and access to critical urological care within the target demographic.

• Given that URWell operates solely on a volunteer-based model, the available resources for delivering essential urological services at a low cost are constrained. Consequently, the scope of services that URWell clinics can offer remains restricted. As part of our research, we also explored these limitations and began efforts to mitigate these issues.

Results:

URWell Clinical Statistics:

• Patients underwent assessment by teams comprising students and residents. The cases were subsequently deliberated upon during teaching rounds in consultation with the attending urologist.

• Since the founding of the URWell Urology clinic in 2021, the clinic has been able to serve 62 patient appointments.
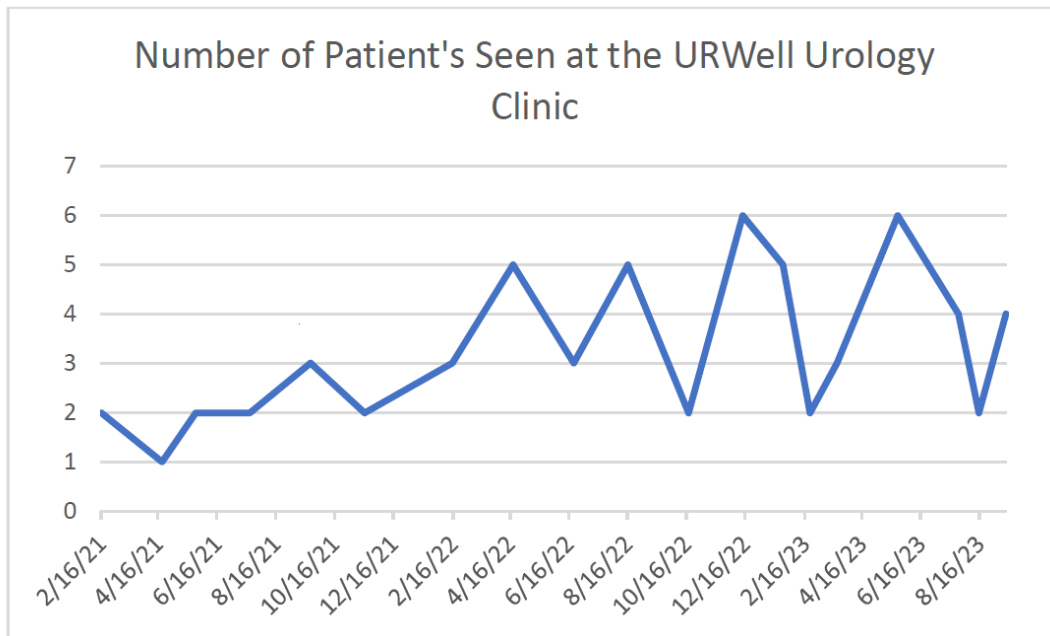


Figure 1: Number of Urological Patient Appointments by Clinic Date
•        Between the years 2021 and 2022, approximately 40% of patients seen were referred for suspected malignancies affecting the prostate, bladder, kidney, and testicle.

*Costs of Services:*
•        The costs of urological care offered at Strong Memorial Hospital are often unaffordable for patients without insurance. While not all urological services offered at Strong are feasibly offered at URWell, many screening and preliminary services are able to be offered at URWell Urology Clinic. Services unable to be provided at the URWell Clinic are instead provided by the Urology Resident Clinic through the URMC Charity Care Program.

- On average, URWell patients pay approximately $12-$250 for urological care services which include lab workups, imaging, and medication. In comparison, the prices for out-of-pocket urological care at Strong Memorial Hospital are much greater. For instance, an ultrasound at Strong Memorial Hospital costs $452.33 on average and a treatment/observation room costs $3330.83 on average. (3)

- With the help of the Urological Care Foundation, we were able to purchase additional equipment to provide more equitable urological care to URWell patients at no additional patient costs. Such equipment included an ultrasound probe, medications, catheters, lubrication, and much more.

*Limitations:*

- It is important to recognize that there are still several limitations to urological care offered at URWell. As a result, there is a high cancellation rate and no-show rate of medical appointments. Such barriers include incomplete and non-integrated patient medical electronic health records, cost of lab work and imaging, transportation to clinical appointments, and referral requirements to the URMC Urology Resident clinic for more complex cases.

| Status | Distinct Patients | Encounters |
|---|---|---|
| Canceled | 18 | 22 |
| No Show | 7 | 7 |
| Occurred | 34 | 47 |
| Rescheduled | 13 | 13 |
| **Grand Total** | **48** | **89** |

Figure 2: Number of urological clinic visits that were canceled, no-show, occurred, and rescheduled. (Please note a rescheduled appointment means that it occurred but on a later date than was originally planned.)

- An additional limitation we encountered pertains to community outreach and the identification of underserved patients requiring urological care, as well as the dissemination of information about our services. To address this challenge, a novel referral program has been instituted, establishing a collaborative network among the three student-led URWell clinics, namely, Asbury, Maplewood, and SJNC. Our intention is to further expand our reach and locate more

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patients in need within the Rochester community by actively engaging in community health fair coordination and outreach initiatives.

Conclusion:
•        The URWell Urology Clinic is instrumental in addressing healthcare disparities in urological care, particularly concerning healthcare access and community outreach. In Rochester, NY, despite the presence of a prominent cancer center, accessibility to cancer screening and evaluations remains limited for medically underserved populations nearby. We propose a viable model for integrating urologic oncology care into primary care, with strong support from local community clinics and academic departments. Our research underscores the lack of accessible cancer screening and evaluation for urban underserved patients. To meet this unmet need, we are actively working to increase the dissemination of information about our urological services, expand community outreach, and alleviate financial burdens associated with care.

References:

1.        Klein, J. B., Nguyen, C. T., Saffore, L., Modlin, C., & Modlin, C. S. (2010). Racial disparities in Urologic Health Care. Journal of the National Medical Association, 102(2), 108–118. https://doi.org/10.1016/s0027-9684(15)30498-3
2.        health.ny.gov. (2021). City of Rochester Health equity report. New York State Department of Health. https://www.health.ny.gov/statistics/community/minority/docs/mcd_reports_2021/monroe_county_city_of_rochester.pdf
3.        Strong Memorial Hospital Charges List. Cost Estimates & Pricing - Pay Bill - University of Rochester Medical Center. (2023). https://www.urmc.rochester.edu/pay-bill/cost-estimates-and-pricing.aspx
4.        K Yuen, A Steinmetz, M Ninomiya, D Ajay (2023) Society of Urologic Oncology - Advancing Comprehensive Uro-oncologic care for the urban underserved. The Journal of Urology. MP49-12. https://www.auajournals.org/doi/pdf/10.1097/JU.0000000000003297.12

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**Preceptor**
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# A coordinated community outreach initiative increases patient volume at a student-run free clinic: A prospective quality improvement study

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## Background

UR Well Maplewood YMCA (URWMY) is a student-run clinic (SRC) that provides primary care and prevention services free of charge to the Maplewood neighborhood and surrounding areas of Rochester, NY. The clinic opened at the Maplewood Family YMCA in February 2023 and is open for two hours every week. To increase patient volume, a coordinated community outreach approach was initiated between April 2023 and September 2023, which consisted of two phases: 1) building partnerships with community organizations and 2) direct community outreach.

## Methods

The pre-intervention period occurred between February 16, 2023 and March 31, 2023. Intervention phase I was between April 17, 2023 and June 30, 2023. During phase I, twelve community organizations (e.g. health agencies, outreach groups) were provided basic information on URWMY electronically, by phone, or in person. Introductory meetings and/or clinic tours were scheduled throughout phase I to build partnerships. Phase II occurred between July 1, 2023 and September 6, 2023, when medical student volunteers conducted direct community outreach by canvassing >50 locations and tabling or presenting at 4 health fairs in partnership with 3 of the community partners established in phase I. Patient volume, clinic capacity, and referral sources were analyzed.

## Results

Forty-one patients were seen at URWMY from February 16, 2023 to September 6, 2023. 26% reported being uninsured. During the pre-intervention phase, URMWY operated at 19% of clinic capacity with on average $0.8 \pm 0.7$ patients/day. In phase I, the clinic was at 23% capacity with a patient volume of $0.9 \pm 0.7$ patients/day. Patient volume increased to $2.7 \pm 2.4$ patients/day in phase II, with the clinic operating at 67% capacity. The top source of patient referrals during the pre-intervention phase was the YMCA (50%). In phases I and II, the top referral sources were employers (71%) and community organizations (30%), respectively.

**Conclusion**

A coordinated community outreach initiative can benefit SRCs seeking to increase patient volume. Building partnerships with local community organizations can have a significant impact on direct community and patient outreach efforts.

## Evaluation of Narcan Delivery at Asbury and Maplewood UR Well Clinics

**Anna Russell**

INTRO: Death rates from opioid overdose have continued to grow.  Public health experts recommend a multi-pronged approach which includes prevention efforts such as Narcan distribution. Narcan (naloxone) can prevent deaths from opioid overdose, a public health crisis in Monroe County where there have already been 183 opioid overdose deaths in 2023. The University of Rochester has a student-run group, UR Well, for the last several years. Interns work full time at St. Joseph's Neighborhood Center for five weeks and work on a scholarly project for three weeks.

METHODS: This project focused on the Narcan program at UR Well's Maplewood (formerly St. Luke's) and Asbury clinic locations, including its uptake, strengths, and areas of weakness. Maplewood and Asbury have been distributing Narcan since 2019 and 2021, respectively. We analyzed data from UR Well RedCap and Strong Recovery and performed qualitative interviews with clinic directors, administrative coordinators, and Strong Recovery staff members.

RESULTS: We found that 68 people at Maplewood and Asbury expressed interest in receiving Narcan between 2021 and 2023. Strengths of the program included ensuring that every patient was offered Narcan and a strong relationship between UR Well and Strong Recovery, part of UR Medicine, which provides Narcan to UR Well through funding from New York State. Weaknesses include that administrative coordinators are not sufficiently trained to train patients on Narcan and that there was discordance between UR Well's records of Narcan provision and Strong Recovery's records.

CONCLUSION:  Distributing Narcan through a community student-run safety net clinic is an opportunity to increase access to Narcan.  Future efforts should consider training all members of the team to be able to teach how to use Narcan as well as solidifying links between the clinics and substance use treatment agencies.  The program is currently being updated to improve tracking and training for the 2023-2024 school year and beyond.

Health Humanities

**Peters, Lily**

## I wish it had worked, too

"I wish it had worked, too" is a collection of poetry and short memoir that seeks to humanize "difficult patients" by sharing my personal experience with mental illness as both a patient and as a nursing assistant. The writing was printed and hand bound into a small book as a reflection of both its deeply personal nature and my intention for it to be shared. As I recovered from mental illness, as I saw myself take on challenges that once seemed impossible, I took with me the notion that anyone can get better. As a nursing assistant, I often saw people at their worst, their most frustrated, confused or scared. The nights were long, but I found a deep well of patience and compassion when I thought about who my patients were outside the hospital—and who they might become when they got better. By sharing my experience, I hope to reveal the potential for growth within ourselves, our peers, and the people we help. I created a physical object so that anyone who draws strength from this idea—*anyone can get better*—might take it with them.

**Prus, Caleb**

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## Richard Maydyng: A Fifteenth-Century London Barber-Surgeon in Harley MS 2381

Today it is difficult to imagine that surgery was once performed by barbers, named for the beards they historically shaved. Yet, in late medieval London, surgery was a significant component of a barber's trade. Blood-letting and tooth-pulling were the barber-surgeon's hallmark procedures, but his practice certainly encompassed much more. By 1462 the London barbers were performing so much surgery they were granted a royal charter, which gave them control over all surgical practice in the city⸺including that of the Fellowship of Surgeons. This poster seeks to further elucidate the methods and day-to-day practices of the London barber-surgeons by examining London, British Library, Harley MS 2381. I argue that Harley 2381 was the notebook of Richard Maydyng, a hitherto unrecognized barber-surgeon active in London sometime between 1461-1483. Harley 2381 is unique in that it is written in Maydyng's hand, with an abundance of evidence of his ownership and use, including the names of his patients, their treatment, and his fees. The barber-surgeon's notes witness his experience in wound care and reveal his personal recipe for *Gracia Dei,* a wound salve. Maydyng also cites his treatment for "sauceflem," a skin disease affecting the face, emphasizing the broad scope of a barber's practice. Harley 2381 thus reminds readers that the barber-surgeons not only had control of London's surgical practice but perhaps also a significant part of non-surgical treatment, making them important practitioners in late medieval England.

International

**Ruth Agwaze**

**Preceptors**

**Dr. David Ross Bearden, M.D.,**

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**Background**:  Adverse childhood experiences (ACEs) such as exposure to violence or abuse drive a variety of poor health outcomes, including higher rates of anxiety, depression, and cognitive impairment. Children with HIV in low-and-middle-income countries (LMIC) are at increased risk of adverse childhood experiences for multiple reasons including disruptions of family structure, poverty, and stigma. The impact of adverse childhood experiences on health outcomes can be mitigated through interventions such as the Common Elements Treatment Approach (CETA), a trauma-informed cognitive behavioral therapy approach developed for use in LMICs. However, little is known regarding the impact of ACEs in children with HIV in LMICs, and there are no tools for the measurement of ACEs validated in Sub-Saharan Africa, where the majority of children with HIV reside. In this study, we sought to develop and validate an instrument for the evaluation of adverse life experiences in children with and without HIV in Zambia.

**Methods**: This is a prospective mixed-methods validation study nested within the HIV-associated Neurocognitive Disorders in Zambia (HANDZ) study, a longitudinal cohort study among 600 children with and without HIV in Zambia. The study took part in two phases. In the first phase of the study, qualitative interviews with children, parents, and experts were utilized to generate a potential battery of questions, and the first iteration of the Adverse Life Experiences in Zambia (ALEZ) was generated. In the second phase of the study, a standardized ALEZ interview questionnaire was administered to all subjects, and all subjects had detailed neurocognitive testing utilizing a full battery of standardized neuropsychological tests as well as an iPad-based NIH Toolbox battery. Face, content and construct validity of the ALEZ were assessed using a qualitative assessment with 15 study participants, and convergent validity was

assessed using correlations with measures of depression, anxiety, cognitive function, and school performance. The Adverse Childhood Experiences International Questionnaire (ACE-IQ), developed by the World Health Organization, was also administered for comparison with ALEZ these measures. Confirmatory factor analysis was utilized to examine the psychometric properties of the ALEZ.

**Results**: The first iteration of the ALEZ included 12 questions covering three separate domains. Domains included exposure to violence and abuse, illness, and family stressors. At baseline, the sample consisted of 304 male and 310 female children aged 11.6 years, of which 331 were HIV-infected (HIV+) (52% male), 208 were HIV-exposed uninfected (HEU) (44% male) and 75 were HIV-unexposed uninfected (HUU) (44% male). Qualitative interviews suggested that the ALEZ was easily understood by pediatric participants and had appropriate face validity and content validity. The ALEZ also had appropriate criterion validity, as established with a multivariate linear regression analysis between ALEZ scores and ACE-IQ scores [$R^2$ =0.11, $F(12, 68)$ = 4.242, p = 5.7e-5]. Quantitative responses to the ALEZ questionnaire demonstrated no significant differences in HIV+, HEU and HUU groups, with median(IQR) scores of 1(0-2), 1(0-3), and 0 (0-1) respectively. While there were also no significant differences between the 3 groups on the ACE-IQ questionnaire scores, all groups demonstrated high ACE-IQ scores. The median (IQR) ACE-IQ scores were 7(3-14) for HIV+ children, 8(4-15) for HEU children and 11(5-17) and HUU children. Multivariate linear regression was used to test the correlation of ALEZ and ACE-IQ scores to Zambian children's depression, anxiety and school performance levels, taking into account each child's sex, age at the time of assessment, socioeconomic status, and baseline health. Results showed that higher ALEZ scores strongly predicted higher anxiety scores [$R^2$ =0.43, $F(12, 68)$ = 4.242, p = 5.7e-5], with a significant interaction effect of HIV-status and socioeconomic status. Higher ALEZ scores also predicted greater depression scores [$R^2$ =0.31, $F(12, 68)$ = 2.551, p = 0.0076].  Similarly, higher ACE-IQ scores strongly predicted higher anxiety scores HIV+, HEU, and HUU [$R^2$ =0.41, $F(12, 68)$ = 2.551, p = 0.00016] and higher depression scores in HIV+ and HUU children [$R^2$ = 0.31, $F(12, 68)$ = 2.936, p = 0.0025], with HIV-positive status leading to a 0.15 increase in ACE-IQ scores than HEU status [p = 0.03, 95% CI of the difference =  0.01- 0.29]. However, neither questionnaire predicted school performance significantly.

 **Conclusion**:  The ALEZ is the first instrument specifically designed to measure adverse life experiences in children and young adults in Sub-Saharan Africa, and preliminary results indicate

appropriate face validity, content validity, and convergent validity. All children in this study demonstrated high ACE-IQ scores but low ALEZ scores. However, both ALEZ and ACE-IQ questionnaires adequately predicted depression and anxiety scores in HIV+, HEU, and HUU children. Further studies are necessary to further refine the instrument and to establish reliability, predictive validity, and criterion validity.

**Contributors: Ammu Dinesh; Brock Scoville**

**Mentors:** Dr. Bailor Barrie, MD, MSc; Dr. Ann Dozier, PhD

**Title:** Evaluation of a Health System Strengthening Intervention on HIV and TB Services in Kono and Kailahun Districts and the Potential Impact of Global Reparations on Maternal Mortality in Sierra Leone

**Objective:**

The objective of the project is to evaluate the impact of a comprehensive primary care health systems strengthening intervention led by the nonprofit organization Partners In Health (PIH) on HIV and TB services in Kono and Kailahun Districts, Sierra Leone, and to place current maternal health disparities in its historical context and evaluation the potential impact of reparative payments on maternal health outcomes.

**Background:**

Sierra Leone is a West African country with a population of over 7 million. It is among the 25 poorest countries in the world, with over 60% of its residents living below the poverty line. There is a critical need for health systems strengthening to prevent future outbreaks from levying such a heavy toll in Sierra Leone. Partners In Health (PIH) and the Ministry of Health and Sanitation (MoHS) are engaging in efforts to strengthen primary care services through training and mentorship, staffing, quality improvement, improvement in supply chain management for essential medicines and equipment, infrastructure investments, strengthening the existing CHW networks and strengthening links between primary health units and Koidu Government Hospital (KGH). Guided by the World Health Organization's Building Blocks approach, strategic objectives will align with improving staff, infrastructure, medicines and equipment, and information systems. Health programs in Sierra Leone are funded vertically, such that international funding is provided for specific, earmarked programs rather than to address overall health needs, leading to malaria, TB, HIV, and maternal and child programs with discrete and disconnected reporting and health worker systems. Thus, PIH's primary intervention is the decentralization of care in the primary health care setting. This includes the integration of disease reporting systems, improving the availability and existence of patient records, and cohesion of counselor and clinical responsibilities. Integrating and de-siloing service delivery while promoting primary care is a novel intervention in Sierra Leone and thus needs to be evaluated prospectively to determine its efficacy in this setting.

Furthermore, to adequately address these inequities, we must contextualize these health inequities historically and politically to understand that they do not exist in a vacuum, but rather have roots in racism, colonialism, and resource extraction. The idea of reparations as a system to make amends for

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historical injustices is gaining traction. Yet, scholarship regarding the ties between reparations for global colonialism and extraction of resources from the Global South by the Global North, and their potential impact on present-day health inequities is sparse. If governments of the Global North paid reparations to countries that they owe, increased investment can be made in vital health systems strengthening programs.

**Methods:**

An initial literature review of the history of Sierra Leone from the 1600s to the present day was conducted to understand the role of Sierra Leone in the global economy and its historical health systems. We began to review historical records with the aim of calculating the resources extracted from Sierra Leone through the enslavement of Sierra Leonean people and review available international data from relevant sources (OECD, IMF, World Bank, UN, Sierra Leonean govt, etc.) to determine the impact of structural adjustment programs on investment in health systems in Sierra Leone.

Chart reviews were conducted at community health center in Kailahun and Kono districts to determine tuberculosis and HIV clinical outcomes. Household surveys were administered in Kono district to collect information regarding poverty levels and barriers to care.

This research is ongoing. Future steps involve completing additional data collection of clinical outcomes and patient satisfaction of care in Kailahun district and completing final data analysis to evaluate quality of care. Next steps also include finalizing calculations of resource extraction from Sierra Leone to ultimately generate a public health model of the Sierra Leone healthcare system and observe the effect of these monetary payments on components of the public sector in Sierra Leone that impact maternal health outcomes.

**Results:**

**Areas of Resource Extraction**

| 1619-early 1800s | TransAtlantic Slave Trade | |
| --- | --- | --- |
| | | |
| 1990s | Structural Adjustment Programs | |
| | Decentralization | |
| 1930s - present day | Extractive Industries, including | |
| | | Titanium Ore (24.2%) |
| | | Iron Ore (18.6%) |
| | | Rough Wood (14.8%) |
| | | Diamonds (12.2%) |
| | | Aluminium Ore (6.2%) |
| | Illicit Financial Flows (IFFs), including | |
| | | Illicit Diamond Mining |
| | | Trade-related |

**Conclusions:**

Using data from primary and secondary sources, we conclude that the material losses for the country of Sierra Leone are significant enough to merit a further investigation into the total amount of reparations. A cost evaluation and economic analysis of the impact of PIH services and the MCOE will require a forthcoming comparison of health services offered by PIH clinics and health services offered in neighboring districts. The preliminary conclusions suggest a significant impact on maternal mortality by

PIH services. A further assessment of MCOE funding, using existing services as a proxy, will be needed to compare the impact of increased funding from a source like reparations on maternal mortality. The strength of the comparison between governmental health centers and PIH clinics is in its ability to project both to impacts on PIH services with increased funding, but also to governmental services with increased funding. While the increase in funding to governmental services will not translate into an exact change in health outcomes as a similar amount spent on PIH, the hope is that a health system which is administered by Sierra Leoneans could theoretically begin to adapt best practices to similar environments in Sierra Leone.

# Alactic Base Excess (ABE), a novel internal milieu parameter: its concept and clinical importance

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**Methods:**

The main database that was used for our systemic review of this literature was Pubmed. Studies that were published up to May 2023 were looked through. Both randomized controlled trials and observational investigations met the criteria for paper. Due to this biomarker being quite novel, there are not many publications on the subject. A collection of 7 peer-reviewed journal articles from 2006 to 2022 were selected for review. The search term was "Alactic Base Excess." Lastly, we implemented systematic methods to mitigate bias throughout all phases of this process.

**Background:**

ABE is a novel parameter that aims to differentiate between metabolic acidosis caused by lactate accumulation and metabolic acidosis induced by the retention of fixed acids (eg: phosphates, sulfates). It is defined as the sum of lactate and standard base excess. ABE has been proposed as a measurement of renal function in cases of sepsis.

**Results:**

Multiple studies have demonstrated that a negative ABE value, signified by < -3 mmol/L, represents an early marker of renal dysfunction, and significantly correlates with higher mortality rates in septic patients. It is believed that a negative ABE value indicates that the standard bases are not being adequately eliminated in the urine and are instead accumulating in the blood, along with lactic acid. The strain on the renal tubules to excrete fixed acids can eventually overwhelm their capacity, leading to a failure of compensatory mechanisms involving organic anion transporters or the proton pump. This can quickly result in acidemia and a worsening glomerular filtration rate (GFR). Notably, research findings have demonstrated that a significant number of patients with a negative ABE value, even without meeting the criteria for acute kidney injury (AKI), later develop worsening kidney function and acidemia to the point of being diagnosed with AKI. It is believed that a neutral ABE value of $\geq$ -3 to < 4 mmol/L indicates that the kidneys are compensating for a buildup of lactic acid. In these cases, patients may have elevated levels of lactic acid in the blood, but the blood pH remains normal as the kidneys effectively concentrate the fixed acids in the urine and maintain pH balance. Positive ABE value of $\geq$ 4 mmol/L suggests that there is no significant concentration of standard bases or lactic acid in the blood, as the kidneys have compensated for

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metabolic acidosis, or the body has employed other compensatory mechanisms to contribute to alkalosis in response to falling blood pH.

**Conclusion:**

ABE is a simple and useful parameter that can be used to better interpret a patient's acid-base status, assess renal function, and general prognosis in sepsis. By incorporating ABE into clinical practice, healthcare professionals can enhance their understanding of the complex acid-base imbalances in their patients and tailor more individualized, effective treatment plans.

## Clinical trial: BIS-guided deep sedation in ICU, evaluation of the impact on delirium and sedation dose.

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**Introduction:**

Delirium is common in critical care patients undergoing deep sedation, often due to excessive sedative drug use. The Bispectral Index (BIS) is a potential tool to mitigate this risk. This trial compares delirium and sedative drug doses in ICU patients under BIS-guided vs. Clinical Scales (CS) sedation.

**Methods:**

Randomized, controlled, double-blinded trial in an Argentinean hospital (April 2019 to December 2021, NCT03840577). Inclusion criteria: deep sedation >8 hours (excl. neurocritical patients). Randomization into control (Richmond Agitation-Sedation Scale) or BIS group (BIS target 40-60). Both groups used a BIS sensor (controls with the screen covered). After the end of deep sedation, BIS sensors were removed, and delirium was assessed twice daily for 14 days using the Confusion Assessment Method for the ICU by researchers blinded to the randomization. Outcomes: coma- and delirium-free days (T-test), subgroup analysis patients with >24 hours sedation, and sedative drug doses (Mixed-Effect model).

**Results:**

99 patients were included (BIS=50, CS=49). Deep sedation duration was similar in both groups (BIS median 2.21[IQR 1.3-3.4]; CS 2.7[IQR 1-4] days). The BIS group had a mean of 7.58 (SD 5.8) delirium-free days vs. 5.6 (SD 6.1) (p=0.1). Subgroup analysis in patients with >24 hours of sedation showed more delirium-free days in the BIS group (BIS 6.9 [SD 5.8]; CS 3.5 [SD 5.3]; p< 0.01). Propofol dose was 10% lower in the BIS group (mean 1.29 vs. 1.44 mg/kg/h; p< 0.01), with lower doses since deep sedation started (coef. BIS -0.23 [95%CI -0.46/-0.001]; p<0.01). Both groups had a dose reduction over time (coef. of hours -.018 [95%CI 0.02/0.01]; p<0.01), without intergroup

differences (coef. interaction term BIS*hours -0.004 [95%CI -0.01 / 0.1];p=0.1).
Midazolam dose was 30% lower in the BIS group (0.21 vs. 0.27 mg/kg/h; p< 0.01), without differences when deep sedation started (0.01 [95%CI -0.04/0.06]; p=0.7), but with an increase over time in the CS group (coef. of hours 0.003 [95%CI 0.006/0.004]) and stable in the BIS group (coef. interaction term BIS*hours -0.004 [95%CI -0.005 /-0.004]).
Conclusion:
BIS-guided deep sedation reduced sedative drugs but only improved delirium and coma-free days in patients that required >24 hours of sedation.

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## Predictive Models for Neurocognitive Decline in HIV+ Youth in Zambia: A Machine Learning Approach

**Objective**: Use machine learning models to evaluate feasibility of modeling techniques and variable importance of predictors of neurocognitive decline in HIV-infected vs. HIV-exposed uninfected youth in Zambia.

**Background**: In Zambia, an estimated 72,000 children are HIV-infected. Despite combination antiretroviral therapy (cART), HIV-associated neurocognitive disorders (HAND) remain a significant complication involving cognitive impairment and developmental delay. The HANDZ study aims to characterize the factors that influence neurocognitive decline in HIV+ youth in Zambia. Data-driven machine learning models can help elucidate these factors and can therefore support clinical interventions for HAND. This study explores the process of creating machine learning models for predicting neurocognitive decline. We present a preliminary model assessing feasibility of modeling techniques for cognitive impairment and the relative importance of features and biomarkers in the determination and development of HAND in Zambia.

**Methods**: Data collected over a 2-year period from 208 perinatally-infected HIV+ children ages 8 – 17 and 208 HIV-exposed uninfected (HEU) controls was used to train three classical machine learning models: logistic regression (LR), random forests (RF), and support vector machines (SVM). Models contained HIV specific predictors, non-specific or both. Cognitive status was the outcome of interest and was calculated using two methods: Standardized-Regression Based (SRB) and Group Based Trajectory (GBT) modeling. We then divided data into 5 subsets: HIV+ with specific HIV predictors, HIV+ with non-specific predictors, HIV+ with all predictors, HEU with non-specific predictors, and HIV+ and HEU with non-specific predictors. To handle missing data, we employed fast missing value imputation by chained random forest. Each subset was then randomly divided into training (80%) and testing (20%) sets for binary classification using 5-fold cross-validation with 10 repeats to avoid overfitting. LR underwent an additional step of LASSO regularization for feature selection. To quantify model performance, we recorded the area under the receiver-operating curve (AUC).

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**Results**: For SRB modeling, RF performed the best (AUC = 0.741) on average across all datasets followed by SVM (AUC = 0.715) and LR (AUC = 0.679) while with GBTM, LR performed the best (AUC = 0.730) followed by RF (AUC = 0.716) and SVM (AUC = 0.703) as seen in Figure 1. SRB and GBTM techniques had no statistically significant differences in performance (p>0.05). Models trained only on HIV-specific variables did not perform better than chance regardless of modeling technique. The addition of HIV-specific variables along with non-specific features did not improve performance with any model. The models identified worst recorded WHO stage, CD4 counts, and nadir CD4 counts as the most important HIV-specific predictors while school performance, height and weight percentiles, grade and socioeconomic status index were identified as the most important non-HIV specific variables.



**SRB Modeling**

| AUC | | | |
|---|---|---|---|
| **Data Subset** | **LR** | **RF** | **SVM** |
| HIV+ Specific variables | 0.365 | 0.540 | 0.532 |
| HIV+ Non-specific variables | 0.881 | 0.893 | 0.910 |
| HIV+ All variables | 0.622 | 0.734 | 0.667 |
| HEU Non-specific variables | 0.761 | 0.847 | 0.769 |
| HIV+ and HEU | 0.766 | 0.694 | 0.699 |
| Average | 0.679 | 0.741 | 0.715 |

**GBTM**

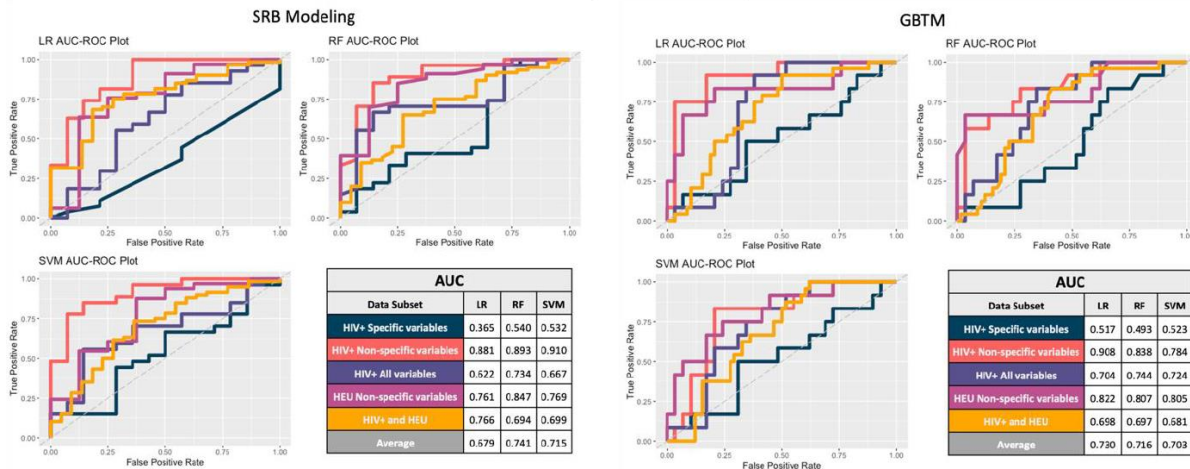| AUC | | | |
|---|---|---|---|
| **Data Subset** | **LR** | **RF** | **SVM** |
| HIV+ Specific variables | 0.517 | 0.493 | 0.523 |
| HIV+ Non-specific variables | 0.908 | 0.838 | 0.784 |
| HIV+ All variables | 0.704 | 0.744 | 0.724 |
| HEU Non-specific variables | 0.822 | 0.807 | 0.805 |
| HIV+ and HEU | 0.698 | 0.697 | 0.581 |
| Average | 0.730 | 0.716 | 0.703 |

*Figure 1: Area Under the Receiver-Operating Curve (AUC-ROC) plots for logistic regression, random forests, and support vector machines for Standardized-Regression Based (SRB) modeling and Group Based Trajectory Modeling (GBTM).*

**Conclusion:** Machine learning can help elucidate factors that closely correlate with neurocognitive decline in HIV+ vs. HEU youth in Zambia. These results provide a preliminary foundation to develop data-driven predictive tools for early intervention in this at-risk population.

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Deja de Fumar, ¡Ejercitándote! (Spanish for: Quit Smoking by Exercising!)

Abstract

Latinos are the largest minority group in the U.S. and account for 17.4% of the current U.S. population and are projected to grow to approximately 30% by 2060. Of the nearly 55 million Latinos that reside in the U.S., over 4 million (8.0%) currently smoke cigarettes. Latinos experience multiple barriers to healthcare access and treatment that result in tobacco-related health disparities. Compared to non-Latino Black and White individuals, Latinos are less likely to receive advice to quit, participate in smoking cessation programs, and use pharmacotherapy or smoking cessation quitlines. Pilot studies assessing the feasibility and acceptability of *Decídetexto* (a smoking cessation text messaging program for Latino who smoke) has shown that the intervention offers a promising strategy to increase the use of Nicotine Replacement Therapy (NRT), generates high satisfaction, significantly increases self-efficacy, and results in noteworthy cessation rates (30% of participants were biochemically verified at Week 12). Despite the success of *Decídetexto*, it was not addressed that 75% of participants did not meet recommended levels of physical activity. Moreover, the role of physical activity in enhancing cessation rates was not leveraged, despite recent evidence suggesting that moderate to vigorous physical activity (MVPA) may enhance cessation rates. Given that smoking and sedentary living are major public health concerns and frequently co-occur amongst Latinos, we must develop interventions that combine smoking cessation and physical activity. In our single arm pilot study, *Deja de fumar ¡Ejercitándote!*, Latinos who smoke and live a sedentary lifestyle (n=20) were enrolled in an intervention that integrated the following components: (1) a 12-week text

messaging coaching program with interactive capabilities, (2) wearable Fitbit devices to monitor physical activity (with a goal of completing 150 minutes of MVPA per week), (3) an online dashboard that manages participant data (incoming and outgoing) from both the messaging program and wearable device, and 4) opportunities for pharmacotherapy support (i.e., NRT). Based off preliminary analysis, overall follow-up rate was assessed to be 18/20 (90%) and the smoking cessation rate was 14/20 (70%). Data regarding physical activity and usage of Fitbit devices is currently being analyzed.

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**Diagnostic value of biomarkers in predicting baked egg oral food challenge outcomes in patients <2 years of age**

**Rationale:**
Baked egg (BE) oral food challenges (OFCs) remain the gold standard for predicting tolerance in egg-allergic children but carry the risk of anaphylaxis. Biomarkers such as specific IgE level (sIgE) and skin prick tests (SPT) have been explored in children under seven years of age to predict adverse outcomes to oral food challenges (OFCs). However, biomarkers and BE OFC outcomes have yet to be well-characterized in patients <2 years of age.

**Methods:**
A retrospective chart review was conducted of 160 patients under seven years of age who underwent BE OFCs at the University of Rochester Medical Center Pediatric Allergy Clinics from May 1, 2012 to June 15, 2023. Patient demographics, family history (FH), past medical history (PMH), age of symptom onset, initial reaction, BE OFC results (dose, reactions, treatments), SPT to egg, and sIgE to egg white (EW) and ovomucoid were recorded. Adverse symptoms during BE OFC were compared by age group using the Chi-square and Fisher's exact tests. SPT and sIgE values prior to the challenge were compared by OFC outcome in children <2 years of age by the Mann-Whitney test. Logistic regression was performed using EW sIgE level at first visit (log-transformed), age at challenge, race, FH of food allergy, and PMH of GERD, eczema, and other food allergies to determine predictors of BE OFC outcome. The Wald test of interaction was used to investigate if the association between EW sIgE and odds of failing the BE OFC differed by age group. ROC curves, specificity, sensitivity, PPV, and NPV at a recommended cutoff to determine OFC outcome were obtained using log-transformed EW sIgE values for patients <2 years of age.

**Results:**
Of the 160 patients, 105 were <2 years of age, and 55 were 2-7 years of age. Among patients that developed adverse reactions during the BE OFC, several symptoms were significantly

milder in patients <2 years of age than 2-7 years of age, specifically pruritus (12.4% vs. 25.5%, p=0.036), anaphylaxis (9.5% vs. 21.8%, p=0.032), and rhinorrhea (1.9% vs. 10.9%, p=0.020) (Table 1). To analyze biomarkers prior to BE OFC challenge by challenge outcome, 3 patients with equivocal results were excluded from further study. Of the remaining 103 patients <2 years of age, 31 patients failed the OFC. Unadjusted for other characteristics, failing the OFC was significantly associated with higher EW sIgE at first visit (p=0.0015).

Log-transformed EW sIgE titer at first visit was significantly associated with the odds of BE OFC outcome in patients <2 years of age (OR 1.71, p=0.025) when adjusted for age at challenge, race, FH of food allergy, and PMH of GERD, eczema, and other food allergies. Patient age (<2 years versus 2-7 years) by EW sIgE titer interaction was statistically significant (p=0.03) in the full sample analysis, indicating that the association between EW sIgE and odds of failing the OFC significantly differed by age group (Table 2). This highlights the importance of establishing guidelines for patients specifically <2 years of age.

ROC analysis with log EW sIgE values at first visit yielded an AUC of 0.7203 (Figure 1). With a cutoff of 1.54 kUa/L, EW sIgE had sensitivity 0.84, specificity 0.62, PPV 0.49, and NPV 0.90.

**Conclusion:**

BE OFC results and biomarker cutoffs vary significantly by age group. In patients <2 years of age, EW sIgE at first visit was predictive of BE OFC outcome.

**Table 1: Symptoms during OFC and treatment by age cohorts**

| OFC Symptoms n (%) | Total N=160 | Age < 2 N=105 | Age 2- <7 N=55 | Comparison* |
|---|---|---|---|---|
| Hives | 40 (25.0) | 27 (25.7) | 13 (23.6) | 0.773 |
| Rash | 6 (3.8) | 4 (3.8) | 2 (3.6) | >0.999 |
| Abdominal Pain | 5 (3.1) | 0 | 5 (9.1) | 0.004 |
| Vomiting | 13 (8.1) | 9 (8.6) | 4 (7.6) | >0.999 |
| Swelling | 2 (1.3) | 0 | 2 (3.6) | 0.117 |
| Respiratory Distress | 1 (0.6) | 1 (1.0) | 0 | >0.999 |
| Cough | 10 (6.3) | 4 (3.8) | 6 (10.9) | 0.094 |
| Pruritus | 27 (16.9) | 13 (12.4) | 14 (25.5) | 0.036 |
| Anaphylaxis | 22 (13.8) | 10 (9.5) | 12 (21.8) | 0.032 |
| Rhinorrhea | 8 (5.0) | 2 (1.9) | 5 (10.9) | 0.020 |
| Flushing | 3 (1.9) | 2 (1.9) | 1 91.8) | >0.999 |
| **Treatment n (%)** | | | | |
| None | 116 (72.5) | 79 (75.2) | 37 (67.3) | 0.284 |
| Epinephrine (1x) | 14 (8.8) | 9 (8.6) | 5 (9.1) | >0.999 |
| Benadryl | 23 (14.4) | 13 (12.4) | 10 (18.2) | 0.321 |
| Cetirizine | 20 (12.5) | 12 (11.4) | 8 (14.6) | 0.571 |

* Binary characteristics are compared using Chi-square test, unless expected cell size is <5 when Fisher's exact test is used.

## Table 2: Logistic Regression Model Summary with the interaction of age and IGE

| Model Effects | Odds Ratio Est. | 95% Confidence Interval | Ho: OR=1 Pr > ChiSq* |
|---|---|---|---|
| log(IGE Egg White first visit)[among those with age < 2 years] | 1.74 | 1.11, 2.72 | 0.03** |
| log(IGE Egg White first visit)[among those with age >=2 years] | 0.80 | 0.46, 1.38 | |
| Race (white vs not) | 1.52 | 0.48, 4.81 | 0.48 |
| Family hx of food allergy (yes vs no) | 0.78 | 0.29, 2.15 | 0.64 |
| Medical hx of GERD (yes vs no) | 0.34 | 0.08, 1.50 | 0.15 |
| Medical hx of eczema (yes vs no) | 2.29 | 0.64, 8.26 | 0.21 |
| Medical hx of other food allergies (yes vs no) | 1.87 | 0.72, 4.83 | 0.20 |

* Chi-square test of Ho: OR=1 vs not =1. P-value is reported. **p-value from the Wald test of interaction between age group and log
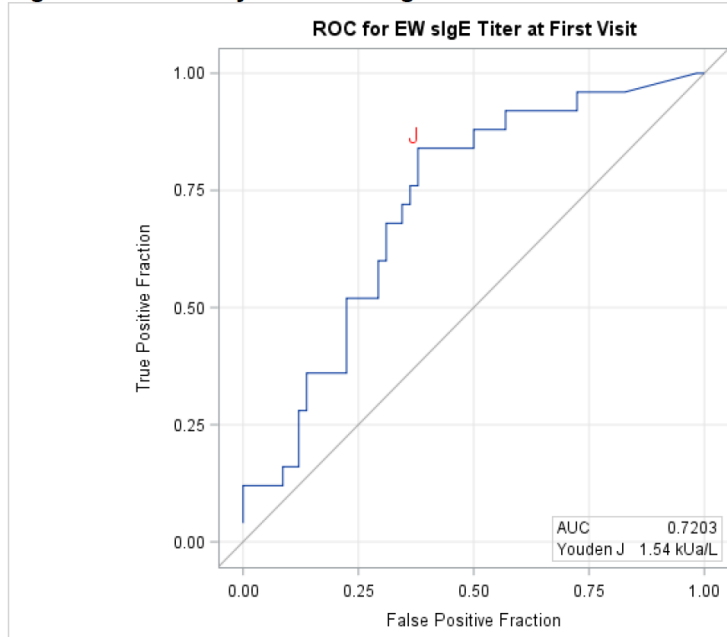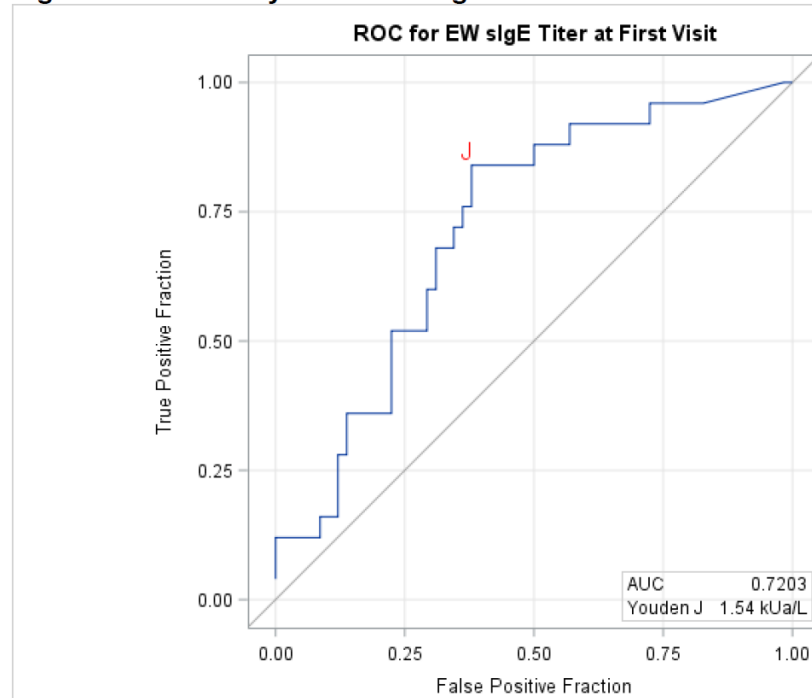
### Figure 1: ROC Analysis for EW sIgE titer at first visit



155

**Figure 1: ROC Analysis for EW sIgE titer at first visit**



ROC for EW sIgE Titer at First Visit

AUC 0.7203
Youden J 1.54 kUa/L

**References:**
1. Leonard, S. A., Caubet, J., Kim, J. S., Groetch, M., & Nowak-Węgrzyn, A. (2015). Baked milk- and egg-containing diet in the management of milk and Egg Allergy. The Journal of Allergy and Clinical Immunology: In Practice, 3(1), 13-23. doi:10.1016/j.jaip.2014.10.001
2. Machinena, A., Riggioni, C., Dominguez, O., Gereda, D., Jiménez-Feijoo, R., Folqué, M., . . . Alvaro, M. (2020, May). Are there any biomarkers that can predict tolerance to baked egg in egg allergic children younger than 6 years? Pediatric Allergy and Immunology, 31(4), 427-430. doi:10.1111/pai.13172
3. Sirin Kose, S., Asilsoy, S., Uzuner, N., Karaman, O., & Anal, O. (2019, October 9). Outcomes of baked milk and egg challenge in cow's milk and Hen's egg allergy: Can tolerance be predicted with allergen-specific IGE and prick-to-prick test? International Archives of Allergy and Immunology, 180(4), 264-273. doi:10.1159/000502957
4. Tan, J. W.-L., Campbell, D. E., Turner, P. J., Kakakios, A., Wong, M., Mehr, S., & Joshi, P. (2013). Baked egg food challenges - clinical utility of skin test to baked egg and ovomucoid in children with Egg Allergy. Clinical & Experimental Allergy, 43, 1189–1195. https://doi.org/10.1111/cea.12153
5. Turner, P. J., Mehr, S., Joshi, P., Tan, J., Wong, M., Kakakios, A., & Campbell, D. E. (2013). Safety of food challenges to extensively heated egg in egg-allergic children: A prospective Cohort Study. Pediatric Allergy and Immunology, 24(5), 450–455. https://doi.org/10.1111/pai.12093

# Machine Learning Serum-Proteomic Analysis Unveils Novel Biomarkers in Atopic Dermatitis: Linking Disease Severity with Staphylococcus aureus Colonization

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**Background:** Atopic Dermatitis (AD) represents a spectrum of inflammatory skin conditions marked by significant clinical and molecular heterogeneity. With rising AD incidence, understanding underlying molecular distinctions and the role of common bacterial agents like Staphylococcus aureus becomes paramount. While individualized treatment paradigms are emerging, they are still nascent and require precise molecular markers to guide clinical decision-making.
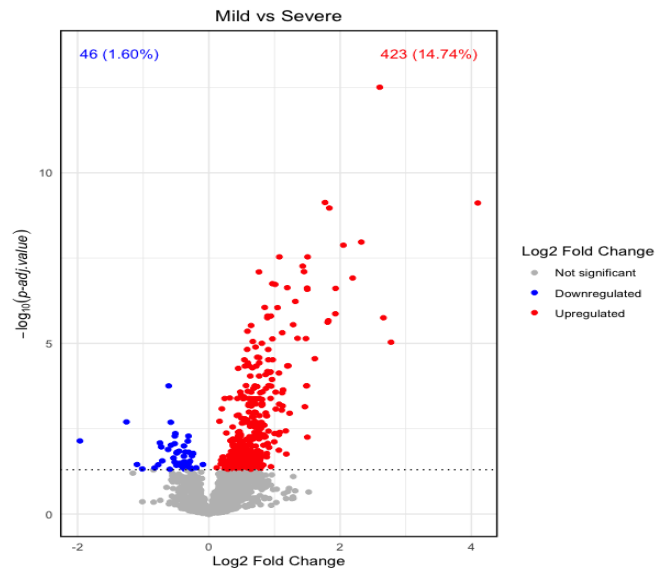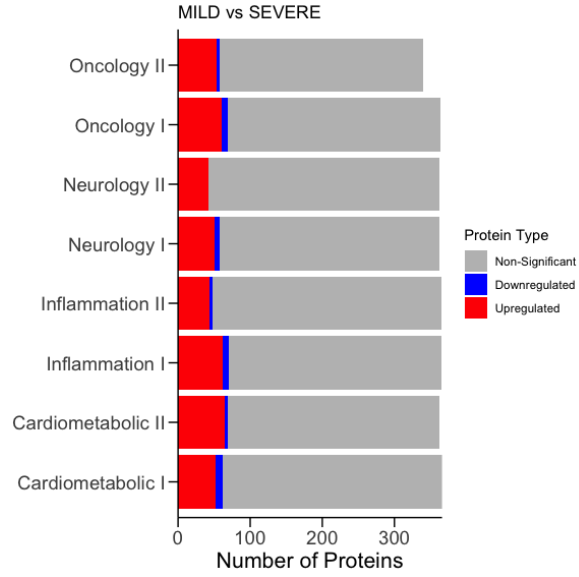
**Objective:** To profile the serum proteome of AD patients, identify molecular markers associated with disease severity, and detect unique proteomic signatures associated with Staphylococcus aureus positivity.
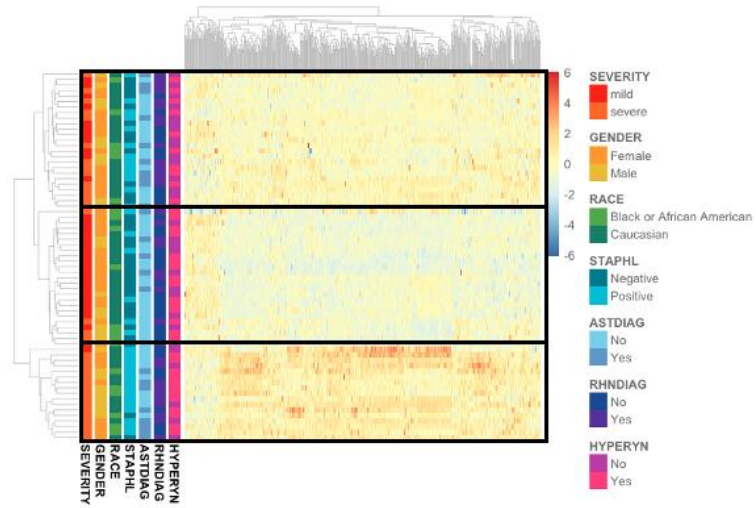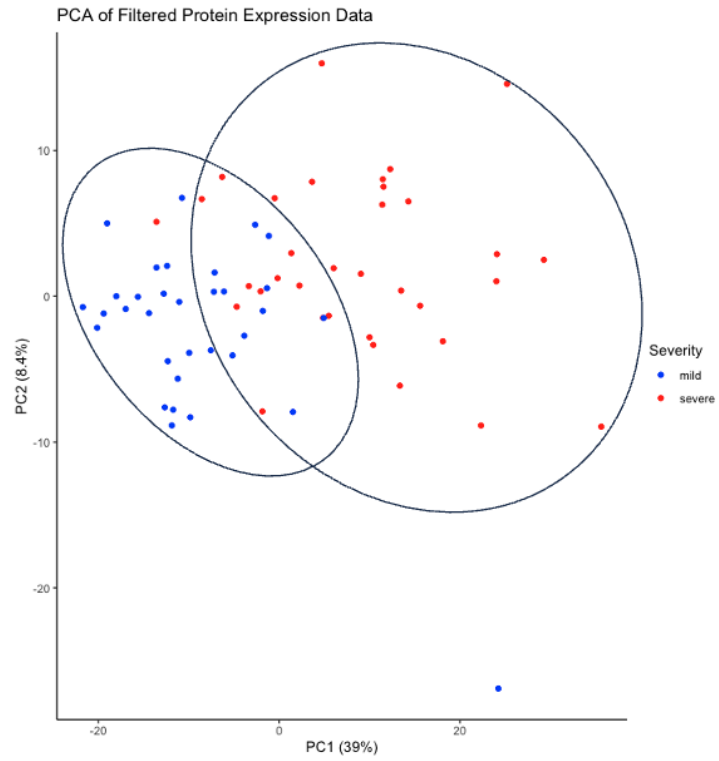
**Methods:** 67 adult AD subjects (33 mild, EASI≤7; 34 severe, EASI≥20) were profiled using the Olink Explore 3072 platform. Differentially expressed proteins (DEPs) were identified using independent t-tests, and False Discovery Rate correction (FDR). Enrichment pathway analyses were facilitated through HPAStainR and StringDB. Machine learning algorithms, including MUVR and Boruta, were employed for robust protein marker selection, and results were validated using 5-fold cross-validation. Pearson Correlation analyses were employed to determine associations of identified biomarkers with relevant clinical parameters.

**Results:** 469 DEPs were identified between mild and severe AD cases, with 46 downregulated and 423 upregulated in severe presentations. HPAStainR matched 233 of these DEPs under the "Skin Epidermal" category. Key terms related to cornification, protease activity, defense responses to gram-positive bacteria, and innate immune responses were spotlighted through StringDB. Of the identified proteins, a set of 20 stood out for AD severity (ROC=0.99) while another 9 were strongly linked to Staphylococcus aureus positivity (ROC=0.86). Correlations with EASI scores and other clinical parameters further underscored the significance of markers like CCL17, IL22, GPR15L, CCL22, and others associated with eosinophil and neutrophil counts.

**Conclusion:** By melding rigorous proteomic analyses with advanced machine learning, we've unveiled a vast array of previously unreported serum proteins pivotal to AD's molecular landscape. These markers

promise to revolutionize AD diagnosis, prognostication, and potentially treatment. As we edge closer to individualized care paradigms, this research reiterates the potential of proteomics, aided by machine learning, in shaping the future of dermatological care.

PCA of Filtered Protein Expression Data

Lambert

Lambert

myeloid leukocyte migration
leukocyte migration
leukocyte chemotaxis
cell chemotaxis
mononuclear cell migration
monocyte chemotaxis
lymphocyte chemotaxis
cellular response to interleukin-1
response to interleukin-1
cytokine-mediated signaling pathway
defense response to bacterium
defense response to Gram-positive bacterium
acute-phase response
antimicrobial humoral response
humoral immune response
positive regulation of defense response
positive regulation of inflammatory response
regulation of inflammatory response
positive regulation of cytokine production
regulation of mononuclear cell proliferation
regulation of lymphocyte proliferation
regulation of leukocyte proliferation
mononuclear cell proliferation
lymphocyte proliferation
leukocyte proliferation
regulation of T cell proliferation
T cell proliferation
leukocyte cell-cell adhesion
regulation of leukocyte cell-cell adhesion
regulation of cell-cell adhesion

monocyte myeloid chemotaxis migration

cellular cytokine-mediated pathway interleukin-1

acute-phase antimicrobial humoral bacterium

positive inflammatory cytokine production

cell cell-cell proliferation adhesion

number of genes
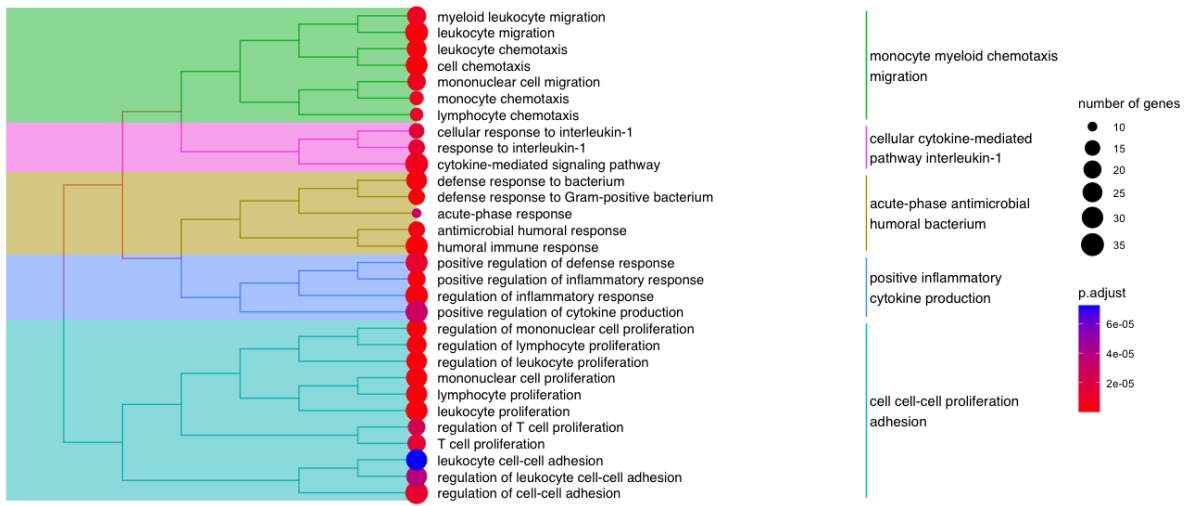● 10
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2e-05

161

**Mahlen, Caleb**

The mechanism by which the brain gives rise to the experience of pain is still unknown. While extensive anatomical and functional mapping has detailed the anatomy of nociceptive input to the brain (McMahon, 2013), a complete physiological model of pain perception does not exist (Wager et al., 2013). Notably, pain perception may be the only sensory experience not associated with a specific brain tissue/homunculus like touch, or vision; instead, a widespread activation is observed when individuals receive painful stimulation, starting from the brainstem periaqueductal gray (PAG), the thalamus, striatum, insula, primary and secondary somatosensory and motor cortices, cingulate and prefrontal cortices (Apkarian et al., 2005). Moreover, direct brain stimulation studies in humans undergoing neurosurgical procedures shows that only 1.4% of 4,160 cortical stimulations concentrated in the medial operculum and adjacent posterior insula gave rise to pain (Mazzola et al., 2012).

In this study we use a new approach to mapping pain perception by drawing on recent advances on the brain mapping of relational abstract knowledge and physical space to identify brain networks mediating pain perception in humans. We hypothesize that, like abstract relational knowledge and physical space mapping, relational knowledge of pain perception will be organized in a grid-like structure that is implicitly formed during learning about pain and that this

grid-like structure will help us better localize the putative "pain cortex".

Our approach involves stimuli composed of combinations of thermal and electrical pain, arranged into a 6x6 grid. It is imperative to establish a reliable relationship between the objective intensity (measured in mA or ºC) delivered to participants and their subjective intensity ratings of these stimuli—otherwise it would be impossible to elicit the grid cell's hypothesized activity. Psychophysical measurements, being highly sensitive to various random effects that are difficult to control, pose a substantial challenge. Distinguishing the genuine signal from extraneous noise in this context remains a formidable task, one that has yet to be directly addressed in existing research. To this end, we will report some interventions we have found that can reduce the variability between the objective and subjective intensity of our stimuli.

# Moderating effect of Social Networks on the relationship between Adverse Childhood Experiences and Suicidality

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## Introduction/Background

Adverse Childhood Events (ACEs) are traumatic events (abuse, neglect and/or household dysfunction) experienced in childhood (<18 years old), that may have devastating consequences on development with lasting effects into adulthood[2]. According to the Centers for Disease Control and Prevention (CDC)[1], ACEs are very common with about 61% of adults reporting one or more types of ACEs experienced and, across 25 states, 1 in 6 adults experiencing four or more ACEs in their lifetime[2]. ACEs have a positive association with chronic physical and mental health concerns such as substance use and suicidal behaviors[2]. Suicide is a major public health problem with the rate of suicide increasing 30% between 2000-2020[3] and in 2020, among people aged 10-14 and 25-34 years, suicide was the second leading cause of death[3].

ACEs and suicidal behavior have pervasive consequences in the lives of the individuals and families affected by them. ACEs can lead to toxic stress that can have a pernicious effect on the development of children[1]. This, in turn, affects children's ability to handle stress in the future and build stable, healthy relationships.

One protective factor found to be associated with a decreased risk of suicidal behavior is a strong, healthy social support network[4]. Research has shown youth social support (familial, community, and school) are associated with lower suicidality scores [10,12]. The combination of familial and school support has also been associated with even lower suicidality scores[12]. Thus, social support and strong social networks may moderate the relationship between ACEs and suicidal ideation and behavior.

## Purpose

ACEs have been shown to be preventable if the risk factors are addressed, however for those who have already experienced ACEs the potential consequences, like suicidality (suicidal ideation and suicide attempts), may not be mitigated but the research on this topic is limited. That is what our research examined; does building and maintaining a strong social network moderate the association between ACEs and suicidal ideation/suicide attempt[2].

We hypothesize that social network quality (e.g., network density, size) moderates the association between ACEs and suicidal ideation and attempts in adulthood, such

that adults who have experienced ACEs but had a better social network in adolescence will be less likely to experience suicidal ideation/attempts. We expected this protective moderation to be dose-dependent as is the relationship between ACEs and suicidality.

## Methods

Data from the National Longitudinal Study of Adolescent to Adult Health (ADD Health) was used to conduct this study. ADD Health is a longitudinal study of a national sample of adolescents from grades 7-12 during the 1994-1995 school year, who have been followed into adulthood with at-home interviews. We used data from Wave I (1994-1995), Wave III (2001) and Wave IV (2008-2009). The ADD Health data has measures for ACEs, social support network and suicide. ACE measures in the ADD Health have been used to conduct research on factors moderating the association between ACEs and health outcomes and behaviors[8]. We used the same measures of ACEs to study the moderating effect of social networks described in previous research[9]. All analyses were conducted in the open-source software, R. Consistent with increasingly important open science principles, both hypotheses and analysis code were pre-registered at the Open Science Platform (osf.io). We used scrambled suicide-related variables to maintain experimenter "blindness". The analysis code uploaded included hierarchical linear regression models, with suicide-related variables as outcomes and ACEs as primary predictors. To test the primary hypotheses that social network variables will reduce the harmful effect of ACEs on subsequent suicide-related outcomes, these models included multiplicative interaction terms (network variables X ACEs). A significant (and negative) regression coefficient for these interaction terms was taken as support for our hypotheses.

## Results

Demographic characteristics of the sample are summarized in Table 1. Regarding suicidal ideation, results of a logistic regression model were contrary to expectations. Specifically, the model indicated one significant interaction between adolescent ACE scores and network density; but in the opposite direction than hypothesized. This significant interaction was subsequently probed with the Johnson-Neyman technique (Figure 1). This follow up interaction probe indicated that as network density increased the effect of ACEs on suicide ideation got stronger, specifically at higher levels of network density, each ACE appeared to increase the risk of suicidal ideation to an even greater degree, than would be the case for lower levels of network density. Regarding suicide attempts, there were no significant interactions.

# **Table 1:** Respondent Sociodemographics Characteristics by ACE Scores

| | | | | | ACE Score | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Demographics** | **0**, N = 41[1] | **1**, N = 1,085[1] | **2**, N = 1,238[1] | **3**, N = 921[1] | **4**, N = 550[1] | **5**, N = 241[1] | **6**, N = 96[1] | **7**, N = 30[1] | **8**, N = 3[1] | **9**, N = 3[1] |
| Age | 30.32 (1.65) | 28.95 (1.77) | 28.96 (1.79) | 28.96 (1.80) | 28.82 (1.81) | 28.80 (1.74) | 28.74 (1.64) | 28.97 (1.71) | 29.67 (0.58) | 29.67 (2.52) |
| Sex | | | | | | | | | | |
| Male | 20 (49%) | 493 (45%) | 552 (45%) | 413 (45%) | 237 (43%) | 104 (43%) | 40 (42%) | 13 (43%) | 2 (67%) | 2 (67%) |
| Female | 21 (51%) | 592 (55%) | 686 (55%) | 508 (55%) | 313 (57%) | 137 (57%) | 56 (58%) | 17 (57%) | 1 (33%) | 1 (33%) |
| Race | | | | | | | | | | |
| White | 29 (71%) | 775 (72%) | 777 (63%) | 563 (61%) | 333 (61%) | 138 (58%) | 60 (63%) | 12 (40%) | 2 (67%) | 0 (0%) |
| Black | 7 (17%) | 204 (19%) | 278 (22%) | 217 (24%) | 126 (23%) | 52 (22%) | 19 (20%) | 12 (40%) | 1 (33%) | 0 (0%) |
| Asian | 3 (7.3%) | 24 (2.2%) | 50 (4.0%) | 29 (3.2%) | 13 (2.4%) | 3 (1.3%) | 3 (3.1%) | 0 (0%) | 0 (0%) | 0 (0%) |
| Native american | 0 (0%) | 4 (0.4%) | 11 (0.9%) | 9 (1.0%) | 6 (1.1%) | 2 (0.8%) | 1 (1.0%) | 1 (3.3%) | 0 (0%) | 1 (33%) |
| Mixed race | 2 (4.9%) | 75 (6.9%) | 120 (9.7%) | 98 (11%) | 71 (13%) | 45 (19%) | 13 (14%) | 5 (17%) | 0 (0%) | 2 (67%) |
| NA | 0 | 3 | 2 | 5 | 1 | 1 | 0 | 0 | 0 | 0 |
| Ethnicity | | | | | | | | | | |
| Non-Hispanic | 39 (95%) | 1,000 (93%) | 1,113 (90%) | 824 (90%) | 487 (89%) | 200 (83%) | 85 (89%) | 27 (90%) | 3 (100%) | 3 (100%) |
| Hispanic | 2 (4.9%) | 81 (7.5%) | 123 (10.0%) | 94 (10%) | 61 (11%) | 40 (17%) | 11 (11%) | 3 (10%) | 0 (0%) | 0 (0%) |
| NA | 0 | 4 | 2 | 3 | 2 | 1 | 0 | 0 | 0 | 0 |
| Education | | | | | | | | | | |
| Less than High School | 3 (7.3%) | 50 (4.6%) | 75 (6.1%) | 64 (6.9%) | 54 (9.8%) | 31 (13%) | 14 (15%) | 4 (13%) | 1 (33%) | 1 (33%) |
| High School Graduate | 24 (59%) | 519 (48%) | 719 (58%) | 562 (61%) | 370 (67%) | 158 (66%) | 71 (74%) | 24 (80%) | 2 (67%) | 2 (67%) |
| College or Higher | 14 (34%) | 515 (48%) | 444 (36%) | 295 (32%) | 126 (23%) | 52 (22%) | 11 (11%) | 2 (6.7%) | 0 (0%) | 0 (0%) |
| NA | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Income | | | | | | | | | | |
| Less than $50,000 | 17 (49%) | 384 (37%) | 516 (45%) | 422 (49%) | 260 (50%) | 120 (54%) | 52 (55%) | 22 (76%) | 2 (100%) | 2 (67%) |
| $50,000-$99,999 | 11 (31%) | 456 (44%) | 438 (38%) | 307 (36%) | 196 (38%) | 80 (36%) | 32 (34%) | 6 (21%) | 0 (0%) | 1 (33%) |
| $100,000 or more | 7 (20%) | 185 (18%) | 198 (17%) | 128 (15%) | 59 (11%) | 24 (11%) | 10 (11%) | 1 (3.4%) | 0 (0%) | 0 (0%) |
| NA | 6 | 60 | 86 | 64 | 35 | 17 | 2 | 1 | 1 | 0 |
| Public Assistance in Youth | 8 (20%) | 172 (16%) | 251 (20%) | 200 (22%) | 171 (31%) | 72 (30%) | 41 (43%) | 17 (57%) | 2 (67%) | 2 (67%) |
| NA | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Health Insurance | | | | | | | | | | |
| Insurance | 9 (22%) | 174 (16%) | 255 (21%) | 201 (22%) | 125 (23%) | 55 (23%) | 27 (28%) | 7 (24%) | 3 (100%) | 1 (33%) |
| No Insurance | 32 (78%) | 907 (84%) | 974 (79%) | 709 (78%) | 420 (77%) | 183 (77%) | 69 (72%) | 22 (76%) | 0 (0%) | 2 (67%) |
| NA | 0 | 4 | 9 | 11 | 5 | 3 | 0 | 1 | 0 | 0 |
| General Health | | | | | | | | | | |
| Poor Health | 1 (2.4%) | 7 (0.6%) | 11 (0.9%) | 15 (1.6%) | 8 (1.5%) | 4 (1.7%) | 2 (2.1%) | 1 (3.3%) | 0 (0%) | 0 (0%) |
| Fair Health | 4 (9.8%) | 66 (6.1%) | 93 (7.5%) | 81 (8.8%) | 58 (11%) | 28 (12%) | 24 (25%) | 7 (23%) | 2 (67%) | 0 (0%) |
| Good Health | 11 (27%) | 304 (28%) | 407 (33%) | 302 (33%) | 208 (38%) | 91 (38%) | 43 (45%) | 12 (40%) | 1 (33%) | 2 (67%) |
| Very Good Health | 19 (46%) | 429 (40%) | 502 (41%) | 353 (38%) | 194 (35%) | 84 (35%) | 20 (21%) | 8 (27%) | 0 (0%) | 1 (33%) |
| Excellent Health | 6 (15%) | 279 (26%) | 225 (18%) | 170 (18%) | 82 (15%) | 34 (14%) | 7 (7.3%) | 2 (6.7%) | 0 (0%) | 0 (0%) |
| Marital Status | | | | | | | | | | |
| Married | 16 (46%) | 502 (48%) | 671 (56%) | 525 (58%) | 307 (57%) | 142 (60%) | 59 (61%) | 18 (60%) | 2 (67%) | 1 (33%) |
| Never Married, separated or divorced | 19 (54%) | 546 (52%) | 527 (44%) | 374 (42%) | 235 (43%) | 94 (40%) | 37 (39%) | 12 (40%) | 1 (33%) | 2 (67%) |
| NA | 6 | 37 | 40 | 22 | 8 | 5 | 0 | 0 | 0 | 0 |

[1]Mean (SD); n (%)

**Figure 1:** Johnson-Neyman plot of the moderating effect of network density on the relationship between ACEs and Suicidal Ideation
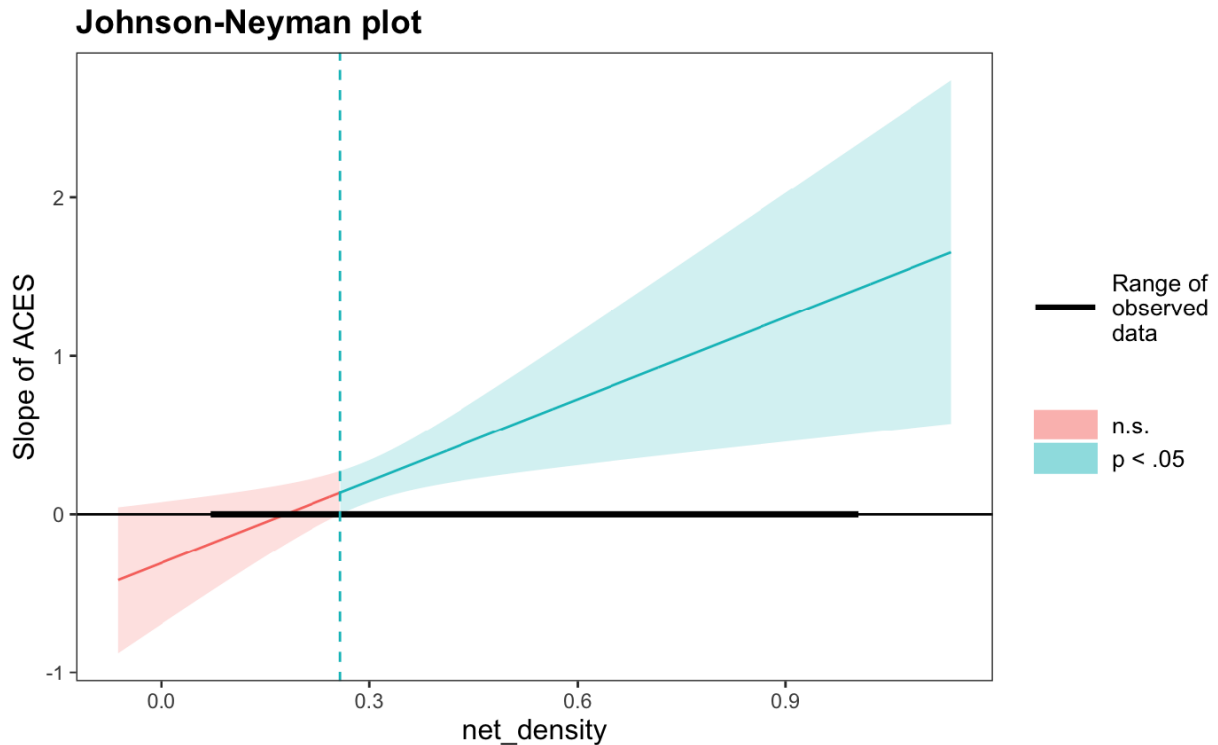


## Discussion and Conclusion

This study found that network density may not serve a protective role as hypothesized, specifically we found as network density increased the effect of each additional childhood ACE had a stronger effect on the risk of suicide ideation in adulthood. This information is important for prevention programs, especially those intended towards building strong social networks and support.

## References

1. Centers for Disease Control and Prevention. (2021). *Adverse childhood experiences (ACEs)*. Centers for Disease Control and Prevention. Retrieved January 14, 2023, from https://www.cdc.gov/violenceprevention/aces/index.html
2. Centers for Disease Control and Prevention (2019). *Preventing Adverse Childhood Experiences: Leveraging the Best Available Evidence.* Atlanta, GA: National Center for Injury Prevention and Control, Centers for Disease Control and Prevention.
3. CDC. CDC WONDER: *Underlying cause of death, 1999–2019.* Atlanta, GA: US Department of Health

and Human Services, CDC; 2020. https://wonder.cdc.gov/Deaths-by-Underlying-Cause.html

4. CDC. *Preventing multiple forms of violence: A strategic vision for connecting the dots*. (2016) Atlanta, GA: Centers for Disease Control and Prevention, National Center for Injury Prevention and Control.

5. Dube SR, Anda RF, Felitti VJ, Chapman DP, Williamson DF, Giles WH. (2001) *Childhood abuse, household dysfunction, and the risk of attempted suicide throughout the life span: findings from the Adverse Childhood Experiences Study*. JAMA.

6. Felitti, V. J., Anda, R. F., Nordenberg, D., Williamson, D. F., Spitz, A. M., Edwards, V., Koss, M. P., & Marks, J. S. (1998). Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults. The Adverse Childhood Experiences (ACE) Study. American journal of preventive medicine, 14(4), 245‑258. https://doi.org/10.1016/s0749-3797(98)00017-8

7. Hardt, J., & Rutter, M. (2004). Validity of adult retrospective reports of adverse childhood experiences: review of the evidence. *Journal of child psychology and psychiatry, and allied disciplines*, *45*(2), 260‑273. https://doi.org/10.1111/j.1469-7610.2004.00218.

8. Hughes K, Bellis MA, Hardcastle KA, Sethi D, Butchart A, Mikton C, Jones L., Dunne MP. (2017) *The effect of multiple adverse childhood experiences on health: a systematic review and meta-analysis*. The Lancet; 2017;2:e356-66.

9. Lee, H., Kim, Y., & Terry, J. (2020). Adverse childhood experiences (ACES) on mental disorders in young adulthood: Latent classes and community violence exposure. *Preventive Medicine*, *134*, 106039. https://doi.org/10.1016/j.ypmed.2020.106039

10. Maimon D, Browning CR, Brooks-Gunn J. Collective efficacy, family attachment, and urban adolescent suicide attempts. J Health Soc Behav. 2010 Sep;51(3):307-24. doi: 10.1177/0022146510377878. PMID: 20943592; PMCID: PMC3110665.

11. Schwartz, J. A., Wright, E. M., & Valgardson, B. A. (2019). Adverse childhood experiences and deleterious outcomes in adulthood: A consideration of the simultaneous role of genetic and environmental influences in two independent samples from the United States. *Child Abuse & Neglect*, *88*, 420‑431. https://doi.org/10.1016/j.chiabu.2018.12.022

12. Standley CJ, Foster-Fishman P. Intersectionality, social support, and youth suicidality: A socioecological approach to prevention. Suicide Life Threat Behav. 2021 Apr;51(2):203-211. doi: 10.1111/sltb.12695. PMID: 33876493.

# Effect Size Mapping of Manipulable Object Representations

# in the Setting of Brain Tumors: A Functional MRI Study.

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The ability to recognize, reach for, and manipulate objects (e.g., utensils, tools) to satisfy one's goals is fundamental for activities of daily living. Prior functional MRI (fMRI) research has found that when participants view images of tools relative to baseline categories (e.g., faces, animals), there is an increased fMRI response in the left premotor cortex (action selection), the left inferior parietal lobule (L.IPL, tool manipulation), the left posterior middle temporal gyrus (L.PMTG, conceptual processing of tools), and the left dorsal occipital cortex (L.DO) extending into the superior parietal lobule (L.SPL, visuospatial analysis for reaching). We have localized this network (see Figure 1), which we refer to as the Tool Use Network. Here, we performed a retrospective analysis of 55 neurotypical control datasets and 107 datasets from participants with a brain tumor (glioma) who took part in an fMRI experiment to localize the Tool Use Network. We hypothesized (H1) that the Tool Use Network would be reliably localized in participants with glioma. We used the neurotypical control dataset as a benchmark to measure our ability to localize the Tool Use Network in the absence of brain injury. We then tested the hypothesis (H2) that within the glioma group, the effect size of the fMRI response would be modulated by the length of time in which tool stimuli were presented (48 vs 32 seconds). H1 was supported when it was found that the number of participants with glioma in whom we could localize the Tool Use Network was no different than the neurotypical control group. H2 was supported when it was found that the effect size of the fMRI response in the L.SPL and L.PMTG was greater in participants who experienced 48 seconds to tool stimuli relative to participants who experienced 32 seconds of tool stimuli. Our results indicate that when developing an fMRI paradigm for neurosurgical planning, one must balance design features (the duration of events) with a patient's ability to sustain attention over multiple runs to maximize the sensitivity and specificity required to map eloquent motor function.

**Figure 1.** fMRI Rendering of the Tool Use Network.
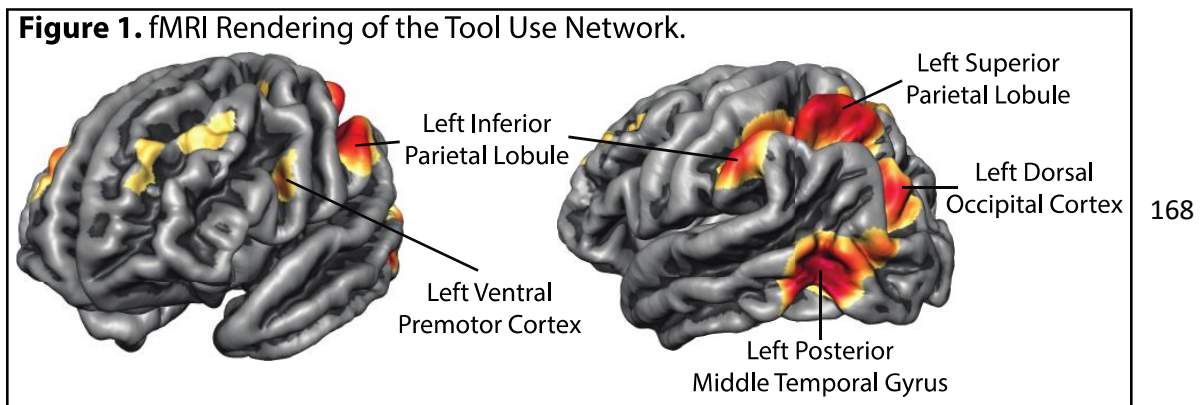
## Off-pump Less invasive HM3 LVAD implantation is Safe and Feasible Compared to the On-pump Technique

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**Introduction:**

Traditionally, HeartMate 3 left ventricular assist device (HM3 LVAD) insertions have been performed on cardiopulmonary bypass, but recent studies have shown that utilizing an off-pump approach may minimize complications associated with HM3 LVAD thoracatomies[2]. Previously, our group at the University of Rochester performed a single-institution study on the perioperative management of an off-pump approach for HM3 LVAD bilateral minithoarcotomies[1]. The cohort for that study was a small cohort of high-risk patients and established that the off-pump approach is a safe alternative for patients who have existing mechanical support. Now, we present a larger cohort of patients who received either off-pump or on-pump HM3 LVAD insertions via less invasive techniques and further evaluate the safety and feasibility of the off-pump approach.

**Methods:**

In this study, we aimed to compare the safety and efficacy of an off-pump HeartMate3 left ventricular assist device insertion versus an on-pump insertion. Specifically, we were looking for characteristics about pre-operation, hospital course, and any complications. We conducted a retrospective review on all the patients who received a HeartMate3 left ventricular assist device at the University of Rochester Medical Center since June 2019. In this cohort, there were a total of 213 patients with 52 patients having an off-pump approach and 161 patients having an on-pump approach. We collected data on these patients using the existing LVAD database and supplemented necessary data through chart review of electronic medical records.

**Results:**

Both the on and off-pump groups were similar in terms of the pre-operative characteristics. There were no significant differences in the pre-operative diagnoses related to cardiac function between the on and off-pump patients. The preoperative LVED echocardiographic variables also had no significant differences between the groups. There were more patients that were categorized as INTERMACS Profile 1 in the off-pump category meaning that they were in critical cardiogenic shock.

Post-operative and hospital course characteristics were also quite similar between the two groups. There were no significant differences in death, right heart failure, or LVAD explantation between the two groups in the pre-discharge period. This trend persisted for the follow-up period, where there were no significances between the off and on pump groups for any post-operative complications. For both the predischarge and follow period, off-pump patients had significantly less disabling stroke outcomes.

**Conclusion:**

The results of this retrospective study indicate that using an off-pump less invasive approach can be a safe and feasible alternative for patients undergoing HM3 LVAD insertions. The off-pump cohort had more patients in critical cardiogenic shock and had similar post-operative characteristics, indicating its efficacy for patients in cardiogenic shock.

**References**:

1. Bernstein WK, Wyrobek J, Vidovich C, Tang J, Lindenmuth D, Gosev I. Anesthetic Considerations for Minimally Invasive, Off-Pump, HeartMate III Implantation. *J Cardiothorac Vasc Anesth*. 2022;36(6):1625-1631. doi:10.1053/j.jvca.2021.12.028
2. Sahutoglu C, Turksal E, Bilic U, et al. Anesthetic Management for Left Ventricular Assist Device Implantation Through Left Thoracotomy: Evaluation of On-Pump Versus Off-Pump. *Transplant Proc*. 2017;49(3):587-592. doi:10.1016/j.transproceed.2017.01.013

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## Investigating the Predictive Utility of Dosimetry for Major Adverse Cardiac Events in Breast Cancer Radiotherapy

**Background:** Radiotherapy (RT) for breast cancer reduces the rates of recurrence and death from breast cancer while also allowing for breast conservation, playing an integral role in overall treatment. However, incidental radiation exposure to the heart increases the risk for cardiovascular (CV) disease, a leading non-cancer cause of morbidity and mortality in long-term survivors of cancer. While mean RT doses received by the whole heart have been associated with an estimated 7% increased risk of significant cardiac events with each Gray (Gy) received, recent studies suggest RT doses to individual coronary arteries and cardiac substructures may better quantify risk. Our research retroactively analyzed clinical and dosimetric factors of patients with breast cancer treated with RT to delineate risk factors for development of post-RT cardiac events.

**Methods:** A retrospective cohort analysis was performed for stage I-III breast cancer patients treated at Stanford Medicine from 2005-2023. Clinical factors were recorded, and cardiac substructures were contoured, including the left anterior descending artery (LAD), left main coronary artery (LMCA), left circumflex (LCX), right coronary artery (RCA), and a combined left substructure (LAD+LMCA+LCX). Radiation doses were recorded as equivalent doses in 2 Gy fractions. Post-radiation cardiac events experienced by patients were categorized into myocardial, constrictive, valvular and/or conductive events.

We investigated the association between cardiac events and multiple continuous variables, including doses to individual cardiac substructures and tumor size, as well as categorical variables such as race, smoking status, and mastectomy. Based on prior cohort study results, logistic regression analyses were performed to assess the association between cardiac events and whether radiation dosage delivered to volume of the left anterior descending coronary artery receiving 15 Gy (LADV15) exceeded 1.5cc or whether volume of the combined left coronary substructures (TotalLeftV15) exceeded 2.5cc, as these threshold values were previously associated with adverse cardiac events.

**Results:** Of 228 identified patients, 23.7% (n=54) received chemotherapy alone, while 174 (76.3%) received a combination of radiotherapy with chemotherapy. The median age at time of treatment was 47 years (range 40.21 - 56.84). Median follow-up time was 114 months (range 96.62-139.83). Following radiotherapy, 7.5% (n=13) experienced at least one cardiac event in a median time of 33.4 months (range 8.9 - 96). The most common type of cardiac event was conductive events (n=8), followed by myocardial (n=3) events. Within the chemotherapy-only cohort, 5.6% (n=3) experienced at least one cardiac event in a median time of 15.6 months (range 0.6 - 68.9). In our analysis of multiple continuous and categorical variables, we found that none of these variables displayed a statistically significant association with cardiac events (p-values > 0.05). Additionally, logistic regression analysis revealed no statistically significant association between LADV15cc > 1.5 cc and cardiac events (*p = 0.41*), nor between TotalLeftV15cc > 2.5 cc and cardiac events, as no observations exceeded this threshold dose.

**Conclusions:** No predictive factors were found within this cohort, as we observed insignificant relationships between cardiac events and breast radiation dose factors. In the context of prior radiotherapy and cardiac studies, we observe that most patients do not receive high enough doses of radiation to significantly increase their risk of experiencing post-RT cardiac events. As modern techniques in breast radiotherapy have improved, including implementation of deep breath inspiratory breath hold (DIBH), radiation dose received by cardiac substructures is often lower than those in previously conducted studies, with 0 cases in this cohort exceeding TotalLeftV15cc thresholds determined from previous studies. As such, our study indicates modern breast radiotherapy delivery may not significantly increase risk of cardiac events.

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**Differentiating between Necrotizing Enterocolitis (NEC) and Food-Protein Induced Allergic Proctocolitis (FPIAP)**

**BACKGROUND:** Necrotizing enterocolitis (NEC) is an inflammatory intestinal condition among neonates which can progress rapidly and become life-threatening. Prompt medical and/or surgical intervention is key for better clinical outcomes. NEC commonly presents with hematochezia. However, cow's milk allergy (CMA) in the form of food protein induced allergic proctocolitis (FPIAP) can also present with hematochezia and does not pose the same risks to the infant. FPIAP is typically treated with removal of milk protein from the diet. Currently, there is no reliable measure to differentiate between NEC and FPIAP. Thus, well-appearing infants with hematochezia often receive rule-out antibiotics and bowel rest for NEC. Improved differentiation between NEC and FPIAP may reduce unnecessary use of these interventions.

**OBJECTIVE:** We sought to evaluate the clinical characteristics of FPIAP in both term and preterm neonates. More specifically, we aimed to compare clinical presentation, feeding habits, medical history, imaging and bloodwork, and resulting treatments between patients with FPIAP and those with NEC.

**METHODS:** This study was a retrospective chart review of 108 records of infants who presented with hematochezia and/or were ultimately diagnosed with NEC or FPIAP. ICD codes of "bloody stool," "cow's milk protein sensitivity," "hematochezia," "milk protein allergy," "milk protein intolerance," "necrotizing enterocolitis," "necrotizing enterocolitis, medical", "necrotizing enterocolitis, presumed," and "necrotizing enterocolitis, surgical" were used to identify eligible NICU patient records at Golisano Children's Hospital and Strong Memorial Hospital Newborn Nursery from 2017 to 2023. Patients were then assigned to one of three groups: NEC, FPIAP, or Mixed Presentation. Categorical data of the NEC

and FPIAP groups were analyzed using Fisher's exact test, while quantitative data of the NEC and FPIAP groups were compared using either a t-test or Mann-Whitney U test, depending on data distribution. For all analyses, a p-value <0.05 indicated statistical significance.

**RESULTS:** 97 subjects were included and categorized into one of the three groups: NEC (n=43), FPIAP (n=42), and Mixed Presentation (n=12). 8 records were excluded due to documented alternative causes of hematochezia, such as anal fissure or swallowed maternal blood. Compared to the NEC group, the FPIAP group had older gestational ages at birth (p=0.0037) as well as higher birth weights (p=0.0009). Furthermore, members of the NEC group exhibited higher prevalence of pneumatosis (p=0.0000) and mottling (p=0.0122) on abdominal x-rays, as well as lower absolute eosinophil counts in bloodwork (p=0.0021). Lastly, subjects in the FPIAP group were more frequently transitioned to a hypoallergenic formula following symptoms compared to their NEC counterparts (p=0.0000).

**CONCLUSIONS:** Our preliminary analysis suggest key differences between infants with FPIAP and NEC, including gestational age, birth weight, imaging results, bloodwork, and feeding outcomes, despite similarities in initial presentation. We plan to expand upon this chart review and conduct a prospective clinical study investigating stool as a non-invasive diagnostic tool for FPIAP.

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### AQP3 as a Potential Biomarker of Pathogenic T-cells in Psoriatic Disease

Psoriatic arthritis (PsA) and psoriasis (PsO) are chronic, immune-mediated inflammatory diseases that can significantly reduce a patient's quality of life. Psoriatic disease can affect all ages with symptom onset presenting as early as in childhood. PsA carries a significant psychological and functional burden of disease. It is associated with absenteeism from work and decreased productivity, correlated with disease activity and physical functioning. Depending on the definition used, PsA occurs in up to 30% of patients with psoriasis (around 2.4 million people) in the United States. In addition, approximately 15% of patients with psoriasis followed by dermatologists have undiagnosed psoriatic arthritis, indicating a higher prevalence. The onset of PsA typically occurs 5-7 years after PsO onset, offering a window for early intervention.

The causes of PsO and PsA are not completely understood, but clinical and epidemiological evidence suggests that these conditions result from a complex interaction between genetic, immunological, and environmental factors. Many studies support the idea that an important aspect of the disease process involves an increased differentiation of T-cells into Th17 cells (a highly pathogenic subtype of helper T-cells) via the IL-17/IL-23 pathway. IL-23 is known to drive the differentiation of CD4+ T-cells into pathogenic Th17 cells, which subsequently produce IL-17. The skin and joint damage observed in both PsO and PsA are believed to be a consequence of the activation of specific inflammatory pathways (including IL-17/IL-23), with some of these pathways overlapping while others remain partially distinct in their mechanisms.

The Ritchlin Lab has shown that the pathogenicity of skin and joint inflammation in PsA are potentially initiated and maintained by activating Th17 cells. They observed increased expression of the water channel protein aquaporin 3 (AQP3) in Th17 cells compared to naïve CD4+ T-cells. Additionally, they observed that exposing human CD4+ T-cells to IL-23 significantly increased AQP3 expression when co-cultured with TGF-beta, IL-1beta, and IL-6. Building on these initial findings in the Ritchlin Lab, I studied the hypothesis that elevated AQP3 expression is a marker for pathogenic Th17 cells by examining the AQP3 expression levels in IL-17-expressing T-cells in skin from untreated PsA patients, PsO patients, and healthy subjects

We also study current treatments for psoriatic arthritis as another way of gaining insight into the disease mechanism and to potentially inform the development of more efficacious targeted biologics. One such drug is Tofacitinib (brand name: Xeljanz), a Janus kinase (JAK) inhibitor that is FDA-approved for use in treating active psoriatic arthritis. It is thought to potentially inhibit type 17 T-cells. Our lab further hypothesized that AQP3 expression in pathogenic IL-17-secreting T-cells will decrease in response to tofacitinib therapy. To test this second hypothesis, I isolated naïve CD4+ T-cells from mouse spleen and cultured them in a mixture of cytokines to induce Th17 differentiation. These cells were cultured in the presence and absence of tofacitinib. This study is still ongoing, and next steps include comparing the expression levels of AQP3 across the different doses at several time points using flow cytometry (FC) and quantitative polymerase chain reaction (qPCR). These findings will reveal a potential marker associated with the pathogenesis of PsO and PsA, making overexpressed AQP3 in Th17 cells a potential target for therapeutic interventions.

Ultimately, decreasing the disease burden patients can experience from psoriatic disease is a major goal of our research. To gain a more comprehensive clinical perspective, I shadowed Drs. Ritchlin and Tausk in their joint-specialty Rheumatology-Dermatology clinic. Interacting with patients provided insight into the more nuanced emotional and logistical complexities of a clinical trial, including pregnancy considerations and insurance restrictions. Beyond identifying a potential biomarker of psoriatic disease, we hope to extend our clinical outreach to an even wider network of under- or uninsured patients and to initiate early treatment before the disease fully manifests.

**Okeson, Riley**
### Subclonal TP53 Mutations in Pediatric Hodgkin Lymphoma
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**Background:** Hodgkin lymphoma (HL) is a malignant lymphoma which accounts for approximately 7% of childhood cancers in the United States.[1] It is one of the most curable pediatric and adult cancers with long-term survival rates now exceeding 90% after treatment with chemotherapy alone or combined with radiation therapy.[2] The current standard of care for classical HL uses combination chemotherapy plus low dose involved field radiation therapy (LDIFRT) for specific indications. While most patients with classic HL will attain a complete remission after initial treatment and achieve long-term disease control, approximately 15% have primary refractory disease or relapse after an initial response to treatment.[4] Despite current treatment options for relapsed or refractory HL, prognosis for these patients is less optimal.

A characteristic of HL is the Hodgkin and Reed-Sternberg (HRS) cell, an abnormal lymphocyte that appears to be multinucleated. Molecular analyses of classic HL have been limited due to the paucity of Hodgkin and Reed-Sternberg (HRS) cells, which usually account for less than 5% of cells as identified by standard CD30 immunostaining.[5] The advancement of nextgeneration sequencing (NGS) techniques in recent years, however, offers an opportunity to further describe the genomic landscape of the disease and identify commonly altered genes. One such gene of interest is the TP53 gene, which codes for the tumor suppressor protein p53. Wild type p53 is essential for maintaining genomic stability and preventing oncogenesis by inducing apoptosis in the presence of DNA damage or mitogenic oncogenes. Mutations in TP53 leading to inactivation of the p53 protein are common in tumorigenesis and a hallmark of many cancers.[6]

Recent genomic analyses of HRS cells from both classical HL and refractory classical HL have identified recurrent alterations in the TP53 gene, among others.[7, 8] The response to radiotherapy for these mutated cells remains debated with some theories suggesting that cancer cells harboring TP53 mutations show reduced sensitivity to radiation therapy, as functional p53 is necessary for radiation-induced cell death. In an analysis of patients with follicular lymphoma treated in a former Southwest Oncology Group (SWOG) study, the patients discovered to have subclonal TP53 mutations did not benefit from the addition of radioimmunotherapy to their chemotherapy backbone, while those without TP53 mutations experienced improved survival.[3] Thus, subclonal TP53 mutations in HL may impact radiation response. However, the incidence and prognostic relevance of TP53 mutations in pediatric HL remains understudied.

**Methods:** We performed p53 immunohistochemistry (IHC) staining on 41 pre-treatment patientderived HL specimens and assigned each two scores based on 1) estimated percentage of stained tumor cells and 2) intensity of stain within these cells. Samples with > 90% positively stained neoplastic cells were assigned a score of 4, 50-90% a score of 3, 10-50% a score of 2, <10% a score of 1, and no staining a score of 0. Sample staining intensity was characterized by the approximate intensity of hematoxylin counter stain. A strong stain, in which no hematoxylin counter stain was visible was given a +++, a moderate stain given ++, and a weak stain given +. We then used ultradeep, targeted TP53 Next Generation Sequencing (NGS) to assess subclonal TP53 mutations in each of these 41 HL specimens and an additional 20 non-malignant lymph node tissue specimens from de-identified, age-matched patients. We applied established methods for concurrent amplification of ultra-conserved regions of DNA as an embedded sequencing noise threshold.[3]

**Results:** IHC p53 staining was evaluable for 35 of 41 HL specimens and reflected a spectrum of tumor proportion and staining intensity (Figure 1). The remaining 6 contained suboptimal sample to evaluate and were excluded from analysis.
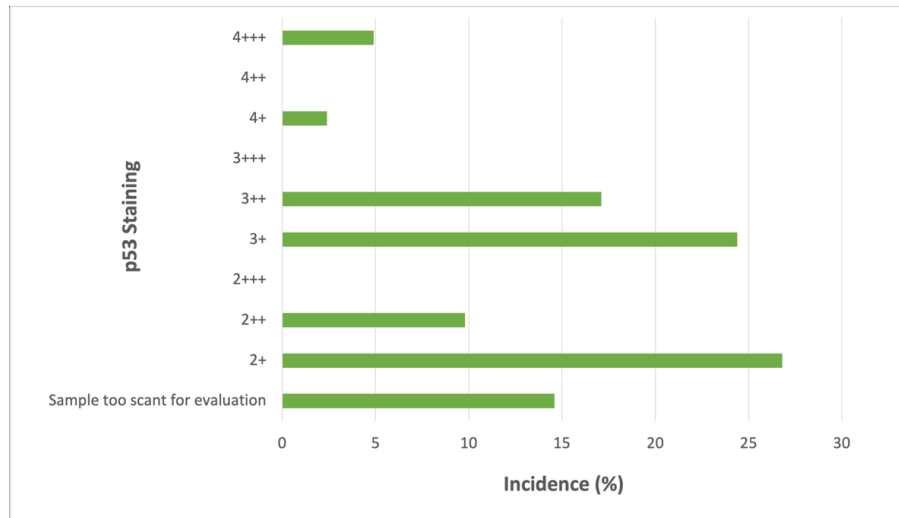


**Figure 1**. *Characterization of p53 staining*. Samples with > 90% positively stained neoplastic cells were assigned a score of 4, 50-90% a score of 3, 10- 50% a score of 2, < 10% a score of 1, and no staining a score of 0. Sample staining intensity was characterized by the approximate intensity of hematoxylin counter stain. A strong stain, in which no hematoxylin counter stain was visible was given a +++, a moderate stain given ++, and a weak stain given +.

Upon NGS analysis of the 41 HL samples, 18 (44%) had inactivating TP53 mutations with a mean variant allele frequency (VAF) of 0.038±0.068 (Figure 2). There was no statistically

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significant difference between the level of p53 staining by IHC and TP53 VAF. Of the 20 nonmalignant
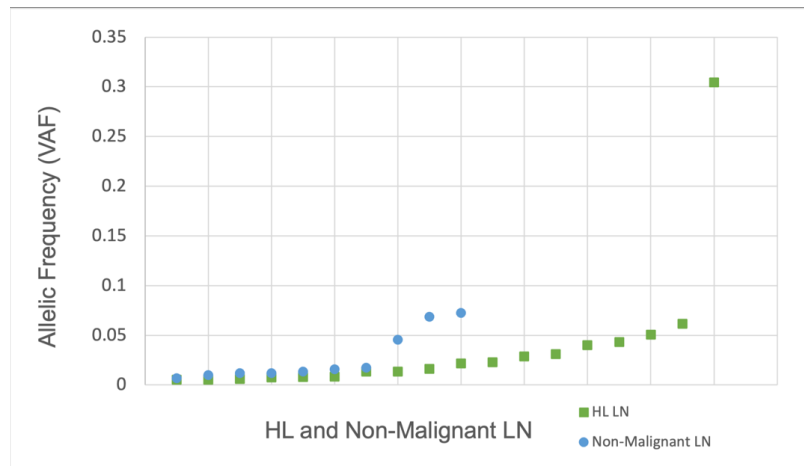LN samples, 11 (55%) also had inactivating mutations with a mean VAF of 0.048±0.074 (Figure 2).



**Figure 2**. *VAF associated with inactivating mutations present in HL and Nonmalignant LN.* The VAF threshold was 0.005, which is based on an embedded sequencing noise threshold from concurrent amplification of ultra-conserved regions of DNA, per established methods.

**Conclusions:** Our findings show a lack of association between p53 IHC staining intensity and TP53 VAF, underscoring the relevance of NGS methods for analysis of subclonal mutation burden. Further, we discovered a comparable incidence of subclonal TP53 inactivating mutations between pediatric HL and non-malignant hyperplastic lymph node tissue. These data suggest that the development of inactivating TP53 gene mutations is not isolated to malignant tissue. Next steps will involve repeat TP53 NGS on matched fresh frozen HL tissue to evaluate the potential for artifactual sequencing errors from paraffin embedded tissue. If validated, our data raise the consideration that subclonal inactivating TP53 mutations may arise in all forms of follicular hyperplasia and highlight the relevance of further studies assessing their prevalence and clinical significance. We also plan to pursue HL microdissection and TP53 NGS on purified RS cells to determine whether inactivating TP53 mutations arise from the malignant cells or the background hyperplastic tissue. These data will offer novel insights into the localization of the genetic instability that may underlie lymphomagenesis and provide valuable insight into sources of therapeutic escape in pediatric lymphoma.

**References**
1. Ward E, DeSantis C, Robbins A, Kohler B, Jemal A. Childhood and adolescent cancer

statistics, 2014. *CA Cancer J Clin*. Mar-Apr 2014;64(2):83-103. doi:10.3322/caac.21219

2. Mauz-Korholz C, Metzger ML, Kelly KM, et al. Pediatric Hodgkin Lymphoma. *J Clin Oncol*. Sep 20 2015;33(27):2975-85. doi:10.1200/JCO.2014.59.4853

3. Burack R. Impact of intra-clonal genetic heterogeneity on progression of folicular lymphoma. *Blood Advances*. 2023;

4. Glimelius I, Ekberg S, Jerkeman M, et al. Long-term survival in young and middle-aged Hodgkin lymphoma patients in Sweden 1992-2009-trends in cure proportions by clinical characteristics. *Am J Hematol*. Dec 2015;90(12):1128-34. doi:10.1002/ajh.24184

5. Tiacci E, Doring C, Brune V, et al. Analyzing primary Hodgkin and Reed-Sternberg cells to capture the molecular and cellular pathogenesis of classical Hodgkin lymphoma. *Blood*. Nov 29 2012;120(23):4609-20. doi:10.1182/blood-2012-05-428896

6. Rivlin N, Brosh R, Oren M, Rotter V. Mutations in the p53 Tumor Suppressor Gene: Important Milestones at the Various Steps of Tumorigenesis. *Genes Cancer*. Apr 2011;2(4):466-74. doi:10.1177/1947601911408889

7. Mata E, Fernandez S, Astudillo A, et al. Genomic analyses of microdissected Hodgkin and Reed-Sternberg cells: mutations in epigenetic regulators and p53 are frequent in refractory classic Hodgkin lymphoma. *Blood Cancer J*. Mar 11 2019;9(3):34. doi:10.1038/s41408-019-0195-7

8. Liang WS, Vergilio JA, Salhia B, et al. Comprehensive Genomic Profiling of Hodgkin Lymphoma Reveals Recurrently Mutated Genes and Increased Mutation Burden. *Oncologist*. Feb 2019;24(2):219-228. doi:10.1634/theoncologist.2018-0058

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## Impact of Systemic Disease Status on CNS Disease Control After Stereotactic Radiosurgery to Breast Cancer Brain Metastases (The SYBRA Study)

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Background:

Unlike metastasis of a primary tumor to other organs, metastasis to the brain has distinct consequences for patients. Most anticancer drugs used to treat metastatic cancers have poor penetration into the brain and are ineffective in treating brain metastasis. Hence, brain metastases are often treated with local therapy like radiation, while patients will receive anticancer drugs for systemic disease (extra-CNS) control. Control of cancer in both CNS and extra-CNS is necessary for survival. Studies investigating factors associated with poor CNS metastasis control or overall survival after standard stereotactic radiation therapy (called stereotactic radiosurgery, SRS) to the brain have identified progressive systemic disease as one of the many significant factors[1-3]. However, these studies have two significant limitations. First, they include patients with various tumor types, which are associated with different biology, systemic treatments, and survival. Second, these studies have investigated the systemic disease status at the time of

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SRS. To investigate the effect of systemic disease status on the CNS disease outcome *after* SRS, it is crucial to assess ongoing systemic disease status *after* and not *at the time of* the SRS administration. Besides, these exploratory studies have investigated systemic disease status as one of the multiple variables affecting the outcome of SRS. Studies primarily investigating the effect of systemic disease on the outcome after SRS to brain metastasis are lacking.

Objective:

Compare the CNS Failure Free Survival (cFFS) and overall survival (OS) after 1st SRS to the brain between those who have early systemic disease progression [early progressing group (EP)] vs. those who don't have early systemic disease progression (non-EP) among breast cancer patients with brain metastasis.

Methods:

We completed a retrospective analysis of patients with brain metastases from breast cancer identified using an existing SRS database of patients from the University of Rochester Medical Center (URMC) Department of Radiation Oncology and through medical record queries completed by the Wilmot Cancer Institute (WCI) informatics team. Key inclusion criteria were: 1. Metastatic breast cancer patients with at least one brain metastasis; 2. Have received first SRS to the brain between January 1st 2010 and July 1st 2023. Key exclusion criteria were: 1. Tumors other than breast cancer; 2. Evidence of leptomeningeal disease at the time of first SRS. Two separate predefined landmarks (LM) were used to define early-progression. In LM1 (LM= 3 months) analysis, patients with systemic disease progression within 3 months from the last day of SRS treatment were included in EP; similarly, in LM2 (LM= 6 months) patients with systemic disease progression within 6 months from the last day of SRS were included in EP. Patients with no evidence of systemic disease progression within the respective LMs were included in the non-EP. Failure of CNS disease control ("CNS failure") was defined as any subsequent radiation to the brain after the 1st SRS. Kaplan-Meier (KM) plots were used to describe the cFFS and OS from each LM, stratified by systemic disease progression status defined at the LM. The non-parametric log-rank test was used to assess whether observed differences in cFFS by systemic progression status are statistically different. Patients with CNS failure before the LM were excluded from the cFFS analysis but were included in the OS analysis. Patients who died before the LM were excluded from both analyses. Cox proportional hazards regression models were used to assess the association between early systemic progression and CNS failure or death while simultaneously adjusting for patient characteristics potentially associated with early progression and CNS failure.

Results:

Out of 164 patients screened, 105 were eligible for the study. Patients, disease, and radiation treatment data among EP vs. non-EP for each LM analysis are described in Table 1.

3-month Landmark Analysis:

Of 105 eligible patients, 23 were excluded from the cFFS analysis (6 CNS failures and 16 deaths prior to LM, 1 follow-up < LM). Out of 82 eligible patients, 14 were included in EP, 68 in non-EP. EP was associated with significantly shorter cFFS than non-EP (Figure 1A), p=0.0017. After adjusting for other important covariates in a Cox model, the rate of CNS failure or death was 3.18 times higher in EP than in non-EP (p=0.0032) (Table 2). Out of 88 eligible patients (82 + 6 with CNS failures before LM also included) for OS analysis, 15 were included in EP, 73 in non-EP. EP was associated with significantly shorter OS than non-EP (Figure 2A), p<0.0001. After adjusting for other covariates, the rate of death was 4.24 times higher in EP compared to non-EP (p=0.0002) (Table 3).

6-month Landmark Analysis:

Out of 105 eligible patients, 39 were excluded from the cFFS analysis (12 CNS failures and 26 deaths before LM, 1 follow-up < LM). Out of 66 eligible patients, 16 were included in EP, 50 in non-EP. EP was associated with significantly shorter cFFS than non-EP (Figure 1B), p<0.0001. After adjusting for other covariates, the rate of CNS failure or death was 3.98 times higher in EP compared to non-EP (p=0.0031) (Table 4). Out of 78 eligible patients (66 + 12 with CNS failures before LM also included) for OS analysis, 20 were included in EP, 58 in non-EP. EP was associated with significantly shorter OS than non-EP (Figure 2B), p<0.0001. After adjusting for other covariates, the rate of death was 4.22 times higher in EP compared to non-EP (p=0.0017).

Conclusion:

These results support the hypothesis that early systemic disease progression after 1st SRS to brain metastasis is associated with a significantly greater risk of failure of CNS disease control and death in breast cancer brain metastases patients. We plan to validate these results on a larger, multicenter dataset.

**Table 1.** Description of overall sample and by systemic failure status at each landmark.

| Patient Characteristic at 1st SRS | Eligible Sample N=105 | cFFS Evaluable 3 Mo LM N=82 | Systemic Failure Prior to 3 Mo Landmark | | cFFS Evaluable 6 Mo LM N=66 | Systemic Failure Prior to 6 Mo Landmark | |
|---|---|---|---|---|---|---|---|
| | | | No (Non-EP) N=68 | Yes (EP) N=14 | | No (Non-EP) N=50 | Yes (EP) N=16 |
| Age, years | | | | | | | |
| Mean (SE) | 59 (1) | 60 (1) | 59 (1) | 65 (3) | 60 (1) | 60 91) | 58 (4) |
| < 50 | 29 (28) | 20 (24) | 18 (26) | 2 (14) | 16 (24) | 11 (22) | 5 (31) |
| 50 – 70 | 56 (53) | 44 (54) | 38 (56) | 6 (43) | 36 (55) | 29 (58) | 7 (44) |
| > 70 | 20 (19) | 18 (22) | 12 (18) | 6 (43) | 14 (21) | 10 (20) | 4 (25) |
| Race | | | | | | | |
| Asian | 5 (5) | 4 (5) | 4 (6) | 0 | 4 96) | 3 (6) | 1 (6) |
| Black | 11 (10) | 10 (12) | 10 (15) | 0 | 8 (12) | 7 (14) | 1 (6) |
| White | 88 (84) | 68 (83) | 54 (79) | 14 (100) | 54 (82) | 40 (80) | 14 (88) |
| Unknown | 1 (1) | 0 | 0 | 0 | 0 | 0 | 0 |
| Hispanic | | | | | | | |
| Yes | 1 (1) | 1 (1) | 1 (1) | 0 | 0 | 0 | 0 |
| No | 100 (95) | 78 (95) | 64 (94) | 14 (100) | 63 (95) | 48 (96) | 15 (94) |
| Unknown | 4 (4) | 3 (4) | 3 (4) | 0 | 3 (5) | 2 (4) | 1 (6) |
| KPS | | | | | | | |
| 90-100 | 43 (41) | 38 (46) | 31 (46) | 7 (50) | 34 (52) | 26 (52) | 8 (50) |
| 70-85 | 48 (46) | 37 (45) | 30 (44) | 7 (50) | 26 (39) | 18 (36) | 8 (50) |
| <70 | 12 (11) | 5 (6) | 5 (7) | 0 | 4 (6) | 4 (8) | 0 |
| Unknown | 3 (3) | 2 (2) | 2 (3) | 0 | 2 (3) | 2 (4) | 0 |
| Hormone Receptors | | | | | | | |
| ER+ / HER2- | 46 (44) | 36 (44) | 28 (41) | 8 (57) | 26 (39) | 18 (36) | 8 (50) |
| ER- / HER2- | 23 (22) | 16 (20) | 12 (18) | 4 (29) | 11 (17) | 8 (16) | 3 919) |
| HER2+ | 33 (31) | 27 (33) | 25 (37) | 2 (14) | 27 (41) | 23 (46) | 4 (25) |
| Unknown | 3 (3) | 3 (4) | 3 (4) | 0 | 2 (3) | 1 (2) | 1 (6) |
| Brain Mets at SRS | | | | | | | |
| 1 | 42 (40) | 33 (40) | 27 (40) | 6 (43) | 30 (45) | 23 (46) | 7 (44) |
| 2-3 | 31 (30) | 23 (28) | 19 (28) | 4 (29) | 18 (27) | 12 (24) | 6 (38) |
| >=4 | 31 (30) | 25 (30) | 21 (31) | 4 (29) | 17 (26) | 15 (30) | 2 (13) |
| Unknown | 1 (1) | 1 (1) | 1 (1) | 0 | 1 (2) | 0 | 0 |
| Fraction Number | | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | 44 (42) | 39 (48) | 29 (43) | 10 (71) | 31 (47) | 20 (40) | 11 (69) |
| 3 | 42 (40) | 27 (33) | 24 (35) | 3 (21) | 19 (29) | 17 (34) | 2 (13) |
| 5 | 16 (15) | 13 (16) | 12 (18) | 1 (7) | 13 (20) | 11 (22) | 2 913) |
| missing | 3 (3) | 3 (4) | 3 (4) | 0 | 3 (5) | 2 (4) | 1 (6) |
| Dose (cGy) | | | | | | | |
| mean (SE) | 2292 (54) | 2248 (65) | 2293 (73) | 2036 (126) | 2242 (77) | 2321 (88) | 1983 (136) |
| median | 2400 | 2100 | 2175 | 1900 | 2060 | 2250 | 1800 |
| (IQR) | (1800, 2700) | (1800, 2700) | (1800, 2700) | (1800, 2100) | (1800, 2700) | (1800, 2700) | (1700, 2100) |
| missing | 2 | 2 | 2 | 0 | 2 | 1 | 1 |
| PTV (cc) | | | | | | | |
| mean (SE) | 12.7 (1.9) | 9.5 (1.3) | 9.7 (1.4) | 8.5 (3.4) | 10.0 (1.5) | 10.5 (1.6) | 8.2 (3.3) |
| median | 5.3 | 4.8 | 5.0 | 2.3 | 5.0 | 7.1 | 3.1 |
| (IQR) | (1.8, 14.8) | (1.6, 13.2) | (1.6, 13.6) | (1.2, 6.2) | (1.7, 13.6) | (2.0, 14.1) | (1.2, 6.9) |
| missing | 5 | 5 | 5 | 0 | 5 | 3 | 2 |

**Table 2.** Adjusted association with time to CNS failure or death from 3-month landmark

| Patient Characteristic | Full Model | | | Reduced Model | | |
|---|---|---|---|---|---|---|
| | Hazard Ratio | 95% CI | P-value | Hazard Ratio | 95% CI | P-value |
| Systemic PD prior to LM1 vs not (EP vs non-EP for LM1). | 3.18 | 1.47, 6.85 | 0.0032 | 2.85 | 1.44, 5.65 | 0.0027 |
| Age (per decade) | 0.81 | 0.64, 1.02 | 0.0679 | 0.81 | 0.65, 1.01 | 0.0588 |
| Race (white vs not white) | 1.08 | 0.45, 2.56 | 0.8648 | | | |
| KPS 90-100 vs <90 | 0.50 | 0.27, 0.89 | 0.0195 | 0.51 | 0.29, 0.91 | 0.0235 |
| ER+/Her2- vs Her2+ | 1.95 | 0.98, 3.89 | 0.0575 | 1.86 | 0.97, 3.59 | 0.0629 |
| ER-/Her2- vs Her2+ | 2.73 | 1.20, 6.22 | 0.0171 | 2.81 | 1.28, 6.16 | 0.0099 |
| Brain Mets at SRS1 (>=2 vs 1) | 2.35 | 1.27, 4,37 | 0.0068 | 2.44 | 1.38, 4.31 | 0.0021 |
| Dose (per 100 cGy) | 1.04 | 0.95, 1.13 | 0.4216 | | | |
| PTV (per log) | 0.99 | 0.81, 1.21 | 0.9293 | | | |
| Fractions (1 vs 3 or 5) | 1.19 | 0.39, 3.57 | 0.7619 | | | |

**Table 3.** Adjusted association with time to death from 3-month landmark

| Patient Characteristic | Full Model | | | Reduced Model | | |
|---|---|---|---|---|---|---|
| | Hazard Ratio | 95% CI | P-value | Hazard Ratio | 95% CI | P-value |
| Systemic PD prior to LM1 vs not (EP vs non-EP for LM1). | 4.24 | 1.97, 9.13 | 0.0002 | 3.74 | 1.94, 7.23 | <0.0001 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Age (per decade) | 0.83 | 0.65, 1.07 | 0.1557 | | | |
| Race (white vs not white) | 1.01 | 0.40, 2.55 | 0.9870 | | | |
| KPS 90-100 vs <90 | 0.54 | 0.27, 1.04 | 0.0659 | 0.57 | 0.30, 1.08 | 0.0840 |
| ER+/Her2- vs Her2+ | 2.20 | 1.07, 4.51 | 0.0312 | 1.99 | 1.01, 3.95 | 0.0482 |
| ER-/Her2- vs Her2+ | 2.13 | 0.86, 5.28 | 0.1042 | 2.14 | 0.88, 5.17 | 0.0926 |
| Brain Mets at SRS1 (>=2 vs 1) | 1.85 | 0.97, 3.54 | 0.0616 | 1.93 | 1.04, 3.58 | 0.0381 |
| Dose (per 100 cGy) | 1.04 | 0.93, 1.16 | 0.4670 | | | |
| PTV (per log) | 1.06 | 0.84, 1.32 | 0.6453 | | | |
| Fractions (1 vs 3 or 5) | 1.76 | 0.43, 7.20 | 0.4304 | | | |

**Table 4.** Adjusted association with time to CNS failure or death from 6-month landmark

| | Full Model | | | Reduced Model | | |
|---|---|---|---|---|---|---|
| **Patient Characteristic** | **Hazard Ratio** | **95% CI** | **P-value** | **Hazard Ratio** | **95% CI** | **P-value** |
| Systemic PD prior to LM2 vs not (EP vs non-EP for LM2). | 3.98 | 1.60, 9.94 | 0.0031 | 2.85 | 1.44, 5.65 | 0.0027 |
| Age (per decade) | 0.84 | 0.63, 1.10 | 0.2029 | 0.81 | 0.65, 1.01 | 0.0588 |
| Race (white vs not white) | 0.90 | 0.32, 2.50 | 0.8398 | | | |
| KPS 90-100 vs <90 | 0.71 | 0.34, 1.48 | 0.3536 | 0.51 | 0.29, 0.91 | 0.0235 |
| ER+/Her2- vs Her2+ | 1.12 | 0.48, 2.59 | 0.7934 | 1.86 | 0.97, 3.59 | 0.0629 |
| ER-/Her2- vs Her2+ | 1.56 | 0.60, 4.09 | 0.3621 | 2.81 | 1.28, 6.16 | 0.0099 |
| Brain Mets at SRS1 (>=2 vs 1) | 2.13 | 1.04, 4.35 | 0.0395 | 2.44 | 1.38, 4.31 | 0.0021 |
| Dose (per 100 cGy) | 1.04 | 0.94, 1.16 | 0.4525 | | | |
| PTV (per log) | 1.04 | 0.82, 1.32 | 0.7425 | | | |
| Fractions (1 vs 3 or 5) | 1.27 | 0.33, 4.83 | 0.7439 | | | |

**Table 5.** Adjusted association with time to death from 6-month landmark

| | Full Model | | | Reduced Model | | |
|---|---|---|---|---|---|---|
| **Patient Characteristic** | **Hazard Ratio** | **95% CI** | **P-value** | **Hazard Ratio** | **95% CI** | **P-value** |
| Systemic PD prior to LM2 vs not (EP vs non-EP for LM2). | 4.22 | 1.71, 10.37 | 0.0017 | 3.28 | 1.58, 6.79 | 0.0014 |
| Age (per decade) | 0.80 | 0.60, 1.07 | 0.1301 | | | |
| Race (white vs not white) | 0.79 | 0.30, 2.06 | 0.6267 | | | |
| KPS 90-100 vs <90 | 0.62 | 0.29, 1.34 | 0.2261 | | | |
| ER+/Her2- vs Her2+ | 1.67 | 0.77, 3.62 | 0.1970 | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| ER-/Her2- vs Her2+ | 1.44 | 0.52, 4.04 | 0.4833 | | | |
| Brain Mets at SRS1 (>=2 vs 1) | 1.72 | 0.84, 3.52 | 0.1407 | 1.82 | 0.95, 3.49 | 0.0706 |
| Dose (per 100 cGy) | 1.03 | 0.91, 1.17 | 0.6406 | | | |
| PTV (per log) | 1.13 | 0.88, 1.45 | 0.3361 | | | |
| Fractions (1 vs 3 or 5) | 1.77 | 0.36, 8.74 | 0.4856 | | | |

SKAWA

**Figure 1**

**A**

**B**



CNS-FFS from 6-Month Landmark

| System PD | Events/Total | Time-Point | KM Est (95% CI) |
|---|---|---|---|
| No | 37/50 | 12 | 52.1 (39.3-69.0%) |
| | | 24 | 23.7 (13.6-41.3%) |
| | | 36 | 18.1 (9.2-35.4%) |
| Yes | 16/16 | 12 | 6.3 (0.9-41.7%) |
| | | 24 | 0.0 (NE-NE%) |
| | | 36 | 0.0 (NE-NE%) |

Logrank P-value: <0.0001

**Figure 2**

**A**



OS from 3 Month Landmark

| System PD | Events/Total | Time-Point | KM Est (95% CI) |
|---|---|---|---|
| No | 45/73 | 12 | 72.5 (62.6-83.9%) |
| | | 24 | 50.7 (39.7-64.8%) |
| | | 36 | 37.6 (27.0-52.4%) |
| Yes | 15/15 | 12 | 33.3 (16.3-68.2%) |
| | | 24 | 13.3 (3.7-48.4%) |
| | | 36 | 6.7 (1.0-44.3%) |

Logrank P-value: <0.0001
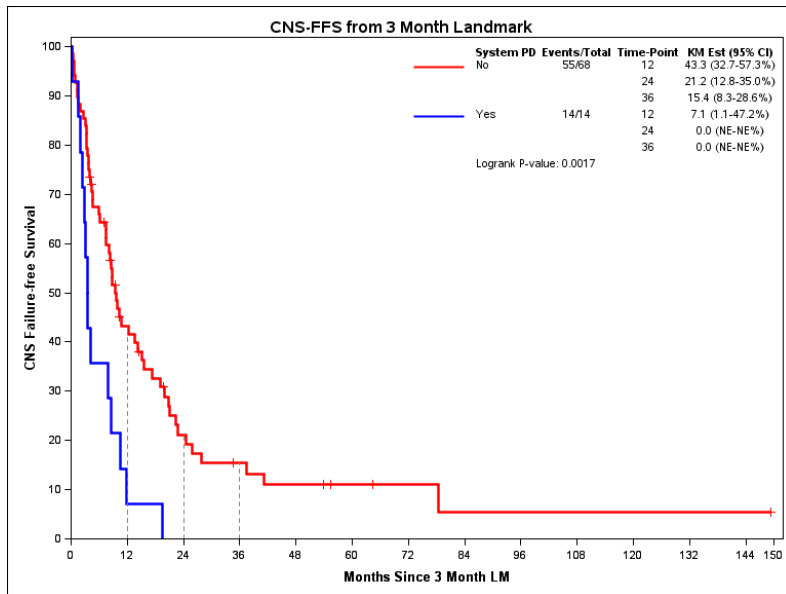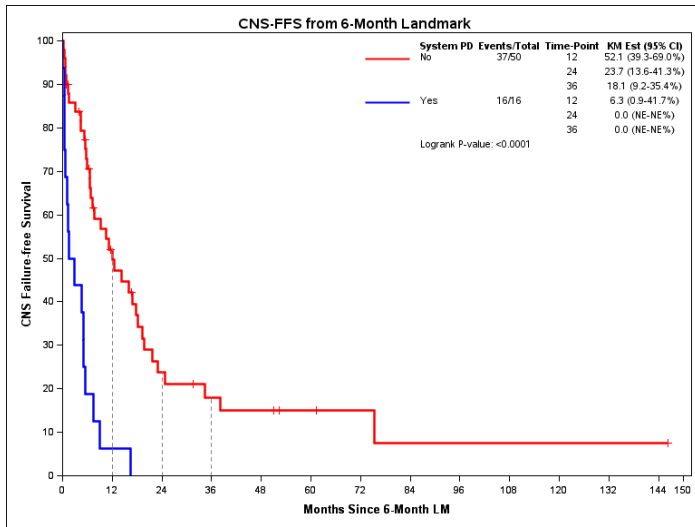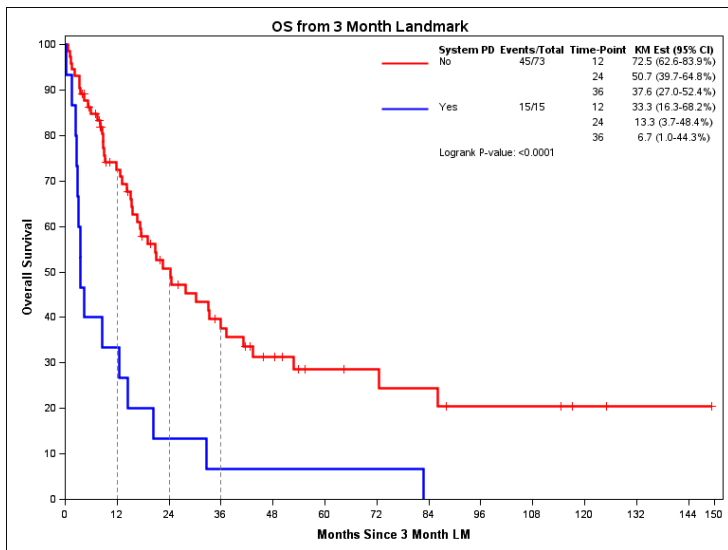
**B**
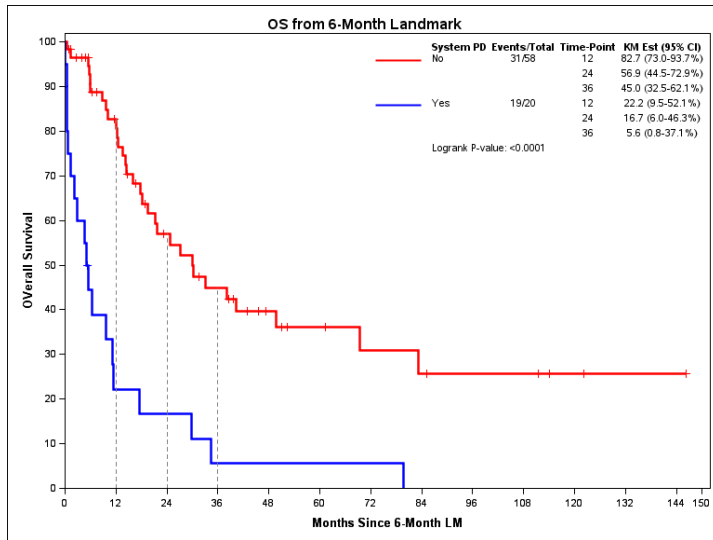


References:

1.   McTyre E, Ayala-Peacock D, Contessa J, et al. Multi-institutional competing risks analysis of distant brain failure and salvage patterns after upfront radiosurgery without whole brain radiotherapy for brain metastasis. *Ann Oncol  Off J Eur Soc Med Oncol*. 2018;29(2):497-503. doi:10.1093/ANNONC/MDX740

2.   Ayala-Peacock DN, Peiffer AM, Lucas JT, et al. A nomogram for predicting distant brain failure in patients treated with gamma knife stereotactic radiosurgery without whole brain radiotherapy. *Neuro Oncol*. 2014;16(9):1283-1288. doi:10.1093/NEUONC/NOU018

3.   Gorovets D, Ayala-Peacock D, Tybor DJ, et al. Multi-institutional Nomogram Predicting Survival Free From Salvage Whole Brain Radiation After Radiosurgery in Patients With Brain Metastases. *Int J Radiat Oncol Biol Phys*. 2017;97(2):246-253.

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### Assessing Accuracy of Human Milk-Derived Human Milk Fortifier Protein Labeling

## BACKGROUND

Premature infants have elevated nutrient needs that necessitate the fortification of human milk (HM). Historically, such fortifiers have been bovine based. Recently, human milk-derived human milk fortifiers (HM-HMF) have become available and highly utilized despite their novelty. In November 2017, the NICU at the Golisano Children's Hospital switched from providing bovine-derived fortifiers to HM-HMF for qualifying infants. The private company that provides HM-HMF standardizes its HM product and labels the protein, fat, and carbohydrate content. However, this has not been independently studied post-manufacturing, and the FDA allows for up to 20% deviation from the labeled value on a food label. A hypothetical variance of 20% from the labeled nutrient value on HM-HMF would be a clinically relevant difference in the care of premature infants.

## METHODOLOGY / PROCEDURES

*Hypothesis 1: There will be a 15% variability between lots of* HM-HMF *in total protein or lactose content*

*Hypothesis 2: At least 10% of the lots from a given HM-HMF product will have a protein concentration that is >10% different from the labeled composition.*

We analyzed the concentration of protein and lactose in 5-10 different lots each HM-HMF products (20, 24, 26, 28, 30, kcal/oz). All samples were measured in duplicate with internal controls. The Bradford assay was used to measure total protein content (BioRad: 50000001, Hercules, CA), and a calorimetric enzymatic assay was used to measure total lactose (Sigma Aldrich: MAK017, St Louis MO).

Statistics and Power:

JMP was used to report descriptive statistics. Variability between lots was calculated as the maximum difference in protein or lactose concentrations between lots, expressed as a percentage of the average concentration. ANOVA and Tukey pair-wise comparisons were used to compare the average protein and

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lactose concentrations between products (base/20, 24, 26, 28, 30kcal/oz). An F-test was used to determine if the standard deviation of protein or lactose differed between products. Protein and lactose concentrations measured in the lab were expressed as a percent deviation from the labeled value. The proportion of lots with a percent deviation > 10% from the labeled value was reported.

**RESULTS**

Average protein concentration was 0.905 ± 0.094 g/100mL (n=10), 2.038 ± 0.166 g/100mL (n=10), 2.322 ± 0.252 g/100mL (n=10), 2.701 ± 0.187 g/100mL (n=11), and 3.217 ± 0.231 g/100mL (n=5) in the 20kcal/oz, 24kcal/oz, 26kcal/oz, 28kcal/oz, and 30kcal/oz products, respectively. Average lactose concentration was 7.296 ± 0.647 g/100mL (n=10), 7.556 ± 0.761 g/100mL (n=10), 7.985 ± 0.606 g/100mL (n=10), 7.580 ± 0.550 g/100mL (n=11), and 7.867 ± 0.506 g/100mL (n=5) in the 20kcal/oz, 24kcal/oz, 26kcal/oz, 28kcal/oz, and 30kcal/oz products, respectively.

Average protein concentration was significantly different between product types (p<0.0001). Pairwise differences in protein concentration between groups also existed (30 kcal/oz > 20 kcal/oz (p<0.0001), 28 kcal/oz > 20 kcal/oz (p<0.0001), 26 kcal/oz > 20 kcal/oz (p<0.0001), 30 kcal/oz > 24 kcal/oz (p<0.0001), 28 kcal/oz > 24 kcal/oz (p<0.0001), 30 kcal/oz > 28 kcal/oz (p<0.0001), 28 kcal/oz > 26 kcal/oz (p<0.0001), 26 kcal/oz > 24 kcal/oz (p=0.0017)). Average lactose concentration was not significantly different between product types (p<0.0001).

With regards to Hypothesis 1: the maximum variability between protein content for the 20kcal/oz products was 29%. This variability was 23%, 41%, 28%, and 17% for the 24kcal/oz, 26kcal/oz, 28kcal/oz, and 30kcal/oz products, respectively. The maximum variability between lactose content for the 20kcal/oz product was 26%. This variability was 30%, 26%, 21%, and 14% for the 24kcal/oz, 26kcal/oz, 28kcal/oz, and 30kcal/oz products, respectively.

With regards to Hypothesis 2: 7 out of 10 of the 20kcal/oz lots differed in protein concentration >10% from the labeled value. In the 24kcal/oz, 26kcal/oz, 28kcal/oz, and 30kcal/oz products, 4 out of 10, 2 out of 10, 2 out of 11, and 3 out of 5 lots, respectively, had protein concentrations >10% different from the labeled value.

**CONCLUSIONS**

These results demonstrate that there is significant variability between lots of HM-HMF and that these products can vary significantly from labeled values. Recognizing this variability is critical when placing feed orders for premature infants and tracking growth outcomes in the NICU. Further study will unveil whether the total caloric content (including measurements of fat) varies similarly.

**Zou, Jonathan**

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### Elucidating Interferon Class Specific Control over Short- and Long-term Keratinocyte Viral Responses

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**Purpose:** Atopic Dermatitis (AD) is a complex inflammatory skin disease that uniquely demonstrates increased susceptibility to severe disseminated cutaneous viral infections. The most severe form of these infections occurs from poxviruses (*Vaccinia Virus*) and herpesviruses (*HSV-1*) resulting in atopic dermatitis eczema herpeticum (ADEH). These infections can lead to life-changing complications such as blindness, meningitis, encephalitis, or death. Type I and II interferons (IFNs) are immunomodulatory classes of cytokines that are well known for their ability to induce an antiviral response through activation of interferon stimulated genes (ISGs). Previous human studies have indicated that a faulty IFN response occurs in subjects experiencing AD with heightened susceptibility to viral infections.

Although cytokine-mediated transcriptional memory is thought to be unique to immune cells, there is an emerging paradigm for interferon induced transcriptional memory in non-hematopoietic cell contexts as well. In human fibroblasts and HeLa cervical epithelial cells after initial interferon treatment and the subsequent transient expression of interferon-stimulated genes returns to baseline, these cells maintain a "memory" state of interferon exposure. This state was revealed upon a second interferon exposure, which resulted in enhanced expression of a subset of interferon-stimulated genes compared to the primary response. We hypothesize that aberrant expression of type 2 cytokines antagonizes the development of an interferon-induced transcriptional memory response in AD patients, which contributes to the increased susceptibility to viral infections. As such, the goal of this project is to **establish that transcriptional memory after interferon treatment exists in keratinocytes and characterize its contribution to antiviral response.**

**Methods:** To test that transcriptional memory is acquired post interferon-treatment, we utilized the immortalized keratinocyte cell line, N/TERT-2G. Cells were cultured and split into three parallel cultures. One was mock treated with KSFM medium (naïve) and the other two were treated with either type 1 (IFNβ) or type 2 (IFNγ) interferons for 24h (priming phase). Cells were

then washed and trypsinized to remove residual IFN and cleave the extracellular domains of IFN receptors, which stops residual signaling. Fresh medium was added, and cells were allowed to proliferate for 48h hours. IFNβ or IFNγ was then added to the primed and naïve cell conditions to assess the ISG response by qPCR 3, 24 and 48 hours post exposure. ISG genes surveyed for expression (*MX1, OAS1, OAS2, ISG15, ISG20, GBP1, GBP4, IFIT1, IFIT2, SOCS1*) were identified from a literature review of differentially expressed genes in AD or ADEH human samples. Additional metrics included barrier formation and viral susceptibility, by TEER and vaccinia virus infection, respectively.

**Figure 1**
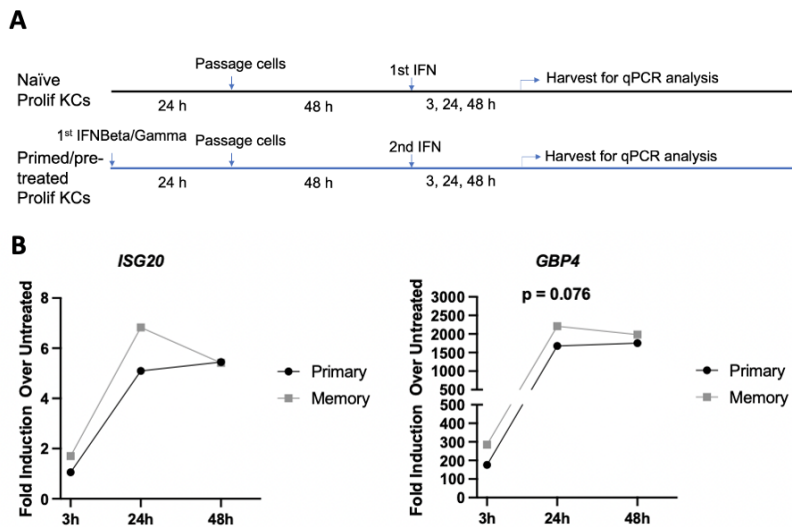


**Results/Conclusion:** After comparing the ISG expression of pretreated cells restimulated with IFN to naïve cells that were not previously treated with IFN before (see Figure 1A, experimental diagram), we found 3 hours after IFNγ treatment, the expression of ISGs *ISG20* and *GBP4* were increased 57.5% and 88.9%, respectively, demonstrating faster and greater induction in pretreated cells (Figure 1B). Interestingly, with the ISG *SOCS1*, we paradoxically found a repressive effect upon IFNβ priming, with expression levels decreasing by 24.0% at 3 hours and 33.0% at 48 hours. Through qPCR, we verified that the ISG expression of keratinocytes primed with either IFN returned to baseline levels after trypsinization and 48 hours of washout, so expression differences in the pretreatment group were not due to residual ISG expression. These IFN-primed keratinocytes also showed a long-term differential barrier response by TEER and differential virus susceptibility to vaccinia virus infection that was sustained 72 hours after

IFN treatment. This is the first documented case of transcriptional memory in keratinocytes and suggests these cells play a larger role in long-term anti-viral protection.

YEAR-OUT RESEARCH

# Title: Provider and nurse recommendations for Influenza and COVID-19 vaccination in obstetric practices: a qualitative analysis

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[4] Center for Disease Control

Background:

Pregnant people face higher morbidity and mortality from influenza (flu) and COVID-19 infection than non-pregnant counterparts. Despite high vaccine efficacy, only 50% of eligible pregnant people received flu vaccine before or during pregnancy and 22% completed COVID vaccination series (including boosters) as of January 2022 and December 2022, respectively.

Objective:

Qualitatively assess how providers and nurses recommend flu and COVID vaccines during prenatal visits in obstetric practices that participated in a flu vaccine communication randomized control trial (RCT) in Rochester, NY and Los Angeles, CA.

Methods:

34 obstetric practices (21 in NY, 13 in CA) participated in an RCT to increase flu vaccination rates. 16 intervention sites received a total of 60 minutes of online training on flu morbidity, vaccine effectiveness, motivational interviewing, discussing protection of the infant, and using presumptive recommendations ("you are due for a flu vaccine"). At the end of the study, provider and nurse participants received a REDCap survey with open ended questions about how they recommend flu and COVID vaccinations during prenatal visits. Data collection occurred from July - October 2022. Investigators applied content analysis to code qualitative data into themes. Results were stratified according to study arm.

Results:

The survey response rate was 46% (124/271); and 44% (104/239) of providers and 59% (19/32) of nurses participated. For flu vaccination, increased risk of flu during pregnancy was the most common theme noted in both study arms (Fig 1, exemplar quotes in Table 1). Intervention sites more frequently described using presumptive recommendations (14% intervention, 3% control) and normalized vaccinating ("we recommend flu vaccine for all prenatal patients", 30% intervention, 23% control) to encourage flu vaccination. Presumptive recommendation for COVID vaccination was infrequent and occurred exclusively in intervention sites (6%). Respondents from intervention sites more often mentioned protection of the baby when discussing COVID vaccination (46% intervention, 38% control).

Conclusion:

In a qualitative analysis of flu and COVID vaccine discussions for practices that participated in a flu vaccine communication RCT, participants in intervention sites more often used presumptive recommendations and normalized vaccinating, in addition to using skills taught for flu vaccination while discussing COVID vaccination. Next steps include formally testing similar interventions to increase COVID vaccination rates for pregnant people.

# Nanoparticulate Mineralized Collagen Scaffolds Activate the Integrin β1 Signaling Pathway

**Jonnby S LaGuardia[1]** BS; Xiaoyan Ren[1] MD, PhD; Meiwand Bedar[1] MSc, MD, PhD; Shahrzad Moghadam[1] BS; Dillon Dejam[1] BS; Kelly Huang[1] BS; Wei Chen[1] PhD; Youngnam Kang, PhD; Justine Lee[1] MD, PhD, FACS

Mentor: Justine Lee MD, PhD, FACS

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**Purpose:**

The capabilities of the extracellular matrix (ECM) to instruct progenitor cell fate determination has resulted in a significant interest in developing ECM-inspired materials for regenerative applications. We previously reported on the ability of nanoparticulate mineralized collagen glycosaminoglycan (MC-GAG) materials to promote *in vitro* osteogenic differentiation of primary human mesenchymal stem cells (hMSCs) as well as *in vivo* skull regeneration as a cell-free, growth factor-free material, suggesting potential for MC-GAG as an off-the-shelf, point-of-care intraoperative solution for skull defects. However, further development is necessary for adequate cerebral protection as the quantity of skull regeneration in the first-generation iteration of MC-GAG reached at most 60% of native calvarium. As MC-GAG is a synthetic material, biomechanical properties, such as stiffness, are tunable for the purposes of improving the desired cellular responses. One of the known signaling pathways for skeletal stem cell commitment is the mechanosensitive integrin β1/focal adhesion kinase (FAK)/yes-associated protein (YAP)/ transcription activator with PDZ- binding motif (TAZ) axis. In this work, we evaluated the activation of this axis in MC-GAG.

**Methods:**

$3 \times 10^5$ primary bone marrow-derived hMSCs cultured on 8 mm in diameter MC-GAG (Young's modulus 3.9 kPa) and collagen glycosaminoglycan scaffolds (Col-GAG, Young's modulus 0.4 kPa), as a control material, were assessed for expression of mechanotransduction and osteogenic markers using quantitative reverse-transcriptase polymerase chain reaction (QPCR) and western blot analyses for integrin β1, β3, α5, as well as proteins involved in mechanotransduction signaling (total and phosphorylated FAK, YAP, and TAZ) and osteogenesis (Runx2).

**Results:**

Compared to two-dimensional cultures, both Col-GAG and MC-GAG induced increased protein, but not gene, expression of integrin $\beta 1$, whereas no significant differences were found in expression levels of other integrins tested ($\beta 3$ and $\alpha 5$). Between the two materials, the stiffer MC-GAG demonstrated a significantly higher quantity of integrin $\beta 1$ protein, phosphorylated FAK, YAP, and TAZ. Furthermore, protein expression of Runx2, FAK, and phosphorylated FAK was also higher on MC-GAG**.**

**Conclusions:**

MC-GAG induced higher protein expression of the integrin $\beta 1$ subunit in primary hMSCs when compared to the less stiff, control Col-GAG material. This finding and the known effects of the mechanical properties of MC-GAG on osteogenic differentiation suggest that specific integrin subunits may be important to MC-GAG induced bone regeneration. Work employing siRNA downregulation of the integrin subunits is currently underway to determine the necessity of each subunit for differentiation.

# An exploratory, cross-sectional study of the relationship between medication adherence and care partner burden of patients with dementia

**Daniel Lee**, PharmD, Grace S. Ro, MD, Emily D. Clark DO, Inga M. Antonsdottir, BSN, RN, Anton P. Porsteinsson, MD

**Mentors/Preceptors:** Emily D. Clark DO, Anton P. Porsteinsson, MD

**Location of Research:** University of Rochester Medical Center: AD-CARE Alzheimer's Disease Care, Research, and Education Program

## Background
Medication nonadherence remains a public health priority and nation-wide issue. Figures estimate that medication nonadherence contributes to excess hospitalizations, mortality, morbidity and healthcare costs. Patients with cognitive impairment are inherently vulnerable to nonadherence and may receive assistance from care partners (CP: informal caregivers who identify as family members, extended family members, and/or friends) for their medications. Emerging evidence indicate that medications contribute to CP burden, and may affect CP's physical, emotional, or financial well-being. The intersection of CP burden and medication adherence are largely unknown.

## Objectives
This study characterizes perceived medication adherence practices and barriers in CPs of patients with dementia in a real-world memory clinic, summarizes subjective CP care burden, and identifies CP characteristics associated with increased burden.

## Methods
A questionnaire for CPs of patients with dementia was developed assessing respondent demographics, the patient's medication practices, and CP burden measured by the Burden Scale for Family Caregivers–short version (BSFC-s). Respondents were recruited by purposive sampling through their association with a university hospital-affiliated memory care program and clinical trials center. Association between respondent characteristics and BSFC-s scores were analyzed by Kruskal-Wallis Test.

## Results
Twenty-three respondents completed the survey, with most experiencing elevated levels of care burden (moderate to very severe). Survey results showed that forgetfulness in

CPs was a common challenge to adherence. Respondents identified perceived benefits in reducing pill burden and simplifying medication regimens. No significant difference was seen between respondent characteristics or BSFC-s score.

## Conclusion

This study reports the findings of a feasible pilot study examining the intersection between medication beliefs and subjective care burden.

**Title: HIGH VALUE PREVENTATIVE HEALTH, OPPORTUNISITIC CANCER SCREENING IN OBSERVATION UNITS**

**Authors: Chanjun Syd Park**, BA; David Adler, MD; Beau Abar, PhD

Author Institutions: University of Rochester School of Medicine, University of Rochester Strong Memorial Hospita

The purpose of this study was to explore the possibility of opportunistic cancer screening for patients admitted to observation units. Observations units commonly serve as an intermediate stage between the emergency department and inpatient hospitalization where patients of appropriate acuity are managed, however many observation units exist serving diverse patient populations ranging from peripartum or post-op surgical. Patients in observation units typically have lower-acuity health concerns and have an average length of stay of 24 hours. Notably, these populations are often managed by hospitalist or emergency medicine providers.

Patients admitted to an observation unit of a large hospital who meet the screening age of the United States Preventive Services Task Force (USPSTF) guidelines for breast, cervical, colorectal, and lung cancer were approached to participate in a short survey about demographics, cancer screening history and barriers to healthcare access. Participants were also surveyed for their receptiveness to cancer screening during hospital admission. Survey data was then analyzed using simple statistical methods.

A total of 16 participants were included in this study. Of the 7 participants eligible for breast cancer screening, only one was found to be not up-to-date with USPSTF screening guidelines. Of the 6 participants eligible for cervical cancer screening, only one was found to be not up-to-date. Of the 14 participants eligible for colon cancer screening, 6 were considered not up-to-date. All 4 participants eligible for lung cancer screening were found to be not up-to-date. All participants were currently under the care of a PCP. Subjects agreed that staying up to date with cancer screening was a priority with an average of 4.0 (1 = strongly disagree; 5 = strongly agree). Additionally, participants expressed agreement to cancer screening during hospitalization if available, with an average of 3.8 (1 = strongly disagree; 5 = strongly agree).

This study demonstrated that patients admitted to hospital observation units would be open to and benefit from hospital-based cancer screening. A significant number of participants were found to be not up-to-date for colon and lung cancer screening. Interestingly, all participants reported having a PCP, demonstrating that opportunistic screening outside of the primary care setting could bridge the gap in screening eligible populations. Opportunistic cancer screening and other preventive public health interventions such as smoking cessation and HIV/AIDs testing have been successfully implemented during ED wait times. Observation units could similarly serve as a ripe setting for opportunistic cancer screening. Furthermore, cancer Basic

screening can be done efficiently and noninvasively with a Fecal Immunochemical Test (FIT) for colorectal cancer or HPV self-swab which could be approved for cervical cancer screening in the near future. Alternatively, if these resources were not available, patient education and referral to community screening resources may provide significant public health benefit.

**Title: Anxiety and Functional Impairment in Chronic Tic Disorder**

**Name: Yelizaveta Sapozhnikov**

Mentor name: Jennifer Vermilion

Author list: Yelizaveta Sapozhnikov, Erika Esposito, Heather Adams, Andrew Ross, Nicole Walsh, Leona Oakes, Jennifer Vermilion

Research location: University of Rochester Medical Center, Department of Neurology

Objective: We aimed to evaluate anxiety in youth with Chronic Tic Disorder (CTD) and to determine the contribution of anxiety symptoms to functional impairment.

Background: CTDs are neurodevelopmental disorders affecting 2-3 % of youth. Anxiety is present in 30-50 % of children with CTD. Co-occurring Anxiety Disorders have been associated with elevated tic severity and impairment. Understanding anxiety symptoms in youth with CTD and their functional impact is important for designing future treatment trials.

Methods: In this cross-sectional study, youth with CTD were evaluated for Anxiety Disorders (Anxiety and Related Disorders Interview Schedule), global functioning (Children's Global Assessment Scale) and severity of tics (Yale Global Tic Severity Scale) and anxiety symptoms (Pediatric Anxiety Rating Scale). Tic severity and global functioning were compared between youth with and without Anxiety Disorders using Pooled t-tests.

Results: We enrolled 35 youth ($M_{age}$ = 11.6 years, $SD_{age}$ = 2.9; 62.9% male). Over half (57.1%) of participants reported clinically significant anxiety symptoms, and 80.0% of participants met DSM-5 diagnostic criteria for at least one Anxiety Disorder. Youth with social phobia and generalized anxiety disorder (GAD) had greater tic severity ($p$ = 0.0026 and $p$ = 0.0005, respectively) compared to youth without these diagnoses. Youth without any Anxiety Disorder diagnosis had overall lower tic severity and better global functioning compared to those with an Anxiety Disorder diagnosis ($p$ = <0.0001 and $p$ = 0.011, respectively).

Conclusions: Anxiety Disorders and clinically significant anxiety symptom severity are common among youth with CTD. Anxiety Disorders are associated with greater tic severity and worse global function. The association between tic severity and anxiety in this sample suggests that there may be a relationship between these symptoms in youth with CTD. This may have implications for treatment of anxious youth with CTD.

**Ruxolitinib 1.5% cream efficacy data for moderate-to-severe chronic hand dermatitis: open-label trial 4-weeks interim analysis**

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**Background:** Chronic hand dermatitis (CHD) is a common condition with a profound negative effect on patients' quality of life (QoL) presenting with a wide range of clinical manifestations often involving a combination of erythema, edema, scaling, vesicles, and fissuring with intense pruritus and pain (1). The clinical heterogeneity reflects the complex, multifactorial pathophysiology, with irritant/allergic contact dermatitis and atopic dermatitis as predominant etiological subtypes (2). Treatment of CHD remains challenging with no FDA-approved medications; routine treatment options include avoidance of relevant allergens/irritants, emollients, topical corticosteroids, calcineurin inhibitors, phototherapy, and systemic immunosuppressive medications (3). Providers and patients are often frustrated with unsatisfactory treatment options for CHD (4). Topical ruxolitinib, currently FDA-approved for vitiligo and AD, is a Jak1/Jak2 inhibitor that blocks the signaling pathway of several cytokines with a potential to block critical inflammation in CHD. An investigator-initiated, open-label, single-site study (NCT05293717) is currently ongoing to assess the clinical efficacy of 12-weeks treatment with ruxolitinib cream 1.5% in recalcitrant

CHD. Here we report the results of an interim analysis after 4 weeks of treatment. This is the first study evaluating the efficacy of ruxolitinib on CHD.

**Objectives:** Investigate clinical efficacy and impact on quality of life after 4 weeks of treatment with ruxolitinib 1.5% in moderate-severe CHD.

**Methods:** This is an open-label investigator-initiated trial in subjects with recalcitrant CHD. After a washout period, subjects (n=15, age 18-75) applied ruxolitinib twice daily to the entire hands. Moisturizers were allowed if consistently used before and during the study; subjects with positive PATCH test that could not avoid the antigen and subjects that reported prolonged contact with water were excluded. Subjects weren't permitted to treat skin

lesions outside of the hands with prohibited medications or the study drug. Clinical assessments include: Investigator Global Assessment (IGA, 5-point scale: clear, almost clear, mild, moderate, severe), Hand Eczema Severity Index (HECSI) a validated scoring system that incorporates both the severity and extent of the disease across fingers, palms, dorsal hands, and wrists (5), Itch Numerical Rating Scale (NRS, average itch over the past 24 hours) and change in QoL were assessed with Dermatology Life Quality Index (DLQI). The study drug diary, a prepopulated calendar for each month, records AM/PM drug application and average and worst itch on a scale of 0 to 10 over the past 24 hours.

**Results:** 14 subjects (8 female; mean age 50 years) completed the first 4 weeks of treatment. Notably, all the subjects had previously failed topicals (corticosteroid and/or calcineurin inhibitors) and in some cases systemic (e.g. oral steroids, methotrexate, phototherapy) treatments. At baseline all subjects had an IGA score $\geq 2$ and moderate-severe HECSI score (mean ± SD: 55.7 ± 23.2). The average itch at baseline was

moderate (NRS, mean ± SD: 5.5 ± 3.39). After 4 weeks of treatment 79% of subjects had a ≥2-point reduction in IGA. 100% subjects reached HECSI-50% and 64% reached a HECSI-75 with a mean reduction in HECSI of 44 ($p<0.01$). 71% of subjects had a ≥ 2 point reduction and 57% of subjects had a ≥ 4-point improvement in average itch (NRS; $p<0.01$). Interestingly, 75% of the subjects had a ≥ 2 point reduction in reported worst daily itch within the first week as noted in their study drug diary. DLQI was significantly reduced ($p<0.01$) in the first month. No treatment related adverse events were reported and no rescue medication were needed.

**Conclusions:** Data from 4 weeks interim analysis are encouraging and suggests that ruxolitinib 1.5% may be an effective and well-tolerated treatment for moderate-severe CHD with significant impact on subject's quality of life. Trial is ongoing to evaluate clinical outcomes at 12 weeks.

Keywords: therapy; chronic hand dermatitis; moderate-severe; jak inhibitor
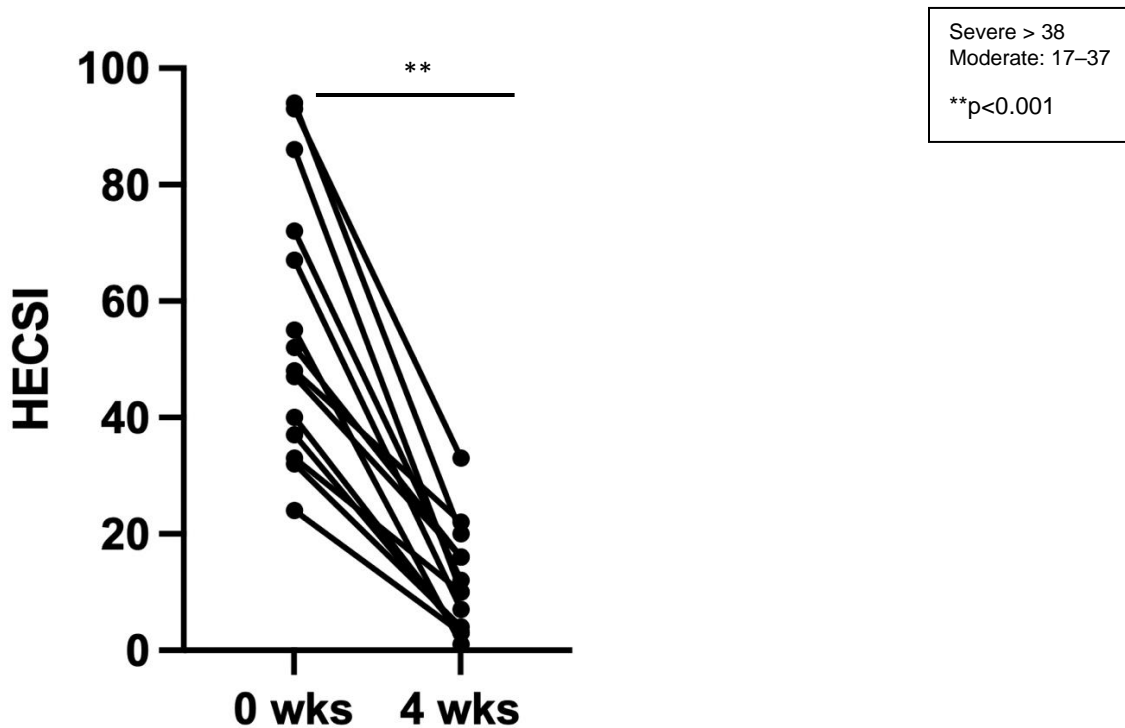
Severe > 38
Moderate: 17–37

**p<0.001

1.      Fowler JF, Ghosh A, Sung J, Emani S, Chang J, Den E, et al. Impact of chronic hand dermatitis on quality of life, work productivity, activity impairment, and medical costs. J Am Acad Dermatol. 2006;54(3):448-57.

2.      Halling-Overgaard AS, Zachariae C, Thyssen JP. Management of Atopic Hand Dermatitis. Dermatol Clin. 2017;35(3):365-72.

3.      Christoffers WA, Coenraads PJ, Svensson Å, Diepgen TL, Dickinson-Blok JL, Xia J, et al. Interventions for hand eczema. Cochrane Database Syst Rev. 2019;4(4):Cd004055.

4.      van Gils RF, Boot CR, van Gils PF, Bruynzeel D, Coenraads PJ, van Mechelen W, et al. Effectiveness of prevention programmes for hand dermatitis: a systematic review of the literature. Contact Dermatitis. 2011;64(2):63-72.

5.      Held E, Skoet R, Johansen JD, Agner T. The hand eczema severity index (HECSI): a scoring system for clinical assessment of hand eczema. A study of inter- and intraobserver reliability. Br J Dermatol. 2005;152(2):302-7.

Clinical Translational Science Institute Research

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**Title:** Telehealth Serious Illness Care Program for Older Adults with Acute Myeloid Leukemia and Myelodysplastic Syndromes: A single-arm pilot study

**Introduction:** Patients acute myeloid leukemia (AML) and myelodysplastic syndromes (MDS), experience shock and anxiety when receiving and navigating their diagnosis. This is compounded by aging-related vulnerabilities, which put older adults with AML and MDS at increased risk of adverse events. Serious illness conversations (SICs) increase patient's understanding of their diagnosis, promote hope, and better prepare patients for the future. Despite the benefits of SICs, these conversations often happen late and are limited by clinician-perceived patient discomfort. We previously adapted the Serious Illness Care Program, an intervention designed to promote SICs, for older patients with AML and MDS. Our adapted SICP is delivered via telehealth to promote patient comfort and includes a geriatric assessment to identify aging-related concerns. The purpose of this study was to assess the feasibility and usability of the adapted SICP via telehealth for older patients with AML and MDS.

**Methods:** We conducted a single-arm pilot study and recruited patients with AML or MDS (≥60 years) and their caregivers. Participants were scheduled for 30- to 60-minute SICP visit with their oncology clinician. Feasibility was measured with retention (>80% considered feasible). Usability was measures with the telehealth usability questionnaire (TUQ, range 1-7; higher is better). We also collected other outcome measures including advance care planning (ACP) engagement, acceptability of the SICP intervention, disease understanding, and healthcare communication. Healthcare communication was assessed using the adapted 6-item Health Care Communication Questionnaire [(HCCQ) range 0-20; higher score is better] and the 1-item Heard and Understood question (range 0-4; higher score is better). Hypothesis testing was performed at α=0.10 due to the pilot nature of this study and small sample size. We elicited participant feedback through audio recorded semi-structured interviews after SICP visits. Interviews were transcribed verbatim, and two investigators independently coded all transcripts using MAXQDA.

**Results:** There were 20 patients and 6 caregivers enrolled in this study with mean ages of 75 (SD 5.9, range 63-87) and 64 (SD 13.7, range 44-77), respectively. The majority of patients and caregivers were White and non-Hispanic(patients: 85%, 17/20; caregivers 100%, 6/6) and non-Hispanic (patients: 80.0%, 16/20; caregivers: 83.3%, 5/6). Of the 19 SICP visits, 13 took place using Zoom, 5 took place using the telephone, and 1 visit took place in person.

The SICP was feasible (retention rate: 95%) and usable. Mean TUQ scores were 5.9 (SD 0.9) and 5.9 (SD 1.1) for patients and caregivers, respectively. From baseline to post-intervention, ACP engagement scores numerically increased [mean +0.4 (SD 1.0); $p=0.12$]. For acceptability, the majority of patients felt the SICP increased sense of control over medical decisions (58.8%, 10/17) and closeness with their clinician (75.0%, 12/16). At post-intervention, patient's estimates of curability and life-expectancy aligned more closely with physicians, but the same was not true for caregivers (Figure 1). Mean scores for HCCQ and Heard and Understood were 18.3 (SD 2.1) and 3.5 (SD 0.5)  for patients, respectively. Mean scores for HCCQ and Heard and Understood were 18.2 (SD 2.9) and 3.7 (SD 0.5)  for caregivers, respectively.

In qualitative interviews, most patients (89.5%, 17/19) and caregivers (100%, 6/6) said they would recommend a SICP visit to others. The majority of patients (94.7%; 18/19) and caregivers (83.3%; 5/6) felt that the patient was prioritized at the SICP visit. Participants appreciated the comfort of telehealth during their SICP visit, felt this program provided them with the opportunity to share their wishes with their oncology clinician, and said that the SICP eased their worries.

**Conclusion:** In this single-arm pilot study, we demonstrated that the adapted telehealth SICP is feasible and usable. The SICP may improve patient's disease understanding and the enhance patient-physician relationship. We will evaluate the preliminary efficacy of the SICP on patient-centered outcomes in a future randomized controlled trial.

**Figure 1**
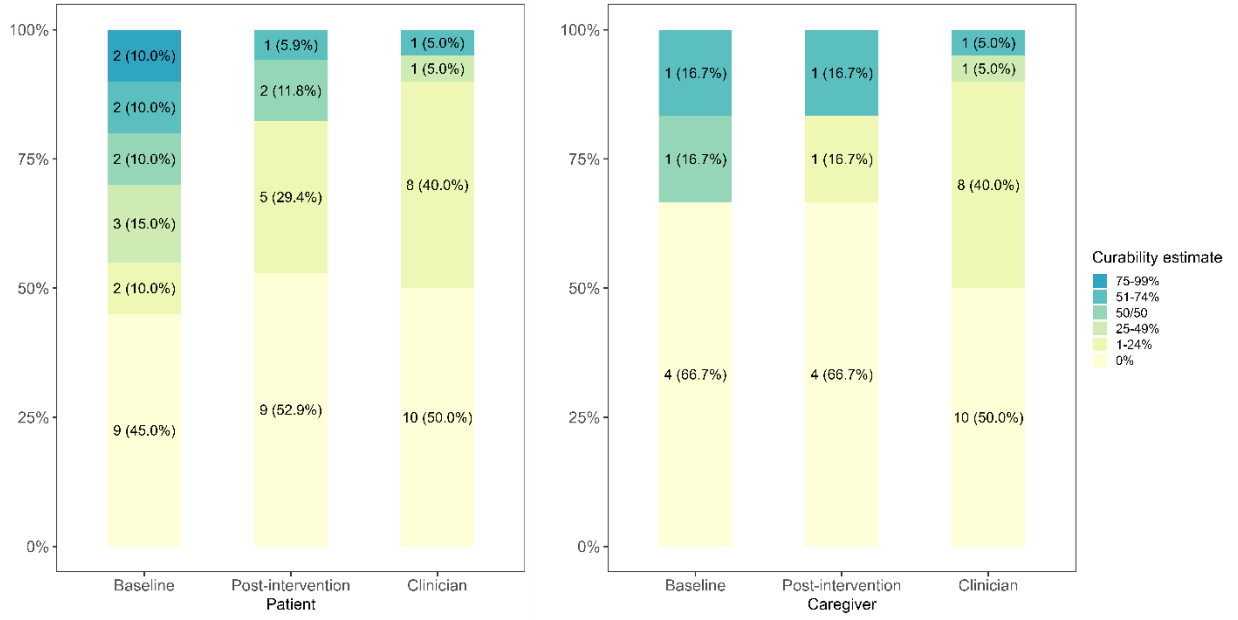
**Infectious keratitis treatment failure – a study of patient and microbial characteristics in Rochester, NY**
**Maretz, Caroline**

**Purpose:** Infectious keratitis (IK) is a devastating disease that, in some patients, can lead to blindness or even loss of the eye despite immediate and intensive topical antimicrobial therapy. To inform clinical prognosis, this study examined patient demographics, systemic and ocular comorbidities, as well as microbial data to determine those factors associated with treatment failure.

**Methods:** A retrospective study was conducted of 407 patients with IK at the University of Rochester, between July 2018 and December 2021 who had documented clinical follow up for at least 2 weeks. Treatment failure was defined as no clinical improvement within 2 weeks of initial presentation and/or need for surgical intervention, including corneal gluing, patch graft, transplant or evisceration. Tests of two proportions were used for statistical analysis to compare patients with treatment failure vs success with regards to a wide range of patient characteristics and microbiologic data.

**Results:** Of 407 patients, 62 (15.2%) experienced treatment failure, of which 37 (58.1%) required surgical intervention. The treatment failure group had significantly higher rates of *Pseudomonas aeruginosa* (p=0.037), fungi (p=0.008), and polymicrobial (p=0.034) cultures. Additionally, age 65+ (p=$1.79e_{-5}$), systemic immunosuppression (p=0.011) and smoking history (p=0.018) were significantly associated with treatment failure. Ocular history associated with treatment failure included prior corneal transplant (p=$8.33e_{-6}$), prior transplant rejection (p=$1.67e_{-5}$), use of topical steroids (p=$1.38e_{-6}$), history of intraocular surgery (p=$2.4e_{-10}$) and visual acuity of 20/250 or worse (p=$1.94e_{-6}$). Patients with treatment failure had significantly higher rates of prescribed fortified antibiotics (p=$7.21e_{-7}$) and bandage contact lenses (p= $7.51e_{-10}$) during their treatment course.

**Conclusions:** These results highlight significant factors associated with IK treatment failure including age >65, immunosuppression, smoking history, and ocular comorbidities (including prior intraocular surgery and poor visual acuity). Patients with treatment failure were also more likely to have polymicrobial, *P. aeruginosa* or fungal infections. This study improves our understanding of IK by identifying key prognostic indicators of treatment failure for this blinding disease.

**Ching-Wei Pan**

**Principal Investigator:**

Laurie Steiner, MD

**Group Members/Co-Authors:**

Kristin Murphy Ph.D., Kathleen McGrath Ph.D., Michael Getman M.S., Anne Koniski M.S., Xiurui Lv M.S., James Palis M.D.

**Research Location:** University of Rochester - Center of Pediatric Biomedical Research

**Title:** Altered Genomic Target of GATA1s Mutation in Transient Abnormal Myelopoiesis

**Background:**

Transient abnormal myelopoiesis (TAM) is a neonatal preleukemic state seen in infants with trisomy 21 (T21), characterized by clonal blast cells that may progress to myeloid leukemia. TAM results from a somatic mutation in *GATA1*, which encodes transcription factor GATA1 critical for hematopoiesis. *GATA1* mutation in TAM results in exclusively expression of short isoform of GATA1 (GATA1s) lacking the first 83 amino acids.[1] The cellular origin and mechanism by which GATA1s results in TAM remains elusive. TAM likely develops in utero, with the clonal blasts emerging from the fetal liver. During development, the fetal liver is seeded by a wave of yolk-sac derived erythro-myeloid progenitors (EMPs) capable of definitive hematopoiesis.[2] We hypothesize that the EMP population is the source of TAM, and the truncated N-terminus in GATA1s results in dysregulated DNA binding and gene expression.

**Objective:**

Investigate differences in GATA1 vs GATA1s binding targets in the EMP population by comparing TAM vs T21 genotypes.

**Design/Methods:**

We modeled TAM in vitro via hematopoietic differentiating patient-derived inducible pluripotent stem cells (iPSCs) harboring GATA1s mutation. Immunophenotypic EMPs were sorted, and nuclei were extracted for Cleavage Under Targets and Release using Nuclease (CUT&RUN) assay to profile GATA1s targets across the genome.

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**Results:**

TAM GATA1s EMPs had significant differences in genome occupancy compared to T21 EMPs, gaining occupancy at 102 sites and decreasing occupancy at 1,195 sites. Gene ontology (GO) analysis of 102 gained sites yielded cell cycling terms, notably involving Cyclin D2 and Cyclin E1. GO analysis of 1,195 decreased occupancy sites revealed Erythropoietin signaling terms, revealing decreased occupancy at STAT5 locus. DNA binding motif analysis revealed that GATA1s in TAM EMPs have altered DNA targets, with decreased recognition of GATA1 motifs, and enriched recognition of STAT5 motifs.

**Conclusions:**

The GATA1s mutation results in altered DNA binding and disrupts the epigenetic landscape in the EMPs. The truncated protein is shown to have significantly decreased occupancy at several GATA1 targets, which may be altering gene expression to prevent lineage commitment and promoting cell cycling/expansion of this progenitor population. Understanding the mechanisms of TAM development may lead to therapies to prevent progression to myeloid leukemia.

**References:**

1. Bhatnagar N, Nizery L, Tunstall O, Vyas P and Roberts I. Transient Abnormal Myelopoiesis and AML in Down Syndrome: an Update. Curr Hematol Malig Rep (2016) 11:333–341.
2. Atkins MH, Scarfò R, McGrath KE, Yang D, Palis J, Ditadi A, Keller GM. Modeling human yolk sac hematopoiesis with pluripotent stem cells. J Exp Med. 2022 Mar 7;219(3):e20211924. doi: 10.1084/jem.20211924.

**John A. Cliburn**

Mentor/Precepotor Names: Michael Becker, MD and Jozal Moore, MD

Research completed at the University of Rochester Medical Center, Wilmot Cancer Institute

**Title:** Performance of the Endothelial Activation and Stress Index and Hematopoietic Cell Transplantation Comorbidity Index for prediction of early survival in matched unrelated donor peripheral blood stem cell transplantation

**Authors:** Jozal W. Moore, Andrea Baran, Kimberly Seymour, Janice Zhao, **John A. Cliburn**, Eric Huselton, Tate Feeney, Jane Liesveld, Michael Becker

**Background**

Identification of patients at risk of early death can guide supportive care following stem cell transplant (SCT). The Endothelial Activation and Stress Index (EASIX) has been reported to predict overall survival (OS) following allogeneic SCT. The Hematopoietic Cell Transplantation Comorbidity Index (HCT-CI) is well-established for the prediction of long-term OS. Here, we externally validate EASIX and HCT-CI for the prediction of day 100 (D100) and D180 OS in matched unrelated donor (MUD) peripheral blood SCT (PBSCT).

**Methods**

Patients ≥ age 18 receiving a first 8/8 or 10/10 MUD PBSCT at our institution from 2011-2021 were included in this retrospective analysis. Those receiving post-transplant cyclophosphamide were excluded. EASIX scores [lactate dehydrogenase (U/L) x creatinine (mg/dL)/platelets ($10^9$ cells/L)], were determined at 4 timepoints: pre-conditioning (preC, day -30 to prior to conditioning), pre-transplant (preT, day -2 to 0), day 0 (D0), and post-transplant (postT, day 2-5). A base 2 log transformation of EASIX was done to minimize skew. HCT-CI was calculated prior to conditioning. Area under the receiver-operator curve (AUC) was used to determine predictive accuracy for HCT-CI and log2(EASIX) with respect to OS, with a value of 1 representing perfect discrimination and 0.5 representing random chance.

**Results**

A total of 242 patients met eligibility criteria. Median age was 59 years; 43.8% were female. The majority (99.2%) had hematologic malignancies, with myeloid neoplasms predominating (84.9%). Myeloablative and reduced-intensity conditioning were most common (53.3% and 44.2%, respectively). Median HCT-CI was 3. Median EASIX at each timepoint ranged from 1.31-3.37 with scores increasing after D0. Prior to D100 15 deaths occurred; 39 occurred prior to D180. D100 OS AUCs were lowest for

EASIX-preC (0.55 [95% CI 0.37-0.73]) and highest for EASIX-postT (0.65 [95% CI 0.49-0.82]). D180 OS AUCs were also lowest for EASIX-preC (0.51 [95% CI 0.40-0.61]), and highest for EASIX-postT (0.64 [95%

CI 0.55-0.73]). AUCs for HCT-CI were 0.59 (95% CI 0.50-0.67) for D100 OS, and 0.61 (95% CI 0.49-0.82) for D180 OS. There was a significant difference in D180 OS AUCs across EASIX timepoints (p=0.01).

**Conclusions**

In patients receiving MUD PBSCT, EASIX measured after conditioning and/or SCT trended toward better prediction of D100 OS, and EASIX-postT was a superior predictor of D180 OS. This may be due to capture of early biomarker responses to the endothelial stress of conditioning and stem cell alloreactivity. However, with best AUCs <0.7, the discriminatory ability of EASIX at any timepoint remained limited. HCT-CI performance was similar to prior reports (AUC 0.57, Shouval 2019), verifying its poor predictivity for early OS in our dataset. Further study is needed to determine if EASIX, particularly measured post-transplantation, may better predict later survival endpoints.

**Poster Title**: How the Pro's Do It: Pattern Recognition in Identifying Retinal Dystrophies

**Authors**: **Adam Rockter**, BS[1], Alex V. Levin, MD, MHSc[2,3]

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**Abstract**:
Pattern recognition is a complex visual and cognitive task. It most often occurs over a variable period of learning that lends itself to the development of expertise based on this skill. In ophthalmology, interpreting optical coherence tomography (OCT) and fundus autofluorescence (FAF) images is a common task which is facilitated by knowledge, familiarity and experience. The learning process spans residency and beyond, and correct impressions of these images are crucial for proper patient care. Retinal dystrophies are sight-threatening conditions which rely on an accurate impression for diagnosis. While it is understood that retina specialists are the experts in their field regarding the interpretation of these images, little has been done to understand the specific strategies that these experts utilize when interpreting an image. In this experiment, we recruited both ophthalmology residents and retina attendings to view OCT and FAF images of retinal dystrophies. A high-precision eye tracker monitored their eye movements during the viewing of each image. Measures included total time spent per image, analysis of attention towards salient and diagnostic features of each image, and exact order of fixation around important anatomic regions of each image. Specific analyses included an area-of-interest analysis comparing time spent in central vs peripheral regions of an image. With this data, we are able to compare the eye movements of ophthalmology trainees and experts to highlight strategies that experts use in their daily practice. The knowledge of these strategies might improve the process of developing expertise in the interpretation of OCT and FAF images for residents.

# *Staphylococcus aureus* abundance is reduced in psoriasis compared with atopic dermatitis and does not associate with disease severity

**Ania Stolarczyk**,[1] Eleanor Pope,[1] Fatima Bawany,[1] Anna De Benedetto,[1] Francisco Tausk,[1] Lisa Beck,[1*] Takeshi Yoshida[1]

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*Mentor

The presence of *S. aureus* (SA) by skin culture correlates with skin barrier function (TEWL) and atopic dermatitis (AD) severity. In contrast, SA skin infections are rare in psoriasis (PS), and little is known about whether SA abundance plays a role in PS severity.

We utilized highly quantitative measures of SA and total bacterial burden by measuring *femA* and 16S rRNA by qPCR, respectively, from lesional (L) and nonlesional (NL) PS skin swabs. We also quantified live SA by colony counts (CFU/cm$^2$) in PS (L & NL) and AD (L & NL) skin. Disease severity was assessed (PASI for PS or EASI for AD).

Thirteen (54%F; 38±12yrs; mean±SD) moderate-to-severe PS (PASI=15±8) were matched for severity and race with eleven AD (EASI=15±3) subjects. SA rCFU (*femA* qPCR) was greater in L vs NL PS skin (p=0.014) as was total bacterial burden (p=0.045). PS culture positivity rates were 38% and 15%, compared to 82% and 73% in AD (L and NL sites, respectively) and 0% in healthy controls (N=11). The SA CFU at L PS was 0.8 CFU/cm$^2$ (geometric mean; range:0-5074) compared to 0.1 CFU/cm$^2$ (range:0-1) in NL PS, while L AD was 155.8 CFU/cm$^2$ (range:0-8000) compared to 20.9 CFU/cm$^2$ (range:0-8000) in NL AD skin. Live SA burden (CFU/cm$^2$) was significantly greater in L AD compared to L PS skin (p=0.0027) as well as in NL AD compared to NL PS skin (p=0.0007). Live SA burden was greater in L AD compared to its NL counterpart (p=0.0156) with a similar trend in PS L vs NL (p=0.0625). SA abundance (CFU or rCFU) and total bacterial burden did not correlate with baseline TEWL or disease severity in PS subjects.

Although SA could be cultured more commonly from PS than healthy controls, neither SA abundance measure reflected PS severity or barrier integrity. Using these highly quantitative methods, we found markedly higher levels of SA in AD (NL & L) skin compared with PS (NL & L). Our work suggests that PS subjects' disease activity is less influenced by SA and that their skin is less hospitable to SA compared to AD subjects.

EXTERNAL RESEARCH

**Name:**
Edgar Alaniz-Cantu

**Advisor:**
Francisco Cartujano, MD

**Site:**
University of Rochester – Community Outreach and Engagement (COE)

**Project Title:**
Understanding the perspectives of lung cancer screening uptake amongst Latinos: A qualitative study

**Abstract:**
Lung cancer is the leading cause of death in the United States (U.S) among both men and women. Incidence and mortality rates vary by race, ethnicity, sex, and socioeconomic status, with Latinos bearing one of the highest burdens of lung cancer incidence and mortality. Evidence suggests that lung cancer screening with Low – Dose Computed Tomography (LDCT) can decrease lung cancer mortality. However, lung cancer screening with LDCT is suboptimal and disparities exist, including poor uptake amongst Latinos, the largest minority group in the U.S. Lung cancer remains the leading cause of cancer-related death among Latinos, and survival rates are lower among Latinos compared with non-Latino whites. This qualitative study consists of semi-instructed interviews in English and Spanish with Latinos adults who are eligible for screening (n=20) to understand their perspectives on lung cancer screening. Participants were recruited using community-based recruitment strategies. The Health Belief Model was used as a framework for qualitative theoretical analysis. Multiple perceived benefits (e.g., early detection, smoking cessation, increased survivorship), susceptibility (e.g., smokers, second-hand smoke, anyone can get lung cancer), severity (e.g., psychological impact, physical burden, family burden) and barriers (e.g., lack of knowledge on eligibility, fear of outcomes, lack of knowledge of procedure/treatment) of lung cancer screening uptake were identified. Moreover, multiple cues to action to pursue lung cancer screening (e.g., influences to get screened, symptoms, self-motivation) were identified. These factors provide concrete operational strategies to address lung cancer screening uptake among Latinos. Further research is needed on how best to integrate these perspectives into lung cancer screening interventions.

# Practices and Perceptions of the use of COVID-19 Positive Organs in Solid Organ Transplant: An International Survey

**Shreya Bhasin[1]**, BA, Mariana Chavez-Villa[1], MD, Rodolfo Alpizar-Rivas[1], MD, Amit Nair[1], MD, Randeep Kashyap[1], MD, Jeremy Taylor[1], MD, Paritosh Prasad[1], MD, Karen Pineda-Solis[1], MD.

[1]*Transplant Surgery, University of Rochester Medical Center*

**Purpose:** At early stages of the pandemic, most organ procurements organizations considered COVID-19 infected donors to be ineligible for organ donation. Recent data suggests safety in the utilization of COVID-19 positive organs, as risk of transmission is remote. The aim of this survey is to the describe the current practices of the utilization of COVID-19 positive organs donors amongst ASTS members.

**Methods:** An anonymous 40-question redcap survey was emailed to the members of the ASTS from June-August 2022.

**Results:** 189 responses were recorded. Incomplete surveys were excluded (n=40). Ultimately 149 surveys from 10 countries were included for analysis. Majority responders were male (67.8%) from North America (95%) and identified as transplant surgeons (75%). Most work at academic institutions (70.9%). Almost all responders (94%) were willing to accept an organ from a donor with a history of COVID-19 who tested negative at time of donation, however there was no consensus on the length of time after disease was resolved. Approximately 70% indicated they accept organs from asymptomatic donors with active disease. 20 responders indicated they would accept an organ from an individual with a history of 'severe' COVID-19 infection and only 1/3rd of the responders would accept an organ from a donor who died from COVID-19 infection. Interestingly, 80% indicated they have protocols at their institution to guide the acceptance of such organs. Approximately 30% of responders would accept an organ from a donor with a high PCR threshold or infiltrates present on CT. 43% were willing to accept an organ from an unvaccinated donor.

**Discussion:** Every year millions of people die waiting for an organ transplant; the gap between available donors and needing recipients remains large. Given the scarcity of globally available organs, it is imperative to better understand the impact of COVID-19 infection on donor eligibility. Despite new evidence that the transmission of COVID-19 in non-lung organs is extremely rare, the results of this survey suggest significant heterogeneity in practice and perceptions of the use of COVID-19 positive organs across international centers. We suggest that the implementation of a standardized protocol is of paramount importance to continue safe transplant activity.

# Body Image and Emotional Well-Being Following Breast Cancer Surgery

**Shreya Bhasin**[a], Estefania Roldan-Vasquez[b], Samir Mitri[b], Rene Flores[b], Ted A. James[b]

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## Background 54

The surgical management of breast cancer is a critical component of treatment that can have a profound impact on the physical, emotional, and functional well-being of patients. This study aims to investigate whether the type of surgery (mastectomy vs lumpectomy) influences emotional well-being (EWB) and body image perception (BI) in patients with breast cancer.

## Methods 60

We surveyed female patients diagnosed with breast cancer from 2021-2022 who were treated at BIDMC. Automated FACT-B surveys were sent via REDCap at 6 and 18 months after surgery. This tool assesses a patient's well-being and quality of life in 5 domains. We used descriptive statistics to conduct a sub-analysis of factors specific to EWB and BI.

## Results

39 patients completed the survey, 43.59% underwent mastectomy, and 56.41% underwent lumpectomy. The mean age of the cohort was $60.20 \pm 12.20$ years old. Overall, there was no significant difference between total emotional wellbeing and body image perception scores per surgery type. However, patients with mastectomy felt significantly more nervous ($p = 0.008$) and worried that their condition would get worse ($p = 0.026$) as compared to patients with lumpectomy. More patients with lumpectomy felt that they were able to feel like a woman ($p = 0.045$) post-surgery as compared to those with mastectomy.

## Conclusion

Our results suggest that patients undergoing breast-conserving therapy had higher EBW, BI and combined scores as compared to total mastectomy. Analysis of PROs can identify areas for further patient-centered support around surgery for breast cancer. Addressing these issues is crucial for psychological well-being post-surgery.

Table 1: Comparison of Emotional Well-Being and Body Image PRO in Patients with Lumpectomy vs Mastectomy for Breast Cancer

| | Lumpectomy<br>n = 22 (56.41%) | Mastectomy<br>n = 17 (43.59%) | p value |
|---|---|---|---|
| **Emotional Well-Being (EWB)** | $20.32 \pm 3.88$ | $18.82 \pm 5.98$ | 0.176 |
| **Body Image (BI)** | $15.43 \pm 3.16$ | $12.77 \pm 6.74$ | 0.055 |
| **Combined EWB BI Score** | $35.75 \pm 5.075$ | $31.59 \pm 12.10$ | 0.077 |

**Bhasin, Shreya APOS 2023**

**Neuropsychiatric Side Effects of Steroids during Treatment for Pediatric Acute Lymphoblastic Leukemia: A Comprehensive Narrative Review**

**Background/Purpose:**

Pediatric Acute Lymphoblastic Leukemia (ALL) affects ~4000 young Americans each year. Steroids are an essential to curative ALL treatment yet have significant neuropsychiatric side effects that decrease quality of life for patients and families. However, incidence and predisposing risk factors are not well understood. This review aims to describe the current literature on neuropsychiatric side effects of steroids in Pediatric ALL.

**Methods:**

A precise search in PubMed and Embase was cultivated using controlled vocabulary terms (MeSH, Emtree) and keywords for the following concepts: pediatrics, steroids, side effects, cancer, and neurobehavioral manifestations. Keywords and controlled vocabulary for each subject were arranged logically and combined with other concepts by Boolean Logic, using the Boolean operator AND, resulting in 642 precise results exploring neurobehavioral side effects of steroids in children with cancer. Results (2010 to date of search) were imported into Covidence systematic review software, and reviewed by SB and AM.

**Results:**

23 articles met inclusion criteria. There is marked variability in research methodology and no standard measurement of neuropsychiatric symptoms. Commonly reported symptoms include mood swings, irritability, depression, anxiety, aggression, insomnia, mania, and psychosis with prevalence between 5-75%.

Heterogeneous research methodology and descriptions of psychiatric symptoms make it difficult to determine risk factors, though dexamethasone, family psychiatric history, and younger age are consistently associated with greater risk of behavioral dysregulation. Genetic predisposition (Bcl1 polymorphism, SNPs in GR gene) may increase susceptibility to developing depression during treatment. Data suggest variable efficacy of antipsychotics, benzodiazepines, hydrocortisone, and potassium-chloride.

**Conclusions and Implications:**

Existing data about neuropsychiatric side effects of steroids in pediatric ALL is extremely heterogeneous, creating challenges for standardized assessment and treatment. The burden of these symptoms necessitates further research to identify and treat vulnerable patients. Standard measurement of these symptoms could be a first step in eventually alleviating this source of distress.

**Learning Objectives**

1. The participant will be able to identify common neuropsychiatric side-effects associated with steroid treatment in pediatric leukemia
2. The participant will be able to describe gaps in the current literature on this subject.

# The Rochester Relapse Risk Scale: Moving towards a standardized approach to predicting substance relapse in liver transplant candidates

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## Background

Alcohol relapse is associated with worse outcomes in patients after orthotopic liver transplant (OLT) but methods of relapse risk assessment vary across transplant centers (Zhu 2018). The aim of our study was to evaluate the ability of the Rochester Relapse Risk Scale ($R_3S$), a relapse predictor model composed of relapse risk factors identified in the substance use literature, to predict relapse and to examine the relationships between the included risk factors and relapse.

## Methods

This was a retrospective, observational cohort study of 409 adult patients with a history of problematic substance use evaluated for OLT at our Center from 1/2012 to 12/2021. The Institutional Review Board approved the study. Participants were evaluated with the $R_3S$ and stratified by relapse risk level, then evaluated for substance relapse for up to five years after evaluation. The primary outcome was rate of substance relapse after evaluation. Univariate analyses evaluated differences between patients with and without substance relapse for each risk factor. Multivariate analysis was then performed for variables with a p-value < 0.20.

## Results

There was a positive correlation between relapse rates and risk category assignment, though relapse rates did not vary significantly between moderate and moderate-high risk individuals. There were independent associations between relapse and <6 months of abstinence (adjusted hazard ratio [HR] 2.052; 95% CI, 1.42-2.96), High-Risk Alcoholism Relapse (HRAR) score >2 (HR 1.78; 95% CI 1.13-2.79), and limited coping (HR 1.46; 95% CI 0.94-2.24).

Discussion

While our data supports a linear relationship between duration of abstinence and relapse, it is not necessarily supportive of the 6-month abstinence cutoff historically popular among transplant centers. Other studies have demonstrated a significant relationship between an HRAR score > 3 and relapse risk (De Gottardi, 2007). We have used a cutoff of HRAR >2 to increase the discernment of problematic use and have found an independent relationship at this lower threshold. We did not confirm an independent relationship between psychiatric comorbidity and relapse as has been previously reported (Erim 2017). However, limited coping had an independent relationship with relapse and may measure a similar aspect.

Conclusion

In our population, the risk levels assigned by the $R_3S$ correlated with relapse rates. Our additional findings that only limited coping, HRAR score >2, and <6 months abstinence have independent associations with relapse suggest that an abbreviated version of the $R_3S$ with fewer factors is the next step in the refinement of this scale.

References

De Gottardi A, Spahr L, Gelez P, et al. A simple score for predicting alcohol relapse after liver transplantation: results from 387 patients over 15 years. Arch Intern Med. 2007;167(11):1183-1188.

Erim Y, Scheel J, Beckmann M, Klein CG, Paul A. Standardized evaluation of candidates before liver transplantation with the transplant evaluation rating scale. Psychosomatics. 2017;58(2):141-150.

Zhu J, Chen PY, Frankel M, Selby RR, Fong TL. Contemporary policies regarding alcohol and marijuana use among liver transplant programs in the United States. Transplantation 2018; 102(3):433-439.

**Gonring, Dakota**

## Validating Noninvasive Indices of Thoracic Aortic Dissection with Magnetic Resonance Elastography

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**Objective:** Dissection-associated aneurysms (DAA) are the leading cause of death related to chronic Type-B aortic dissections (TBAD). Conventional imaging cannot distinguish high-risk DAAs that would benefit from early surgical intervention. We propose the feasibility of aortic stiffness as measured by magnetic resonance elastography (MRE) as a biomarker to help make this distinction. We validate MRE stiffness measures in 3D-printed PVA hydrogel phantoms with human-like dissection geometries and demonstrated the first successful application of MRE in a human thoracic aorta with a healthy volunteer.

**Methods:** All phantoms had a 10% PVA true lumen and a 10%, 15%, 20%, or 25% false lumen. The phantoms and the thoracic aorta of a healthy volunteer were imaged in a 3T-MR scanner. A pneumatic driver created mechanical vibrations within the aorta. A cardiac-gated spin-echo echo planar imaging (SE-EPI) sequence was utilized. In vivo end-diastolic images were chosen for analysis to minimize blood flow artifacts.

**Results:** The MRE shear stiffness of the various PVA false lumen sides of the phantoms were 32.19, 51.48, 59.29, and 73.53 ± 2.66 kPa, respectively. Figure 1 shows the correlation ($R^2$ = 0.99) between MRE and rheometric stiffness measurements of the four phantoms with different PVA concentrations. Figure 2 shows MRE local frequency estimations of stiffness from the human aorta with a mean shear stiffness of 3.37±0.83kPa.

**Conclusion:** We present a validation and feasibility study of MRE in the thoracic aorta. Future research will allow for developing predictive indices for TBAD DAA development.
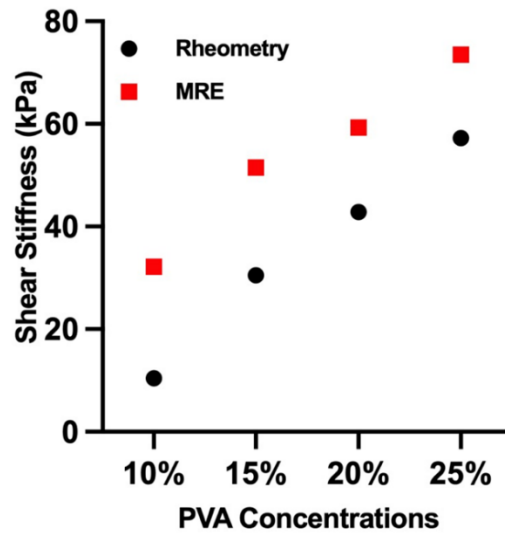
**Figure 1:** Correlation plot ($R^2$=0.99) between MRE and rheometric stiffness measurements of phantoms with different PVA-c concentrations of 10%, 15%, 20, and 25%.
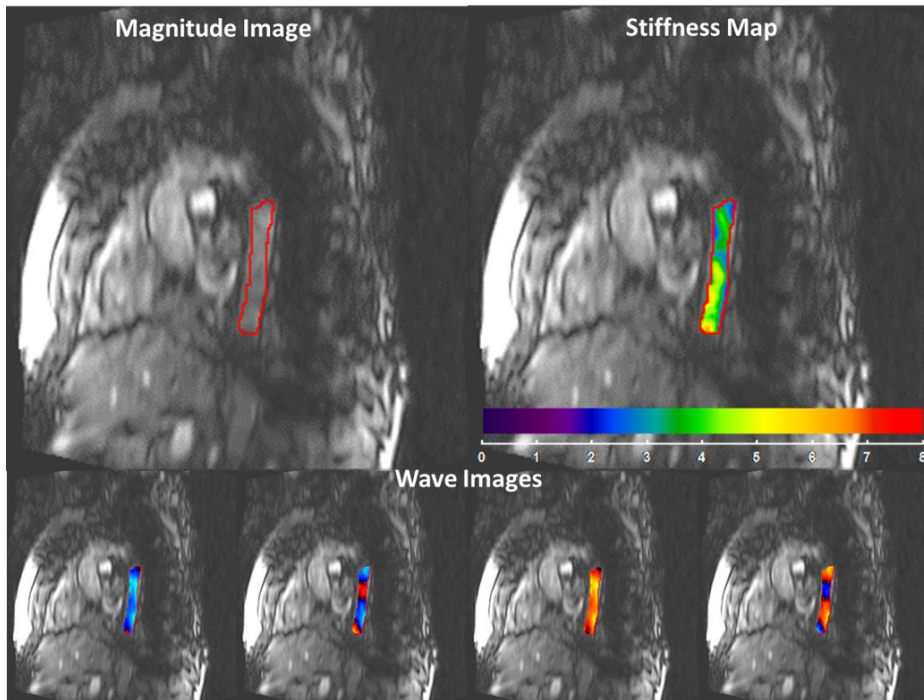


**Figure 2:** Magnitude image, four snap shots of wave images at different time points in read direction, and stiffness map of the thoracic aorta of a healthy volunteer with a mean shear stiffness of 3.37±0.83kPa.

**Associations between coping, quality of life, and mental health in those with olfactory dysfunction**

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Mentor: Jonathan Overdevest, MD, PhD

**Introduction**: Olfactory dysfunction (OD) is a highly prevalent and persistent symptom of COVID-19 infections. Smell loss has been shown to impair appetite, social relationships, and ability to sense danger, which can greatly impact quality of life (QoL). Because coping strategies have been shown to moderate the effect of disease symptoms on functional and affective outcomes, the aim of this study was to determine whether certain coping strategies moderate quality of life outcomes.

**Methods**: Participants with subjective OD after COVID-19 infection underwent Sniffin' Sticks olfaction testing and completed various questionnaires including the BRIEF-Cope and Coping Strategies Inventory-Short Form (CSI-SF) to elicit coping strategies, the Questionnaire of Olfactory Disorders-Negative Statements (QOD-NS) for olfactory specific QoL, the Patient-Reported Outcomes Measurement Information System-29 (PROMIS-29) for general QoL, and the Beck Anxiety Inventory (BAI) and Patient Health Questionnaire-9 (PHQ-9) to assess mental health. Participants also reported their subjective olfactory function in a survey. ANOVA and spearman correlations were used for statistical analysis.

**Results**: Participants with both subjective and objective OD (n=69) had a significantly higher mean QOD-NS score compared to the normosmic cohort (n=7) (p<0.0001). Among individuals with subjective and objective OD, QOD-NS was correlated with avoidant (r=0.353, p=0.006) and disengagement coping (r=0.373, p=0.002). PROMIS-29 was also correlated with avoidant (r=0.417, p=0.003) and disengagement coping (r=383, p=0.004). PHQ-9 was correlated with avoidant (r=0.496, p<0.001), approach (r=–0.265, p=0.042), engagement (r=–0.252, p=0.044), disengagement (r=0.480, p<0.001), and emotion-focused coping (r=0.277, p=0.027). Lastly, BAI was correlated with avoidant (r=0.413, p=0.001), disengagement (r=0.368, p=0.002), and emotion-focused coping (r=0.261, p=0.035).

**Conclusion**: Individuals with OD have notably poor olfactory-specific quality of life. Among those with OD, approach and engagement coping mechanisms are associated with better mental health, whereas avoidant and disengagement coping tracks with worse QoL and mental health. These findings offer an opportunity to counsel patients accordingly.

**Jones, Deaton**

## Abstract

The Funded Away Rotations for Minority Medical Students (FARMS) Database (www.farmsdatabase.com) was developed in 2019 and is maintained by the Medical Student Pride Alliance as a resource for medical students underrepresented in medicine (URM) interested in scholarships for visiting electives. The aim of this project was to explore usage patterns of the FARM Database using Google Analytics, including relative and sequential use of the four search functions: Host Institution, Location, Specialty, and Tags (used to denote the different URM groups eligible for each scholarship). We found that specialty and location were important factors for medical students interested in visiting elective scholarships, with Obstetrics and Gynecology being the most searched specialty. Of the URM tags, Women was the most used filter, followed by LGBTQ+ and Racial/Ethnic Minorities. Improved configuration of the Events Flow report – which was not optimally configured for the data collected thus far – can help elaborate on some of these findings. Moreover, continued data collection through the current and future application cycles will beget new and deeper insights.

## Background & Aims

The Funded Away Rotations for Minority Medical Students (FARMS) Database (www.farmsdatabase.com) was developed in 2019 and is maintained by the Medical Student Pride Alliance as a resource for medical students underrepresented in medicine (URM) interested in scholarships for visiting electives. The FARMS Database, like other similar databases, details visiting elective scholarships and eligibility requirements for racial/ethnic minorities but, unlike others, it is the only database that provides additional detail for the following URM groups: disabled, educationally disadvantaged, first generation, LGBTQ+, religious minorities, socioeconomically disadvantaged, and women. Thus, the FARMS Database is a rich source of information regarding how URM students engage with visiting elective scholarships. The aim of this project was to explore usage patterns of the FARM Database, including relative and sequential use of the four search functions: Host Institution, Location, Specialty, and Tags (used to denote the different URM groups eligible for each scholarship).

## Methods

We compiled scholarships in Google Sheets and used Awesome Table to display information from Google Sheets on the Google Site-hosted FARMS Database. We used JavaScript to implement Google Analytics on these platforms to track how deidentified users engaged with the database's search functions (events). Using the Top Events and Events Flow reports, we recorded the overall use of each search function and the order in which search functions were used, respectively.

## Results

Between September 1, 2022, and July 31, 2023, 1,313 users logged 1,696 unique sessions (1.29 sessions/user) and 3,364 events (2.0 events/session): 1,467 using the Specialty search function (43.6%), 789 using Location (23.5%), 589 using Tags (17.5%), and 519 using Host Institution (15.4%). Of the specialties, Obstetrics and Gynecology was the most searched (15.6%), followed by Anesthesia (8.3%), Medicine and Dermatology (6.7% each), Family Medicine (6.5%), Surgery (6.3%), and Orthopedic Surgery (6.2%). With respect to URM tags, Women was the most searched (22.2%), followed by LGBTQ+ (21.6%), Racial/Ethnic Minorities (19.4%), First Generation (14.6%), Socioeconomically Disadvantaged (12.1%), Educationally Disadvantaged (4.1%), Religious Minorities (3.9%), and Disabled (2.2%). Due to the free form search fields for location and host institution, we could not aggregate data.

## Discussion & Conclusions

Google Analytics was successfully implemented to assess usage of the FARMS Database. We found that specialty and location were important factors for medical students interested in visiting elective scholarships, with Obstetrics and Gynecology the most searched specialty. Of the URM tags, Women was the most used filter despite that tag including the second fewest number of scholarship opportunities. This finding could be explained by a greater number of female medical students compared to other minority groups. Moreover, considering a majority of Obstetricians and Gynecologist are women, this may explain that specialty being the most searched. LGBTQ+ was the second most used filter, which was possibly the result of regular promotion by the Medical Student Pride Alliance. On the other hand, the tag for disabled students produces the third most scholarship opportunities, yet that tag was used the least in searches. This could be explained by a fewer number of disabled medical students compared to other minority groups. It may also suggest that disabled students are less aware of scholarship opportunities for which they are eligible. Improved configuration of the Events Flow report – which was not optimally configured for the data collected thus far – can help clarify some of these findings. Moreover, traffic to the FARMS Database is highest during the visiting elective application cycle – generally spring through fall of each year; thus, continued data collection through the current and future application cycles will beget new and deeper insights.

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## Association of plasma GFAP with postoperative delirium in older adults

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**Background:** Delirium is a transient state of confusion with many potential long-term consequences, particularly in older adults following acute stressors such as surgery; however, its exact pathophysiological cause is unknown. Astrocytosis, a series of astrocytic changes in response to CNS insults and quantified by plasma glial fibrillary acidic protein (GFAP) levels, is a promising theory that may allow early prediction and interventions for post-operative delirium.

**Methods:** Data were obtained from the Successful Aging after Elective Surgery (SAGES) study, a prospective, longitudinal cohort study of older adults (age 70+) enrolled between 2010 and 2013 prior to undergoing elective surgery. A pre-operative baseline interview was conducted to assess demographics, physical function, cognition, and other variables. To quantify pre-operative GFAP levels, blood was drawn during the baseline interview and measured with the Neurology 4-Plex E assay using a Quanterix HD-X analyzer. Following surgery, participants were assessed daily during hospitalization for delirium using the Confusion Assessment Method (CAM) and a validated chart review method. Other hospital outcomes collected included length of stay,

discharge location, and cost of hospitalization. After discharge, participants were interviewed 1-2 times each year to re-assess functioning and cognition. Long-term outcomes included institutionalization, mortality, and rehospitalizations. All outcome analyses were adjusted for age, sex, surgery type, and comorbidities as defined by the Charlson Comorbidity Index.

**Results:** 560 participants were initially enrolled in the SAGES study, of which 30 were excluded due to insufficient blood sample volume or other quality control issues. The remaining 530 samples were separated into quartiles of pre-operative GFAP levels. Of the participants in the first quartile (lowest GFAP concentration), 16% developed delirium during their hospitalization; of those in the fourth quartile, 27% developed delirium – a statistically significant adjusted relative risk of 1.7 (95% CI: 1.01-2.9, $p < 0.05$). Average delirium severity, as quantified by peak CAM-S score during hospitalization, was also statistically significant in the third and fourth quartiles relative to the first, with an adjusted mean difference of 0.5 in both (third quartile 95% CI: 0.03-0.9; fourth quartile 95% CI: 0.1-1.0). However, short-term outcomes - relative risk of long hospital stay (>5 days), relative risk of discharge to acute care facility, and mean difference in cognitive performance from baseline to 1-month post-op – were not statistically significant in any quartile relative to the first. Analyses of long-term outcomes are still in progress.

**Conclusion:** This study provides evidence that plasma GFAP level, a measure of astrocytosis and brain vulnerability, is strongly associated with both post-operative delirium incidence and severity in older adults undergoing surgery. Other short-term outcomes have not shown significant associations; however, because GFAP is a marker of vulnerability particularly for long-term neurological consequences, long-term outcomes currently undergoing analysis are likely to be more strongly associated with GFAP levels. Thus, the pre-operative measurement of GFAP levels may be a clinically useful tool in identifying "high-risk" patients with greater odds of developing post-operative delirium, allowing clinicians and caregivers to intervene with targeted prevention strategies prior to surgery.

Rhythmic Temporal Coordination Boosts Memory During Sustained Attention

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**Introduction:** Previous research has demonstrated that rhythmic neural activity temporally coordinates the sampling of behaviorally important information, both from the external environment and from internal
memory stores. This rhythmic sampling, occurring about four times per second, seems to help avoid potential conflicts when there are overlapping neural resources. For example, this occurs when the same
neural population is representing multiple, to-be-remembered items. Everyday tasks, such as driving a car, often require concurrent external and internal sampling. Previous research has shown that external and internal information are processed in the same brain regions. Here, we therefore tested whether rhythmic neural activity helps to coordinate the concurrent sampling of external and internal information, i.e., when these complementary processes are in potential conflict.

**Methods:** During this study, 18 adults (11 female) performed a dual-attention (i.e., external sampling) and working memory (i.e., internal sampling) task while high-density EEG was recorded (Figure 1A). During the task, participants were initially presented with either a green circle, indicating where an external target might occur, a to-be-remembered item (i.e., a vertical or horizontal grating), or both (i.e., dual-task trials). After a delay period, the participant was either presented with a low-contrast visual target (i.e., an external target) or a memory probe. The participant then indicated whether the target or the previously presented to-be-remembered item was either a vertical or a horizontal grating. For dual-task trials when external sampling was probed, the visual target matched the previously presented, to-be-remembered item on 50% of trials.

**Results:** We found that if the attention probe matched the prior memory grating, accuracy and reaction time improved significantly ($p < 0.05$), and the Event Related Potentials (ERPs) differed based on whether these gratings matched. Together, these findings indicate that participants experienced a different neurological reaction to probes that were previously primed with the memory grating, and that priming with a matching probe assisted the participant in detecting the subsequent grating. This effect was evident regardless of the spatial locations of the gratings. Furthermore, consistent with our hypothesis that transient
bursts of neural activity coordinate spatial memory, we found that the relative strength of working memory representations alternates over time in a frequency-specific manner (Figure 1B). Specifically, robust bands of significant relationships between phase and reaction-time were found at theta and gamma (35-55 Hz) frequencies (Figure 1C). Both relationships were localized to the central midline region, with gamma also

demonstrating a cluster in the frontal midline region (Figure 1D). Interestingly, there also existed a relationship between phase and the reaction time (RT) to the low-contrast attention grating in the theta range, but only during trials when the low-contrast grating matched the preceding memory grating.

**Conclusion:** Here, we demonstrated a relationship between rhythmic neural activity (4-6 Hz) and behavioral performance (i.e., response times) during the internal sampling task. We also found that the ability to detect a low-contrast visual target (i.e., either a vertical or a horizontal grating) was enhanced when that target was preceded by a matching to-be-remembered item, in other words, when the visual target matched an existing memory trace. We also observed a relationship between rhythmic neural activity and behavioral performance (i.e., response times) during the external sampling task. However, that relationship only existed during dual-task trials when the low-contrast visual target was a match for the preceding to-be remembered item. We therefore hypothesize that rhythmic fluctuations in the ability to detect the visual target resulted from fluctuations in the strength of the working memory trace (rather than fluctuations in perceptual sensitivity). These findings demonstrate an interaction between concurrent external and internal sampling, consistent with overlapping neural resources. In the future, we plan to test whether changes in the rhythmic coordination of neural activity might be implicated in disorders of attention, such as ADD and ADHD.
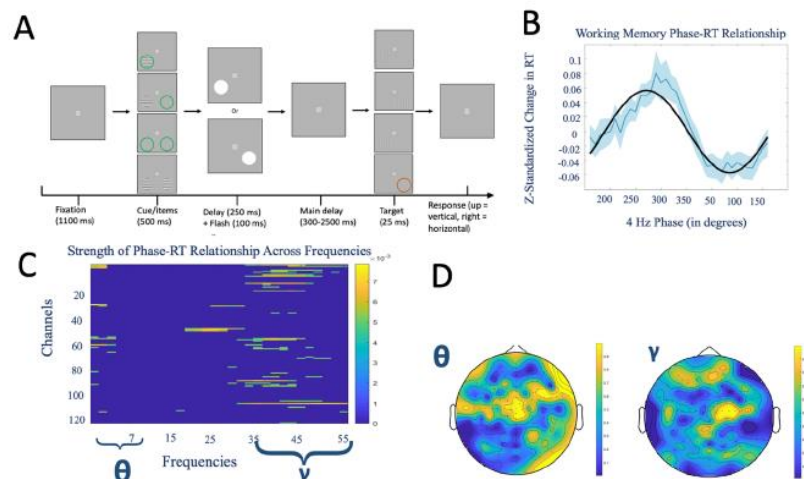


**Figure 1:** *Phase of neural activity corresponds to working memory representation.* Participants engaged in a dual working memory and attention task (A). A one-cycle sin wave at theta frequency (4 Hz) is fitted to z-standardized changes in reaction time (RT) (B). Statistically significant (p < 0.05) phase-RT relationships for all frequencies and channels are displayed, with robust bands of significant relationships at low theta and gamma frequencies (C). Scalp topography of theta and gamma phase-RT relationship strength reveals clusters at the midline central region for both bands, and a cluster in the frontal midline region for gamma.

**Elucidating the Role of Erythropoietin on Stem Cell Homing and Engraftment Syndrome in Autologous Hematological Stem Cell Transplant**

**Jayesh Menon**, Samuel Weeks M.D, Janice Zhang M.D, Omar Aljitawi M.D

**Introduction:**

Hematological Stem Cell Transplant (HSCT) is recognized as a vital treatment modality for several immunodeficiencies and hematological malignancies, with multiple myeloma (MM) accounting for over 30% of all transplants in the United States in 2020. Despite improvements in the 5-year survival rate for MM, post-transplant complications like engraftment syndrome (ES) and relapse remain prevalent with incidence rates of 7-15% and 15-21%, respectively.ES is a systemic response following HSCT marked by non-infectious fever, rash, diarrhea, and in severe cases, pulmonary infiltrates and hypoxia. This clinical presentation has been shown to be mediated by pro-inflammatory cytokines and degranulation of neutrophils following repopulation of the cell lineage. Prior work has established that erythropoietin (EPO) diminishes the ability of donor stem cells to home to the bone marrow and skews subsequent hematopoiesis to the erythroid lineage, contributing to PGF. This aberrant EPO-driven homing and differentiation may be implicated in the pathogenesis of ES and can be remediated by hyperbaric oxygen (HBO) treatment, providing an avenue for further investigation into the use of HBO clinically. These findings prompted two ongoing clinical trials at our institution assessing the effect of HBO treatments on the engraftment of donor stem cells and the reconstitution of hematopoietic lineages in MM patients. In the phase II randomized clinical trial, patients either receive one HBO pre-treatment or directly undergo Auto-HSCT; whereas, in the subsequent phase I trial, patients receive three HBO treatments, wherein one treatment is provided prior to Auto-HSCT and two more following transplant. In this retrospective study, we aim to document the effect of HBO treatment on the incidence and severity of engraftment syndrome as measured by clinical findings as well as the pro-inflammatory cytokine IL-6, which has been shown to be upregulated in patients with ES. Subsequent in-vitro studies aimed to assess the effect of various EPO receptor (EPO-R) inhibitors on hematopoietic stem cell migration towards bone-marrow derived factors to further elucidate the role of EPO signaling in stem cell homing.

**Methods:**

Retrospective analysis was performed by collecting data from patients enrolled in the phase I trial (NCT04862676) and phase II trial (NCT04862676) from day 5 to day 15 of transplant. Patients were grouped into three cohorts - no HBO (n-HBO), single treatment HBO (s-HBO), and three treatment HBO (m-HBO). Clinical data on fever, oral and GI mucositis, and demographic data were collected from the electronic medical record (EHR) and utilized in accordance with the Spitzer and Maiolino criteria to document incidents of engraftment syndrome. Serum from day +1, +3, +7, +15 of transplant was assayed for IL-6 concentration using sandwich ELISA. In-vitro transmigration assay was performed by pre-treating human erythroid leukemia (HEL) cells for 24 hours with proprietary EPO-R inhibitors (URV-02, URV-02 Ref, URV-03) in the presence and absence of EPO at concentrations of 2.5uM, 5.0uM, 10uM, and 40uM. Cells were washed of pre-treatment conditions and incubated at 37 degrees celsius at 5% $CO_2$ for four hours. These cells were then assayed for their ability to migrate across a 12 micrometer filter (transmigration insert) in the presence and absence of media containing stromal derived factor 1 (SDF-1), a bone marrow derived chemokine.

**Results:**

A total of 87 patients were included in the retrospective study. 38 patients were included in the n-HBO and s-HBO cohorts, and 11 were included in the m-HBO cohort. The incidence of ES syndrome, meeting either the Spitzer or Maiolino Criteria, for the n-HBO, s-HBO, and m-HBO cohorts was 27% (95% confidence interval (CI) = 13.8%-

44.1%), 21.1% (95% CI = 9.6%-37.3%), and 18.2% (95% CI = 2.3%-51.8%), respectively (Fisher's exact test p=0.77). The median number of fever days (defined as a 24-hour period with at least one body temperature reading ≥ 38oC) for n-HBO, s-HBO, and m-HBO was 1 day (Interquartile range (IQR) 0-2), 1 day (IQR 0-2) and 0 days (IQR 0-1), respectively (Kruskal-Wallis pvalue=0.04). Any grade oral mucositis incidence was 42.4%, 28.6%, and 0% for n-HBO, s-HBO, and m-HBO respectively (Fisher's exact p-value= 0.02). There was only one incidence of grade 3 ≥ oral mucositis across cohorts. The median duration of any grade oral mucositis in days was 0 for all cohorts, IQR was 0-3, 0-4, and 0-0, for n-HBO, s-HBO, and m-HBO, respectively (Kruskal-Wallis p=0.04). The incidence of any grade GI mucositis was 87.5%, 80%, and 100% for n-HBO, s-HBO, and m-HBO, respectively. There was insufficient evidence of a difference in the incidence or duration of GI mucositis between cohorts. Median peak plasma IL-6 concentration was 11.21 (IQR 5.87-27.92), 14.59 (IQR 5.2027.80), and 3.44 pg/ml (IQR 1.16-16.29) for n-HBO, s-HBO, and m-HBO, respectively (Kruskal-Wallis p=0.1). Pairwise comparisons using mixed models of IL-6 concentration on day +7 of transplant for mHBO vs. s-HBO, m-HBO vs. n-HBO, and s-HBO vs. n-HBO resulted in p-values 0.13, 0.11, and 0.85, respectively. In-vitro transmigration assay revealed a dose-dependent increase in HEL transmigration after normalizing for baseline migration (range: 2.06% - 22.56%). Across two trials, the optimal dosage of EPO-R inhibitors was determined as 10uM for URV-02, 40uM for URV-02 Ref, and 40.0uM for URV-03, yielding an average transmigration (above control) of 11.99%, 16.71%, and 22.56% respectively.

**Conclusions:**
EPO has been shown to be a modulator of stem cell homing and EPO-R blockade has demonstrated a marked improvement in the ability of stem cells to migrate into the bone marrow. Clinically, this effect can be reproduced through HBO treatment prior to stem cell transplant as shown by a decrease in the duration and severity of ES symptoms in the m-HBO cohort. Additionally, a decrease in serum IL-6, trending towards significance, was noted in response to m-HBO therapy. These findings in conjugation provide further evidence for the role of EPO signaling in stem cell homing and the use of HBO clinically as an intervention to improve post-transplant outcomes.

[1] Aljitawi, O.S., et al., *Hyperbaric oxygen improves engraftment of ex-vivo expanded and gene transduced human CD34$^+$ cells in a murine model of umbilical cord blood transplantation.* Blood Cells Mol Dis, 2014. 52 (1): p. 59-67.
[2] Aljitawi, O.S., et al., *Erythropoietin modulation is associated with improved homing and engraftment after umbilical cord blood transplantation.* Blood, 2016. 128 (25): p. 3000-3010.
[3] Center for International Blood and Marrow Transplant, a contractor for the C.W. Bill Young Cell Transplantation Program operated through the U. S. Department of Health and Human Services, Health Resources and Services Administration, Healthcare Systems Bureau. *Number of Transplants by Specific Disease*. Last Updated: April, 2022.
[4] Chia, J. Y. and R. J. Folz (2008). Chapter 58 - Pulmonary Complications of Hematopoietic Stem Cell Transplantation. Clinical Respiratory Medicine (Third Edition). R. K. Albert, S. G. Spiro and J. R. Jett. Philadelphia, Mosby: 737-746.
[5] Chim CS, Liu H, Lie AK, Chan EY, Ho S, Wong M, Kwong YL. Unsustained complete response of less than 24 months after autologous stem cell transplantation predicts aggressive myeloma with short survival. Hematol Oncol. 2014 Dec;32(4):205-11. Doi: 10.1002/hon.2131. Epub 2014 Jan 29. PMID: 24473998.
[6] Cheung, K.Y., et al., *Hyperbaric oxygen treatment effects on in vitro cultured umbilical cord blood CD34(+) cells.* Cytotherapy, 2018. 20 (1): p. 87-94.
[7] Cornell RF, Hari P, Drobyski WR. Engraftment Syndrome after Autologous Stem Cell Transplantation: An Update Unifying the Definition and Management Approach. Biol Blood Marrow Transplant. 2015 Dec;21(12):2061-2068. doi: 10.1016/j.bbmt.2015.08.030. Epub 2015 Aug 29. PMID: 26327628; PMCID: PMC4639405.

[8] Fielding CA, McLoughlin RM, McLeod L, Colmont CS, Najdovska M, Grail D, Ernst M, Jones SA, Topley N, Jenkins BJ. IL-6 regulates neutrophil trafficking during acute inflammation via STAT3. J Immunol. 2008 Aug 1;181(3):2189-95. doi: 10.4049/jimmunol.181.3.2189. PMID: 18641358.

[9] Kimura, Fumihiko, et al. "Platelet Engraftment Failure Leads to Poor Overall Survival Even after Neutrophil Engraftment without Relapse." *Biology of Blood and Marrow Transplantation*, vol. 19, no. 2, Feb. 2013, https://doi.org/10.1016/j.bbmt.2012.11.048.

[10] Khandelwal P, Mellor-Heineke S, Rehman N, Lane A, Smiley K, Villanueva J, Marsh RA, Grimley MS, Davies SM, Filipovich AH. Cytokine Profile of Engraftment Syndrome in Pediatric Hematopoietic Stem Cell Transplant Recipients. Biol Blood Marrow Transplant. 2016 Apr;22(4):690-697. doi: 10.1016/j.bbmt.2015.12.016. Epub 2015 Dec 29. PMID: 26740373. [11] Lemieux, Christopher, et al. "Outcomes after Delayed and Second Autologous Stem Cell Transplant in Patients with Relapsed Multiple Myeloma." Bone Marrow Transplantation, vol. 56, no. 11, 2021, p. 2664, https://doi.org/10.1038/s41409-021-01371-1. Accessed 14 Apr. 2023.

[12] Lemieux C, Muffly LS, Iberri DJ, Craig JK, Johnston LJ, Lowsky R, Shiraz P, Rezvani AR, Frank MJ, Weng WK, Meyer E, Shizuru JA, Arai S, Liedtke M, Negrin RS, Miklos DB, Sidana S. Outcomes after delayed and second autologous stem cell transplant in patients with relapsed multiple myeloma. Bone Marrow Transplant. 2021 Nov;56(11):2664-2671. Doi: 10.1038/s41409-021-01371-1. Epub 2021 Jun 23. PMID: 34163014; PMCID: PMC8715953.

[13] Lipe B, Divine C, Abhyankar S, Singh AK, Ganguly S, Lin TL, Baran A, Cantilena AR, Bhatti S, Shune L, Abdelhakim H, McGuirk J, Allin D, Aljitawi OS. Results of the First Clinical Study in Humans That Combines Hyperbaric Oxygen Pretreatment with Autologous Peripheral Blood Stem Cell Transplantation. Biology of blood and marrow transplantation, 2019 Sep; 25(9):1713-1719. Epub 2019 Jun 03.

[14] Man Y, Lu Z, Yao X, Gong Y, Yang T, Wang Y. Recent Advancements in Poor Graft Function Following Hematopoietic Stem Cell Transplantation. Front Immunol. 2022 Jun 2;13:911174. Doi: 10.3389/fimmu.2022.911174. PMID: 35720412; PMCID: PMC9202575.

[15] Sheth V, Jain R, Gore A, Ghanekar A, Saikia T. Engraftment Syndrome: Clinical Features and Predictive Factors in Autologous Stem Cell Transplant. Indian J Hematol Blood Transfus. 2018 Jul;34(3):448-453. doi: 10.1007/s12288-017-0899-4. Epub 2017 Nov 15. PMID: 30127551; PMCID: PMC6081308.

[16] Sonneveld P. Management of multiple myeloma in the relapsed/refractory patient. Hematology Am Soc Hematol Educ Program. 2017 Dec 8;2017(1):508-517. Doi: 10.1182/asheducation-2017.1.508. PMID: 29222299; PMCID: PMC6142583.

**Title:** Clinical Correlations and Imaging Characteristics of COVID-19-Associated Pulmonary Embolism

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**Keywords:** COVID-19, pulmonary embolism, venous thromboembolism, imaging.

**Background:** Pulmonary embolism (PE) is the 3rd most common cardiovascular cause of death in the U.S. and is a known consequence of COVID-19 infection. There is little data comparing clinical characteristics and imaging findings between COVID-19-associated PE (CAPE) and non-COVID-19-associated PE (NCAPE). Our study examines existing clinical databases to characterize both the acute and medium-term manifestations of CAPE compared to NCAPE, as well as provide insight into how PE care changed during a stress on the healthcare system.

**Methods:** 647 patients with PE were retrospectively identified, of which 288 have been adjudicated thus far. Demographics, medical history, echocardiography, computed tomography angiography, therapeutics, and outcomes were reviewed from hospital presentation and up to 12 months from discharge. Certain outcomes were followed up to time of data collection (up to 3 years post-discharge). The CAPE cohort was defined as having a positive PCR test for SARS-CoV-2 within 30 days of admission.

**Results:** 45 patients had CAPE and 243 had NCAPE. Age (mean ± SD, 64.7 ± 12.1 vs 67.9 ± 16.1 years), gender (42% vs 51% male), weight (95.9 ± 34.8 vs 91.7 ± 27.3 kg), initial PESI score (109 ± 38 vs 106 ± 39), and baseline number of comorbid cardiopulmonary conditions (2.56 ± 1.45 vs 2.31 ± 1.57) were similar between the two populations. Numerically, history of prior DVT was higher in CAPE (15.6%) than in NCAPE (9.9%), with 3 of 7 CAPE patients with history of DVT/PE on anticoagulation (AC) at time of presentation. Both populations had similar baseline levels of platelet inhibitor use (24.4% vs 21.4%) and AC use (6.67% vs 7.82%). Patients with CAPE tended to have PEs located in the mainstem, lobar, or segmental branches (25%, 25%, and 30%), whereas NCAPE patients tended to have more centrally located lesions (22%, 31%, and 28% for saddle, mainstem, and lobar, respectively). The ventricles were more often

normal in size in CAPE patients (52% vs 28% and 76% vs 55% for right and left, respectively), as well as in function (52% vs 33% and 83% vs 74%). 84.4% of CAPE patients were still living at the time of data collection compared to 76.5% of NCAPE patients. For patients who had follow-up quality of life (QOL) data at 6 months, fewer CAPE patients had returned to baseline (25% vs 49%). The recurrence rate of VTE was 11.1% in both CAPE and NCAPE patients.

**Conclusions:** Baseline health and demographics appear to be similar between the CAPE and NCAPE groups. CAPE patients have higher rates of peripheral (defined as segmental and subsegmental) PE, whereas NCAPE patients have higher rates of central PE. NCAPE patients have higher rates of both right and left ventricular enlargement and dysfunction. CAPE patients experience a slower return to baseline quality of life. VTE recurrence rates are equivalent between the two groups; this supports recent findings suggesting that provoked PE (CAPE) has a similar recurrence rate as unprovoked PE.

**Optimization of an *In Vitro* Model of Staphylococcal Abscess Communities to Study Bactericidal Mechanisms**

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**Introduction**: *Staphylococcus aureus*, the primary pathogen in bone infections, possesses unique capabilities to evade antibiotic therapy. For example, *S. aureus* forms abscesses within bone marrow or surrounding soft tissue, known as Staphylococcal abscess communities (SACs),[1] which protect the bacteria from antibiotics and host immunity via a fibrin pseudocapsule. While vancomycin, the standard of care (SOC) antibiotic for MRSA infections, is ineffective against SACs, previous studies demonstrate that sitafloxacin, a second-generation fluoroquinolone clinically used in Japan, can kill *S. aureus* inside SACs *in vivo* with degradation of the encasing fibrin ring.[2] To confirm sitafloxacin's ability to influence fibrin ring structure and elucidate sitafloxacin's bactericidal mechanism of action, we aimed to develop an *in vitro* model. Here, we demonstrate the adaptation of a previously described *in vitro* SAC model[3] to compare the efficacy of sitafloxacin vs. vancomycin, and to characterize the indirect effects on fibrin pseudocapsule synthesis and degradation

**Methods:** *In vitro* SACs were grown using *S. aureus* JAR 06.01.31 as previously described.[3] Briefly, overnight cultures were diluted to ~14 colony-forming units (CFUs) in 25 μL of tryptic soy broth (TSB) and incubated between 2 layers of 1.78 mg/mL polymerized rat tail collagen in a 48-well plate. Gels were then overlaid with human serum, serum supplemented with fibrinogen, or plasma and incubated at 37°C. After 24 hours, gels containing mature SACs were fixed in 2.5% glutaraldehyde/4% paraformaldehyde, postfixed in buffered 1.0% osmium tetroxide, and embedded within 100% epoxy resin. One-micron sections were stained with Toluidine blue to identify the location of SACs within the gel for subsequent thin sectioning at 70 nm onto formvar/carbon copper slot grids and imaging with Hitachi 7650 TEM. In parallel, 5 μm fresh frozen sections were stained with H&E. For antibiotic treatments, the minimum inhibitory concentration (MIC) was calculated using broth microdilution, with the MIC being defined as the lowest concentration of antibiotic inhibiting visible bacterial growth. Mature SACs were then overlaid with sitafloxacin and vancomycin at 100x and 1000x their relative MIC, in addition to phosphate-buffered-saline (PBS) as a control. After 24 hours of incubation, collagen gels were either processed for TEM or homogenized, sonicated, and enumerated for CFUs. Statistical analysis was performed using one-way ANOVA with Tukey's multiple comparisons test, with $p < 0.05$ considered significant.

**Results:** While overlaying the collagen gel with serum alone supported robust bacterial growth, SACs formed within the gel did not possess a fibrin pseudocapsule (**Figure 1**). In contrast, SACs grown with serum supplemented with 3 mg/mL fibrinogen had a dense fibrin ring that encased the bacterial community. This could be replicated by using heparinized plasma as the growth medium, although the pseudocapsule did not appear as dense under TEM. Importantly, collagen gels overlaid with plasma utilizing EDTA or citrate as an anticoagulant did not have visible SAC formation, with only plasma containing heparin proving sufficient for the model. To determine whether antibiotic efficacy against SACs could be compared within our model, the MIC of sitafloxacin and vancomycin against planktonic JAR 06.01.31 was calculated (0.00005 mg/mL and 0.00625 mg/mL, respectively). Plasma (heparin) overlying mature SACs was then replaced with sitafloxacin or vancomycin diluted in PBS to 100x or 1000x their relative MIC. After 24 hours of treatment, at 100x its MIC, vancomycin-treated SACs contained similar numbers of bacteria compared to the untreated control (**Figure 2A**). However, interrogating mature SACs with sitafloxacin at 100x its MIC caused a significant decrease in the total CFUs recovered from each gel. A comparable reduction in CFUs was only exhibited by vancomycin at 1000x its MIC. Morphologically, SACs treated with sitafloxacin at 1000x the MIC had notable degeneration of the pseudocapsule (*), in addition to antibiotic-killed

bacteria (red arrows), characterized by cell wall remnants and vacuole formation (**Figure 2B**). In contrast, the pseudocapsule of vancomycin-treated SACs remained intact (#), with little evidence of antibiotic-induced death as the vast majority of the bacteria appeared as dense cocci with septal walls, corresponding to active bacterial replication (**Figure 2C**). These findings align with prior studies, which establish that sitafloxacin is potent against SACs *in vivo*, while vancomycin has limited bactericidal activity.

**Discussion:** Establishing a robust and easily reproducible *in vitro* model for SAC formation to study mechanisms of antimicrobial action creates the potential to improve treatment for bone infection. Here, we successfully adapt an *in vitro* SAC model to assess antibiotic tolerance and integrity of the fibrin pseudocapsule. With the current SOC, vancomycin, having limited efficacy against SACs both *in vivo* and *in vitro*, an understanding of how sitafloxacin kills bacteria within SACs and disrupts the encasing fibrin can aid the development of a successful treatment strategy. Since sitafloxacin itself cannot directly degrade the fibrin ring, sitafloxacin must influence the structure's disruption by acting on the encased bacteria. The accessory gene regulator (*agr*) quorum sensing system of *S. aureus* typically favors dissemination from the SAC once nutritional sources are depleted by inducing the secretion of staphylokinase. Staphylokinase can complex with plasminogen to cleave other plasminogen molecules to plasmin, leading to the degradation of the fibrin pseudocapsule. We believe that sitafloxacin uniquely acts on this pathway, leading to the digestion of the fibrin ring. In future studies, we will utilize our *in vitro* model to perform bulk RNA sequencing over the lethal time course of sitafloxacin to define how sitafloxacin activates *agr* and, in turn, disrupts the fibrin pseudocapsule. Moreover, replicating this model with the methicillin-resistant USA300 LAC strain will allow a more rigorous comparison to prior *in vivo* data.

**Significance/Clinical Relevance:** This work will delineate mechanisms by which antibiotics influence formation and degradation of the fibrin pseudocapsule that encases SACs, and serves as a rapid screening tool for novel antimicrobials that kill SACs to improve therapy for bone infection.

**References:** 1) Cheng et al. *FASEB J* 25:3393-404 (2009), 2) Ren et al. *Front Cell Infect Microbiol* 12:910970 (2022), 3) Hofstee et al. *Infect Immun*. 88(11):e00293-20 (2020).

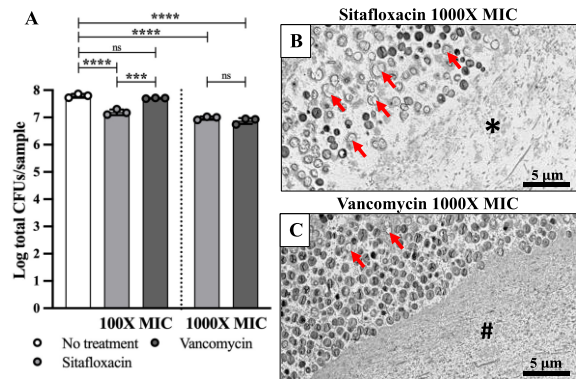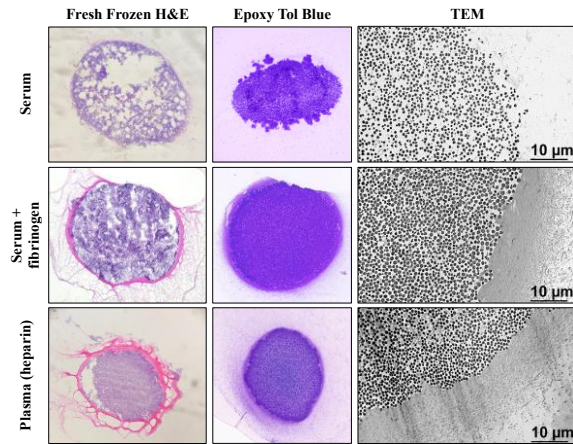**Figure 1. Fibrinogen promotes fibrin pseudocapsule formation**





**Figure 2. Sitafloxacin is more effective than vancomycin against SACs *in vitro***