

across the study period, where 66.82% of counties had broadband present in 2017 versus 92.57% in 2020. A major jump occurred from 2018 to 2019, where 64.96% of counties had broadband present in 2018 compared to 91.09% in 2019. Broadband access also rose, where the average proportion of households with broadband was 69.43% in 2017 and 78.24% in 2020. The increase in both broadband presence and access from 2017 to 2020 was larger in rural counties compared to urban counties. Specifically, the increase in the probability of having broadband present from 2017 to 2020 was 30% higher in rural compared to urban counties (95% CI: 1.24, 1.38). The increase in the proportion of households with broadband was 1.21% higher from 2017 to 2020 in rural compared to urban counties (95% CI: 0.004, 0.021). **DISCUSSION/SIGNIFICANCE OF IMPACT:** While broadband presence and access both increased from 2017 to 2020, the observed increases were larger in rural compared to urban counties. Improvements in broadband access in the US are continuously needed to increase the use of telehealth and, subsequently, lessen rural/urban disparities in healthcare access and disease detection.

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Defining return to sport in anterior cruciate ligament (ACL) injury recovery with mobile markerless motion capture: A cross-sectional analysis of factors associated with return to activity

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OBJECTIVES/GOALS: Approximately 250,000 anterior cruciate ligament (ACL) tears occur annually in the USA. Symptoms generally improve after ACL reconstruction (ACLR), but 20% of athletes do not return to sport. It is not clear how biomechanical function and mental health impact return to activity, so the purpose of this study is to evaluate their effect on return to activity following ACLR. **METHODS/STUDY POPULATION:** Patients age 18 years and older who have undergone primary ACLR at a single institution who are one year out from their initial procedure will be recruited by email. Patients will be excluded if they had a concomitant or subsequent ligamentous knee injury in the follow-up period since their index procedure. Additionally, patients will be excluded if they do not have access to a mobile phone with video recording capability. The primary outcome will be joint angle kinematics and postural balance metrics derived from patient recorded mobile-phone videos while performing several provocative exercises (sit-to-stand, Star Excursion Balance test). Patients will also be given surveys assessing knee symptoms, psychological readiness for return to sport, mental health, athletic history, and current return to sport level. **RESULTS/ANTICIPATED RESULTS:** We predict that psychological readiness for return to sport following ACL injury and biomechanical postural stability will each be independently associated with return to sport timing following ACLR. Additionally, we anticipate that psychological readiness, as measured by higher ACL-Return to Sport Index scores, will be more strongly associated with return to sport compared to biomechanical movement quality (better gross postural control on skeletal modeling). In other words, higher psychological readiness for return to sport will have a stronger independent association with return to sport level compared to biomechanical movement quality measures. **DISCUSSION/SIGNIFICANCE OF IMPACT:** This study also aims to define return to sport in terms of biomechanics and psychological readiness in an athletically

heterogenous population. Additionally, we will test the feasibility of patient-led, remote, mobile, marker less motion capture for assessment of biomechanical function and distribution of patient-reported outcome measures.

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Predictors of variability in Apple Watch step count data from a 3-year prospective cohort

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OBJECTIVES/GOALS: Physical activity (PA) is a well-documented protective factor against many cardiovascular diseases. PA guidelines to reduce these risks and the impact of variability are unclear, and most studies only examine a 7-day activity window. This study aimed to examine factors related to variability in step counts in a 3-year study of adults aged ≥ 18 years. **METHODS/STUDY POPULATION:** Included were 6,525 participants from the Michigan Predictive Ability and Clinical Trajectories study, a prospective cohort of community-dwelling adults enrolled between 8/14/2018 and 12/19/2019 who received care at Michigan Medicine and were followed for 3 years. Data were collected from Apple Watches provided to participants via the HealthKit. This secondary analysis included those with ≥ 4 valid weeks of data (≥ 4 days with at least 8 hours of wear time). Season was defined as Spring (March 20–June 20), Summer (June 21–September 21), Fall (September 22–December 20), and Winter (December 21–March 19). GEE models against the outcome of variability, defined as weekly standard deviation of step counts, and the predictor of season were adjusted for age, sex, race/ethnicity, weekly average step count, diabetes, and body mass index. **RESULTS/ANTICIPATED RESULTS:** The average (standard deviation (SD)) step counts by season were 7101 (3434) in Spring, 7263 (3354) in Summer, 6863 (3236) in Fall, and 6555 (3211) in Winter. Compared to winter, there was statistically significantly higher variability in all other seasons (p). **DISCUSSION/SIGNIFICANCE OF IMPACT:** In this cohort of community-dwelling adults, we found significant differences in variability of physical activity by season, age, and BMI. Future work will examine how this variability impacts the risk of development of cardiovascular disease, incorporating the impact and recovery trajectories of COVID-19 and other acute respiratory infections.

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The role of bitter taste receptors (T2Rs) in aspirin-exacerbated respiratory disease

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OBJECTIVES/GOALS: Aim 1: Assess the correlation between Tuft cell T2R functionality and Th2 sinonasal inflammation, disease burden, and post-surgical outcomes in AERD patients. Aim 2: Determine if hyperfunctional Tuft cell T2Rs enhance denatonium-stimulated inflammatory responses in nasal epithelial air-liquid interface (ALI) cultures from AERD patients. **METHODS/STUDY POPULATION:** Aim 1: We will conduct a prospective cohort study

with 82 AERD patients. Taste sensitivity to denatonium (DB), serving as a proxy for tuft cell T2R functionality, will be assessed using a validated 13-point scale, and correlations with clinical outcomes – SNOT-22, histopathologic, CT, and endoscopic scores – will be analyzed using linear regression. Aim 2: Sinonasal epithelial cells will be collected from AERD patients either hyper- or hyposensitive to DB and from healthy controls. We will establish ALI cultures and expose them to varying DB concentrations. Secretions will be analyzed for antimicrobial peptide release via bacterial kill assays and for IL-25 and β -defensin 2 via ELISA. Tuft cell frequency and baseline IL-25 mRNA expression will be assessed using immunofluorescence and quantitative real-time polymerase chain reaction, respectively. RESULTS/ANTICIPATED RESULTS: We expect that higher DB taste sensitivity in AERD patients will correlate with worse clinical outcomes, reflected by elevated 6-month postoperative SNOT-22 scores, indicating increased symptoms. Additionally, we anticipate that preoperative Lund-MacKay and Lund-Kennedy scores, along with histopathological metrics, will be worse in DB-hypersensitive patients, establishing a link between taste sensitivity and disease burden. In vitro, we predict that AERD patients with DB hypersensitivity will demonstrate significantly higher IL-25 and β -defensin 2 secretion and reduced bacterial colonies in kill assays. We also expect increased tuft-cell frequency and baseline IL-25 mRNA in AERD-derived cultures compared to healthy controls, highlighting T2R functionality's role in AERD pathogenesis. DISCUSSION/SIGNIFICANCE OF IMPACT: This project aims to investigate a putative new role for Tuft cells in AERD pathogenesis by correlating Tuft cell T2R functionality with outcomes in AERD patients and with inflammatory response in vitro. Findings could lead to predictive clinical taste tests and future genotyping studies to identify T2R polymorphisms correlated with AERD severity.

91 The Effect of Pesticide Exposure on Immunological Responses in Children Against SARS-CoV-2

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OBJECTIVES/GOALS: To assess the effect on the immune response to COVID-19 in children exposed to pesticides. The hypothesis is that increased pesticide exposure results in different immunological response to COVID-19. The goal of the proposal is to improve scientific knowledge on factors affecting COVID-19 and identify a modifiable factor to reduce these disparities. METHODS/STUDY POPULATION: A cross-sectional analysis of children (aged 5–17 years) with asthma to assess pesticide exposure and immune markers of SARS-CoV-2. SARS-CoV-2 infection or vaccination was determined with blood exposome RNA analyses assessed from blood samples taken at baseline. Immunological response was measured using neutralizing, phagocytizing, and NK-activating antibody responses biomarkers using plasma antibody isotyping, effector functions, T-cell activation-induced marker (AIM), and recall cytokine secretion assays on lysed, whole blood. Pesticide exposure was assessed as concentration of four urinary metabolites in a spot urine sample adjusted for creatinine. Unadjusted regression models were created to assess the effect of 3-phenoxy benzoic acid, a common pyrethroid pesticide, on immune markers. RESULTS/ANTICIPATED

RESULTS: Children's (N = 30) average age was 10 years (interquartile range: 8–11). A majority of children were male (63%) and Non-Hispanic Black (73%). The majority of children had markers of SARS-CoV-2 infection (77%). Of the 4 pesticide metabolites assessed, only 3-PBA was commonly found (77% of samples > LOQ). Higher urinary concentrations of 3-PBA are associated with a significant (p < 0.05) association with inflammatory markers. DISCUSSION/SIGNIFICANCE OF IMPACT: Significant associations in cytokine and inflammatory marker may indicate a Th2-skewed response, and dysregulated cytokine responses can lead to severe disease. A suggested increase in T-cell activation markers (e.g., CD4, CD8) may indicate potential exhaustion if excessively activated.

92 Prevalence of heteroresistance in urinary *Escherichia coli* in Metropolitan Atlanta, Georgia

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OBJECTIVES/GOALS: Urinary tract infections (UTIs) cause significant morbidity, and many patients require multiple courses of antibiotics increasing the risk of antibiotic resistance. We determined the prevalence of urinary antibiotic heteroresistance (HR), which has been associated with treatment failures in vivo, to three first-line antibiotics for UTIs. METHODS/STUDY POPULATION: Clinical urine *Escherichia coli* isolates from patients in metropolitan Atlanta, Georgia in August 2023 were collected as part of public health surveillance performed by the CDC-funded, Georgia Emerging Infections Program (EIP). Only the first *E. coli* isolate collected for each patient was included in this study. Antibiotic susceptibility was determined through medical record review. HR to nitrofurantoin, trimethoprim-sulfamethoxazole, and fosfomycin was determined by population analysis profiling (PAP), where broth dilutions of *E. coli* were plated on increasing concentrations of the antibiotic. HR was defined as survival of >1 in 106 cfu but fewer than 50% survival at 1X antibiotic breakpoint (bp), resistant as > 50% survival at 1X bp and susceptible as survival of RESULTS/ANTICIPATED RESULTS: Among 355 patients, 21 (5.9%) were resistant or intermediate to nitrofurantoin and 92 (26%) were resistant to trimethoprim-sulfamethoxazole. Antibiotic susceptibility data were missing from 5 (1.4%) and 11 (3%) of isolates for nitrofurantoin and trimethoprim-sulfamethoxazole, respectively. Susceptibility testing was not routinely performed nor reported for fosfomycin, thus excluded. PAP revealed that of the total 355 isolates, 3 (0.84%) were heteroresistant to nitrofurantoin, 17 (4.8%) were heteroresistant to trimethoprim-sulfamethoxazole, and 27 (7.6%) were