Annual Meeting Abstracts

2025

Boston, Massachusetts

Health equity

Effect of Care Management on Pre-eclampsia among Medicaid beneficiaries in North Carolina Monisa Aijaz*, Christopher Shea, Arrianna Planey,

Background: Preeclampsia significantly impacts maternal health, causing severe morbidity and mortality in the U. S., with notable racial disparities. The reasons for these disparities remain unclear; however, structural racism and social stressors may contribute to racialized inequities. North Carolina's Medicaid-managed Pregnancy Medical Home (PMH) program uses a medical and social risk screener, providing care management for high-risk pregnancies. However, evidence on the heterogeneous effects of care management on preeclampsia among racial groups is limited.

Objective: This study investigates the effect of care management on pre-eclampsia among Medicaid beneficiaries enrolled in the PMH program in North Carolina.

Data and Measures: This study used a dataset linking Medicaid claims, birth certificate data, and Community Care of North Carolina's pregnancy risk screen data. The independent variable was intensive care management, defined as ≥5 face-to-face interactions with a caseworker.

Analysis: We used a bivariate maximum likelihood estimation model to examine the effect with an instrumental variable approach to address selection bias and endogeneity. The instrument used was the rate of care management per county per year.

Findings: From January 1, 2017, to December 31, 2019, there were a total of 33,710 pregnancies with at least one pre-eclampsia risk factor among non-Hispanic Black and White Medicaid beneficiaries in the PMH program. Those receiving intensive care management had a 9.6-percentage-point (Standard Deviation: 0.034; 95%) lower likelihood of developing pre-eclampsia compared to those who did not receive intensive care management. We find that among those receiving intensive care management, non-Hispanic Black pregnant individuals [-0.078; SD: 0.033] had a 1.3 percentage-point [Chi2: 6.96; p-value-0.008] lower predicted probability of developing pre-eclampsia than non-Hispanic White pregnant individuals [-0.065; SD: 0.028].

Conclusions: Effective care management reduces pre-eclampsia among racial groups, with a significantly greater reduction observed in non-Hispanic Black pregnant individuals participating in North Carolina's PMH program, underscoring the importance of care management in addressing their clinical and social health needs and highlighting the potential for reducing disparities in pre-eclampsia.

Policy

Increasing Access to WIC During Pregnancy: Evidence from an RCT Jenna Nobles*, Marianne Bitler, Shannon Malloy, Fiona Weeks,

The Special Supplemental Nutrition Program for Women, Infants and Children (WIC) is a cornerstone safety net program for pregnant people in the US. Though half of people giving birth are eligible, WIC is significantly underenrolled. We tested a new approach to connect low-income pregnant people to WIC resources. In the US, 95% of people under 40 have smartphones and pregnancy tracking apps are common. We partnered with a popular app company to implement an RCT designed to support digital enrollment in WIC. Pregnancy app users were invited to take a survey to learn about free pregnancy resources. WIC-eligible participants were randomized into a treatment arm, which provided information about WIC benefits and an enrollment link; or into a control arm, which instead provided general information about nutrition in pregnancy. Respondents were reinterviewed 1-3 months after the pregnancy due date. At present, 6,879 WIC-eligible participants have completed the prenatal survey; 1,435 of those also completed the postnatal survey, providing information about pregnancy and infant health. Analysis of incoming study data is ongoing. Early results indicate that people exposed to the WIC educational intervention may be more likely to enroll themselves (46.5% vs. 42.8%, p=0.16) and their infants (38.1% vs. 34.8% p=0.19) in WIC. Participants in the treatment group were more likely to know that WIC offers breastfeeding support in addition to resources for infant formula (64.9% vs. 59.0%, p=.024). Common reasons reported for not enrolling included concerns about eligibility (39.3%) and not knowing much about WIC (21.8%). This study is the first to experimentally test approaches to encourage WIC use, evaluate WIC impacts in pregnancy with exogenous variation in WIC use, and identify barriers to WIC uptake in the era of digital recruitment. Apps may provide a low-cost, scalable way to educate millions of people about US safety-net resources and support their use during pregnancy.

Policy

The 2021 Child Tax Credit expansion and perinatal health: a quasi-experimental study
Deborah Karasek*, Daniel Collin, Justin White, Guangyi Wang, Rita Hamad,

Objective: Poverty alleviation policies play an important role in mitigating socioeconomic and racial/ethnic disparities in perinatal health. The 2021 temporary expansion of the Child Tax Credit (CTC) provided monthly payments of up to $300 per child during July-December 2021 and allowed the most economically disadvantaged families to qualify. It has been linked to decreased material hardship and food insecurity, but few studies have examined effects on perinatal health. The goal of this study was to estimate impacts of the 2021 CTC expansion on perinatal health, including differences among minoritized populations.

Methods: Data were drawn from national birth certificate files (January 2021-February 2022; N=3,487,943) and the Pregnancy Risk Assessment Monitoring System (PRAMS; January-December 2021; N=28,874). Using quasi-experimental difference-in-differences analyses in each data set, we compared changes in perinatal outcomes before versus after the 2021 CTC expansion for CTC-eligible versus ineligible individuals. Outcomes included gestational hypertension, gestational diabetes, birthweight, preterm birth (<37 weeks' gestation), low birthweight (<2,500 grams), small-for-gestational-age (SGA), and large-for-gestational-age (LGA).

Results: In birth certificates, the CTC expansion was associated with reduced birthweight (-5.54 grams, 95%CI: -7.83, -3.25) and reduced LGA births (-0.26 percentage points, 95%CI: -0.38, -0.14). In PRAMS, the CTC expansion was associated with reduced SGA (-2.77 percentage points, 95%CI: -4.99, -0.55). There was no association for other outcomes. Among subgroups, individuals without Medicaid had decreased birthweight; individuals with lower education, Medicaid, and those who were unmarried had reduced SGA births.

Conclusions: The 2021 CTC expansion was associated with improvements in birthweight distribution, perhaps due to decreased financial insecurity, with more positive impacts on SGA among those of lower socioeconomic status.

Health equity

Impacts of the ACA Medicaid Expansion on Prepregnancy and Postpartum Medicaid Coverage and Mental Health Outcomes Among American Indian & Alaska Native and White Birth Givers Yasamean Zamani-Hank*, Danielle Gartner, Jennifer Richards, Mary Owen, Claire Margerison,

American Indian and Alaska Native (AIAN) birth givers are at increased risk of experiencing perinatal depression compared to non-Hispanic white birth givers. The Patient Protection and Affordable Care Act's (ACA) Medicaid expansions may uniquely impact access to mental health screening among AIAN people and ultimately alleviate longstanding disparities. We assessed the impacts of the ACA Medicaid expansion on self-reported prepregnancy and postpartum Medicaid coverage, prepregnancy self-reported depression and postpartum depressive symptoms, and postpartum well-being, and whether impacts differed, among a sample of AIAN and Non-Hispanic white (NHW) birth givers (n=37,782) from Phases 7 and 8 of the Pregnancy Risk Assessment Monitoring System (2012-2021). We conducted a difference-in-difference analysis to assess whether prepregnancy and postpartum outcomes among these two groups changed significantly between pre-expansion (2012-2013) and post-expansion (2014-2021) periods among states that expanded Medicaid in 2014 (n=16) versus states (n=10) that did not. The ACA Medicaid expansion was associated with significant increases in both prepregnancy and postpartum Medicaid coverage among both AIAN birth givers (19.3 percentage point [ppt] increase; p<.01) and NHW birth givers (17.0 ppt increase; p<.01), respectively, but there were no significant differences in impact between the groups. Expansion was associated with a 14.1 ppt (p<.01) increase in prepregnancy self-reported depression among NHW birth givers, but not for AIAN women. There were no statistically significant differences in postpartum depressive symptoms or well-being for either AIAN or NHW birth givers. While the ACA Medicaid expansion was associated with significant increases in prepregnancy and postpartum Medicaid coverage, the expansion did not differ in its impact on Medicaid coverage or mental health outcomes between AIAN and NHW birth givers.

Child health and development

The Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) and Cerebral Palsy Risk Among Hispanic Mothers and Children in California Yunyue Shi*, Haoran Zhuo, Giselle Bellia, Zeyan Liew,

Cerebral Palsy (CP) is the most common childhood physical disability in the United States, affecting 2 to 3 per 1,000 children. While the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) has been associated with improved birth outcomes, the potential impact of WIC on CP risk is unclear, particularly among Hispanic groups. To estimate the effect of maternal use of WIC on offspring CP risk, we conducted a California statewide cohort study by analyzing birth records from 2007 to 2015 and CP diagnostic records from the Department of Developmental Services. Our analysis included 1,455,242 Hispanic mothers and their singleton births covered by Medi-Cal (California's Medicaid program) who were eligible for enrollment in WIC. We performed logistic regression analysis to estimate the odds ratio (OR) and 95% confidence interval (CI) for CP associated with prenatal WIC use, adjusting for confounding factors. We used causal mediation analyses to examine the mediating roles of preterm birth and low birth weight. Overall, 91.2% of Hispanic mothers covered by Medi-Cal used WIC during pregnancy. WIC users were more likely to be younger, foreign-born, overweight or obese, have three or more children, and have lower education compared with non-users. Overall, a 20% decrease in the odds of CP (OR=0.80, 95% CI: 0.68–0.93) was observed among the offspring of Hispanic mothers covered by Medi-Cal who used WIC compared with non-users. The estimated protective effect of WIC on CP was stronger among Hispanic mothers covered by Medi-Cal who had less than a high school education (OR=0.63, 95% CI: 0.50–0.80). Approximately 10–19% of the total association was estimated to be mediated through preterm birth or low birth weight. Our findings suggest that prenatal WIC use was associated with reduced CP risk in the offspring of Hispanic mothers with lower socioeconomic status. Maximizing WIC enrollment is recommended to benefit this vulnerable population for CP risk.

Fertility and fecundity

Ambient air pollution mixtures and fecundability in a preconception time-to-pregnancy cohort Michelle Klawans*, Kathryn Konrad, Ian Buller, Johanna Jahnke, Alexander Keil, D. Robert McConnaughey, Anne Steiner, Anne Marie Jukic,

Background: While previous studies have found associations between air pollution and fertility, none have used exposure mixtures models. This study aimed to assess the effect of ambient air pollution mixtures on fecundability.

Methods: Time to Conceive participants were females aged 30-44 living in central North Carolina attempting to conceive and had no known history of infertility. Ambient concentrations of particulate matter less than 10 microns in diameter (PM10) or 2.5 microns (PM2.5), ozone (O3), carbon monoxide (CO), nitric oxide (NO), nitrogen dioxide (NO2), and sulfur dioxide (SO2) obtained from the U.S. Environmental Protection Agency were linked to geocoded residential addresses at enrollment. Five exposure windows were assessed: spermatogenesis, early follicle development, follicular and luteal phases of the menstrual cycle, and implantation. For each window and pollutant, we calculated average and single-day peak concentrations. Time to conception was the number of menstrual cycles from enrollment until a positive urinary home pregnancy test. We used quantile g-computation to estimate the association of a simultaneous quantile increase of all pollutant concentrations in an exposure window with the probability of conception, adjusting for attempt cycle number, season, age, BMI, education, parity, race/ethnicity, occupation, smoking, and alcohol use, and partner age, race/ethnicity, and smoking.

Results: Participants (N=924) contributed 3,671 cycles, of which 626 were conception cycles. During early follicle development, a quantile increase in all pollutant concentrations at once was associated with a fecundability odds ratio of 1.185 (95% confidence interval: 1.004-1.398). No associations were observed for other exposure windows or peak pollutant concentrations in any exposure window.

Conclusions: In areas of relatively low pollutant levels**,** exposure to ambient air pollutant mixtures does not appear to negatively impact the probability of conceiving.

Health equity

Racial/Ethnic Residential Segregation and Pre-Pregnancy Obesity: Addressing Structural Barriers to Health Equity Rana Chehab*, Assiamira Ferrara, Liwei Chen, Amanda Ngo, Mara Greenberg, Yeyi Zhu,

Pre-pregnancy obesity, a major public health concern, is linked to lifelong adverse outcomes. The association of racial/ethnic residential segregation with pre-pregnancy obesity remains unclear.

This cross-sectional study included pregnant individuals at Kaiser Permanente Northern California in 2011-2021. Residential segregation using the address at last menstrual period, assessed via Getis-Ord Gi* statistics, classified neighborhoods as low (<0), medium (0–1.96), or high (>1.96) segregation for each race/ethnicity. Pre-pregnancy body mass index was based on weight within 12 weeks pre-pregnancy and height within one year. Poisson regression estimated obesity risk (≥27.5 kg/m² for Asian/Pacific Islanders [API], ≥30 for others) vs. healthy weight (<23 kg/m² for API, <25 for others), adjusting for confounders and stratified by race/ethnicity.

Among 388,854 individuals (mean [SD] age 30.9 [5.4] years; 26.7% API, 6.9% Black, 27.8% Hispanic, 38.6% White), pre-pregnancy obesity prevalence was highest in Black (40.0%), followed by Hispanic (36.1%), API (23.3%), and White (22.1%). High vs. low Black and Hispanic segregation were respectively associated with higher obesity risk in API (1.13 [1.11–1.14]; 1.16 [1.15–1.17]), Black (1.06 [1.04–1.08]; 1.08 [1.07–1.10]), Hispanic (1.07 [1.06–1.08]; 1.11 [1.10–1.12]), and White (1.10 [1.09–1.11]; 1.17 [1.16–1.18]) individuals. Conversely, high vs. low White segregation was associated with lower obesity risk in API (RR 0.88 [0.87–0.90]), Black (0.90 [0.88–0.93]), Hispanic (0.87 [0.86–0.88]), and White (0.86 [0.86–0.87]) individuals. API segregation was not associated with obesity risk in API, Black, and Hispanic individuals, but it was associated with higher risk in White individuals (1.05 [1.04–1.06]).

These findings highlight higher pre-pregnancy obesity risk in Black and Hispanic segregated neighborhoods, contrasting lower risk in White segregated neighborhoods, emphasizing structural targets for advancing reproductive health equity.

Gynecological health

Hormonal Contraceptive Use Among Women with Sickle Cell Disease Maya Thirkill*, Maya Thirkill, Natalie Poliektov, Jessica Spencer, Penelope Howards,

Background: People with sickle cell disease (SCD) face increased risks of pregnancy-related illnesses and death compared to those without SCD. Limited research in this population makes contraceptive counseling challenging, which may exacerbate the risk of unintended pregnancies and limit opportunities for reproductive care. The primary objective of the analyses was to describe patterns in hormonal contraceptive use among women with SCD.

Methods: Women with SCD (n=152) and a comparison group of Black women (n=256) who were between the ages of 20 – 45 years, were not currently pregnant, and had not had a hysterectomy were eligible to participate. Both groups were interviewed about their lifestyles, obstetric histories and goals, reproductive health, and lifetime contraceptive use.

Results: Of the women with SCD, 68.9% reported ever using hormonal contraception in their lifetime, while 25.8% reported using a contraceptive at the time of the interview. Among those who had ever used hormonal contraception, progestin-only methods were more commonly reported (78.8%) compared to methods that contained progestin and estrogen (7.7%). The progestin shot was the most frequently reported method. Approximately 29.4% of the women with SCD who discussed contraceptive safety with a clinician used hormonal contraception at the time of the interview versus 8.0% of those who had not had such discussion. An age-adjusted logistic regression indicated that women with SCD had 20.9% lower odds (Adjusted Odds Ratio: 0.79; 95% CI: 0.48,1.32) of having ever used hormonal contraception compared to the comparison group.

Conclusion: Women with SCD were slightly less likely to use hormonal contraception in their lifetime than the comparison group. However, those with SCD who received contraceptive counseling from a clinician were more likely to use hormonal contraception in their lifetime than those who had not.

Gender and sexual identity

Sexual orientation disparities in unintended pregnancies and pregnancy outcomes Payal Chakraborty*, Corinne H. Rocca, Colleen A. Reynolds, Kodiak R.S. Soled, Sarah McKetta, Natalia Linos, Ange-Marie Hancock, Danielle Bessett, Sebastien Haneuse, Brittany M. Charlton,

Background: Sexual minority (SM) people may be at increased risk of unintended (mistimed or unwanted) pregnancies. Yet, little research has examined sexual orientation differences in unintended pregnancies and their outcomes.

Methods: We pooled data from two cohorts, the Nurses' Health Study 3 and Growing Up Today Study (analytic N=19,031 pregnancies 1978–2024). We fit multinomial models to estimate associations between mistimed and unwanted (vs. intended) pregnancies comparing completely heterosexual participants and four SM groups (heterosexual with same-sex experience, mostly heterosexual, bisexual, and lesbian/gay). We used generalized estimating equations (GEE) with inverse probability of treatment weights (IPTW) and inverse cluster size weights (ICSW) to address multiple pregnancies per person, confounding, and informative clustering. Within strata of intended, mistimed, and unwanted pregnancies—using log-binomial GEE models with IPTW/ICSW—we examined differences in induced abortion and negative perinatal outcomes (pregnancy loss, preterm birth, low birthweight, gestational hypertension/diabetes, preeclampsia) by sexual orientation.

Results: Compared to pregnancies to completely heterosexual participants, all SM groups had higher unwanted vs. intended pregnancies (RRRs from 1.42–5.92). Those to mostly heterosexual (RRR: 1.27, 95% CI: 1.16–1.40) and bisexual (1.73, 95% CI: 1.39–2.15) participants were more likely to be mistimed vs. intended. Intended, mistimed, and unwanted pregnancies to all SM groups were more likely to end in abortions. Mistimed pregnancies to bisexual (RR: 1.67, 1.07–2.60) and lesbian/gay (3.51, 1.60–7.69) participants were more likely to end in loss.

Conclusions: SM people had higher induced abortion use for unintended pregnancies, possibly suggesting positive care access. SM inequities in pregnancy loss are higher in mistimed pregnancies. Disparities in unintended pregnancies must be addressed to ensure reproductive autonomy for all.

Gynecological health

Racial Disparities and Age at Diagnosis in the Association Between Endometriosis and Cardiovascular Disease Risk Chidinma Oli*, shaira kee, Robert Cook,

Background: Endometriosis, a chronic gynecological condition, has been associated with an increased risk of cardiovascular disease (CVD). However, little is known about how this risk varies across racial groups or whether the age at diagnosis of endometriosis affects CVD risk.

Objective: To examine if the relationship between endometriosis and CVD varies by race and whether age at diagnosis of endometriosis is associated with CVD risk.

Methods: We analyzed data from the National Health and Nutrition Examination Survey (NHANES) 1999–2006 for women aged 20–54 years with self-report endometriosis diagnosis and CVD (history of congestive heart failure, coronary heart disease, angina, heart attack, or stroke). Age at endometriosis diagnosis was categorized into 13-29 and 30+ years; race as Non-Hispanic White or Black. We used multivariable logistic regression with stratified analysis to assess the relationship between endometriosis and CVD by race and if age at endometriosis diagnosis predicts CVD risk, adjusting for age, smoking status, and education level.

Results: Among 3,719 women, 320 (10.3%) reported a diagnosis of endometriosis, with an overall CVD prevalence of 130 (3.3%). Women with endometriosis had a significantly higher prevalence of CVD (6.7%) compared to those without endometriosis (2.9%, p 30 years had significantly higher odds of CVD compared to those without endometriosis (aOR = 2.7; 95% CI: 1.4–5.2), while no significant difference was observed for those diagnosed at 13–29 years (aOR = 1.8; 95% CI: 0.8–4.1).

Conclusion: Endometriosis is a stronger CVD risk factor for Black women and when diagnosed in later adulthood, highlighting the need for further research

Child health and development

GUIDANCE FOR INTERNATIONAL GROWTH STANDARDS: A SUITE OFSTATISTICAL PACKAGES FOR CONSISTENT GROWTH ANALYSES USING INTERNATIONAL STANDARDS

Eric Ohuma*, Simon Parker, Bancy Ngatia, Linda Vesel,

Understanding how and why child growth patterns change is necessary to characterize global health inequalities. Sustainable Development Goal (SDG) 3.2 aims to reduce preventable newborn deaths by at least 12 deaths per 1,000 live births and child deaths to 25 per 1,000 live births by 2030. However, large gaps remain in achieving these goals: currently 59 and 64 (of 194) countries will miss the targets for child and neonatal mortality, respectively. Infant mortality is associated strongly with non-optimal growth. Therefore, accurate growth assessment using international prescriptive growth standards is a key step towards efficient, accurate, and comparable tracking of progress towards achieving the SDGs. Different growth standards exist and can lead to differences in growth estimates due to lack of comparability as a result of how they were constructed (prescriptive vs descriptive approaches), study design, statistical methodology, etc. Growth of preterm and term infants should be assessed against a respective standardof optimal growth. The WHO GS describe optimal growth in term babies. These standards were not gestational age specific, and INTERGROWTH-21st aimed to fill this gap by developing gestational age- and sex-specific standards for size at birth in babies from 24 weeks' gestational age. In addition, INTERGROWTH-21st developed postnatal growth standards for preterm infants. However, guidance on transition between the WHO and INTERGROWTH-21st standards is unclear and has implications for growth assessment. To facilitate standardized growth assessment, the Guidance for International Growth Standards (GIGS) project has developed a suite of statistical packages in R, Stata, and SAS. These packages simplify accurate application of the WHO Child Growth Standards and growth standards from the INTERGROWTH-21st project. This talk will introduce the GIGS packages and their functionality for standardized growth assessment in R, Stata, and SAS.

Child health and development

Severe neonatal morbidity and all-cause and cause-specific mortality through infancy and late adolescence – a nationwide cohort and sibling cohort study Hillary Graham*, Kari Johansson, Martina Persson, Mikael Norman, Neda Razaz,

Background: While global child mortality has decreased, understanding risk factors associated with mortality through childhood and early adulthood remains crucial. Severe neonatal morbidity (SNM) is a key health indicator, but its long-term impact on mortality beyond infancy has not been well studied.

Objectives: To examine the association between SNM diagnosed during the first 27 days of life and all-cause and cause-specific mortality from infancy through late adolescence.

Design: Nationwide, population-based cohort study in Sweden.

Participants: 2,098,752 liveborn singleton infants ≥22 weeks gestational age, born between January 2002 and December 2021.

Exposures: Infants with any SNM diagnoses or procedures within 27 days after birth.

Main outcome measures: All-cause mortality and cause-specific mortality from 28 days up to a maximum of 21.2 years. Adjusted hazard ratios (aHR), and 95% confidence intervals (CI) were estimated using Cox proportional hazards models, adjusted for infant and maternal characteristics. A sibling-control analysis was also performed.

Results: Among 2,098,752 children included in the study, 49,225 (2.4%) were diagnosed with SNM during the neonatal period. During the median follow-up of 10.5 years (interquartile range 5.70-15.56 years), overall 3618 children died. The mortality rate for children with SNM was 1.81 per 1,000 person-years compared with 0.13 per 1,000 person-years for those without SNM, with an aHR of 5.92 (95% CI, 5.27-6.64). Neonatal neurological conditions were the leading morbidity associated with a 17.7-fold increase in all-cause mortality after 28 days of life (95% CI, 15.2-20.5). The associations between SNM and all-cause mortality were more substantial in girls than in boys and in those born at term. SNM was associated with elevated mortality risk from infections, and disorders in the nervous-, circulatory-, respiratory-, and metabolic systems. Sibling-control analysis showed the associations were unaffected by familial confounding.

Conclusions: These findings suggest that SNM may be a significant risk factor for childhood mortality. Efforts to prevent severe neonatal morbidity, early identification, and long-term follow-up care may help further reduce mortality.

Child health and development

Developmental Readiness for Complementary Feeding: Associations with Initiation before 6 months Diane Putnick*, Akhgar Ghassabian, Priscilla Clayton, Rajeshwari Sundaram, Edwina Yeung,

The American Academy of Pediatrics' recommendation to introduce complementary food around 6 months is coupled with suggestions that parents evaluate infants' readiness on various developmental markers with little research base. We hypothesized that mothers who assess their infants as more developmentally advanced are more likely to begin feeding complementary foods before 6 months, and that variation in infant development explains race/ethnic differences in timing of complementary feeding.

In Upstate KIDS, a cohort of 3446 singletons and 2029 multiples, mothers assessed 9 markers of development and reported any complementary feeding before 6 months term-corrected age. Mixed-effect models estimated adjusted odds ratios (aOR) between developmental markers and complementary feeding accounting for within-family variance, sociodemographics, breastfeeding, infant reflux, and maternal depression. Direct and indirect effects of race/ethnic differences in complementary feeding through a 9-point total development score were computed via path analysis.

Infant sitting (aOR 1.60; 95%CI:1.32-1.93), head control (1.51; 1.26-1.81), reaching (1.19; 1.04-1.37), mouthing (1.26; 1.08-1.46), and having a good appetite (1.61; 1.15-2.24) were uniquely associated with complementary feeding before 6 months. Having a fussy temperament, teeth, and 2 weight indicators were not. A 1-point increase in a total development score was associated with higher odds of complementary feeding (aOR:1.26; 1.19-1.33). Race/ethnic differences in the development score explained non-Hispanic Black vs. White differences in the odds of complementary feeding before 6 months (indirect aOR:1.05; 1.01-1.10; direct:1.21; 0.83-1.78).

Results suggest that mothers are using their infants' developmental markers to decide when to begin complementary feeding. Observations of racial/ethnic differences in the timing of complementary feeding may be explained by perceptions of developmental readiness, in line with recommendations.

Child health and development

Severe maternal morbidity and the associated risk of cerebral palsy in children Asma Ahmed*, Bénédicte Driollet, Emmalin Buajitti, Jennifer Hutcheon, Laura Rosella, Seungmi Yang,

Background

Severe maternal morbidity (SMM) has been linked to perinatal complications, but the evidence on associations with children's neurodevelopmental disorders is unclear. We assessed associations between SMM and cerebral palsy (CP) in children.

Methods

A longitudinal, population-based cohort study of all live births in Ontario, Canada, between 2003 and 2019 followed up through 2020. SMM was identified from inpatient or emergency department diagnoses during the index pregnancy or postpartum (20 weeks gestation to 42 days postpartum) based on validated algorithms, and CP was defined as a single inpatient or 2 or more outpatient diagnoses at least two weeks apart between birth and the end of follow-up (age 1-17 years). We estimated crude and adjusted associations using Poisson regression models.

Results

Of 2,136,816 children included, 41,396 (2%) were exposed to SMM. In a median follow-up period of 9.5 years (IQR 5.2-13.7), 5,352 children were diagnosed with CP ((272 CP cases (0.7%) exposed to SMM). The average annual CP incidence was 7.5 per 10,000 child-years in those exposed to SMM and 2.5 per 10,000 in the unexposed. Children of mothers with SMM had an increased risk of CP (Risk Ratio (RR): 2.71 (95% CI: (2.39-3.06), adjusted for maternal sociodemographic and clinical factors). All SMM subtypes were associated with increased risks of CP, with the strongest associations observed for severe hypertensive disorders (RR: 3.29 (2.44-4.33), followed by other SMM subtypes (RR: 2.81 (2.30-3.39)).

Conclusion

In this population-based study of over 2 million births, severe maternal morbidity was associated with increased risk of cerebral palsy. This risk was observed across major morbidity subtypes, including severe hypertensive disorders, hemorrhage, and sepsis. These findings highlight the potential benefits of optimizing maternal health and may support the need for early monitoring of children exposed to these adverse maternal events to detect early signs of cerebral palsy.

Pregnancy outcomes

Intersectional Multilevel (MAIHDA) Analysis of Preterm Birth Disparities in the United States Meredith Cahill*, Claire Margerison,

Preterm birth (PTB) impacts about 10% of U.S. births and is associated with increased morbidity, mortality, and healthcare burdens. Disparities by maternal race/ethnicity, nativity, age, education, and parity suggest that intersectional structural inequities may shape risk. Grounded in an ecosocial framework, we used Intersectional Multilevel Analysis of Individual Heterogeneity and Discriminatory Accuracy to examine PTB disparities across axes of maternal social identity, focusing on group differences, discriminatory accuracy, and interaction effects to deepen understanding of PTB disparities and identify high-risk groups. Using 2018-2019 natality data (n=7,008,531; PTB prevalence=9.9%), we grouped observations into 264 strata defined by maternal race/ethnicity, nativity, age, education, and parity. We used generalized linear mixed-effects models with a binomial-logit link to assess variability in PTB among strata. Predicted probabilities of PTB ranged from 5.2% (95%CI:4.4-6.2) to 28.4% (95%CI:25.5-31.6) and were highest among non-Hispanic (NH) Black, U.S.-born women 35+ years of age with ≤high school education, and lowest among NH-White, foreign-born women <35 with a college degree. Stratum-level differences explained 3.8% of total variation in probability of PTB, with the greatest proportion attributable to education (33.1%), age (24.8%), and race/ethnicity (22.9%). Overall, main effects accounted for 90.7% of variation, with 9.3% attributable to interactions. Significant random effects occurred for 91 of the 264 strata. These findings suggest within-stratum differences drive variations in preterm birth, but structural factors like educational status and race/ethnicity also contribute to variation. The finding that some variation in PTB is attributable to interaction effects combined with significant random effects in many strata indicates that intersectional inequities in PTB also exist.

Health equity

Allostatic load, racial and economic segregation, and birth outcomes Cynthia Wynn*, Beatrice Palazzolo, Michael Petriello, Gwendolyn Norman, Nicholas Weil, Ananda Sen, Sarah Comstock, Kimberly McKee,

Objectives: Structural racism may affect birth outcomes through chronic stress. We examined if the Index of Concentration at the Extremes, a measure of racial and economic segregation, was associated with gestational age at birth and assessed allostatic load (i.e., the physiologic response to chronic stress) as a biosocial mechanism of structural racism.

Methods: Using data from the Michigan Archive for Research on Child Health cohort, part of the National Institutes of Health Environmental Influences on Child Health Outcomes Consortium, we examined a subset with select biomarkers and prenatal records. Index scores ranged continuously from -1 to 1 (least-most privilege) and were categorized into quintiles. We operationalized allostatic load using eight parameters drawn from inflammatory biomarkers and prenatal records, deriving a sum score dichotomized as ≥4 (high) or <4 (low). We assessed, separately and together, associations between the Index, allostatic load, and our outcome, gestational age at birth, using Generalized Estimating Equations with zip code as the cluster level.

Results: Of the n=389, 46% were Black, 16% of which were preterm births versus 9.6% of non-Black births. Black pregnant people were four times more likely to have an allostatic load score ≥4 (Odds Ratio=4.1, 95% Confidence Interval=2.2, 7.5) and had a significant half-week reduction in gestational age at birth (β=-0.6, 95% CI=-1.1, -0.06) compared to non-Blacks. Pregnant people living in the highest Index quintile had shorter gestational ages at birth than the lowest quintile, but the effects were not significant (β=0.34, 95% CI=-0.37, 1.0). The Index was not associated with allostatic load ≥4 (p=0.6).

Conclusion: Although allostatic load was higher among Black pregnant people, we did not find evidence that the Index was associated with allostatic load or gestational age at birth. Other structural racism constructs may drive some of the racial differences in allostatic load and birth outcomes.

Women’s health

Complications in pregnancy and maternal long term cardiovascular disease risk – it is not enough to focus only on women’s first pregnancies Aditi Singh*, Rolv Skjærven, Sage Wyatt, Suzan Carmichael, Allen Wilcox, Liv Grimstvedt Kvalvik,

Background: It is well established that pregnancy complications increase the risk of premature maternal CVD death. Previous studies have primarily focused on first pregnancies due to the rarity of data on successive pregnancies. We previously (2012) showed that one child mothers face an especially high risk for CVD death, both with and without complications.

Methods: Based on the Medical Birth Registry of Norway, we linked successive singleton pregnancies to women during 1967-2020. To ensure information on complete reproduction, women with first pregnancies after 2013 were excluded.

We created 6 groups of women: Women with two or more pregnancies and no complications (a; reference), complications only in 1st pregnancy only (b), complications only in later pregnancies (c), or complications in 1st and later (d), and women with only one pregnancy and no (e) or complications (f).

We studied 6 complications: preeclampsia (term and preterm, separately), preterm birth, perinatal death, small for gestational age (2.5%), placental abruption.

Results: Women without complications but only one pregnancy had a 2.0 fold hazard ratio (HR) compared to (a). For women with two or more pregnancies, among those with complications only in first pregnancy, only in later, or in both 1st and later, the HRs varied between 1.3 – 2.2; 1.6 – 2.7, and 1.6 – 4.8, respectively. The HR for one child mothers varied from 3.6 – 6.6.

Conclusions: “The state of the art”, focusing 1st pregnancies to women, does not even capture half of the women that have complications in pregnancies.

Though complication risk is higher in first pregnancy, women with a first complicated pregnancy have lower CVD mortality than those with later complicated pregnancies. This indicates that what causes complications in first pregnancies are less related to CVD than what causes CVD in later pregnancies. Also, including women with only one pregnancy into analyses of the association, the CVD inflates the HRs.

Mental health

Identifying maternal psychosocial stress domains during pregnancy and associations with postpartum depression and anxiety Satvinder K. Dhaliwal*, Jaynia Anderson, Kaitlyn Sutton, Anna B. Flynn, Gabriella Villegas,

Background: Maternal psychosocial stress can negatively impact perinatal health and is influenced by factors such as socioeconomic characteristics, systemic barriers to care, and lifestyle stressors. These experiences are known to elevate the risk of postpartum depression and anxiety, but few studies have assessed multiple individual stressors occurring together in a racially and ethnically diverse birthing population.

Methods: Using data from the Maternal and Infant Health Assessment (MIHA), representing 356,000 California residents with a live birth, we implemented principal components analysis to identify psychosocial stress domains. Then, we built successive multivariable Cox proportional hazards models to assess associations of psychosocial stress during pregnancy with postpartum depression and anxiety. Model 1 included all psychosocial stress domains as independent variables. Model 2 adjusted for maternal demographic characteristics and Model 3 further adjusted for perinatal characteristics.

Results: We identified six psychosocial stress domains – Racial Discrimination, Financial Stressors, Relationship Stressors, Lack of Support, Housing Instability, and Substance Use – which accounted for 9.9% of variance in the data. In fully adjusted models, Racial Discrimination (Hazard Ratio=1.25 [95% CI: 1.17, 1.34]), Financial Stressors (1.30 [1.22, 1.39]), Relationship Stressors (1.27 [1.21, 1.33]), and Lack of Support (1.20 [1.14, 1.27]) were associated with postpartum depression. In comparison, Racial Discrimination (1.32 [1.24, 1.39]), Financial Stressors (1.24 [1.17, 1.32]), Relationship Stressors (1.23 [1.17, 1.29]), Lack of Support (1.14 [1.08, 1.20]), Housing Instability (1.12, [1.06, 1.18]), and Substance Use (1.14 [1.08, 1.20]) were all associated with postpartum anxiety.

Discussion/Conclusion: Understanding multifaceted psychosocial stress domains can help tailor upstream interventions by focusing on individual resources as well as systemic supports.

Health equity

When Education Fails to Protect: Severe Maternal Morbidity at the Intersection of Race/Ethnicity and Maternal Education Rashida S. Smith-Webb*, Martha M. Werler, Samantha E. Parker Kelleher, Collette N. Ncube,

Background: Health disparities in severe maternal morbidity (SMM) across various dimensions of social inequality are well documented; however, limited research has explored how multiple axes of marginalization intersect to shape these disparities. Guided by intersectionality theory, we examined differences in SMM rates at the intersection of race/ethnicity and education.

Methods: We used the Massachusetts Pregnancy to Early Life Longitudinal Data System to identify nulliparous birthing people, aged 12-55 years, from 1998-2021. SMM during delivery hospitalizations was determined using the Centers for Disease Control and Prevention criteria. We used binomial regression models to estimate SMM rates and RD (95% CI) per 10,000 deliveries for six intersectional groups, defined by race/ethnicity (Black, Hispanic, White) and maternal education (no college degree, college degree or higher), adjusted for age, nativity, marital status, and delivery year.

Results: Rates of SMM were highest for Black birthing people with a college degree or higher (314) and lowest for their White counterparts (213). For White and Hispanic birthing people, higher levels of education were associated with lower rates of SMM. However, among Black birthing people, rates of SMM were similar for those with (314) and without a college degree (310). Compared to White birthing people with a college degree or higher, Black birthing people, regardless of education, had an excess of about 100 SMM cases: no college degree RD=102 (75, 128); at least a college degree RD=98 (83, 113). For Hispanic birthing people, RDs of 25 (4, 45) and 58 (46, 70) were observed for those with and without a college degree, respectively. Similar patterns emerged, albeit attenuated when examining SMM without blood transfusions.

Conclusion: Higher levels of education offer little protection against SMM for Black birthing people. Addressing structural racism and other socioeconomic drivers is critical to mitigating disparities in SMM

Child health and development

Trajectories of Epigenetic Aging from Birth to Adolescence Across Different Cardiovascular Risk Groups Yi Ying Ong*, Sheryl Rifas-Shiman, Wei Perng, Anne Bozack, Zachary Laubach, Andres Cardenas, Marie-France Hivert, Emily Oken, Henning Tiemeier, Izzuddin Aris,

Background

Higher epigenetic age acceleration (EAA) in adults has been associated with poorer cardiovascular health (CVH). We aim to investigate EAA trajectories in different CVH groups across childhood and adolescence, two sensitive periods for CVH establishment.

Methods

We studied 244 children in a Boston-area pre-birth cohort with data on DNA methylation and the four American Heart Association's Life's Essential 8 (LE8) health factors (body mass index, blood pressure, non–high-density lipoprotein cholesterol, fasting glucose) to calculate CVH score (0-100 pts) in early adolescence. Using DNA methylation data from cord blood and peripheral leukocyte at mid-childhood (7-11y) and early adolescence (12-15y), we calculated GrimAge EAA. We used unadjusted linear spline mixed effect models to characterize EAA trajectories from birth to early adolescence and estimated differences in rate of change in EAA among those with low-moderate (<80pts) vs. high-optimal (≥80pts) CVH in early adolescence.

Results

Half of the participants were female. In early adolescence, 25% had low-moderate CVH, mean (SD) calendar age and GrimAge EAA was 13.0 (0.63) and -0.14 (2.47) years, respectively. Mean (SD) change in GrimAge EAA years per year of chronological age was -0.01 (0.34) from birth to mid-childhood and 0 (0.45) from mid-childhood to early adolescence. The low-moderate (vs. high-optimal) CVH group had faster rate of GrimAge EAA change from birth to mid-childhood (0.13 [95% CI -0.02, 0.28] years per year of chronological age) and from mid-childhood to early adolescence (0.08 [-0.06, 0.21] years per year of chronological age). In early adolescence, the low-moderate (vs. high-optimal) CVH group had GrimAge EAA of 0.75 (0.15, 1.35) years (vs. -0.47 [-0.82, -0.11] years).

Conclusion

Those with low-moderate CVH in early adolescence had increased EAA change across childhood and attained higher EAA in early adolescence, suggesting the utility of GrimAge EAA as a marker of CVH in early life.

Environment/climate change

Prenatal per- and polyfluoroalkyl substances (PFAS) exposures and longitudinal blood pressure measurements in children aged 3-18 years: Findings from a racially and ethnically diverse U.S. prospective birth cohort Zeyu Li*, Guoying Wang, Xiumei Hong, Tammy Brady, Colleen Pearson, Jessie Buckley, Xiaobin Wang, Mingyu Zhang,

Background: Prenatal PFAS exposures may increase offspring blood pressure (BP), but long-term studies in diverse populations are limited.

Methods: Participants were from the Boston Birth Cohort, a predominantly Black and Hispanic, low-income, and urban cohort. We measured PFAS in maternal plasma collected at delivery and extracted offspring BP from medical records. We derived age-, sex-, and height-specific BP percentiles and defined elevated BP as systolic/diastolic BP ≥90th percentile (ages 3-<13y) or ≥120/80 mmHg (ages 13-<18y). We used linear and modified Poisson mixed-effects models to examine associations of PFAS with BP percentiles and elevated BP. We used linear spline mixed-effects models to predict BP trajectories at ages 3-18y by PFAS levels. We adjusted for covariates selected with a Directed Acyclic Graph.

Results: We analyzed 13,404 BP measures from 1,094 children (median follow-up: 12y [IQR: 9-15y]; 61% Black and 22% Hispanic). Overall, each doubling of PFDeA, PFNA, and PFUnA was associated with a 1.02 (95% CI: 0.16-1.88), 1.15 (95% CI: 0.10-2.19), and 0.76 (95% CI: 0.14-1.39) percentile higher systolic BP, respectively. There were age-, sex-, and race/ethnicity-specific associations for PFDeA, PFHpS, PFNA, and PFUnA. For example, associations of PFDeA with systolic BP percentile were stronger in older (β3-5y=0.40; β6-12y=1.06; β13-18y=2.55), male (βmale=1.51; βfemale=0.52), and Black (βBlack=1.75; βHispanic=0.45) participants. In males, each doubling of PFHpS was associated with a 1.09 (95% CI: 1.01-1.18) times risk of elevated BP at ages 6-12y and a 1.17 (95% CI: 1.02-1.34) times risk at 13-18y, with no increased risk at 3-5y. PFHpS was associated with dose-dependent divergence in BP trajectories beginning at ages 13y.

Conclusions: Prenatal PFAS exposures are associated with higher offspring BP, with stronger associations in adolescents, males, and Black children. Prenatal PFAS may have intergenerational, long-term, and latent hypertensive effects.

Fetal loss/stillbirth/infant mortality

Wildfire Smoke Exposure: A Threat to Infant Health in California Sneha Ghimire*, Sandie Ha,

Background: Evidence suggests that wildfire has detrimental impacts on perinatal health. However, its effect on infant death risk is unclear. The alarming increase in wildfire frequency and intensity across the world underscores the critical need to examine the relationship between acute exposures to wildfire PM2.5 and infant death.
Methods: In this case-crossover study, we examined 10,014 singleton infant deaths (deaths of a live birth within 1 year) in California during the fire season (May-October) of 2009-2019. Wildfire PM2.5 was estimated using a previously published machine learning model that incorporates Environmental Protection Agency (EPA) monitoring data, satellite plume classifications, and meteorological variables. Daily ZIP code-level concentrations were calculated using population and area-weighted averages. Conditional logistic regression models compared exposures shortly before infant death (case period) with times when no such event occurred (control periods) for the same mothers, accounting for time-invariant factors. Case periods were the event day (lag0) and the preceding 6 days (lag1-lag6), with control periods selected by a time-stratified approach. Odds ratios (OR) and 95% confidence intervals (CI) were calculated for each 10-unit increase in exposure while adjusting for temperature, humidity, ambient PM2.5, and ozone.
Results: Wildfire PM2.5 was associated with higher odds of infant death ranging from 6-9% observed within two days of exposure, although these associations were not statistically significant. The strongest association was observed within the same day of exposure (aOR lag0 1.09, 95% CI: 0.98,1.207) and one day before the event (aOR lag1 1.06, 95% CI: 0.96,1.19). Associations were more pronounced among younger mothers aged 18-25 years, Hispanic mothers, high income-neighborhood, and male babies but they were not significant.
Conclusions: As global warming intensifies, more intense wildfire seasons may contribute to an increased risk of infant death. Reducing wildfire exposure is crucial to protect these vulnerable populations.

Child health and development

Pediatric neurodevelopmental outcomes following forceps, vacuum, and second stage cesarean delivery Maya Rajasingham*, Sarka Lisonkova, Neda Razaz, Giulia Muraca,

Background

While operative vaginal delivery is recommended as a safe alternative to second stage cesarean delivery (SSCD), the long-term neurodevelopmental outcomes following these deliveries are understudied. We aimed to examine the association between mode of delivery in the second stage of labour and attention deficit hyperactivity disorder (ADHD), autism spectrum disorder (ASD), and intellectual disability (ID).

Methods

We conducted a population-based, retrospective cohort study using health administrative databases to identify singletons born at term gestation without malformation, following forceps, vacuum, sequential instrument use, or SSCD in British Columbia, Canada (2000-2019). The follow-up period was from one year of age to diagnosis, death, emigration, or study completion. Separate Cox proportional hazards models were used to assess the association between mode of delivery and each neurodevelopmental outcome, adjusting for maternal demographic and clinical factors. Mediation analyses assessed the contribution of severe birth trauma and birth asphyxia to the association between mode of delivery and ADHD, ASD, and ID.

Results

Among 92,393 children, the rates of ADHD, ASD, and ID were 6.6, 1.8 and 0.3 per 1,000 person-years, respectively. Compared with SSCD, children born after sequential instrument had a 13% higher ADHD rate (7.8 vs. 6.5 per 1,000 person-years; adjusted hazard ratio [aHR] 1.13, 95% confidence interval [CI] 1.00-1.28) and children born with vacuum had a 48% higher ID rate (0.3 vs. 0.2 per 1,000 person-years; aHR 1.48, 95% CI 1.08-2.03). Neither birth trauma, nor asphyxia, mediated the relationship between mode of delivery and ADHD and ID, respectively. No association between mode of delivery and ASD was found.

Conclusion

Compared with SSCD, sequential instrument use was associated with an increased risk of ADHD and vacuum was associated with an increased risk of ID. Further investigations of these associations are warranted.

Child health and development

Exploring Patterns in Age at Menarche: The Effect of Are Deprivation Index Through a Lifecourse Perspective in the Bogalusa Heart Study Eunsun Gill*, Katherine P. Theall, Dohyeong Kim, Soo Jung Kang, Courtney J. Thomas, Jessica A. Broach, Lydia A. Bazzano, Camilo Fernandez, Emily W. Harville,

Introduction: Early and late menarche are related to adverse health outcomes. Area Deprivation Index (ADI), a measure of neighborhood socioeconomic conditions, may influence age at menarche (AAM), but its lifecourse evidence remains limited. We explored the influence of evolving ADI on AAM and moderating effect of obesity in the Bogalusa Heart Study (BHS).

Methods: A secondary longitudinal study (1974–2004) was conducted among 1,821 girls from the BHS, with up to six follow-up visits. ADI, based on 16 block-group census variables via factor analysis, was measured repeatedly and divided into quintiles (Q; Q1=least deprived; Q5=most). AAM was self-reported in year and month. Weibull accelerated failure time model analyzed the association between ADI and AAM, adjusting for race, exam year, maternal and paternal education, maternal smoking, systolic blood pressure, glucose, total cholesterol, and obesity with multiple imputation.

Results: Data from 1,821 girls (55.7% White; 44.3% Black; AAM: 7.1–16.8 years; median follow-up=4.2 years) showed a J-shaped association between ADI and AAM, with lower and higher deprivation linked to earlier menarche compared to the middle. Compared to girls in Q4, those in Q2 (Time ratio [TR]=0.97, 95% CI: 0.95–0.98), as well as those in Q1 and Q5 (TR=0.98; 95% CI: 0.97–0.99; TR=0.98; 95% CI: 0.96–1.00) exhibited earlier menarche, while the Q3 had a smaller effect (TR=0.99; 95% CI: 0.96–1.00, overall p=0.004). BMI modified the association, with significant effects among normal weight (Q2 vs. Q4: TR=0.97) and overweight (Q1 vs. Q4: TR=0.94), but not among obese (Q5 vs. Q4: TR=1.06; p for interaction: 0.045)

Conclusions: Both low and high neighborhood deprivation were associated with earlier menarche, a reproductive milestone linked to cardiometabolic and reproductive health risks. Environmental deprivation may shape long-term health trajectories via its influence on AAM.

Keywords: area deprivation index; menarche; neighborhood deprivation

Obstetric health

Identifying Cardiovascular Health Profiles in Pregnancy: A "Life's Essential 8"-Based Approach to Assessing Risk of Hypertensive Disorders of Pregnancy Chelsea DeBolt*, Rebecca M. Cohen, Zhan Zhao, Katherine Mccarthy, Kimberly B. Glazer, Rebecca Cohen

Background: Hypertensive disorders of pregnancy (HDP) increase perinatal morbidity and lifetime cardiovascular (CV) risk. Research has identified independent HDP risk factors but not multifactorial presentations of clinical and behavioral measures that may predict HDP. We characterized CV risk profiles in an obstetric population using American Heart Association Life's Essential 8 (LE8) indicators and measured associations with HDP.

Methods: We studied singleton nulliparous pregnancies from the nuMoM2b cohort, excluding those with preexisting hypertension or diabetes. Latent class analysis (LCA) identified CV risk profiles from LE8 indicators at 6-14 weeks' gestation: blood pressure (BP), body mass index (BMI), and self-reported diet, sleep, smoke exposure, and physical activity (PA). Model selection was based on fit indices and interpretability. Class labels were assigned from item response probabilities. We assessed predictors of class membership and odds of HDP with logistic regression.

Results: Of 6,304 study participants, 24% developed HDP. We identified a four-class LCA solution with interpretative labels of **Healthy Behaviors/Normal BMI&BP** (43%), **Sedentary/Normal BMI&BP** (31%), **High Snoring/Elevated BMI** (18%), and P**oor Behaviors/Normal BMI&BP** (8%). Two risk profiles were associated with HDP: the **High Snoring/Elevated BMI** class had 2.4 times the odds (95% confidence interval: 2.1-2.8) and **Poor Behaviors/Normal BMI&BP** had 1.5 times (1.2-1.8) the odds of HDP versus **Healthy Behaviors/Normal BMI&BP**. Individuals in the two highest HDP risk profiles were more likely to be unmarried, Non-Hispanic Black, have public insurance, and report high periconceptual stress.

Conclusions: We characterized distinct CV risk profiles in early pregnancy and identified combinations of behavioral and clinical risk factors most associated with HDP. The two high risk profiles suggest avenues for multifactorial, personalized interventions on modifiable behaviors to mitigate HDP risk.

Gynecological health

Evaluating Measurement Error in the Relationship Between Uterine Fibroids and Atherosclerotic Cardiovascular Disease Julia DiTosto*, Sunni Mumford, Jennifer Lewey, Jarcy Zee, Anuja Dokras, Kyle Busse, Snigdha Alur-Gupta, Stefanie Hinkle, Enrique Schisterman, Ellen Caniglia,

Preliminary claims data suggest uterine fibroids, a common gynecologic condition, increase the risk of atherosclerotic cardiovascular disease (ASCVD), though measurement error may affect risk estimates.

Females aged 18-50 with fibroids (N=450,177), age-matched to 5 females with gynecologic claims in the same month, were identified in Optum's de-identified Clinformatics® Data Mart Database (CDM) (2000-2022). Pooled logistic regression models estimated Crude and Adjusted 1, 3, 5, and 10-year risk ratios (RR) and 95% confidence intervals (CI) for fibroids on ASCVD, weighted for baseline confounding, incident fibroid diagnoses in controls, and Optum CDM® disenrollment. Probabilistic bias analyses (1,000,000 simulations) addressed measurement error for misclassification of exposure (fibroids) and a confounder (obesity) using beta distributions for sensitivity and specificity, assuming non-differential misclassification. Multiple bias modeling sequentially adjusted for biases in reverse order of occurrence and accounted for random error. Multiple bias modeling adjusted sequentially for biases, with the median RR and 95% simulation intervals (SIs) reported. Bias-adjusted RRs were divided by the Adjusted-to-Crude RR ratio to account for measured confounding.

The Adjusted RRs before probabilistic bias analyses ranged from 2.46 (1-year) to 1.81 (10-years). Adjusting for exposure misclassification shifted results away from the null (1-year RR: 3.27, 95% SI 3.00, 3.69), while obesity misclassification shifted results toward the null (1-year RR: 1.98, 95% SI 1.85, 2.23). The multiple bias-adjusted RR attenuated the observed RR (1-year RR: 2.17, 95% CI 2.04, 2.42). Analysis results were consistent across timeframes for the 3, 5, and 10-year RRs.

Probabilistic bias analyses for measurement error attenuated results but confirmed the robust relationship between uterine fibroids and ASCVD.

Women’s health

Maternal cardiovascular disease mortality following cesarean delivery: A population based cohort study Yeneabeba Tilahun Sima*, Liv Grimstvedt Kvalvik, Aditi Singh, Rolv Skjaerven,

Background
Cesarean delivery (CD) rates are rising globally. While existing research focuses on the effects of CD on women’s cardiovascular disease (CVD) mortality after individual births, its broader impact across a woman’s entire reproductive history remains underexplored.

Methods
This prospective cohort study analyzed data from the Medical Birth Registry of Norway and the Norwegian Cause of Death Registry, including women who gave their first birth between 1967 and 2014. The exposure variables were mode of delivery (CD/ vaginal delivery (VD)) for the first and second births, and parity (one/ two or more births). The outcome was maternal CVD mortality before age 70. Cox regression models were used to analyze data, reporting hazard ratios (HR) with 95% confidence intervals (CIs), adjusted for maternal age, education, year of delivery, and pregnancy complications.

Results
A total of 1,033,188 women were included in the study, with 83% having two or more births. The prevalence of CD was 18% among women with a single birth, while 12% of multiparous women had a CD at their first birth. Compared to women with two consecutive VDs, the risk of dying from CVD was highest among women with one child and a CD (HR: 1.75, 95% CI: 1.65–1.86), followed by women with one child and a VD (HR: 1.41, 95% CI: 1.37–1.45). Among women with two or more births, CVD mortality was slightly elevated for those with a CD in their second birth and for those with recurrent CDs, whereas a CD at the first birth followed by a VD did not increase the risk.

Conclusion

Our findings show variations in CVD mortality among women with CD, indicating factors beyond the procedure may play a role in the increased risk. This highlights the need to evaluate CD across a woman’s reproductive history to better understand its broader implications on CVD mortality.

Women’s health

Reproductive history and brain imaging: The CARDIA study Emily Harville*, Ilya Nasrallah, Kristine Yaffe, Cora Lewis, Erica Gunderson,

Background: Almost two-thirds of people living with Alzheimer’s are women. Reproductive history is associated with later-life cardiometabolic health, and, while cardiometabolic health is associated with dementia and Alzheimer’s, the literature linking reproductive history and cognitive health is limited and inconclusive.

Methods: Data from 471 women (mean age=54.0, range 43-61) participating in the CARDIA Brain MRI study were used. MRIs measures of brain volume, white matter fractional anisotropy, and cerebral brain perfusion were generated. Reproductive history was self-reported. Gravidity, parity, and history of pregnancy complications (miscarriage, gestational diabetes, low birthweight, preterm birth) were examined as predictors of total brain volume and volume of regions of interest relative to memory or identified in previous studies, using linear models with control for age, total cranial volume, and gravidity (when relevant).

Results: Total volume and total white matter volume were highest in those who were gravidity/parity 1 or 3+. Ventricle volume was highest in nulligravida/nullipara. There were no associations between gravidity/parity and any other volume measure. History of preterm birth, low birthweight, miscarriage, or gestational diabetes were not associated with any of the volumetric measures. Higher gravidity and parity were generally associated with higher cerebral blood flow, and gravid women also seemed to have greater fractional anisotropy and lower trace in white matter. Other reproductive history measures were not associated with these outcomes.

Conclusions: Gravidity and parity were associated with some global brain measures at midlife, generally in the direction of better brain health in parous compared to nulliparous women. History of pregnancy complications were not associated with these outcomes, perhaps due to low power or to lack of a genuine association.

Women’s health

Gestational hypertension and risk of cardiovascular disease development in women who have had infants with congenital heart defects in Arkansas, 1997 to 2011. Emine Bircan*, Mohammed Orloff, Laura Hays, Jun Ying, Hari Eswaran, Wendy N Nembhard,

Preeclampsia and gestational hypertension are common hypertensive pregnancy disorders, with preeclampsia a recognized risk factor for future cardiovascular disease (CVD). Similarly, adverse pregnancy outcomes, including carrying a fetus with congenital heart defects (CHDs), are linked to an increased CVD risk later in life. Women with pregnancies complicated by both CHDs and gestational hypertension may face an elevated CVD risk. This study examines the association between gestational hypertension and CVD risk in women with CHD-affected pregnancies.

Data from the Arkansas site of the National Birth Defects Prevention Study (1997–2011) included 1,423 women with a CHD-affected pregnancy, 1,426 women with a non-CHD birth defect pregnancy, and 1,020 women who delivered infants without structural defects. Maternal sociodemographics, pregnancy complications, and periconceptional risk factors were obtained via telephone interviews. These data were linked to the 2000–2022 Arkansas All-Payers Claims Database to identify subsequent CVD cases. CVD, classified using ICD-9/10-CM codes, included ischemic heart disease, cerebrovascular disease, hypertension, and other heart conditions. Cox proportional hazards models were used to estimate unadjusted and adjusted hazard ratios (HRs) with 95% confidence intervals (CIs) based on time to the first CVD event.

Among women with gestational hypertension (n=521), CHD was found no impact on the CVD risk. Among women without gestational hypertension (n=3,348), those with CHD-affected pregnancies had a hazard ratio (HR) of any CVD of 1.4 (95% CI of HR: 1.1–2.1) against women with pregnancies without structural birth defects.

In women with gestational hypertension, CHD-affected pregnancies were not associated with an increased risk of CVD, likely due to the dominant influence of gestational hypertension as a primary risk factor, potentially obscuring additional effects.

Birth defects

Periconceptional neighborhood-level socioeconomic position and early childhood mortality among infants born with critical congenital heart defects Sanjida Mowla*, Nina Forestieri, Matthew Oster, Elizabeth Ailes, Shannon Evans, Sarah Fisher, Charles Shumate, Paul Romitti, Suzan Carmichael, Philip Lupo, Anne Marie Darling, Wendy Nembhard, Jeanette Stingone, Thomas Luben, Chantel Martin, Andrew Olshan, Tania Desrosiers, National Birth Defects Prevention Study ,

Neighborhood-level sociodemographic factors are associated with survival among infants with birth defects, but their impact into early childhood is unclear. We examined the role of neighborhood-level socioeconomic position (nSEP) on 5-year survival among children with critical congenital heart defects (CCHDs). Children with a CCHD in the National Birth Defects Prevention Study (1999-2011) were included. CCHDs were grouped by severity into univentricular heart defects (UVHDs; most severe) and biventricular heart defects (BVHDs). We linked data to vital records to ascertain mortality up to 5 years of age. The Neighborhood Deprivation Index (NDI), based on the 2000 US Census and the American Community Survey, defined census-tract nSEP (low, moderate, high deprivation) using self-reported maternal periconceptional address. Kaplan-Meier survival curves and log-rank tests assessed survival by CCHD severity and NDI overall. Cox proportional hazards models calculated hazard ratios (HRs) and 95% confidence intervals, adjusting for birth period and maternal factors including education, employment, household income, race/ethnicity, and periconceptional residential moves. Five-year survival was 88.0% among 2,089 children with CCHDs, 63.2% among 353 children with UVHDs, and 93.9% among 1,649 children with BVHDs. Survival differed by NDI among all CCHDs and BVHDs ($p<0.001$) but not UVHDs. For all CCHDs and BVHDs, survival was lowest among children of mothers living in high NDI areas (85.2% and 91.1%). Adjusted HRs showed high periconceptional NDI (vs. low) was associated with decreased survival, though non-significant, for all CCHDs (1.28 [0.90, 1.82]) and BVHDs (1.29 [0.75, 2.22]), while estimates for UVHDs were closer to the null (1.07 [0.65, 1.77]). Children with CCHDs born to mothers in high deprivation areas had reduced 5-year survival, with this pattern less pronounced for severe defects. Further research is needed to identify key neighborhood factors impacting survival.

Birth defects

Descriptive and risk factor analysis of total anomalous pulmonary venous return: The National Birth Defects Prevention Study, 1997-2011 and the Birth Defects Study to Evaluate Pregnancy Exposures, 2014-2021 Jada Scott*, Eva Williford, Meredith Howley, Sarah Fisher, Jeffrey Dayton, Angela Lin, Matthew Oster, Tania Desrosiers, Lorenzo Botto,

Total anomalous pulmonary venous return (TAPVR) is a rare heart defect in which all four pulmonary veins do not connect to the left atrium, instead draining into the right atrium or directly into other venous systems. Given the few identified risk factors, we sought to explore risk factors for TAPVR using data from the National Birth Defects Prevention Study (NBDPS; 1997-2011) and the Birth Defects Study to Evaluate Pregnancy Exposures (BD-STEPS; 2014-2021), two multi-site, population-based, case-control studies of birth defects. We identified established risk factors from the literature and used logistic regression to calculate crude and adjusted odds ratios (aOR) and 95% confidence intervals for the risk of TAPVR associated with maternal demographics, health and pregnancy history, and medication use. In an exploratory analysis among NBDPS cases and controls, we used random forest, a data mining procedure, to compare TAPVR cases and non-malformed controls for 163 variables (including dietary, demographic, and behavioral) to identify new potential risk factors. In the primary analysis including 393 TAPVR cases and 13,914 controls, we observed elevated associations between TAPVR and maternal age at delivery < 20 (aOR 2.00; 1.30-3.06) and 20-24 (aOR 1.62; 1.19-2.22) vs. 25-29 years; and having one or more previous livebirths (vs. none; aOR 1.69; 1.25-2.27). Maternal race/ethnicity was associated with TAPVR such that non-Hispanic Black individuals had the lowest risk (aOR 0.55; 0.35-0.85) while individuals of other maternal race/ethnicity categories had the highest risk (aOR 1.72; 1.19-2.44) compared to non-Hispanic White individuals. In addition to these, the random forest also identified maternal fish consumption as an important predictor. Our findings confirmed previously observed associations between TAPVR and younger maternal age, previous livebirths, and maternal race/ethnicity. Maternal fish consumption is a novel association that deserves further investigation.

Birth defects

Prevalence of Congenital Heart Defects Among Children with and Without Administratively Reported Fetal Alcohol Spectrum Disorders, 2016-2022 Amanda Dorsey*, Karrie Finn Downing, Nicholas Deputy, Mary Kate Weber, Penelope Howards,

Background: Fetal alcohol spectrum disorders (FASDs) are lifelong conditions caused by prenatal alcohol exposure. Some congenital heart defects (CHD) are alcohol-related, but their co-occurring prevalence among children with FASDs is not well understood. We used two administrative databases to explore CHD prevalence among U.S. children with and without FASD diagnoses.

Methods: We used 2016-2022 Merative™ MarketScan® Multi-State Medicaid and Commercial data limited to children ≤17 years old with ≥1 year of continuous enrollment and complete reporting of mental health and substance use services during at least part of their enrollment. International Classification of Disease codes identified FASD and severe and non-severe CHD diagnoses. Prevalence of CHD was calculated by FASD status. After matching on enrollment length, and age and year at the start of enrollment, we then calculated log-binomial prevalence ratios (PRs) and 95% confidence intervals (CIs) comparing CHD prevalence among those with versus without FASDs, overall and by age group. In the Medicaid data, we also stratified by demographic characteristics and analyzed severe and non-severe CHD diagnoses separately.

Results: Among 8,620,831 children in the Medicaid data, 5.2% with FASDs and 1.0% without FASDs had CHD (matched cohort PR = 3.1 [CI: 2.6, 3.8]). Among 10,462,292 children in the Commercial data, 5.6% with FASDs and 0.2% without FASDs had CHD (matched cohort PR= 7.1 [CI: 4.1, 12.6]). When further limiting to children 0-3 years old at enrollment, PRs were 2.7 (CI: 2.2, 3.2) in the Medicaid and 6.7 (CI: 3.8, 11.9) in the Commercial data. In the Medicaid data, PRs were similar when stratified by sex, race, and CHD severity.

Conclusion: CHD was more common among children with FASDs than without FASDs both in Medicaid and Commercial data, even when matching on enrollment length, age, and year. Increased provider awareness about CHD as a potential FASD comorbidity may improve timely diagnosis and CHD care.

Birth defects

The antenatal detection of severe congenital anomalies in the third trimester of pregnancy: a population-based registry study Isabelle Monier*, Nathalie Lelong, Alexandra Benachi, Jean-Marie Jouannic, Sara Hachem, Babak Khoshnood, Jennifer Zeitlin, Jennifer Zeitlin

Objective: A third trimester ultrasound is recommended for all pregnant individuals in France. To estimate the proportion of severe congenital anomalies detected for the first time during the third trimester and to assess its effects on perinatal outcomes.

Methods: Data come from the Paris Registry of Congenital Malformations in 2001-2021 including all live births and stillbirths ≥22 weeks of gestation and terminations of pregnancy for fetal anomaly (TOPFA) at any gestation with congenital anomalies during pregnancy and until hospital discharge. The registry covers ~25,000 deliveries/year. Based on a EUROCAT study, 9 severe anomalies were included: anencephaly, encephalocele, spina bifida, hydrocephalus, limb reduction defect, bilateral renal agenesis, diaphragmatic hernia, omphalocele, gastroschisis and severe congenital heart defects. We estimated the proportion of these anomalies detected during the third trimester by organ system. We also described perinatal outcomes and factors associated with third-trimester detection including socioeconomic factors and timing of prenatal care initiation.

Results: Out of 16,512 singleton malformed fetuses, 3,253 (19.7%) had severe congenital anomalies and 11.6% were detected for the first time during the third trimester. Third trimester detection rates ranged from 17.9% for severe anomalies of nervous system, 13.2% for diaphragmatic hernia and 10.3% severe congenital heart defects to 2.1% for severe congenital anomalies of the kidney and urinary tract and 1.6% for severe abdominal well defects. Perinatal and infant mortality for these cases was 23.1% (13.2% late TOPFA, 1.6% stillbirths, 8.3% infant mortality); these percentage were 19.3% (11.2%, 0.6% and 7.5%, respectively) when excluding genetic anomalies.

Conclusion: A substantial proportion of severe congenital anomalies are detected with a third trimester ultrasound. This should be considered in policies aimed at optimal prenatal detection of congenital anomalies.

Child health and development

Exploring Patterns in Age at Menarche: The Effect of Are Deprivation Index Through a Lifecourse Perspective in the Bogalusa Heart Study Eunsun Gill*, Katherine P. Theall, Dohyeong Kim, Soo Jung Kang, Courtney J. Thomas, Jessica A. Broach, Lydia A. Bazzano, Camilo Fernandez, Emily W. Harville,

Introduction: Early and late menarche are related to adverse health outcomes. Area Deprivation Index (ADI), a measure of neighborhood socioeconomic conditions, may influence age at menarche (AAM), but its lifecourse evidence remains limited. We explored the influence of evolving ADI on AAM and moderating effect of obesity in the Bogalusa Heart Study (BHS).

Methods: A secondary longitudinal study (1974–2004) was conducted among 1,821 girls from the BHS, with up to six follow-up visits. ADI, based on 16 block-group census variables via factor analysis, was measured repeatedly and divided into quintiles (Q; Q1=least deprived; Q5=most). AAM was self-reported in year and month. Weibull accelerated failure time model analyzed the association between ADI and AAM, adjusting for race, exam year, maternal and paternal education, maternal smoking, systolic blood pressure, glucose, total cholesterol, and obesity with multiple imputation.

Results: Data from 1,821 girls (55.7% White; 44.3% Black; AAM: 7.1–16.8 years; median follow-up=4.2 years) showed a J-shaped association between ADI and AAM, with lower and higher deprivation linked to earlier menarche compared to the middle. Compared to girls in Q4, those in Q2 (Time ratio [TR]=0.97, 95% CI: 0.95–0.98), as well as those in Q1 and Q5 (TR=0.98; 95% CI: 0.97–0.99; TR=0.98; 95% CI: 0.96–1.00) exhibited earlier menarche, while the Q3 had a smaller effect (TR=0.99; 95% CI: 0.96–1.00, overall p=0.004). BMI modified the association, with significant effects among normal weight (Q2 vs. Q4: TR=0.97) and overweight (Q1 vs. Q4: TR=0.94), but not among obese (Q5 vs. Q4: TR=1.06; p for interaction: 0.045)

Conclusions: Both low and high neighborhood deprivation were associated with earlier menarche, a reproductive milestone linked to cardiometabolic and reproductive health risks. Environmental deprivation may shape long-term health trajectories via its influence on AAM.

Keywords: area deprivation index; menarche; neighborhood deprivation

Child health and development

Exploring Maternal Thyroid Hormones as Mediators in the Association Between Prenatal Exposure to Endocrine Disrupting Chemicals and Child Cognition in the SELMA study

Marlene Stratmann*, Chris Gennings, Carl-Gustaf Bornehag,

Background: Endocrine disrupting chemicals (EDCs) are associated with both thyroid hormones and neurodevelopment, yet, no previous studies have looked at the potential mediating effect of thyroid hormones on the association between EDC exposure and neurodevelopment.

Aims: To explore if the association between prenatal exposure to EDCs and child neurodevelopment is mediated by thyroid hormones, stratified by child sex and gestational age at the time of sample collection.

Methods: For 572 mother-child pairs from the Swedish Environmental Longitudinal, Mother and child, Asthma and allergy (SELMA) study, a mixture of 26 EDCs (phenols, phthalates,per- and polyfluoroalkyl substances and persistent chlorinated compounds) and thyroid hormones, as measured by a ratio between thyroxine (T4) and triiodothyronine (T3), were measured in maternal serum and urine. Neurodevelopment of the child was assessed with the Wechsler Intelligence Scale for Children. We used a weighted quantile sum regression index to divide the mixture into deciles and create one exposure variable. Linear regression analyses were adjusted for relevant confounders and stratified by sex, as well as early or late gestational age at time of sampling (<10 or ≥ 10 weeks gestation). Mediation was measured using the causal framework and the product method. Chemicals of concerns were identified in those that show a potential mediating effect by thyroid hormones.

Results: For boys (≥ 10 weeks gestation) the average causal mediation effect of the T4/T3 ratio was -0.32 (95% CI -0.82, 0.02), corresponding to a non-significant mediated proportion of 20%. For boys (<10 weeks gestation) and girls (<10 and ≥ 10 weeks of gestation), no mediation could be detected. Chemicals of concern for boys (≥ 10 weeks gestation) are PBA, BPF, TCP, MCiNP, MEP and MBzP.

Conclusion: These results point towards a potentially important mediating effect by TT4/TT3 ratio in the mother and a lower IQ in boys (≥ 10 weeks gestation).

Child health and development

Is toddlerhood the key? Toddler diet quality and its association with childhood cardiovascular and body composition metrics Xuanxuan Zhu*, Diane L. Putnick, Priscilla K. Clayton, Tzu-Chun Lin, Edwina Yeung,

Background. Cardiovascular and body composition metrics are key indicators for chronic diseases like cardiovascular and neurodegenerative disease. Although widely studied in adolescents and adults, the association of early-life diet quality on later cardiovascular and body composition metrics remains understudied. This study evaluates the association of toddlers' diet quality with such metrics in middle childhood.

Methods. In the Upstate KIDS cohort, mothers reported toddlers' daily intake of specific foods like dairy, fruit, vegetables, meat, and sweetened beverages along with weekly frequencies of fast food, breakfast intake and multivitamin use at 30/36 months of age. The Youth Healthy Eating Index (YHEI), calculated based on this information, measured diet quality on a scale of 0-80, with higher scores indicating better quality. Cardiovascular measures (e.g., blood pressure, pulse wave velocity, and heart rate) and body composition (e.g., fat, bone mineral content, fat-free mass) were measured at clinic visits at 9-10 years. Mixed effects models estimated associations, adjusting for maternal race/ethnicity, age at delivery, WIC participation, private insurance, pre-pregnancy BMI, etc.

Results. The mean YHEI score at 30/36 months of age was 44.287.96 among 440 toddlers included in the study (53.48% male, 87.47% non-Hispanic white). Toddler YHEI scores were not associated with any cardiovascular measures. YHEI scores were associated with lower levels of fat (adjusted β=-0.10, 95% CI: -0.18, -0.02), bone mineral content (adjusted β=-0.01, 95% CI: -0.02, -0.003), and fat mass index (adjusted β=-0.05, 95% CI: -0.09, -0.01) in children averaging 9.4 years old.

Conclusion. Higher toddler diet quality is associated with lower fat accumulation in middle childhood, pointing to the importance of high-quality diet as early as toddlerhood. Future studies are warranted to explore the association between diet quality, specifically for certain nutrients, and body composition.

Child health and development

Characterizing postnatal trajectories of breast bud diameter in male and female infants using latent class mixed models Paige Tomer*, Shanshan Zhao, Natalie Shaw, Virginia Stallings, Andrea Kelly, Walter Rogan, David Umbach, Mandy Goldberg,

Background: Most infants are born with breast tissue that is expected to regress. The natural history of breast tissue across minipuberty, a period of sex-specific postnatal endocrine activity, has not been well-characterized. Our objective was to describe variation in sex-specific age trajectories of breast bud diameter across minipuberty.

Methods: We used data from 147 boys and 136 girls participating in the Infant Feeding and Early Development study, a longitudinal cohort of healthy, term infants enrolled during 2010-2013 from the Philadelphia area. Breast bud diameter was assessed via ultrasound within 72 hours of birth and every 4-8 weeks thereafter up to 24 weeks in boys and 32 weeks in girls. We log2-transformed the geometric mean of left and right breast bud diameters and applied latent class linear mixed models to cluster age trajectories of breast bud diameter in boys and girls separately. We selected the number of latent classes using several statistical metrics and visual inspection. We used the LCMM package in R 4.4.1 for model fitting.

Results: We identified two trajectory groups in boys: one with a larger diameter at birth that declined with age (n=115, 78%), the other with a smaller initial diameter that remained stable (n=32, 22%); the groups had similar diameters by age 24 weeks. Three trajectory groups were identified in girls: stable (n=75, 55%), decreasing (n=42, 31%), and increasing (n=19, 14%). Compared to the stable group, the decreasing group had a similar diameter at birth that decreased with age, whereas the increasing group started with a smaller diameter but increased to the size of the stable group by age 20 weeks.

Conclusions: We identified distinct patterns of breast bud diameter in male and female infants; patterns that may reflect differences in endocrine activity during minipuberty. Most infant girls maintained or experienced growth in breast bud tissue, while only a minority exhibited the expected regression by 32 weeks of age.

Child health and development

Pre- and postnatal maternal psychosocial factors and children's cardiovascular health: A systematic review Adrija Chakrabarty*, Farah Qureshi, Michelle Zorine, Alexa Freedman,

Background: A growing body of work finds that psychosocial factors in early life can predispose cardiovascular disease (CVD) in adulthood. Emerging evidence further suggests that some psychosocial factors may influence health as early as fetal life, with maternal exposures conferring risks to children through intergenerational processes.

Objective(s): The aim of this systematic review is to synthesize observational research investigating associations between maternal psychosocial exposures during and after pregnancy and children's cardiovascular-related health outcomes across the life course.

Methods: Studies were identified through searches in the PubMed, Embase, and PsycINFO databases. Maternal psychosocial exposures included intrapersonal factors (e.g., depression) and interpersonal factors (e.g., social support) assessed in pregnancy and up to 1 year postpartum. Health outcomes of interest included clinical indicators of CVD as well as biological risk factors (e.g., blood pressure, body mass index) in children.

Results: A total of 45 studies were included in our review. With respect to exposure timing, 34 evaluated factors in the prenatal period, 20 studied factors postnatally, and 9 assessed exposures in both periods. Considering exposure type, most studies evaluated adverse exposures while very few assessed protective factors (42 vs. 4 studies). Also, more studies focused on intrapersonal factors than interpersonal (38 vs. 12 studies). Findings were generally heterogeneous across exposure type. Prenatal and interpersonal factors were more likely to be associated with child cardiovascular outcomes than postnatal and intrapersonal factors. Among studies of protective factors, none found associations with child cardiovascular outcomes.

Conclusions: Results from studies of mostly adverse psychosocial exposures found children of mothers who had negative experiences in pregnancy – particularly interpersonal experiences – tended to have worse cardiovascular outcomes.

Child health and development

Pediatric neurodevelopmental outcomes following forceps, vacuum, and second stage cesarean delivery Maya Rajasingham*, Sarka Lisonkova, Neda Razaz, Giulia Muraca,

Background

While operative vaginal delivery is recommended as a safe alternative to second stage cesarean delivery (SSCD), the long-term neurodevelopmental outcomes following these deliveries are understudied. We aimed to examine the association between mode of delivery in the second stage of labour and attention deficit hyperactivity disorder (ADHD), autism spectrum disorder (ASD), and intellectual disability (ID).

Methods

We conducted a population-based, retrospective cohort study using health administrative databases to identify singletons born at term gestation without malformation, following forceps, vacuum, sequential instrument use, or SSCD in British Columbia, Canada (2000-2019). The follow-up period was from one year of age to diagnosis, death, emigration, or study completion. Separate Cox proportional hazards models were used to assess the association between mode of delivery and each neurodevelopmental outcome, adjusting for maternal demographic and clinical factors. Mediation analyses assessed the contribution of severe birth trauma and birth asphyxia to the association between mode of delivery and ADHD, ASD, and ID.

Results

Among 92,393 children, the rates of ADHD, ASD, and ID were 6.6, 1.8 and 0.3 per 1,000 person-years, respectively. Compared with SSCD, children born after sequential instrument had a 13% higher ADHD rate (7.8 vs. 6.5 per 1,000 person-years; adjusted hazard ratio [aHR] 1.13, 95% confidence interval [CI] 1.00-1.28) and children born with vacuum had a 48% higher ID rate (0.3 vs. 0.2 per 1,000 person-years; aHR 1.48, 95% CI 1.08-2.03). Neither birth trauma, nor asphyxia, mediated the relationship between mode of delivery and ADHD and ID, respectively. No association between mode of delivery and ASD was found.

Conclusion

Compared with SSCD, sequential instrument use was associated with an increased risk of ADHD and vacuum was associated with an increased risk of ID. Further investigations of these associations are warranted.

Child health and development

Differential Blood Lead Level Screening Practices Across Demographic and Provider Groups Aaliyah Alston*, Callie Brown, Elizabeth Jensen,

The American Academy of Pediatrics recommends screening for lead exposure at the 12 and 24 months well child check (WCC) visit using blood-based lead screening. Medicaid guidelines require screening for blood lead at 12 and 24 months. In a retrospective cohort design study using data from a large health system with a diverse patient population, we assessed for disproportionate blood lead level (BLL) screening practices. We included all WCC encounters within 2 months before or after age 12 (n=7,231) and 24 months (n=14,956) and assessed whether BLL screening had been conducted within 90 days prior to or following the WCC encounter (encounters from July 2015 – February 2024). Screening was compared according to patient race, ethnicity, insurance status, provider specialty, and clinic type. Differences in proportion screened were assessed using the chi square test. We observed significant differences in the proportion of children screened according to race and ethnicity with Black or African American race (68.3% at 12 months, 66.0% at 24 months) and Other (73.9% at 12 months, 72.4% at 24 months) having the highest screening rates, and American Indian or Alaska Native (51.4% at 12 months, 36.6% at 24 months) having the lowest ($p<0.01$). Hispanic or Latino were more likely to be screened as compared to non-Hispanic or Latino ($p<0.01$ for both and at both 12 and 24 months of age). Children with public insurance were more likely to be screened (12 months: 69.5%, 24 months: 70.5%) compared to those with private insurance (12 months: 65.4%, 24 months: 50.8%) ($p <0.01$ for both 12 and 24 months). Children were more likely to be screened in a Pediatric clinic, as compared to a Family Medicine clinic (12 months: 71.9% vs 44.6%, $p <0.01$, 24 months: 66.1% vs 31.8%, $p<0.01$). This study illustrates potential disproportionate BLL screening practices across patient and provider factors, and opportunities to improve adherence to screening recommendations through provider education.

Child health and development

New Opportunities for Epidemiological Research through NIH's HEALthy Brain and Child Development (HBCD) Study Darci Johnson*, Kathy Cole, Jennifer Zink, Christopher Sarampote,

Children exposed to risk factors such as prenatal substance exposure and early life adverse events are at risk for atypical neurological trajectories. The HEALthy Brain and Child Development (HBCD) Study, the largest long-term study of early brain and child development in the United States, aims to identify the range of variability in neurodevelopmental trajectories and investigate how risk and resilience factors may impact these trajectories. HBCD is a multi-site, longitudinal cohort study sponsored by over a dozen National Institutes of Health (NIH) Institutes, Centers, and Offices and will enroll 7,200 families during pregnancy and follow them throughout childhood. The final cohort will include 50% of participants from the general pregnant population. Another 25% of the cohort will be enriched with participants who have used substances prenatally (including 12% who us opioids). The final 25% of participants will be matched to the substance using participants based on sociodemographic factors, but without prenatal substance use. Measures for parents include pregnancy information, and biospecimens (blood, urine, nails, and saliva), and medical and family history, while measures for infants and children include anthropometrics, medical and family history, biospecimens (urine, saliva, and stool) and social, emotional, and cognitive function. Children will also receive EEGs and MRIs from early infancy to assess brain activity and growth. The first data release is scheduled for early 2025, and will include pregnancy and early infant measures on over 1,600 pregnancies and 600 infants. Data will be available publicly via the NIH Brain Development Cohorts (NBDC) Data Sharing Platform, consistent with an open-science framework, promoting perinatal and pediatric research. Knowledge gained from the HBCD Study will help inform critical perinatal and early-childhood policies and interventions.

Child health and development

Association of neighborhood vulnerability with timing of puberty in Project Viva: a prospective pre-birth cohort study Sabrina A Karim*, Sheryl L Rifas-Shiman, Allison J Wu, Li Yi, Marie-France Hivert, Emily Oken, Izzuddin M Aris,

Background: Earlier pubertal onset is linked to higher chronic disease risk in adulthood. While various factors can affect pubertal onset, the role of early-life neighborhood vulnerability is understudied. We examined associations of neighborhood vulnerability in pregnancy and early childhood with timing of puberty in Project Viva, a US pre-birth cohort.

Methods: We linked geocoded residential addresses in pregnancy and early childhood (mean 3.2y, SD=0.4) to census tract-level Social Vulnerability Index (SVI), a relative measurement of neighborhood disadvantage, categorized into quintiles from very low (<20th%ile) to very high (≥80th) SVI. Outcomes include age at peak height velocity (APHV), age at menarche in females, parent-reported pubertal development score (PDS), and child-reported sexual maturity rating (SMR). We evaluated sex-specific associations of SVI with pubertal outcomes using linear regression for APHV and menarche, and parametric survival for PDS and SMR models. We adjusted for maternal variables (education, smoking, household income, age at menarche, pre-pregnancy BMI) and corrected for clustering by census tract.

Results: In female children (n=1,032), very high SVI (vs. very low) in pregnancy was associated with earlier menarche (β=-0.30y; 95%CI -0.71, 0.11) and moderate SVI in early childhood was associated with earlier menarche (β=-0.47y; 95%CI -0.79, -0.16). There was no strong association between SVI and APHV, or time to attain PDS>1 or SMR>1 in females. In male children (n=1,096), very high SVI in pregnancy was associated with earlier APHV (β=-0.28y; 95%CI -0.57, 0.017) and high SVI in pregnancy with earlier time to attain PDS>1 (HR=1.06; 95%CI 1.02, 1.10). Very high SVI in early childhood was linked to earlier time to attain SMR>1 in males only (HR=1.03, 95%CI 1.00, 1.05).

Conclusion: Addressing disparate contexts within vulnerable neighborhoods in early life may be a potential avenue to achieve equitable pubertal outcomes in children.

Child health and development

Breastfeeding and parental leave duration among mothers with infants born above and below 34 weeks Brianna Keefe-Oates*, K. Griffin Gorsky, Louisa H. Smith,

Preterm infants have lower rates of breastfeeding due to physiological and environmental (e.g., hospitalization) factors yet breastmilk is particularly beneficial to this group. For employed mothers overall, a shorter parental leave is associated with decreased breastfeeding, but little is known about this relationship among those with preterm infants.

We aimed to describe differences in breastfeeding, its association with leave duration, and barriers to breastfeeding, by gestational age at birth. Using data from the Pregnancy Risk Assessment and Monitoring System, we examined these relationships among mothers returning to work, comparing experiences of mothers with infants born <34 weeks gestation (who may may benefit most from breastmilk), to mothers with infants born ≥34 weeks. We assessed associations between leave duration >8 weeks with ever breastfeeding and breastfeeding ≥12 weeks, with logistic regression models to control for confounders and assess effect modification of having a baby born <34 weeks.

In unadjusted analyses, mothers with babies born <34 weeks had similar proportions of ever breastfeeding compared to other mothers (93% vs. 92%), but lower proportions of breastfeeding at 12 weeks (60% vs. 67%). The <34-week group was more likely to never breastfeed because it was too hard (37% vs. 15%) but less likely to never breastfeed due to a return to work (12% vs. 37%). In adjusted models, leave duration of 8+ weeks was associated with ever breastfeeding (odds ratio: 1.4, 95% confidence interval: 1.2-1.6), and breastfeeding at 12 weeks (1.3, 1.1-1.4), with no significant interaction with gestational age at birth.

Longer leave is associated with breastfeeding regardless of preterm status. Many respondents with infants born <34 weeks (31%) said they stopped breastfeeding for a reason not provided on the survey. More research is needed to understand barriers for this group and determine how to create conducive environments for breastfeeding.

Child health and development

Placental DNA methylation of Stress-linked Genes Predicts Infant Stress Response Nafisa Nawal Islam*, Nafisa Nawal Islam, Susan Murphy, Qiuyi Wu, Xing Qiu, Jessica Brunner, Richard Miller, Emily Barrett, Thomas O'Connor,

Background: Clinical and epidemiological evidence links prenatal maternal distress-associated epigenetic programming to multiple developmental outcomes, including altered stress response, and mental health outcomes in children, with lasting effects into adolescence and beyond. In our population-based ECHO-UPSIDE study, we test whether placental DNA methylation (DNAm) of stress-linked candidate genes (FKBP5, NR3C1, and HSD11B2) programs stress regulation in infants during the first year of life.

Methods: Pregnant individuals at not greater than normal medical risk were recruited at <14 weeks gestation in Rochester, New York (N=326). Using bisulfite pyrosequencing, we examined DNAm changes in the selected CpG sites in the key stress-linked candidate genes from placenta tissue collected at birth. Infant stress measures were measured at 6 and 12 months via salivary cortisol before and after a stressor. We used linear regression analysis to examine the relationship between placental DNAm and two cortisol measures (reactivity and total output), adjusting for covariates (infant sex, gestational age, maternal pre-pregnancy BMI, race/ethnicity, delivery mode).

Results: Replicating and extending prior work, hypermethylation in the placental NR3C1 gene was reliably associated with total cortisol output and stress reactivity, indexed by the area under the curve with respect to ground (AUCg) and increase (or change) (AUCi) in 12-months old. However, associations between DNAm and cortisol measures at 6 months of age were null.

Conclusions: Our data indicate that methylation of the placental NR3C1 gene is linked to hypothalamic-pituitary-adrenal (HPA) axis function at 12 months of age, a core component of fetal-placental biology that may have lasting effects on health and behavior. Further analyses will consider possible timing effects of changes in maternal distress across pregnancy and associated epigenetic changes on child stress response, and explore differences by child sex.

Disability status

Prenatal healthcare utilization and experiences by disability status: Pregnancy Risk Assessment Monitoring System (PRAMS) 2018-2020 Hedda Boege*, Cheryl Stein, Lauren Berube, Rachel Ryan, Andrea Deierlein,

Objective: To examine associations between disability and prenatal healthcare utilization and experiences among persons with a live birth in the United States.

Methods: We used 2018–2020 Pregnancy Risk Assessment Monitoring System (PRAMS) data from 24 sites that included the Washington Group Short Set of Questions on Functioning. Extent of disability was categorized as no difficulty, some difficulty, and a lot of difficulty based on participants' responses to difficulty functioning in six core domains: seeing, hearing, mobility, cognition, self-care, and communicating. Participants reported receipt of any prenatal care (yes/no). Among participants with prenatal care, they reported receipt of specific health-related questions during prenatal care visits (yes/no). Multivariable Poisson regression with robust standard errors calculated adjusted prevalence ratios (aPR) and 95% confidence intervals (CI) controlling for age, education, marital status, parity, and insurance.

Results: Of 42,513 participants, 59.0%, 34.3%, and 6.7% reported no, some, and a lot of difficulty, respectively. Participants with a lot of difficulty were nearly three times more likely to report no prenatal care (aPR=2.82, 95% CI: 1.58–5.03) than those with no difficulty; there was no difference in receipt of prenatal care for participants with some difficulty (aPR=1.05, 95% CI: 0.72–1.53). Compared to those with no difficulty, participants with some and a lot of difficulty were more likely to report that a healthcare provider did not ask them about gestational weight gain; alcohol consumption; emotional or physical abuse; feeling down or depressed; drug use; HIV testing; breastfeeding intentions; or plans to use birth control postpartum (aPR ranged from 1.11 to 1.47).

Conclusion: Findings highlight areas for prenatal healthcare intervention, including education and training for providers, to reduce perinatal health disparities among persons with disabilities.

Disability status

Maternal and neonatal outcomes among Hispanic birthing persons in California with different types of physical disabilities Willi Horner-Johnson*, Bharti Garg, Jonathan Snowden, Aaron Caughey, Jaime Slaughter-Acey, Anne Valentine, Ilhom Akobirshoev, Monika Mitra,

Background: Prior research has shown higher risk of adverse perinatal outcomes for Hispanics with physical disabilities, but little is known about variations within this heterogeneous population. We examined differences by type of physical disability to identify subgroups at greatest risk.

Methods: We analyzed linked hospital discharge and vital records data from California, 2008-2020. We included singletons with gestational age 23-42 weeks born to Hispanics. We compared birthing people with diagnosis codes for major injuries (n=234), congenital anomalies (n=1225), musculoskeletal disorders (n=5519), or nervous system disorders (n=2754) to those with no disabilities. Modified Poisson regressions assessed associations of physical disability type with outcomes (cesarean delivery, severe maternal morbidity [SMM], preterm birth, low birthweight, small for gestational age [SGA], and neonatal intensive care unit [NICU] admission) while adjusting for sociodemographic and clinical confounders.

Results: Each physical disability group differed significantly from those with no disabilities on most outcomes. Adjusted relative risk (aRR) of SMM was largest for those with major injuries (aRR=3.21; 95% CI: 1.82, 5.67) or nervous system disorders (aRR=2.93; 95% CI: 2.47, 3.47). Risk of cesarean delivery, preterm birth, and low birthweight were highest for those with injuries or congenital anomalies. Risk of NICU admission was higher in neonates of patients with congenital anomalies (aRR=1.19; 95% CI: 1.05-1.35) or nervous system disorders (aRR=1.14; 1.05-1.24), whereas the association was not significant for musculoskeletal disorders (aRR=1.06; 0.99-1.13) or major injuries (aRR=1.06; 0.79-1.41).

Conclusions: Among Hispanic birthing people with physical disabilities, those with congenital anomalies, injuries, or nervous system disorders may be more likely to experience adverse outcomes. However, all people with physical disabilities had greater risk than those with no disabilities.

Disability status

Patient disability status and stigmatizing language documented in hospital birth admission notes Sarah Harkins*, Ismael Hulchafo, Jihye Scroggins, Maxim Topaz, Veronica Barcelona,

Patients with disabilities have higher rates of adverse perinatal health outcomes compared to patients without disabilities. Stigmatizing language documented in clinical notes may contribute to perinatal health disparities by conveying clinician biases that perpetuate disability discrimination and result in differential care. In this cross-sectional study, we used natural language processing (NLP) to identify stigmatizing language in the electronic health record (EHR) for patients over 20 weeks' gestation admitted for labor and birth at two hospitals in the Northeast United States between 2017-2019 (N=19,094). Disability status was the primary exposure measured using ICD-10 codes for physical, sensory, or intellectual and developmental disabilities in the EHR. Study outcomes were stigmatizing language categories (marginalized identities, difficult patient, and unilateral decisions) defined by prior qualitative analyses. We identified stigmatizing language from free-text clinical notes using a fine-tuned, transformer-based NLP model (ClinicalBert) and applied multivariable logistic regression to examine associations. Approximately 3% of patients had a disability. Compared to patients without disabilities, patients with disabilities were more likely to have any stigmatizing language documented (adjusted odds ratio [aOR]=1.75, 95% confidence interval [CI]=1.47, 2.09). Patients with disabilities were also more likely to have stigmatizing language documented in the difficult patient (aOR=1.96, 95% CI=1.65, 2.33) and unilateral decisions categories (aOR=1.27, 95% CI=1.06, 1.53). There were no significant differences for the marginalized identities category (aOR=1.19, 95% CI=0.87, 1.62). Documentation of stigmatizing language in hospital birth admission notes differed by patient disability status. These findings support the need for equitable documentation practices and interventions to mitigate clinician bias to improve perinatal health for patients with disabilities.

Environment/climate change

Wildfire smoke and fetal loss in California Dana Goin*, Marianthi-Anna Kioumourtzoglou, Tarik Benmarhnia, Rachel Morello-Frosch, Michael Leung, Amy Padula,

Background: Wildfires in California have been increasing in number and severity over the last several decades, and there is mounting evidence that they adversely affect reproductive health. However, there is a gap in the literature about the relationship between wildfire smoke and fetal loss.

Objective: To evaluate the effect of increased wildfire smoke during pregnancy on the rate of fetal loss using live birth-identified conceptions (LBIC).

Methods: We used California birth records from 2017-2019 and linked pregnancies to Census places using geocoded addresses. We estimated the week of conception for each birth and calculated the weekly count of LBICs for each Census place. We then linked this cohort of LBICs (identified by each Census place and week) to wildfire particulate matter (PM2.5) data for 40 weeks of pregnancy. We used a quasi-Poisson regression model with distributed lag terms to estimate the rate ratio of LBICs. We also estimated the fetal loss count difference (CD) using G-computation with nonparametric bootstrap for inference. We included weekly non-wildfire PM2.5 and temperature as confounders.

Results: For a given week of pregnancy, wildfire PM2.5 had a right-skewed distribution with a mean (SD) of 5.2 (33.2) µg/m3 Approximately 30% of the Census place-weeks had non-zero wildfire PM2.5 levels. We observed a reduction in livebirths and thus an increase in fetal loss associated with higher wildfire PM2.5 exposure. We identified three gestational periods for which associations were the strongest: weeks 1-3, 26-28, and 37-40 of pregnancy. We observed the largest effect estimates during gestational week 1 (RR=0.996, 95% CI 0.992, 1.000 ;and CD = 0.15, 95% CI 0.11, 0.22) and week 40 (RR = 0.995, 95% CI 0.991, 0.999; and CD=0.20, 95% CI 0.13, 0.31) associated with a 5 µg/m3 increase in wildfire PM2.5.

Conclusions: Wildfire smoke exposure, especially during gestational weeks 1-3, 26-28, and 37-40, is associated with an increased risk for fetal loss.

Environment/climate change

Urinary Concentrations of Early and Mid-Pregnancy Parabens and Gestational Diabetes: A Nested Case-Control Study within the PETALS Cohort Alicia Peterson*, Alicia Peterson, Yeyi Zhu, Juanran Feng, Monique Hedderson, Stacey Alexeeff, Assiamira Ferrara,

Parabens are widely used preservatives with endocrine-disrupting properties, but their role in glucose metabolism during pregnancy is unclear. This study examines prospective associations between urinary concentrations of four parabens in early and mid-pregnancy and gestational diabetes (GDM).

A matched case-control study nested within a diverse longitudinal pregnancy cohort (PETALS) with universal GDM screening matched GDM cases to two controls (111 cases; 222 controls). Urine samples collected 2015-2017 in early (14±2.3 weeks) and mid-pregnancy (20±2.4 weeks) were analyzed for paraben concentrations with mass spectrometry. Area-under-the-time-concentration-curve (AUC) assessed cumulative exposure. Conditional logistic regression models evaluated associations between paraben concentrations and GDM, adjusting for covariates. We a priori examined effect modification by Asians/Pacific Islanders (A/PI) race/ethnicity due to the case-control matching and GDM prevalence highest among A/PI.

Participants were 31±5 years and 40% A/PI, 33% Hispanic, 14% White and 9% Black. Methylparaben and propylparaben had >94% detection, while ethylparaben and butylparaben ranged from 22%-51%. Paraben exposure was not associated with GDM overall. Among A/PI, higher methylparaben concentrations exhibited higher odds of GDM: early-pregnancy OR 1.14 per IQR (95% CI: 0.89,1.47) and AUC 1.08 (0.89,1.30) compared to non-A/PI (early-pregnancy 0.81 [0.61,1.07] and AUC 0.70 [0.43,1.12]; Pinteraction=0.02 and 0.03, respectively). A/PI mid-pregnancy ethylparaben exposure (detectable vs non-detectable) was linked to higher GDM odds (2.06 [0.87,4.87] vs. non-A/PI 0.54 [0.21,1.40]; Pinteraction=0.046).

Although overall paraben exposure was not associated with GDM, interactions by A/PI race/ethnicity suggested potential increased odds of GDM related to methylparaben and ethylparaben exposure. Future studies should explore paraben exposure in diverse populations.

Environment/climate change

Impact of exposure to air pollution mixtures on sperm epigenetic age Carrie Nobles*, Timothy Canty, Pauline Mendola, Lindsey Russo, Kaniz Rabeya, Karen Schliep, Akanksha Singh, Allison Ring, Rachael Hemmert, Neil Perkins, Matthew Peterson, Erica Johnstone, Richard Pilsner,

Introduction: While air pollution is associated with decrements in semen quality, underlying mechanisms and impacts on fertility remain less understood. Air pollution-induced redox stress may disrupt the blood-testes barrier similar to aging, leading to changes in sperm DNA methylation associated with poorer semen quality and longer time to pregnancy.

Methods: We evaluated air pollution and sperm epigenetic age (SEA), the acceleration or deceleration of age-related changes in sperm DNA methylation, among 1220 men in the FAZST Trial (2013-2018) from Utah, residing predominately along the Wasatch Front. Residential exposure to nitrogen dioxide (NO2), ozone (O3), sulfur dioxide (SO2), and fine particulate matter (PM2.5) and its constituents was estimated by the Community Multiscale Air Quality Model fused with monitor data and averaged across susceptible windows of spermatogenesis. Single- and multipollutant models and mixture models (quantile-based g-computation) adjusted for participant characteristics. Secondary analyses adjusted for season and temperature.

Results: We observed accelerated SEA with higher O3, higher NO2, and lower SO2 (e.g. MD 0.292 [95% CI 0.030, 0.553], MD 0.192 [95% CI -0.049, 0.434], and MD -0.052 [95% CI -0.118, 0.015] years per IQR in multipollutant models during mitosis, respectively), with no clear associations for total PM2.5. In mixture models breaking down PM2.5 constituents, the air pollution mixture was associated with accelerated SEA (e.g. MD 0.211 [95% CI 0.003, 0.420] years per quantile increase during meiosis), with O3, NO2, sulfates, and nitrates contributing most strongly to positive weights (e.g. 32.8%, 30.8%, 19.6%, and 15.2%, respectively, during meiosis). Findings were similar adjusting for season and temperature.

Discussion: Exposure to air pollution during cell division stages of spermatogenesis along the Wasatch Front was associated with accelerated SEA, with NO2 and its secondary pollutants the strongest contributors.

Environment/climate change

County-level radon and offspring wheezing and asthma Yijia Zhang*, Elizabeth F Minsky, Meghan Angley, Shai Bejerano, Brian J Smith, Erin M Bell, Diane L Putnick, Edwina H Yeung, Ka Kahe,

Background The health risks of radon exposure beyond lung cancer are understudied. Maternal radon exposure, along with tobacco smoke, may be connected to offspring respiratory health.

Methods Upstate KIDS, a population-based prospective cohort consists of more than 5000 pregnancies from 57 counties in New York (excluding NYC). County-level radon exposure was measured by Lawrence Berkeley National Laboratory (LBL), categorized into ≥ 2 and <2 picocuries per liter (pCi/L), and linked to participants. Data on child wheeze was obtained from questionnaires completed around 4, 8, 12, 18, 24, 30, and 36 months of age and “persistent wheeze” defined as “yes” on two or more questionnaires. Asthma was defined as any maternal report of physician-diagnosed asthma or prescription of asthma medication or inhaler and assessed at two time points: up to 36 months and 7–9 years. Multivariable mixed-effects logistic regression was used to calculate adjusted odds ratios (aOR) and 95% confidence intervals (CI).

Results Maternal age averaged 30.7 years, and most were non-Hispanic White (80.0%). The median radon concentration is 1.29 pCi/L. Largely due to attrition, sample sizes for the analysis of wheezing, asthma up to 36 months, and asthma at 7–9 years were 5,683; 3,714; and 1,963, respectively. Radon was positively but not significantly associated with persistent wheeze (aOR = 1.25, 95% CI: 0.36–4.36). When stratifying by maternal smoking, the association remained in the same direction among never-smokers, but not smokers. The associations were also non-significant for both asthma outcomes.

Conclusions The ecological nature of the exposure assessment, limited variability in radon levels, and insufficient statistical power may have contributed to the observed non-significant associations between radon exposure and child asthma. However, these findings do not rule out a potential association. Future studies employing individual-level radon measurements and larger sample sizes are needed.

Environment/climate change

Placental tissue metals levels, gross placental morphometry and placental efficiency in a modern birth cohort in Brooklyn NY. Carolyn Salafia*, Rachel Coyte, Theresa Girardi, Dawn Misra,

In a community-based cohort with mandated universal placental examination 2010-2016, we assessed metals and placental measures in a random subsample of 1000 male and 1000 female term births. Formalin fixed paraffin embedded villous tissue was punched from their archived tissue blocks and extracted for 10 metals (aluminum (Al), cadmium (Cd), chromium (Cr), copper (Cu), iron (Fe), manganese (Mn), lead (Pb), selenium (Se), strontium (Sr), zinc (Zn)) with PerkinElmer DRC II ICP-MS. Three placental morphometry measures were considered: placental weight (grams); chorionic plate (fetal side of placenta) area (centimeters(cm)^2); placental disk thickness (average, cm) and variability (standard deviation, cm) were extracted from the surgical pathology report. Placental efficiency is represented as the proportionality between the size of the baby and the size of their nutrient supply organ, computed as the birthweight:placental weight ratio. Spearman's correlations (P) were computed between metal levels and measures of placental morphometry and efficiency. Given the multiple comparisons, we used a p-value cut point of 0.01. Placental weight was positively correlated with Mn (P=0.065), Pb (P=0.060), and Sr (P=0.092) and negatively with Zn (P=-0.061). Chorionic plate area was positively correlated with Mn (P=0.069) and Sr (P=0.092). Disk thickness was positively associated with Cu (P=0.081), Mn (P=0.088), Pb (P=0.079) and Sr (P=0.171). Thickness variability was negatively associated with Cr (P= -1.01), Cu (P = -1.00), Mn (P = -1.49), Pb (P = -0.013), and Sr (P = -0.314,). Fetoplacental weight ratio was positively corelated with Zn (P=0.075), and negatively with Mn (P = -0.013), Pb (P = -0.058), and Sr (P = -0.099). Sex-specific effects appeared to occur for a few of the metals (Cd, Cu, Sr, Zn) with selected placental outcomes. Metals were associated with placental size and efficiency in this term birth cohort with universal placental examination but with variability. These exposures may reverberate into health later in life.

Environment/climate change

Residential radon exposure and birth weight Meghan Angley*, Yijia Zhang, Uma Reddy, Ka Kahe,

Objective: Radon is the major source of background radiation exposure in the U.S. Only one other study has examined residential radon and birth weight, despite the fact that ionizing radiation exposure during pregnancy is known to cause fetal growth restriction.

Methods: We used data from the Nulliparous Pregnancy Outcomes Study: Monitoring Mothers-To-Be (nuMoM2b), a multi-center prospective cohort study of women. Estimates of residential radon exposure in pCi/L at the county level were developed by the Lawrence Berkeley National Laboratory and linked to participants by maternal address. Birth weight (BW) was collected via chart abstraction. BW was converted to z-scores for gestational age and infant sex using the INTERGROWTH-21st standards. Linear mixed models included random effects for study center and adjusted for maternal age, BMI, smoking, education, percent of the federal poverty level, season of conception and average PM2.5 levels during pregnancy. We also examined interaction by maternal smoking status in the 3 months prior to pregnancy.

Results: We excluded participants whose pregnancies ended prior to 20 weeks gestation and implausible birth weight values. Of the 6,278 women with non-missing data included in the analysis, the median county-level radon concentration was 1.6 pCi/L (IQR: 0.9-2.8). After adjustment for confounders, radon was not associated with BW z-scores (-0.02 [95% CI: -0.05, 0.02]). However, radon was associated with lower BW z-scores among women who smoked ≥20 cigarettes/day (-0.16 [95% CI: -0.33, 0.01] and those who smoked 0 – <20 cigarettes/day (-0.06 [95% CI: -0.13, 0.01]), but not those who did not smoke prior to pregnancy (0.00 [95% CI: -0.04, 0.03]).

Conclusions: Radon was found to be associated with lower birthweight among women who smoked prior to pregnancy. Next steps include obtaining radon measurements at a more granular level and examining how residential radon exposure affects trajectories of fetal growth.

Environment/climate change

Critical gestational windows of heat exposure associated with preterm birth: A nationwide observational study Shuhei Terada*, Hisaaki Nishimura, Naoyuki Miyasaka, Nobutoshi Nawa, Takeo Fujiwara,

Background: Emerging evidence indicates a short-term association between high ambient temperature and preterm birth (PTB). However, it remains unclear whether certain gestational weeks are particularly susceptible to heat exposure. This study aimed to identify critical gestational windows associated with an increased risk of PTB.

Methods: We used data from the Japan Perinatal Registry Network database, which includes singleton live births born between January 1, 2016, and December 31, 2020, to identify PTB cases (22–36 weeks of gestation). Heat exposure was defined as weekly mean ambient temperatures above the 90th percentile during the warm season (May–September) for each prefecture, and was compared with mild temperatures (below the 90th percentile). The association between heat and preterm birth was evaluated by gestational week, restricting to the warm season, while adjusting for confounders. Bayesian meta-regression was applied to identify critical gestational windows of heat exposure. Additionally, PTB cases were stratified into three categories: extremely preterm (<28 weeks), very preterm (28–31 weeks), and moderate or late preterm (32–36 weeks).

Results: Among 986,910 registered singleton live births, 113,235 PTB cases were identified. Positive and significant associations were found during the second trimester, specifically for gestational weeks 16 to 21. The strongest association was at gestational week 18 (odds ratio [OR] 1.12, 95% CI 1.09, 1.15). Similar patterns were observed in stratified analyses for extremely preterm, very preterm, and moderate or late preterm.

Conclusion: Our findings suggest an association between heat exposure during the second trimester of pregnancy and an increased risk of PTB.

Environment/climate change

Prenatal exposure to nitrogen dioxide and neurodevelopmental delays in children among Medicaid recipients: a national cohort study Wanyu Huang*, Xinye Qiu, Krista Huybrechts, Sonia Hernandez-Diaz, Matthew Shupler, Hayon Michelle Choi, Michael Leung, Yaguang Wei, Joel Schwartz, Antonella Zanobetti, Marc Weisskopf, Stefania Papatheodorou,

Objective: Prenatal period is critical for brain formation and children's neurodevelopment, yet few epidemiologic studies have examined the effects of prenatal exposure to gaseous pollutants, compared to PM2.5, particularly in underprivileged populations. Nitrogen dioxide (NO2) is one of the gaseous pollutants, also deemed as a traffic emission tracer.
Methods: We assigned ambient NO2 concentrations at the residential zip code of mother-infant pairs in a longitudinal cohort from the Medicaid Analytic eXtract (MAX). Identification of autism spectrum disorder (ASD) and attention-deficit/hyperactivity disorder (ADHD) were based on ICD-9 codes. Weekly prenatal NO2 levels from spatiotemporal models were calculated over the gestational period. We applied distributed lag models (DLM) coupled with stratified Cox models (by county, birth year, race), adjusting for temperature, relative humidity, maternal age, behavioral risk factors (e.g. smoking, alcohol, drug use), SES (area-level), as well as season of delivery.
Results: We included 1,616,197 births from 2001 to 2014. We observed a positive association between a 10 ppb increase of prenatal NO2 exposure and the hazard of ASD across lag0 to 38 weeks during the gestational period, with a cumulative HR of 1.08 (95% CI: 1.01, 1.15) as the overall effect. We observed no association between NO2 exposure and ADHD (cumulative HR: 0.97, 95% CI: 0.94 – 1.00) (Fig. 1).
Conclusion: Among the Medicaid population, prenatal exposure to NO2 was associated with increased risk of ASD but not ADHD. This is the first and largest study providing evidence on gaseous pollutants and neurodevelopment delays, among the US socioeconomically disadvantaged population.

Environment/climate change

Associations between exposure to organophosphate esters and pro-inflammatory cytokines in the UPSIDE pregnancy cohort Carolyn Kinkade*, Thomas O'Connor, Xing Qiu, Jessica Brunner, Richard Miller, Kurunthachalam Kannan, Kristin Scheible, Emily Barrett, Stephanie Shiau,

Organophosphate esters (OPEs) are prevalent in consumer products, including furniture, electronics, and textiles, leading to ubiquitous environmental presence and human exposure. In humans, OPE exposure is associated with adverse immune outcomes including reduced vaccine response, allergy, asthma, and inflammation; but less understood in the context of pregnancy. The objective of this study was to examine associations between OPE exposure and cytokines during pregnancy.

Serum and urine samples were collected during the second trimester from participants in the UPSIDE pregnancy study (Rochester, NY, n=265). Detection and quantification of nine OPEs in urine was performed using solid phase extraction and liquid chromatography tandem mass spectrometry For the current analysis we focused on three OPE metabolites detectable in >90% of samples: bis(1,3-dichloro-2-propyl) phosphate (BDCPP; median 1.06 ng/ml), di-n-butyl phosphate (DBUP/DIBP, median 0.17 ng/ml), and bis-(2-propylheptyl)-phthalate (DPHP, 0.97 ng/ml). From serum samples, cytokines (IL-1β, IL-6, IL-2, IL-8, TNF-α, IFN-γ; pg/ml) were assayed using Milliplex Human High Sensitivity T Cell Magnetic Bead Panel and C-reactive protein (CRP; ng/ml) was measured by ELISA. Multivariable linear models examined specific gravity adjusted, log transformed OPE concentrations in relation to log2 transformed cytokines, adjusting for covariates.

In adjusted models, BDCPP was positively associated with IL-6 (β(95% CI): 0.07 pg/ml (0.01, 0.13) and IL-8 (β(95% CI): 0.08 pg/ml (0.01, 0.14). DBUP/DIBP was inversely related to IL-8 (β(95% CI): -0.15 pg/ml (-0.29, -0.01). No associations with DPHP or the other cytokines were observed.

OPE exposure was associated with alterations in pro-inflammatory cytokines in pregnant individuals. Given that altered immune markers in pregnancy are linked to increased risk of preterm birth and small for gestational age (SGA), this finding is important because it could inform intervention efforts. Future work will include analysis of OPEs as chemical mixtures in relation to immune marker latent profiles.

Fertility and fecundity

Preconception dietary patterns in association with live birth and early pregnancy loss: a couples-based approach Kyle Busse*, Stefanie Hinkle, Bhaavna Peri, Derartu Ahmed, Enrique Schisterman, Ellen Caniglia, Naria Sealy, James Mills, Erica Johnstone, Pauline Mendola, Ginny Ryan, Matthew Peterson, Jim Hotaling, Leah Lipsky, Sunni Mumford,

Infertility affects 1 in 6 U.S. couples. In up to 30% of cases, the cause is unexplained. Our objective was to estimate associations of live birth and early pregnancy loss (<20 weeks' gestation) with preconception diet patterns of female and male partners seeking fertility treatment.

Data came from 2370 male participants and female partners in the Folic Acid and Zinc Supplementation Trial. Scores for 4 diet patterns were estimated at baseline, during preconception. These included 2 diet quality indices (Healthy Eating Index-2015 [HEI] and Mediterranean Diet) and 2 fertility-specific patterns (Pro-Fertility and Fertility Diet) associated with greater female fertility in previous studies. Log-binomial models estimated crude and adjusted risk ratios (RR) per 1 standard deviation (SD) increase in diet pattern score, separately for each partner and combined (sum of partners' scores). In pregnancy loss models, inverse probability weights accounted for selecting on pregnant couples (n=1054). RRs were also estimated by infertility diagnosis (any vs. none) and median time trying to conceive (<19.5 vs. ≥19.5 months). Multiple imputation was used for missingness.

Of 2370 couples, 821 had a live birth and 287 had an early loss. A 1 SD higher HEI score was suggestive of greater likelihood of live birth for females, males, and combined (adjusted RR=1.05 [95% CI 0.99-1.11] for all three), as was a 1 SD higher Mediterranean Diet score (Females: 1.05 [0.99-1.12]; Males: 1.05 [0.99-1.11]; Combined: 1.06 [1.00, 1.12]). For females, a higher Fertility Diet score was also associated with greater likelihood of live birth (1.05 [0.99-1.12]). HEI was positively associated with the likelihood of live birth among females without an infertility diagnosis (1.07 [1.01-1.15]) and females trying for <19.5 months (1.08 [1.00-1.16]). No associations were observed for early pregnancy loss.

For couples seeking fertility treatment, higher diet quality may improve the likelihood of a live birth.

Fertility and fecundity

Hair relaxer use and anti-mullerian hormone concentrations in a North American cohort

Lauren A. Wise*, Ruth J. Geller, Dmitrii Krivorotko, Geralyn Lambert-Messerlian, Amelia K. Wesselink,

Introduction: Hair relaxers (chemical straighteners) are used by millions of North Americans, particularly people of color. Relaxer use has been associated with an increased risk of hormone-dependent reproductive outcomes, including early puberty, subfertility, and uterine fibroids. The effect of hair relaxer use on concentrations of anti-mullerian hormone (AMH), a biomarker of ovarian reserve, has not been studied.

Methods: We analyzed baseline data from Pregnancy Study Online (PRESTO), a preconception cohort study of North American pregnancy planners (2015-2024). We restricted analyses to 838 females aged 21-44 years without a diagnosis of PCOS. Participants reported on lifetime hair relaxer use including age at first use, frequency and duration of use, and number of burns. We assayed AMH concentrations using picoAMH (Ansh labs). We used modified Poisson regression to estimate prevalence ratios (PR) and 95% CIs for associations between hair relaxer use and low AMH (<1.8 ng/ml to denote low AMH corresponding to <20% without evidence of polycystic ovarian morphology), adjusted for age, race, ethnicity, BMI, smoking, and history of subfertility.

Results: Overall, 2% of participants were current users and 10% were former users of hair relaxers; 15% of ever users began at ages <10 years. Median AMH was 5.5 ng/ml. Compared with never use of hair relaxers, PRs for current and former use were 2.01 (95% CI: 0.74-5.44) and 0.85 (95% CI: 0.54-1.34), respectively. Among ever users, prevalence of low AMH was highest for those with the greatest frequencies and durations of use (≥3 times/year vs. never use: PR=1.52, 95% CI: 0.65-3.56; ≥10 years vs. never use: PR=1.47, 95% CI: 0.46-4.67; frequency ≥3 times/year + duration ≥5 years vs. never use: PR=1.28, 95% CI: 0.51-3.18), though precision was limited. No appreciable associations were seen with age at first use or number of burns.

Conclusion: Some measures of hair relaxer use were associated with a higher prevalence of low AMH.

Fertility and fecundity

Validation of Administrative Healthcare Records for Women with Infertility Rachel Myrer*, Leslie Farland, Anna Pollack, Joseph Stanford, Matthew Peterson, Christy Porucznik, Karen Schliep,

Background: Infertility affects approximately 12.1% of women and 9.4% of men in the U.S. Administrative healthcare records offer a cost-effective means to study infertility in large populations over time. However, the validity of these records to identify infertility cases remains underexplored, particularly in the U.S. where insurance coverage for fertility treatments is limited.

Objective: Validate infertility diagnoses in administrative healthcare records using self-reported time to pregnancy (TTP) as the primary reference method.

Methods: We utilized data from the Endometriosis, Natural History, Diagnosis, and Outcomes (ENDO) study (2007–2009), focusing on participants from the Utah site linked to the Utah Population Database (UPDB). The primary reference method (gold standard) for infertility was defined as having a self-reported TTP of 12 months or more. Women were infertile in the test method if they had an ICD-9 infertility diagnosis prior to or within one month of starting the ENDO study. Diagnostic accuracy was assessed using sensitivity, specificity, positive predictive value, negative predictive value, and Cohen’s kappa.

Results: The study included 505 women. The test method (UPDB) showed 77.0% agreement with the primary reference method (TTP). Sensitivity was low (15.5%), but specificity was high (98.1%). Positive predictive value was 74.0% and negative predictive value was 77.2%. Cohen’s kappa indicated slight agreement (k=0.18, CI 0.10-0.26).

Conclusions: Diagnostic codes in administrative records exhibit high specificity but low sensitivity for identifying infertility. This suggests that while these codes are reliable for confirming non-infertility, they miss many true infertility cases. Future research should address sociodemographic disparities in infertility diagnoses and incorporate additional data sources such as prescriptions, procedures, male partner records, and clinical notes to improve sensitivity and reduce false negatives.

Fetal loss/stillbirth/infant mortality

Stress in pregnancy and the risk of stillbirth by race/ethnicity among infants with birth defects Meredith Howley*, Jada Scott, Eva Williford, Uma Reddy, Eleni Papadopoulos, Suzan Carmichael, Chris Cunniff, A.J. Agopian, Elizabeth Ailes, Kristen Van Buren, Nahed ElHassan, Wendy Nembhard, Sarah Fisher, Jada Scott

Non-Hispanic (NH) Black women have increased risk of stillbirth (SB). Among those affected by SB, NH Black women report more stress during pregnancy than women of other races/ethnicities. While stress during pregnancy is associated with SB, it is unknown if stress is linked to SB among infants with birth defects. We used data from two multi-site studies of birth defects, the National Birth Defects Prevention Study (2006-2011) and the Birth Defects Study To Evaluate Pregnancy exposureS (2014-2021), to evaluate the association between stress and SB by maternal race/ethnicity among infants with a birth defect. Participants self-reported stress they experienced three months before conception through the first trimester related to their relationships, legal/financial problems, abuse/violence, illnesses/injuries and death of family/friend. We restricted our analysis to birth defect cases with no known genetic cause, which included 221 SB and 8,156 livebirths (LB). We used log binomial models to estimate the adjusted relative risk (RR) and 95% confidence interval (CI) for the association between high vs. low stress (3-5 vs. 0-2 stressors) and SB, stratified by maternal race/ethnicity and adjusted for maternal age. We assessed effect measure modification by maternal race/ethnicity on the additive and multiplicative scales. High stress was reported by 21.3% of SB and 18.7% of LB. NH Black women more frequently reported high

stress (34.3% SB; 26.5% LB) than Hispanic (17.5% SB; 19.0% LB) or NH White women (20.6% SB, 16.3% LB). Compared to NH White women with low stress, we observed increased risk of SB among NH Black women with low stress (RR 1.9, 95% CI 1.2–2.9), Hispanic women with low stress (RR: 1.4, 95% CI: 1.0-1.9), and NH Black women with high stress (RR 2.6, 95% CI 1.4–4.7). Our results suggest effect modification between stress and SB by race/ethnicity on both the additive and multiplicative scales.

Fetal loss/stillbirth/infant mortality

The impact of migraine and comorbidity on risk of neonatal outcomes: A retrospective cohort study in Ontario, Canada Melina Albanese*, Susan Bondy, Christine Lay, Manav Vyas, Zhiyin Li, Jun Guan, Hilary Brown,

Migraine is associated with adverse neonatal outcomes (ANO). We examined the separate and combined impacts of migraine and comorbidity on risks of perinatal mortality (stillbirth/neonatal mortality at <28 days), preterm birth (PTB), and small for gestational age (SGA). This population-based cohort study used health administrative data to identify singleton obstetrical deliveries in Ontario, Canada, 2007-2022. We compared ANO in females (1) with pre-pregnancy migraine and ≥1 comorbidities (termed, 'other chronic conditions (CC)'), (2) migraine only, (3) other CC only, and (4) neither migraine nor other CC (referent). Multivariable modified Poisson regression controlled for maternal age, parity, income quintile, immigration status, and fetal sex. We then tested for additive interaction between migraine and other CC by measuring relative excess risk due to interaction (RERI) and attributable proportion due to interaction (AP). Among n=1,075,266 births, 7.7% of mothers had both migraine and other CC, 3.7% migraine only, 43.1% other CC only, and 45.6% neither. Compared to the referent, risk of perinatal death was highest in those with migraine and other CC (adjusted relative risk (aRR) 1.46, 95%CI 1.24-1.72), followed by other CC only (1.24, 1.13-1.38), and migraine only (1.14, 0.89-1.47). Risk of PTB was highest in those with migraine and other CC (1.59, 1.55-1.63), followed by other CC only (1.32, 1.30-1.34), and migraine only (1.11, 1.07-1.16). Migraine and other CC were not associated with SGA. We found evidence of additive interaction between migraine and any CC for PTB (RERI 0.15, 95%CI 0.09-0.21; AP 9.6%, 95%CI 6.0-13.1%). None of the risk of perinatal death in those with both migraine and other CC was attributable to additive interaction. Migraine and related comorbidity may increase the risk of certain ANO, and the presence of both exposures may contribute to excess risk. Early identification of migraine and other CC and appropriate intervention may reduce risk.

Fetal loss/stillbirth/infant mortality

Incident SARS-CoV-2 infection and risk of miscarriage Emily Liu*, Nina Oberman, Lyndsay Avalos, Charles Quesenberry, Monique Hedderson,

SARS-CoV-2 infection during pregnancy has been associated with multiple adverse maternal and infant outcomes. However, it is unclear whether infection in early pregnancy affects risk of miscarriage.

In a cohort study of 94,953 singleton pregnancies at Kaiser Permanente Northern California between March 2020 through August 2023, we examined the association between incident SARS-CoV-2 infection in pregnancy and miscarriage, defined as fetal loss prior to 20 weeks gestation. Prenatal SARS-CoV-2 infection was defined by a positive polymerase chain reaction or rapid test for SARS-CoV-2 or a COVID-19 diagnosis. We used Cox proportional hazard models and treated SARS-CoV-2 infection as a time-varying exposure, with follow-up beginning at 2 weeks prior to the date of the last menstrual period through 20 weeks gestation and right censoring at the occurrence of a non-viable fetal outcome. We examined the SARS-CoV-2 infection by any infection and by variant based on infection date (i.e., Early, Delta, and Omicron variants). Models were adjusted for pregnancy onset year, vaccination status, age, race and ethnicity, parity, public insurance, pre-pregnancy body mass index, and pre-existing hypertension, diabetes, and anxiety.

There were 5812 (6.1%) pregnancies with incident SARS-CoV-2 infection. The mean gestational age at infection was 10.1 weeks (Standard Deviation: 6 weeks). Less than 0.5% of infected patients required supplemental oxygen or ventilation and 63% were vaccinated at the time of infection. SARS-CoV-2 infection was associated with an increased risk of miscarriage (Hazard Ratio [HR] 1.14; 95% Confidence Interval [CI]: 1.01, 1.29) compared to uninfected pregnancies. No heterogeneity of effect by COVID-19 variant was detected. Individuals in preconception or early pregnancy should take precautions to reduce the risk of SARS-CoV-2 infection.

Global health

Prevalence of Multiple Sexual Risk Behaviors and Association with Contraceptive Use Among 13–17-Year-Olds: A Cross-National Analysis of The Global Student Health Survey in 18 Caribbean Countries Shaheen Khan Kaplan*, Jonathan Lambo, Zalika Ruddock-Scott, Jonathan Lambo

Introduction: Early sexual experiences can be problematic for adolescents, particularly when linked to substance use. This study explores the prevalence of lifetime and multiple sexual partners, their associations with condom use, and the impact of adolescent risk behaviors on the relationship between multiple partners and inconsistent condom use.

Methods: We analyzed health outcomes among adolescents aged 13-17 across 18 Caribbean countries using data from the Global School-based Student Health Survey from 2007-2018. The analysis considered covariates such as age at first sexual intercourse, having sexual intercourse before age 14, and drug/alcohol use as indicators of sexual risk behaviors. Logistic regression models were used to analyze associations.

Results: The prevalence of multiple sexual partners increased across the 18 countries (Odds Ratio [OR 1.06, 95% confidence interval [CI]: 1.03-1.06, p trend <0.001), with males showing significantly higher prevalence than females. The odds of condom use slightly increased, with 65.9% of males and 59.5% of females (p=0.02) reporting condom use. Of the 18 countries, only Grenada and the Dominican Republic showed a significant increase in the odds of condom use among males with multiple sexual partners. The final model was adjusted for country and age at first sexual intercourse and stratified by alcohol use. The odds of condom use among adolescents having multiple sexual partners, compared to those without, was lower among adolescents who consumed alcohol (OR 0.97 95%CI=0.85-1.10) than those who did not (OR 1.19 95%CI=1.02-1.38).

Conclusions: Our study found a strong association between alcohol use and having multiple sexual partners along with a negative influence on condom use. There is an urgent need to educate young people about the impact of alcohol on partner choice and the increased risk of sexually transmitted infections through targeted interventions.

Global health

Prevalence and Patterns of Self-Care Contraceptive Method Use Among Women of Reproductive Age in Lagos, Nigeria from 2019-2022 Elikem Togo*, Sian Curtis, Ilene Speizer, Janine Barden-O'Fallon, Jess Edwards, Funmilola OlaOlorun,

Background: Challenges in delivery and access to sexual and reproductive health services in Nigeria related to COVID-19 led to concerns among public health practitioners about an increase in unintended pregnancies and unsafe abortions. Self-care contraceptive methods can mitigate effects of COVID-19, as they can be managed by users with low contact with health services, while still addressing users' reproductive health. However, the use of self-care contraceptive methods in Nigeria is unclear.

Objective: To assess the prevalence and patterns of self-care contraceptive methods use among a cohort of reproductive-age women in Lagos, Nigeria from 2019-2022.

Methods: The Performance Monitoring for Action Nigeria (Lagos) panel survey collected data on contraceptive use from women of reproductive age in Lagos, Nigeria from 2019-2022. We conducted a secondary analysis of these data and categorized contraceptive methods as self-care or non-self-care based on their form of administration and source. Contraceptive methods administered by health care providers were categorized as non-self-care. Contraceptive methods that are self-administered or primarily sourced from pharmacies were categorized as self-care (e.g. withdrawal, condoms, the pill). We calculated prevalence of self-care contraception use among all contraception users.

Results: Of the 4,621 participants, 39.1% were contraceptive users, and, of those, 74.8% used self-care contraceptive methods. Among users of self-care contraceptive methods, the most popular methods were male condoms (31.0%), withdrawal (27.9%) and the pill (8.0%). Among users of non-self-care contraceptive methods, most (47.4%) used implants.

Conclusion: There was a higher prevalence of use of self-care contraceptive methods than non-self-care contraceptive methods, yet overall contraceptive use remains low. More research is needed to identify strategies for targeted promotion of contraceptive use.

Gynecological health

Chronic Kidney Disease and Endometriosis: Findings from the Endometriosis, Natural History, Diagnosis, and Outcomes (ENDO) Study Karen Schliep*, Leslie Farland, Anna Pollack, Madeleine Paulsen, Jennifer Majersik, C. Matthew Peterson, Kathryn Rexrode, Michael Varner, Karen Schliep, Rachael Hemmert

Chronic inflammation and oxidative stress play a role in the pathogenesis of endometriosis as well as cardiovascular disease (CVD) and chronic kidney disease (CKD). Prior research suggests an increased risk of CVD among women with endometriosis. However, the relationship between endometriosis and CKD has not been well studied. Using biospecimens collected in the ENDO (2007–2009) Study cohort Utah site (n=377), we examined the cross-sectional association between endometriosis diagnosis, typology, staging and the prevalence of CKD. We enrolled menstruating women with no prior endometriosis diagnosis undergoing laparoscopy for any indication. Women completed questionnaires and provided a urine sample prior to surgery. Surgeons captured post-operative gynecologic diagnoses using ASRM gold-standard criteria for endometriosis. CKD was defined as albumin to creatinine ratio greater than 30 mg/g. We calculated adjusted prevalence risks (aPR) of endometriosis and CKD adjusting for baseline age, race/ethnicity, marital status, body mass index, parity, smoking, alcohol, and physical activity. 41% of participants were diagnosed with endometriosis. 7% of women had an albumin to creatinine ratio > 30mg/g. We found no association between an endometriosis diagnosis and CKD (aPR: 0.54 [95% CI: 0.20, 1.42]). A similar null, but positive, association with CKD was found for women who had minimal/mild (aPR: 1.83 [95% CI: 0.66, 5.07]) or moderate/severe (aPR: 1.92 [95% CI: 0.55, 6.65]) endometriosis, versus none. Regarding typology, women with ovarian endometrioma and deep infiltrating endometriosis had a 3.97 (95% CI 0.96, 16.45) higher adjusted prevalence of CKD compared to women with no endometriosis. No association was found between superficial endometriosis and CKD (aPR: 1.40 [95% CI: 0.46, 4.26]). While we observed no association between endometriosis overall and CKD, further investigation assessing association between more severe typologies of endometriosis and CKD is warranted.

Gynecological health

Mental health and gestational weight gain: A comparison between Brazilian cohorts
Audencio Victor Victor*, Audencio Victor Victor, Patricia Helen Rondo,

Introduction: The mental health of pregnant women is critical as it influences both maternal and neonatal outcomes. This study investigates the association between maternal mental health and gestational weight gain (GWG) in two Brazilian cohorts conducted in different periods.

Methods: The Jundiaí cohort (1997-2000) included 875 pregnant women, while the Araraquara cohort (2017-2024) evaluated mental health of 556 pregnant women from 2017 to 2019. Maternal mental health was assessed using the General Health Questionnaire (GHQ), the State-Trait Anxiety Inventory (STAI), and the Perceived Stress Scale (PSS) during the first, second, and third trimesters. GWG was categorized as adequate, insufficient, or excessive based on Institute of Medicine guidelines. Statistical analysis included bivariate tests (Kruskal-Wallis, chi-square, or Fisher's exact test) and multinomial ordinal logistic regression to evaluate associations.

Results: In the Jundiaí cohort, high stress levels in the first trimester were associated with lower odds of insufficient GWG (adjusted OR for second quartile: 0.36, 95% CI: 0.18-0.71). In the second trimester, high anxiety levels (TAI ≥ 40) were associated with higher odds of insufficient GWG (adjusted OR: 1.76, 95% CI: 1.12-2.76). In the third trimester, high stress levels (PSS fourth quartile) were associated with higher odds of insufficient GWG (adjusted OR: 1.72, 95% CI: 1.02-2.91). In the Araraquara cohort, no significant associations between mental health and GWG were found.

Conclusions: Our findings highlight the importance of incorporating psychosocial support in prenatal care to improve maternal and neonatal outcomes. Variations in socioeconomic and temporal contexts may influence the relationship between mental health and GWG. Future research should explore the underlying mechanisms and develop interventions tailored to different socioeconomic and temporal contexts.

Keywords: Maternal mental health, gestational weight gain, prenatal care, psychosocial support, Brazilian cohorts

Gynecological health

Combined oral contraceptive use and bacterial vaginosis in US premenopausal individuals

Shannon Taylor*, Mandy Hall Kwalton, Dawn Misra, Xiaoyu Liang, Kristen Upson,

Bacterial vaginosis (BV), a dysbiosis of the vaginal microbiome, is the most common cause of vaginal discharge. Estrogen supports lactic acid production which inhibits BV. Several studies of estrogen-containing combined oral contraception (COC) use have reported decreased BV prevalence. However, most studies relied on self-report rather than pharmaceutical data on COC use. In a cross-sectional study we evaluated the association between COC use and BV using data from National Health and Nutrition Examination Survey (NHANES) cycles 2001-2004. Current COC use was ascertained by self-report during the NHANES exam interview; data on COC brand (2001-2002 cycle) permitted ethinyl estradiol (EE) dose estimation. During the household interview, COC prescription names were collected; 90% showed the container to the NHANES interviewer. BV was classified by Nugent criteria (negative, intermediate, and positive) using a vaginal Gram stain. Among non-pregnant, premenopausal individuals ages 20-49 (unweighted n=1460), we conducted multinomial logistic regression to estimate the adjusted odds ratios (aOR) and 95% confidence intervals (CI), accounting for the complex survey sampling. Current COC use was reported by 18% of participants and was associated with 50% lower odds of intermediate (aOR 0.51, 95%CI: 0.34-0.77) and positive BV (aOR 0.49, 95%CI: 0.30-0.80). Using 2001-2002 data, most (72%) were users of COCs containing ≥35 mcg EE; small numbers limited EE dose evaluation in analyses. In contrast, using prescription medication data, only 7% of participants were current COC users and used COCs for median 2.5 years (interquartile range: 0.9-8.0 years). COC use was strongly associated with reduced odds of intermediate BV (aOR 0.33, 95%CI: 0.18-0.63) and positive BV (aOR 0.17, 95%CI: 0.07-0.43). Defining COC use using pharmaceutical data revealed stronger associations than using self-reported data. Further research on pharmaceutical aspects of COC use on BV prevalence is warranted.

Gynecological health

Hair relaxer use and menstrual disturbances in a North American cohort Ruth Geller*, Amelia Wesselink, Samantha Schildroth, Tamarra James-Todd, Nyia Noel, Donna Baird, Lauren Wise,

Background: Use of hair relaxers (chemical straighteners) is associated with higher risks of hormonally mediated conditions, but its relation to menstrual function during adulthood is unknown. We hypothesized that current and former use of hair relaxers would be associated with abnormal uterine bleeding (AUB) and dysmenorrhea.

Methods: We analyzed baseline data from Pregnancy Study Online (PRESTO), an internet-based preconception cohort study of North American pregnancy planners. We included 14,366 participants aged 21-39 years who enrolled during 2014-2024 and reported on their typical menstrual cycle characteristics during the past couple years when not using hormonal contraceptives. We queried details of lifetime hair relaxer use including age at first use, frequency per year, duration of use, number of burns, and the longest-used brand. We defined AUB as cycle length <24 or >38 days, flow ≥7 days, irregular cycles, and/or heavy flow (>30 pads/tampons per menses). We defined dysmenorrhea as severe cramps requiring medication and bed rest. We used log-binomial regression to estimate prevalence ratios (PR) and 95% CIs for the associations of hair relaxer use with AUB and dysmenorrhea, adjusted for sociodemographic and lifestyle confounders.

Results: Overall, 2% of participants were current users and 10% were former users of hair relaxers; 75% of ever users initiated use before age 20 years. The frequencies of AUB and dysmenorrhea were 31% and 8%, respectively. Compared with never use of hair relaxers, PRs for current use were 1.16 (95% CI 1.00-1.33) for AUB and 1.30 (95% CI 0.94-1.80) for dysmenorrhea; former use was not strongly associated with either outcome. Compared with never use of hair relaxers, participants who reported ever experiencing burns had a higher prevalence of dysmenorrhea (1-4 burns: PR=1.42, 95% CI 1.04-1.93; ≥5 burns: PR=1.46, 95% CI 1.00-2.13).

Conclusion: Some measures of hair relaxer use were positively associated with menstrual disturbances.

Gynecological health

Cruciferous vegetable intake and endometriosis outcomes Sable Fest*, Britton Trabert, Naoko Sasamoto, Kristen Upson, Holly Harris,

Endometriosis is a chronic gynecologic condition often associated with pelvic pain. Cruciferous vegetable intake has been observed to be positively associated with endometriosis diagnosis in one prior study, with pain suggested as a potential mechanism; however, research in this area is sparse. Our objective was to examine the impact of cruciferous vegetable intake on endometriosis diagnosis and acyclic pelvic pain. Among 18-49-year-old enrollees of an integrated healthcare system, we identified 283 incident, surgically confirmed endometriosis cases diagnosed between 1996-2001 who were compared to 660 age-matched controls. Participants completed an interview including a food frequency questionnaire. Logistic regression was used to estimate adjusted odds ratios (ORs) for the association of cruciferous vegetable intake (broccoli, cabbage, cauliflower, Brussels sprouts) with: 1) endometriosis diagnosis and 2) acyclic pelvic pain severity among cases. Compared to those consuming <1 serving/week, consuming >2 servings of cruciferous vegetables/week was associated with a higher risk of endometriosis diagnosis (OR 1.40, 95% CI 0.92-2.12, p-trend=0.09). Additionally, we observed a positive association between increasing cruciferous vegetable intake and acyclic pelvic pain severity among cases, with this association being strongest among individuals with non-ovarian endometriosis (>2 servings/week vs. <1: OR 6.25, 95% CI 1.77-22.07, p-trend=0.006). Our data suggest that individuals with non-ovarian endometriosis lesions may experience more severe pelvic pain symptoms with higher cruciferous vegetable intake. Given that dietary changes are a common self-management strategy among individuals with endometriosis, disentangling the heterogeneity in pain presentation by lesion location in the relation between dietary intake and endometriosis outcomes could help individualize dietary recommendations and improve health-related quality of life among people with endometriosis.

Health equity

Racial Disparities in Maternal Health and Birth Outcomes in Jefferson County, Kentucky 2017-2022 Felicia Pugh*, Seyed Karimi, PhD, Nick Peiper, PhD, Kira Taylor, Laura Schummers, ScD, Natalie DuPré, ScD,

Severe maternal morbidity (SMM) risk has tripled over the past 30 years. Adverse infant birth outcomes in the U.S. have also increased with substantial Black-White disparities, which interrelated causes may partially explain. This work compares the frequency of adverse maternal and infant birth outcomes by maternal race (Black vs White) in Jefferson County, Kentucky, 2017-2022. We used Jefferson County inpatient hospital delivery and birth certificate records of self-identified Black or White birthing parents. We estimated the incidence of each outcome: SMM, stillbirth, pre-term birth (PTB), and small for gestational age (SGA) with 95% confidence intervals (CI) overall and by race. We used logistic regression to estimate odds ratios (ORs) and 95%CIs, comparing the odds of each outcome by race (Black vs. White), adjusted for a set of explanatory variables and pandemic effects. Among 45,646 deliveries, SMM occurred in 8.0 per 1,000 deliveries (95%CI 8.0, 8.1) to White patients and 14.8 per 1,000 (95%CI 14.6, 15.1) to Black patients. The disparity was similar for stillbirth (White 7.2 per 1,000 [95%CI 7.1, 7.2]; Black 12.7 per 1,000 [95%CI 12.5, 13.0]). Among 46,296 births, PTB and SGA occurred in 7.9% (95% CI 7.8, 8.0) and 6.0% (95%CI 5.9, 6.0) of deliveries to White patients, but 11.4% (95%CI 11.2, 11.6) and 13.7% (95%CI 13.5, 14.0) to Black patients. Disparities persisted after adjusting for maternal, infant, and healthcare factors: OR of SMM: 1.5 (95%CI 1.2, 1.9); stillbirth OR 1.4 (95%CI 1.1,1.7); PTB OR 1.4 (95%CI 1.3, 1.5); SGA 2.3 (95%CI 2.1, 2.4) and considering pandemic effects. Findings confirm substantial Black-White disparities in SMM and adverse birth outcomes, highlighting the need to understand the complex relationship of individual characteristics and socioeconomic status. State and local entities can provide a broader understanding of these indicators through Maternal Morbidity Review (MMR) and Fetal Infant Mortality Review (FIMR) committees.

Health equity

Evaluation of a Remote Blood Pressure Monitoring Program during Pregnancy: Utilization and Implementation Outcomes Elizabeth Howard*, Emily Harville, Sherri Longo, Kirsten Dorans, Joseph Biggio,

Background: Black and rural women are substantially more likely to experience a poor maternal outcome than their White and urban counterparts. Remote blood pressure monitoring (RBPM) has been proposed as a method to improve equity in maternal outcomes during pregnancy. Evaluations of program implementation with a focus on equity are scarce in the literature.

Objectives: To identify factors associated with enrollment, retention, and patient engagement in RBPM and to evaluate program implementation outcomes in the context of racial and geographic disparities.

Methods: This retrospective cohort study using electronic health record data identified 34,387 eligible pregnancies (29,897 unique patients) from November 2016 to October 2023.

Results: 8,471 pregnancies (24.6%) had no RBPM offer made by the provider; 1,371 pregnancies (4.0%) declined participation; 7,509 pregnancies (21.8%) had an order placed but did not sign the consent form; 6,471 pregnancies (18.8%) consented but did not submit a remote BP reading required to become enrolled; and 10,565 pregnancies (30.7%) enrolled in Connected MOM. Of those who were offered participation, 40% of eligible patients enrolled in the program; however, White (44.3%) and urban patients (40.0%) were more likely to be enrolled than Black (35.3%) and rural patients (24.5%) ($p<.0001$). Lower patient engagement was associated with Black race ($p<.0001$), rural residence ($p=0.030$), and having a public insurance payer ($p<.0001$). Highly engaged patients were more likely to have highly engaged providers (RR=1.06, 95% CI, 1.02-1.11).

Conclusion: Given the lower adoption in Black and rural patients, identifying and addressing barriers at each step along the enrollment pathway is required for equitable implementation and improvement in maternal outcomes. Provider engagement in RBPM programs should be encouraged to improve patient engagement, especially among Black patients.

Health equity

Quantifying intersectional effects of maternal race and immigration-related factors on obstetric trauma in Ontario, Canada: A population-based cohort study Irina Oltean*, Parnian Hossein Pour, Maya Rajasingham, Francis Nyguyen, Dr. Rohan D'Souza, Dr. Giulia Muraca,

Introduction: Factors underlying the differential burden of obstetric trauma by maternal race are unclear. We sought to quantify the association between maternal race and obstetric trauma and to examine the roles of maternal immigration status, duration of residence in Canada, and primary language in this association.

Methods: We performed a population-based cohort study of individuals with singleton, cephalic, vaginal births ≥20 weeks gestation in Ontario (2012-2021). Maternal race was self-reported and recorded by care providers in pre-specified categories: Asian, Black, White, other, and missing. The primary outcome was obstetric trauma (e.g., severe perineal lacerations, injuries to the pelvis). Modified Poisson regression was used to obtain adjusted rate ratios (ARRs) and 95% confidence intervals (CIs). We assessed interaction between maternal race and each immigration-related factor by including interaction terms in the regression models. Likelihood ratio tests were used to evaluate the significance of interactions, comparing models with and without the interaction terms.

Results: The study included 501,887 individuals; 26.1% Asian, 6.1% Black, 60.9% White, 4.6% other, and 2.3% with missing information on race. Crude rates of obstetric trauma were higher among Asian (7.5%) and lower among Black (3.3%) versus White individuals (4.9%); however, after adjustment, both Asian (ARR 1.89, 95% CI 1.66-2.15) and Black race (ARR 1.18, 95% CI 1.04-1.47) were associated with higher rates of obstetric trauma versus White individuals. There was significant interaction between maternal race and duration of residence in Canada ($p < 0.0001$), such that the rate of obstetric trauma decreased among Asian and Black individuals and increased among White individuals with increasing duration of residence.

Conclusion: Racial inequities persist in obstetric trauma, with higher rates among Asian and Black individuals that attenuate as maternal duration of residence in Canada increases.

Health equity

The association between immigration, pregnancy complication and birth outcomes Tamar Wainstock*, Israel Yoles,

Aim: Immigrants, possibly due to cultural and health behavior differences or the psychological stress associated with the immigration, may be at increased risk for pregnancy complication. This study aimed to research the association between immigration and the risk for adverse pregnancy outcomes.

Methods: A population based retrospective cohort study was performed, including all singleton deliveries which occurred between the years 1991-2021 in a large medical center. Healthcare services are free of charge to all citizens, including immigrants. Exposure was defined based on maternal country of birth and the years since immigration (categorized into four quartiles: 0-7, 7-15, 15-23 and 23-54 years before delivery). Pregnancy outcomes were compared between immigrants and non-immigrants. Multivariable generalized estimation equation (GEE) binary models were used to address confounding variables.

Results: The study included 369,152 deliveries, of them 86.7% (320,166) were of non-immigrants and the remaining were of immigrants. Immigrants were significantly older, with higher incidence of gestational diabetes mellitus (GDM) and hypertensive disorders (adjusted odds ratio(OR)=1.54; 95%CI 1.47-1.61, 1.69;95%CI 1.64-1.78, for GDM and hypertensive disorders, respectively, adjusted for maternal age, infertility treatment and obesity, $p<0.001$ for all). The increased risk for GDM was similar regardless of the time since immigration, however the risk for hypertensive disorders was lower with longer time since immigration (adjusted OR=1.81; 95%CI 1.69-1.95 and 1.49; 95%CI 1.38-1.62, for 0-7 and 23-54 years before delivery, respectively). Immigrants were at lower risk for Low birthweight, small for gestational age, preterm deliveries and mortality.

Conclusion: Immigrants were at increased or lower risk for certain pregnancy complications. These findings suggest pregnancy follow-up plan should be tailored by population characteristic including immigration status.

Health equity

Racial Residential Segregation and Prenatal Depression among US born and non-US born Pregnant Individuals Kendria Kelly-Taylor*, Nila Nathan, Joshua Nugget, Carla Wicks, Lyndsay Avalos,

Racial residential segregation has been linked to racial and ethnic disparities in prenatal depression, yet little is known how this relationship differs by maternal nativity (US born vs. non-US born). This study examined differences in the association between racial residential segregation and prenatal depression diagnosis (PND) among US born and non-US born pregnant Asian, Black, Hispanic, and White individuals. A retrospective cohort of pregnant individuals receiving prenatal care at Kaiser Permanente Northern California from 2013 to 2019 (n=246,945) was analyzed, including 169,303 US born and 77,642 non-US born individuals. Nativity was obtained from birth records. Racial residential segregation, defined by Getis-Ord Gi* statistic, was categorized as low, medium, and high for each racial/ethnic group. PND, defined by diagnostic codes, and covariates (maternal age, partnered status, substance use (smoking, alcohol, other substances), neighborhood deprivation) were captured via electronic health records. Modified Poisson regression models with robust standard errors estimated the adjusted relative risk (aRR) for different segregation levels, stratified by race/ethnicity and nativity. High (vs. low) segregation was associated with lower risks of depression among US born and non-US born Asian (aRR:0.80, 95%CI:0.71-0.90; aRR:0.84, 95%CI:0.76-0.94, respectively) and White individuals (aRR:0.94, 95%CI: 0.91-0.99; aRR:0.84, 95%CI:0.70-1.00, respectively), yet a higher risk was observed among Black US born pregnant individuals (aRR:1.12, 95%CI:1.00-1.24). The risk of PND did not differ significantly for US born or non-US born Hispanic individuals by neighborhood segregation. Findings suggest the associations of racial residential segregation on PND differ by race, ethnicity, and nativity. Residing in a highly segregated neighborhood is associated with higher PND risk for Black pregnant individuals, with the greatest magnitude observed among US-born.

0193 P1

No Entries Found

Infectious disease/COVID

Impact and risk factors of Long-COVID among women infected ≥3 months ago: Findings from a cross-sectional study Mandy S. Hall*, Dola Pathak, Charles W. Given, Horng-Shiuann Wu,

Female sex has been associated with a higher prevalence of Long-COVID; however, few studies have evaluated risk factors for Long-COVID within women and the impact Long-COVID has on their physical and mental health. We conducted a secondary analysis using data from a cross-sectional Long-COVID survey study over two patient cohorts (year 2020-2021 and year 2021-2022). The study population comprised female individuals ≥ 21 years that tested positive for COVID-19 infection ≥3 months ago via a hospital registry (n=153). We used logistic regression to estimate the prevalence ratios (PR) and 95% CIs for the association between participant characteristics and symptom status (symptomatic vs. asymptomatic). We further used linear regression to estimate the percent difference in the Patient-Reported Outcomes Measurement Information System (PROMIS) t-scores and 95% CIs by symptom status. We adjusted for cohort in our analyses. Majority of women (n=100) remained symptomatic, reported ≥one symptom related to COVID-19 and/or its treatment at time of survey. We observed 2.5 times the prevalence of Long-COVID symptoms in women ≥55 years (vs. 21-34 years; PR 2.58, 95%CI: 1.05, 6.33). Our data suggested positive associations between being symptomatic and inpatient hospitalization at time of infection (vs. emergency department; PR 2.07, 95%CI: 0.80, 5.36), ≥one comorbidity (vs. none; PR: 1.93, 95%CI: 0.81, 4.60), and ≥Bachelor's degree education (vs. ≤high school graduate; PR 1.89, 95%CI: 0.82, 4.38). Women reported an average of 5.4 symptoms (SD=4.2); fatigue (56%), difficulty remembering (54%), and joint or muscle pain (45%) were the top reported symptoms. Using PROMIS t-scores, physical function was 42% lower (95%CI: -59, -18) and cognitive function was 52% lower (95%CI: -71, -23) in symptomatic versus asymptomatic women. Given the impact of Long-COVID on physical and cognitive function, further investigation into risk factors for Long-COVID in women is warranted.

Infectious disease/COVID

Evidence of a causal association between RSV infection during infancy and childhood asthma: a two-sample instrumental variable analysis of Kids' Inpatient Database David Watson*, Amanda Nickel, Mansi Kanuga, Randy Foss, Elizabeth Ristagno, Chung Wi, Young Juhn,

Background: The association between RSV infection during infancy and childhood asthma is well known from observational studies. We propose an instrumental variable (IV) analysis to assess the causal effect of RSV hospitalization in infancy on childhood asthma using birth month as an IV, which can account for unmeasured confounders like genetics.

Methods: When birth month is grouped as high (Sept-Feb) and low (Mar-Aug) RSV risk, the two-sample IV estimator is the difference in asthma hospitalization incidence rates (IRs) among children born in high and low risk months divided by the difference in RSV hospitalization IRs among infants born in high and low risk months. Reported as per 10,000 children, IRs are estimated from the US Census and Kids' Inpatient Database, a triennial random sample of pediatric US admissions; e.g., RSV IRs of children <1 year old are estimated from the year 2000, and asthma IRs of 3-year-olds are estimated from 2003.

Results: Among children <1 year old in 2000, RSV IR for children born in high-risk months was 202 versus 90 for children born in low-risk months for a difference of 112 cases per 10,000 children ($p<0.001$). Among 3-year-old children in 2003, the asthma IR for children born in high-risk months was 30.6 versus 26.3 for children born in low-risk months for a difference of 4.4 cases per 10,000 children ($p<0.001$). The IV estimate is interpretable for a small subgroup of 1% of the population, for whom RSV infection in the first year of life causes a 3.9 percentage point increase in the risk of asthma hospitalization at 3 years ($p<0.001$). The effect was similar in other birth years and slightly smaller for asthma hospitalizations at older ages (all $p<0.01$).

Conclusion: Although not applicable for all children, our results suggest a causal effect of RSV hospitalization in infancy on subsequent asthma hospitalization for a small subgroup. Future work should identify this subgroup via risk factors and interrogate the strong IV assumptions.

Mental health

Change in hospitalization rates for mental health and substance use disorders from before to after the start of the COVID-19 pandemic among Illinois youth, overall and by sex Caitlin Meyer*, Julia Howland, SJ Doi, Abigail Holicky, Kristin Rankin,

Background: The COVID-19 pandemic exacerbated mental health and substance use (MHSU) disorders among youth, who may be hospitalized if their MHSU needs are not met by outpatient services. This study examined changes in hospitalization rates for MHSU disorders among Illinois youth from before (2018-2019) to after (2021-2022) the start of the COVID-19 pandemic, overall and by sex.

Methods: This study used Illinois hospital discharge data for youth aged 3-17 to examine rates of inpatient MHSU hospitalizations (n=21,992 annually) per 10,000 population, before and after the start of the pandemic. Primary diagnosis codes were used to identify hospitalizations for MHSU disorders and categorize them into disorder subtypes. Rate ratios (RR) and 95% CIs for change over time were estimated using Poisson regression with an interaction term for sex.

Results: MHSU hospitalization rates for Illinois youth decreased significantly from before (96.2 per 10,000) to after (89.5 per 10,000) the start of the pandemic. This masks divergent trends by sex; females' rates increased (RR=1.05, 95% CI: 1.03-1.07), while males' rates decreased (RR=0.76, 95% CI: 0.75-0.78; interaction p-value<0.0001). By 2021-2022, females had double the rate of MHSU hospitalizations as males (95% CI: 1.97-2.05). Overall, about three-quarters of youth MHSU hospitalizations were for mood disorders. Despite an overall decrease in MHSU hospitalization rates over time for males, they saw a similar increase as females in hospitalization rates for suicide attempts (overall RR=1.80, 95% CI: 1.58-2.05) and non-suicidal self-injury (RR=1.80, 95% CI: 1.72-1.88).

Conclusion: Nearly 22,000 hospitalizations for MHSU disorders occur each year among Illinois youth, with females bearing the largest burden. Enhanced access to and coordination of outpatient mental health services may reduce these hospitalizations, particularly for suicide attempts and non-suicidal self-injury, which have increased in recent years for both sexes.

Mental health

Maternal perinatal depressive disorders and the risk of attention deficit and hyperactivity disorder in offspring: A linked data study Biruk shalmeno Tusa*, Rosa Alati, Kim Betts, Getinet Ayano,

Background: Maternal perinatal depression may increase the risk of neurodevelopmental disorders such as attention deficit hyperactivity disorder (ADHD), in children, either directly or through indirect pathways involving adverse birth outcomes. This study assesses the risk of ADHD in offspring born to mothers with perinatal depressive disorders, examining both the direct and indirect pathways through adverse birth outcomes.

Methods: The study employed a retrospective cohort design, utilising administrative-linked health data from New South Wales. Maternal perinatal depressive disorders and offspring ADHD were identified using the International Classification of Diseases (ICD-10) codes. A generalised linear model with a binomial distribution and a log link function was applied to estimate the direct association. Additionally, a mediation analysis examined the mediational effect of low birth weight, low Apgar scores, and preterm birth on the association between maternal antenatal depressive disorder and ADHD.

Results: After adjusting for potential confounders, offspring of mothers with antenatal, postnatal, and perinatal depressive disorders are 2.10 (RR = 2.10, 95% CI = 1.46–3.03), 1.80 (RR = 1.80, 95% CI = 1.11–2.92), and 2.16 (RR = 2.16, 95% CI = 1.57–2.97) times more likely to have ADHD compared to their counterparts, respectively. The impact of maternal antenatal depressive disorder on offspring ADHD was mediated by preterm birth, but not by low birth weight or low Apgar scores. The proportion of the total effect mediated by preterm birth was only 0.73%, indicating this mediation effect was very minimal, about 45 times smaller than the direct effect.

Conclusion: Our study revealed that maternal perinatal depressive disorders are associated with an increased risk of offspring ADHD, with very minimal or no mediating effects from adverse birth outcomes. Therefore, implementing early intervention strategies aimed at improving maternal mental health is crucial to reducing the risk of ADHD in children.

Mental health

Hurricane experience and pregnancy-specific anxiety: M-O-M-S on the Bayou Emily Harville*, Gloria Giarratano, Michelle Patterson, Karen Weis,

Background: Pregnant women living in a disaster recovery environment may be at risk for pregnancy-specific anxiety. We tested this in a prenatal peer support program, Mentors Offering Maternal Support, focused on improving mental health in hurricane-affected areas in southern Louisiana.

Methods: Thirty-two participants in M-O-M-S on the Bayou reported their experiences of 2020/2021 hurricanes and worries about future storms, and completed the Prenatal Self-Evaluation Questionnaire (PSEQ), which assessed readiness and fears of labor and birth, relationships, and identification and acceptance of pregnancy. The relationship between hurricane experience and PSEQ scales was tested using Spearman correlations and chi-square tests.

Results: Most participants were either Black (46.9%) or White (31.3%) and had at least some post-high school education (81.3%). Most (78.1%) said their most severe experience was of Hurricane Ida. More severe experience of hurricanes was most strongly correlated with higher anxiety related to relationship with mother (r=0.26, p=0.18) and with birth preparation (r=0.23, p=0.24). Increased hurricane worries were associated with lower concerns of pain and control in labor (r=-0.37, p=0.04), and with more negative partner relationships (-0.24, p=0.20). For the subscales of hurricane experience, having a family member with illness or injury due to the hurricane was associated with less preparedness for labor, increased relationship anxiety with mother and partner, and more concerns about well-being in labor. Experience of damage or danger was not associated with PSEQ scales, nor was hurricane experience associated with acceptance of or identification with pregnancy.

Discussion: Some disaster experiences may reduce the ability of pregnant women to prepare for labor or to cultivate their relationships.

Mental health

Social support mitigates the effect of traumatic birth experiences on posttraumatic stress symptoms in a low-income cohort. Katherine Bowers*, Alonzo Folger, Robert Ammerman,

Posttraumatic stress disorder (PTSD) is a psychiatric condition emerging from trauma, characterized by symptoms like intrusion, avoidance, arousal, and cognitive and mood changes. Trauma during childbirth is a distinct event that can lead to PTSD-Birth Trauma (PTSD-BT), and which can have negative effects on attachment and infant behavioral health. Black and Latinx women are nearly three times more likely to experience childbirth-related traumatic stress. However, PTSD-BT is understudied, especially in low-income mothers and racial minorities. We therefore evaluated posttraumatic stress symptoms (PTSS) in a low-income cohort of women in Cincinnati. The Pregnancy and Infant Development (PRIDE) Study, follows women participating in a home-visiting program, from pregnancy through 18 months postnatal. We used descriptive statistics and linear regression to link self-reported pregnancy conditions (e.g., hypertension, gestational diabetes) and labor complications (a proxy for birth trauma e.g., fetal distress, failure to progress) to posttraumatic stress symptoms (PTSS) (measured using the Posttraumatic Stress Checklist – Civilian (PCL-C)) at 1-month postnatal. Among 214 participants with a PCL-C at one month, 48 (22.6%) scored ≥14, indicating post-traumatic stress difficulties. Additionally, 33.3% of participants with labor complications scored ≥14 at one month postnatal, compared to 19% without complications, a statistically significant difference (p=0.03). Adjusting for age, race, depression, and early life adversity, labor complications were positively associated with PTSS (β=1.93, 95% CI: 0.50, 3.37). No association was found for pregnancy complications, suggesting specificity for traumatic birth experiences in contributing to PTSS rather than general health challenges during pregnancy. We also identified a significant interaction (p=0.03) with maternal social support, with the association evident only among women with low social support (β=4.32, 95% CI: 1.93, 6.71).

Mental health

Association between disrespectful maternity care and postpartum depression at two months: a national population-based study Marianne Jacques*, Anne Chantry, Sarah Tebeka, Anne Evrard, Alexandra Doncarli, Nathalie Lelong, Camille Le Ray, Marianne Philibert

Background: Postpartum depression (PPD) is a common condition, with harmful effects on mother and child. Over the past decade, reports of poor birth experiences due to disrespectful care have come from high-income countries, and a growing body of evidence indicates that they can have medium- and long-term health consequences. The aim was to assess the association between disrespectful maternity care and PPD at 2 months after childbirth with national population-based data.
Methods: All women from the 2021 Enquête Nationale Périnatale (ENP) (all births in France during one week) who completed the 2-month follow-up questionnaire were included. Two-month PPD was defined as an Edinburgh Postnatal Depression Scale (EPDS) score ≥13. Disrespectful care (health-care professional's inappropriate words, gestures, or attitudes) during childbirth and/or the postpartum stay was reported by women at 2 months postpartum. The association between disrespectful care and PPD was assessed by using Poisson regression with robust variance, adjusted for confounders and weighted to account for attrition. Sensitivity analyses were conducted among a subgroup of women in lower risk of PPD (no history of psychological/psychiatric care, no prenatal depressive symptoms, and no self-assessed prenatal psychological distress).
Results: Among the 7189 women analyzed, 24.9% (95% confidence interval [CI], 23.8-26.0) reported experiencing disrespectful maternity care, and the prevalence of 2-month PPD was 16.6% (95% CI, 15.7-17.6). After adjustment, women reporting disrespectful maternity care were more likely to have 2-month PPD (adjusted relative risk [aRR] 1.37; 95% CI 1.20-1.56), including those in the group at "lower risk for PPD" (aRR 1.69; 95% CI 1.33-2.14).
Conclusion: One-quarter of women reported experiencing disrespectful care during childbirth and/or their postpartum stay. After careful adjustment for most of the known vulnerability factors, this experience was associated with a higher prevalence of PPD at 2 months. Given the concerning incidence of PPD and its consequences, these results underline the importance of raising awareness among health-care professionals and providing appropriate resources to enable them to provide respectful maternity care.

Methods

Validation of ICD-10 diagnosis codes for antepartum iron-deficiency anemia Anna Booman*, Sara Siadat, Brian Bateman, Irogue Igbinosa, Elliott Main, Deirdre J. Lyell, Cecilia Leggett, Stephanie Leonard,

Iron deficiency anemia during pregnancy increases risk of adverse perinatal health outcomes, with stark racial disparities: prevalence is more than twice as high in Black compared with White pregnant individuals. Modern epidemiologic research largely relies on International Classification of Diseases, Clinical Modification, 10
th
Revision (ICD-10) diagnosis codes to identify individuals with antepartum anemia, yet their validity remains unknown. Our objective was to assess the validity of ICD-10 codes for antepartum anemia compared with the diagnostic gold standard of hemoglobin or hematocrit measurements. We used commercial insurance claims data from the Merative™ MarketScan® Research Database for pregnancies during 2018-2022. Those with hereditary anemia (e.g., sickle cell) were excluded. Antepartum anemia was defined using clinically recommended hemoglobin and hematocrit thresholds (<11.0 g/dL and <33% in the first and third and <10.5 g/dL and <32% in the second trimester, respectively). We calculated Cohen’s kappa, sensitivity, specificity, positive predictive value, and negative predictive value of the ICD-10 codes. Among 70,752 pregnancies, 30.2% had antepartum anemia based on hemoglobin and hematocrit values and 12.0% had at least one ICD-10 diagnosis code indicating antepartum anemia. Cohen’s kappa between anemia identified through laboratory values and ICD-10 codes was 0.205 (95% confidence interval [CI]: 0.196, 0.215). Sensitivity of the ICD-10 codes was 0.238 (95% CI: 0.233, 0.244); specificity was 0.932 (95% CI: 0.929, 0.934); positive predictive value was 0.602 (95% CI: 0.591, 0.612); and negative predictive value was 0.739 (95% CI: 0.735, 0.742). These findings suggest low sensitivity, but high specificity, of ICD-10 diagnosis codes for antepartum anemia. Researchers should be aware of the limitations of relying solely on ICD-10 codes for antepartum anemia and consider conducting bias analyses when hemoglobin and hematocrit measurements are unavailable.

Methods

Tree-based scan statistics to evaluate drug safety in pediatric populations: sulfamethoxazole/trimethoprim as a positive test case Kelly Fung*, Loreen Straub, Timothy Savage, Massimiliano Russo, Helen Mogun, Thomas Deramus, Georg Hahn, Shirley Wang, Krista Huybrechts,

Clinicians treating pediatric patients rely on evidence generated in adults. However, the safety profile of medications may differ for children. Tree-based scan statistic (TBSS) approaches can be used to identify safety issues by screening thousands of potential adverse outcomes while controlling type 1 error, but their performance in pediatric populations has not been evaluated.

The study objective was to assess whether TBSS can identify rare, serious adverse effects and describe the pattern of unsuspected alerts using the known association of sulfonamides and Stevens-Johnson Syndrome (SJS) as a test case.

Using Medicaid (2008-2018) and MarketScan (2008-2021) databases, we compared children who initiated sulfamethoxazole/trimethoprim (SMX-TMP) to those initiating cephalexin and clindamycin, respectively. The outcome tree was based on hierarchical groupings of diagnostic codes in the International Classification of Disease system. Incident outcomes were identified in the 30 days after treatment initiation, using a 90-day washout. We adjusted for confounders using propensity score overlap weights. A p-value threshold of 0.05 was used to define statistical alerts for potential safety signals.

There were 2,939,183 children exposed to SMX-TMP, 3,908,066 to cephalexin, and 755,945 to clindamycin. Comparing SMX-TMP to cephalexin, 278 statistical alerts were detected out of 8,517 outcomes screened. Among these, 11 alerts were considered clinically plausible adverse events; the remainder being related to infections or chronic illnesses. Compared to clindamycin, 144 alerts were identified, 10 of which were clinically plausible. Increased risks for SJS were identified in both comparisons.

TBSS detected the known risk of SJS, a rare but serious condition associated with SMX-TMP, without raising many additional clinically plausible alerts, supporting the feasibility of the approach. Follow-up of these plausible alerts and further evaluation of the TBSS approach will be important.

Methods

Evolving Identities or Racial Misclassification? Fluidity in self-reported race among American Indian birthing people in Michigan Danielle Gartner*, Bendu Sherman, Ross Rogers, Beedoskah Stonefish, Jessica Saucedo, Heesu Kim, Yanzeng Li, Candice Johnson,

Introduction: While it is established that American Indian and Alaska Native (AIAN) people are often misracialized in administrative data, less is known about changes in AIAN people's self-reported racial identity response over time. Moreover, it is unclear if racial identity response change has implications for public health surveillance, particularly of racial disparities in birth outcomes.

Methods: We used maternally linked birth certificates from Michigan (MI) to identify birthing persons that had ≥2 live births and self-identified as AIAN, alone or in combination, for birth between 2014 and 2022 (N=4598). After observing self-reported racial identity over time, we categorized each birthing person as having changed or not changed racial identity response. We then recalculated state-level year and AIAN specific preterm birth prevalence to determine impacts of response change on estimates of preterm birth.

Results: Twenty-three percent (1051) of multiparous AIAN birthing people identified as AIAN at each birth, while 77% used different racial identity responses across births. Specifically, 7% (325) changed ≥2 times to include or exclude AIAN identity and 70% (3222) either started identifying as AIAN or stopped identifying as AIAN at their second (or later) birth(s). After accounting for identity response change on AIAN classification, the state-level preterm birth rate did not change drastically.

Discussion: There is significant fluidity in self-reported racial identity response among AIAN birthing people in MI, though this population churn appears to have minimal implications for surveillance of preterm birth. However, single, point-in-time racial responses, particularly for AIAN people, may not be sufficient for purposes of racially categorizing AIAN birthing people. It is unclear if documented changes in response to race questions on birth certificates are indicative of actual identity change and if they are linked to individual level birth outcomes.

Methods

Validity of diagnostic codes used to ascertain maternal injuries during pregnancy Asma Ahmed*, Riyan Deria, Rosalba Barojas Chavarria, Allie Sakowicz, David Stamilio, Elizabeth Jensen,

Background

Maternal injuries affect 6-8% of pregnancies and are associated with perinatal complications. Previous research on maternal injuries has relied on International Classification of Diseases (ICD) codes to define maternal injuries. However, the validity of these codes remains unclear. We aimed to validate ICD-10 codes used to ascertain injuries using medical chart reviews as the gold standard.

Methods

A retrospective cohort study of all births occurring at Atrium Health Wake Forest Baptist Medical Center in 2022-2023 (n=6297 births). We randomly selected 100 subjects with ICD-10-indicated injury and 100 subjects without indication of injury. Two independent reviewers, blinded to the ICD-10-based classification, conducted the chart review. We examined the validity of relevant injury-related codes (V00-Y38 [external causes of morbidity]; S00-T79 [injury, poisoning and certain other consequences of external causes]; and O9A.2-O9A.4 [injury, poisoning and certain other consequences of external causes complicating pregnancy, childbirth and the puerperium]) and calculated positive predictive values (PPV) for different algorithms defined by varying the encounter type and the list of codes used. We also validated codes specific to transportation accidents (V00-V99) and falls (W00-W19).

Results

The algorithm that included all injury-related ICD-10 codes without encounter type restrictions showed moderate PPV (71%, 95% CI: 61%–79%) and high negative predictive value (96%, 95% CI: 90%–98%). PPV was maximized when including ICD-10 codes related to external causes of morbidities (V00-Y38) and restricting encounter type to inpatient or emergency department encounters (PPV 100% (93%-100%). Transportation accident and fall codes also demonstrated high PPVs.

Conclusions

This study characterizes the accuracy of ICD-10-based algorithms for ascertaining maternal injuries during pregnancy. These findings can help improve inference by providing bias parameters for future research.

No Entries Found

Nutrition/obesity

Planetary Health Diet during pregnancy and major pregnancy complications: Findings from a multisite, diverse United States cohort Shan-Xuan Lim*, Elizabeth DeVilbiss, Priscilla Clayton, Neil Perkins, Jessica Gleason, Katherine Grantz, Cuilin Zhang, Jagteshwar Grewal,

Emerging data from non-pregnant populations revealed Planetary Health Diet (PHD)'s role in promoting cardiometabolic health. However, such data during pregnancy is lacking. As such, we aimed to (1) characterize PHD scores in a racially/ethnically diverse cohort of US women, and (2) examine associations between PHD scores and major pregnancy complications.

A FFQ assessed 1st trimester diet, and ASA24 at up to 4 visits assessed 2nd and 3rd-trimester diets of women enrolled in the NICHD Fetal Growth Studies–Singletons (N=1980). Presence of major pregnancy complications was abstracted from medical records. To increase generalizability of findings, the analytical sample was weighted according to the race/ethnic distribution of low-risk US births in 2011. Overall and stratified PHD scores by race/ethnicity, pre-pregnancy BMI and vegetarian status were calculated. Adjusted odds ratios (95% CI) of major pregnancy complications were estimated using logistic regression.

Weighted mean (SD) PHD scores were 95.7 (10.7) during 1st trimester (8-13 weeks) and were lower but remained consistent throughout pregnancy [Mean (SD) of 16-22, 24-29, 30-33, and 34-37 weeks: 87.5 (12.8), 87.5 (13.3), 87.0 (12.5) and 86.9 (12.5)]. Mean PHD scores did not vary significantly by race/ethnicity, pre-pregnancy BMI or vegetarian status. Compared with women in the lowest tertile of the PHD (≤ 91.4), those in the highest tertile (≥ 100.4) had increased odds of gestational anemia [OR (95% CI): 1.09 (0.59, 2.02)] and reduced odds of hypertensive disorders of pregnancy [Mild: 0.38 (0.07, 2.04), Severe: 0.41 (0.09, 1.91)], gestational diabetes mellitus [0.51 (0.16, 1.64)] and preterm birth [0.46 (0.14, 1.46)], although associations were not statistically significant.

Higher PHD adherence was not significantly associated with major pregnancy complications among low-risk singleton pregnancies. Future studies of larger sample sizes are warranted to examine the health implications of PHD during pregnancy.

Nutrition/obesity

Maternal egg consumption during pregnancy and infant possible egg allergy Xiaozhong Wen*, Fatima Mohammed, Awnish Shankar, Priyadharshan Manohar, Sri Ijjapureddy, DeMarco Ogletree, Todd Rideout,

Objectives: To examine the associations of maternal egg consumption during pregnancy and different egg components/preparation methods with possible egg allergy in infants.

Methods: We analyzed data from a U.S. cohort of 884 mother-infant dyads in the Infant Feeding Practices Study II. In late pregnancy, mothers reported the frequency and portion size of consuming egg-related foods in the past month, including total eggs, whole eggs, egg whites, egg substitutes, eggs with fat, and egg salads. We used multivariable logistic and linear regression models to examine associations between maternal egg consumption and infant possible egg allergy from birth to 12 months, adjusting for maternal socio-demographics, Healthy Eating Index, parent atopy, child sex, eczema, and breastfeeding duration.

Results: Infants of mothers who consumed eggs during pregnancy tended to have a lower risk of possible egg allergy (1.4% vs 2.9%; confounder-adjusted odds ratio or aOR, 0.23 [95% confidence interval or CI, 0.05-1.04]; P-value=0.056), compared to infants whose mothers never consumed eggs. One egg/week increment in maternal total egg consumption corresponded to 0.66 (95% CI, 0.43-1.03) times lower risk of infant possible egg allergy. When examining specific egg foods, the results for whole egg consumption were similar to those for total egg consumption. Infants of mothers who consumed whole eggs during pregnancy had a potentially lower risk of possible egg allergy (1.2% vs 3.7%; aOR, 0.30 [95% CI, 0.08-1.18]; P-value=0.085), compared to infants whose mothers never consumed whole eggs. The risk of infant possible egg allergy decreased with maternal consumption of whole eggs, and aOR was 0.63 (95% CI, 0.39-1.02; P-value=0.061) per one egg/week increment in maternal consumption of whole eggs. However, no meaningful associations existed between maternal consumption of other egg-related foods (i.e., egg whites, egg substitutes, eggs with fat, and egg salads) during pregnancy and the risk of infant possible egg allergy.

Conclusions: Maternal consumption of total eggs and whole eggs during pregnancy might offer some protection against possible egg allergy in infants.

Nutrition/obesity

Infant bean food consumption and risk of early childhood obesity Xiaozhong Wen*, Divya Choudhary, Amy Millen, Todd Rideout,

Objectives: To examine the associations between infant bean food consumption during pregnancy in the first 2 years and the risk of childhood obesity from 2 to 5 years.

Methods: We analyzed data from a U.S. cohort of 2,896 children in the WIC Infant and Toddler Feeding Practices Study 2 (WIC ITFPS-2). The caregiver reported infant bean consumption (i.e., dried beans and chili) using 24-hour dietary recalls. The frequency of consumption was calculated across six age points in year 1, four age points in year 2, and ten age points in years 1 and 2 combined. Outcome measures included the risk of obesity, body mass index z-score (BMIz), and weight-for-height z-score (WHz) from 2 to 5 years of age. We used multivariable logistical and linear regression models to examine the associations of infant bean consumption with binary (obesity) and categorical (BMIz and WHz) outcomes, respectively, adjusted for socio-demographic characteristics, maternal pre-pregnancy BMI, the child's birth weight, and breastfeeding duration.

Results: A higher dried bean consumption tended to be associated with reduced obesity risk in females during year 2, and the confounder-adjusted odds ratio or aOR per one-level increment in dried bean consumption frequency was 0.81 (95% confidence interval or CI, 0.66-1.01; p=0.059). Similarly, infant chili consumption was not associated with obesity risk in the total sample, but there was a trend toward reduced obesity risk in males consuming chili in year 2 (aOR, 0.73 [95% CI, 0.52-1.03]; p=0.070). Dried bean consumption in year 2 (mean difference, -0.15 [95% CI, -0.30 to 0.01]; p=0.062) and both years combined (-0.17 [95% CI, -0.33 to 0.00; p=0.044) was associated with a significant reduction in BMIz from 2 to 5 years among females. Infant chili consumption was not associated with BMIz or WHz, except for a trend toward reduced WHz in males consuming chili in year 2 (-0.11 [95% CI, -0.24 to 0.01]; p=0.070) and both years combined (-0.10 [95% CI, -0.21 to 0.01]; p=0.083).

Conclusions: In males, infant chili consumption seemed to be associated with a reduced risk of obesity and lower BMIz. In females, infant dried bean consumption was associated with lower BMIz and possibly a reduced risk of obesity.

Nutrition/obesity

Peanut food consumption and gestational diabetes Xiaozhong Wen*, Fatima Mohammed, Awnish Shankar, Priyadharshan Manohar, Sri Ijjapureddy, DeMarco Ogletree, Todd Rideout,

Objectives: To examine the associations between maternal peanut food consumption during pregnancy and the risk of gestational diabetes (GDM).

Methods: We analyzed data from a U.S. cohort of 1,397 mother-infant dyads in the Infant Feeding Practices Study II. In late pregnancy, mothers reported the frequency and portion size of consuming peanut foods in the past month, including peanuts and peanut butter. We used multivariable logistic regression models to examine associations between maternal peanut food consumption and the risk of GDM, adjusting for maternal socio-demographics, Healthy Eating Index, and pregnancy-related characteristics.

Results: On average, mothers consumed 0.21 cups/week of peanuts and 2.38 tablespoons/week of peanut butter during pregnancy. Older age, higher education, higher household income, higher Healthy Eating Index, and WIC non-recipient were associated with higher peanut food consumption. Mothers consuming peanuts at low (1-3 times per month; 5.0% with GDM) or moderate (1-2 times per week; 6.3%) frequency had a similar risk of GDM to mothers not consuming peanuts (6.6%). The confounder-adjusted odds ratio (aOR) was 0.74 (95% confidence interval or CI, 0.44-1.26) and 0.76 (95% CI, 0.37-1.56), respectively. However, mothers consuming peanuts at high frequency had a significantly higher risk of GDM (18.6% vs. 6.6%; aOR, 3.00 [95% CI, 1.57-5.73]; p-value=0.001) compared to non-consumers. However, the risk of GDM was significantly lower among mothers consuming peanut butter at low frequency (4.3% vs 7.3%; aOR, 0.48 [0.25-0.93]; p-value=0.031) compared to non-consumers. The other two groups of peanut butter consumers did not have significantly different risk of GDM from non-consumers: 6.5% (aOR, 0.86 [95% CI, 0.46-1.61]) for mothers consuming peanut butter at moderate frequency and 11.1% (aOR, 1.48 [95% CI, 0.81-2.70]) for mothers consuming peanut butter at high frequency.

Conclusions: The association between peanut food consumption and the risk of GDM seems to depend on the consumption frequency: null or protective association for low or moderate frequency, while high frequency may increase the risk.

Nutrition/obesity

Prevalence of Healthy Lifestyle Characteristics in Early Pregnancy: Results from a Prospective Pregnancy Cohort in Michigan Michael Yeboah*, Azam Najaf Kouchak, Jean Kerver,

Prevalence of Healthy Lifestyle Characteristics in Early Pregnancy: Results from a Prospective Pregnancy Cohort in Michigan

Yeboah, Michael,1 Najaf Kouchak, Azam,1 Kerver, Jean1

1Department of Epidemiology and Biostatistics, Michigan State University, East Lansing, Michigan, USA.

Introduction: Maternal healthy lifestyle characteristics (HLCs) during pregnancy are associated with both maternal and child health benefits. We aimed to estimate the prevalence of 4 HLCs during early pregnancy, individually and combined, among a sample of pregnant women in Michigan.

Methods: Data are from the Michigan Archive for Research on Child Health (MARCH), a statewide prospective pregnancy cohort based on a probability sample of all births in Michigan's Lower Peninsula. The analytic sample (n=1,227) includes self-reported survey data collected at participants' first prenatal care visit, whenever that occurred in their pregnancy. Maternal demographic characteristics were abstracted from the birth certificate. HLCs were defined as: healthy weight (body mass index of 18.5-24.9, using pre-pregnancy weight), nonsmoking (no cigarette smoking at the time of pregnancy determination, regardless of vaping or other substance use), fruit and vegetable consumption (F&V; ≥ 5 servings/d), and regular physical activity (PA; ≥ 150 minutes moderate-to-vigorous physical activity/wk). Prevalence was defined for each HLC individually and combined.

Results: Maternal characteristics included: race (54.8% White, 25.7% Black), ethnicity (4.2% Hispanic), and age (19.1% 18-24 y, 61.2% 25-34 y, 19.6% 35+ y). Prevalence (95% confidence interval) of individual HLCs were: healthy weight 35.4% (32.6-38.3); nonsmoking 77.3% (74.7-78.7); F&V 7.6% (6.2-9.4); regular PA 17.9% (15.7-20.3). The combined prevalence of all 4 HLCs was only 1.2% (0.7-2.1).

Conclusion: Results indicate extremely low adherence to HLC recommendations for pregnant women but are not surprising given the low adherence to HLC among the US population. Findings underscore the need for public health initiatives to create environments that support healthier lifestyles for most people.

Obstetric health

Comorbidities and Complications: How the effect of cesarean delivery on postpartum rehospitalization varies by condition Ruby Barnard-Mayers*, Eugene Declercq, Christina D. Yarrington, Eleanor J. Murray, Martha M. Werler,

Introduction: Numerous studies have linked having a cesarean delivery to an increased risk of maternal morbidities. However, there is a lack of information on how different indications for cesarean deliveries modify these effects.

Objective: We aimed to understand how different indications of cesarean delivery act as potential effect modifiers for the effect of cesarean delivery on postpartum rehospitalization among nulliparous, term, singleton, vertex pregnancies in Massachusetts.

Methods: Data for this study come from the Pregnancy to Early Life Longitudinal data system, which uses birth certificate and hospital discharge records from all deliveries in Massachusetts from 2011 to 2018. Cesarean delivery, the exposure of interest, was based on both the birth certificate and discharge records. Postpartum rehospitalization included observational and emergency visits between 2 and 365 days after delivery. We examined EMM for five subgroups: chronic/acute disease, fetal conditions, uteroplacental abnormality, labor complications, and no documented indication. Within each of these groups we calculated adjusted RRs and RDs for the effect of cesarean delivery, compared to vaginal delivery, on rehospitalization adjusting for demographic and pregnancy characteristics.

Results: The risk of rehospitalization for vaginal deliveries was 20.5% for vaginal deliveries and ranged from 18% to 24% across the 5 indication groups for cesareans. The smallest effects were identified among birthing people with no indication (aRD: 0.05%) and with any chronic or infectious disease (aRD: 0.09%). The largest effect was among those with a uteroplacental abnormality (aRD: 2.91%; aRR: 1.22).

Discussion: We discovered modest evidence of EMM by indication for the effect of cesarean delivery on postpartum rehospitalization on both the relative and absolute scale. Our results suggest that birthing people with a uteroplacental or anatomic abnormality may benefit from a higher level of postpartum care.

Obstetric health

Association of delivery location, race, and ethnicity with postpartum readmission among US military service members, 2013-2021 Sandra Maduforo*, Celeste Romano, Clinton Hall, Gia Gumbs, Ava Conlin,

Background: A 2014 Military Health System review reported higher rates of postpartum readmission (PPR) among deliveries at military hospitals vs. civilian hospitals. Previous work has also reported racial disparities in PPR across military and civilian hospitals. This research aims to further assess variation in PPR by delivery location and race and ethnicity from 2013-2021.

Methods: Live born deliveries among US military service members, 2013-2021, were identified using data from the Department of Defense Birth and Infant Health Research program. PPR was defined as an admission record within 30 days of discharge from the delivery hospitalization. Modified Poisson regression models estimated crude risk ratios (RR) and 95% CIs to quantify associations between PPR and race and ethnicity, stratified by delivery location. White service members acted as the reference group for comparison.

Results: Of 115,853 deliveries, 66.5% (n=77,011) occurred at military hospitals. Overall, 2.1% (n=2,466) deliveries resulted in PPR. PPR was higher among military vs. civilian deliveries (RR=1.10, 95% CI: 1.01-1.20). Black or African American service members had the highest overall incidence of PPR (3.1%) and were more likely to experience PPR for military (RR=1.76, 95% CI: 1.58-1.98) and civilian deliveries (RR=1.69, 95% CI: 1.44-2.00). Native Hawaiian or Pacific Islander service members were at increased risk for PPR among military hospital deliveries (RR=1.41, 95% CI: 1.00-2.00), with no increased risk among civilian deliveries. Multiracial and Hispanic or Latino service members had a higher risk of PPR for civilian hospital deliveries (RR=1.37, 95% CI: 0.99-1.90 and RR=1.22, 95% CI: 1.00-1.50, respectively), and no increased risk among military deliveries.

Conclusions: Crude risk of PPR was higher among deliveries at military vs. civilian hospitals, and uniquely high for Black or African American service members. Future work should investigate causes of differential readmission.

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Obstetric health

Temporal changes in maternal characteristics and the rising trend in cesarean delivery in British Columbia, Canada Sarka Lisonkova*, Mackenzie Campbell, Julie van Schalkvyk, Yasser Sabr, Marianne Vidler, Janet Lyons, Kenneth Lim, Deborah Money,

Objectives: British Columbia (BC) has the highest rate of cesarean delivery in Canada. We examined whether the increasing temporal trend in cesarean delivery (CD) could be explained by changes in risk factors in a pregnant population.

Methods: We included all women who delivered in BC, 2008/09-2020/21 (n=563 253); with data obtained from the BC Perinatal Database Registry. Modified Poisson regression was used to estimate the annual average change in the rate of CD overall, and specifically for primary and repeat CD. We examined changes in these trends changed after adjusting for maternal risk factors: age, body-mass-index, parity, gravidity, in-vitro-fertilization, chronic diseases, etc. Unadjusted and adjusted rate ratios (RR and ARR) and 95% confidence intervals (CI) expressed the average change in rates per year.

Results: CD rates increased from 30.3% to 37.8% of deliveries during the study period, with an average 1.8% increase per year (RR=1.018, 95% CI 1.017-1.020). Primary CD rates increased from 18.3% to 23.2%, and repeat CD from 12.1% to 14.4%. After adjustment for temporal changes in maternal factors, this increase attenuated to 1.2% per year (ARR=1.012, 95% CI 1.010-1.013). Thus, estimated one third of the overall increase in CD rates was accounted for by changes in maternal characteristics over time. Unadjusted primary CD increased by 2.0% per year (RR=1.020, 95% CI 1.018-1.021), reducing to 1.2% per year after adjustment (ARR=1.012, 95% CI 1.010-1.013). Repeat CD rates in multiparous women increased by 1.6% per year (RR=1.016, 95% CI 1.014-1.018), reducing to a 1.2% increase after adjustment (ARR=1.012, 95% CI 1.010-1.014).

Conclusion: Rates of CD in BC increased by 20% from 2008/09 to 2020/21. Temporal changes in maternal characteristic accounted for approximately 30% of this increase. Temporal increase was observed in both primary and repeat CD; estimated 40% and 25% of these trends, respectively, were explained by changes in maternal risk factors.

Obstetric health

Examining the Rural-Urban Divide in VBAC Rates: A Multi-State Study Andrew Williams*, Reese Seigle, Myckynzie Schroeder, Dennis Lutz, Reese Siegle

In the United States, rates of vaginal birth after a caesarean (VBAC) have climbed from 12.4% of births with a prior cesarean in 2016 to 14.6% of births with a prior cesarean in 2022. The rise in VBAC is attributed to increasing cesarean delivery overall. Given limited access to labor and delivery facilities among rural populations, we examined disparities in VBAC by rurality.

We used 2016-2021 Pregnancy Risk Assessment Monitoring System data from 43 jurisdictions, and included 88,753 participants with at least 1 prior birth. VBAC was identified from birth certificate data. Urban counties were identified as Metropolitan Statistical Areas, rural counties were not in Metropolitan Statistical Areas. Logistic regression models estimated odds ratio(OR) and 95% confidence intervals(CIs) for the odds of VBAC among rural compared to urban residents. Models were adjusted for maternal demographic and health factors, and weighted to account for survey design.

The analytic sample included 81% urban residents, and 3.6% of births were VBAC deliveries. Among urban residents, 3.8% had VBAC deliveries, compared to 2.9% of rural women ($p<.01$). In fully adjusted models, rural residents had 18% lower odds (OR:0.82,CI:0.71,0.95) of VBAC compared to urban residents.

Rural women were less likely to achieve VBAC compared to urban women. Barriers to VBAC in rural facilities include lack of ob-gyns, lack of anesthesia, and fear of legal liability. Further investigations are warranted to examine the role of socioeconomic (i.e. insurance status, education) and structural factors (i.e., access to care, policy) in disparate VBAC experience.

Obstetric health

Associations Between Race/Ethnicity, Physical Activity, and Adherence to Recommendations for Activity Restriction in Pregnancy Gladys Smith*, Ellie Mayers, Maria Fernandez, Ellen Caniglia, Stefanie Hinkle, Sunni Mumford, Enrique Schisterman, Beth Pineles, Gladys Smith

Bedrest and activity (BAR) restriction are often recommended in pregnancy despite associations with worse pregnancy outcomes, and may exacerbate disparities in outcomes. We aimed to determine whether agreement with and adherence to healthcare provider-recommended BAR during pregnancy differed by race/ethnicity.

A validated internet-based cross-sectional survey was distributed to females aged 18-54 who were pregnant or had been pregnant in the past year. Participants were asked if BAR had been recommended, and if so, who made the recommendation, whether they agreed with the recommendation, whether the specific recommendation was adhered to, and how they changed their activity. All findings were weighted by age and race/ethnicity based on the target population of all U.S. births in 2022 to account for differential response rates. Primary outcomes were BAR agreement and BAR adherence. A secondary outcome was change in activity level.

1500 survey responses were obtained. 40% of respondents reported provider-recommended BAR with no difference by race/ethnicity ($p=0.72$); NH (non-Hispanic) Asian or Pacific Islander (API) 34%, NH Black 40%, Hispanic 38%, NH White 41%, and Other/Unknown 43%. Among participants with BAR, 79% of respondents agreed with recommendations, and 81% of respondents were adherent to recommendations. Neither agreement ($p=0.70$) nor adherence ($p=0.26$) to recommendations differed by race/ethnicity. Agreement with the recommendation was not associated with changes in activity level ($p=0.17$), but changes in activity differed by race/ethnicity (NH API 66%; NH Black 53%; Hispanic 56%, NH White 59%, Other 46%, $p<0.01$).

Most participants agreed with and were adherent to BAR. Race/ethnicity was not associated with agreement with or adherence to restrictions but was associated with changes in activity level during pregnancy. Future work should understand how these differences may relate to racial/ethnic disparities in pregnancy outcomes.

Obstetric health

Antepartum anemia and postpartum mental health conditions Cecilia Leggett*, Elizabeth Sherwin, Anna Booman, Brian Bateman, Elliott Main, Deirdre Lyell, Danielle Panelli, Stephanie Leonard, Iro Igbinosa, Stephanie Leonard

Antepartum anemia affects 16% of pregnancies in the United States (US). Previous studies have shown an association between anemia and postpartum depression when relying on symptom-based screening tests for depression and diagnosis codes for anemia; however, these markers are non-diagnostic and prone to subjectivity. We evaluated the association between anemia based on lab values and mental health conditions diagnosed and treated up to 6 months postpartum.

We used data from livebirths in the US Merative™ MarketScan® Research Database from 2018-2022 excluding those with history of hereditary anemia or pre-existing mental health conditions. Anemia was defined as hemoglobin <11 g/dL or hematocrit <33% after 20 gestational weeks. We used ICD-10 diagnosis codes and pharmacy prescriptions within six months of delivery to identify individuals with postpartum mental health conditions, which included depression, anxiety, bipolar disorder, post-traumatic stress disorder, and other serious mental health conditions.

Among 28,739 pregnancies, 10,186 (35%) had anemia with mean hemoglobin 10.4 g/dL compared to the group without anemia with mean hemoglobin 12.0 g/dL, $p<0.001$. The anemia group was more likely to have a history of prior cesarean delivery and multifetal gestation ($p<0.001$). The rate of mental health conditions (12%) was similar between people with and without anemia after adjusting for potential confounders (adjusted risk ratio 1.01; 95% CI, 0.95, 1.08).

Our findings suggest anemia among the commercially insured may not be associated with development of postpartum mental health conditions as documented by ICD codes and prescription medication fulfillment. Future studies exploring the effects of anemia on postpartum mood and mental health are warranted.

Occupational

Medicaid-covered deliveries among working families Candice Johnson*, Dawn Misra, Danielle Gartner, Claire Margerison,

Introduction. Medicaid covers the cost of necessary healthcare during pregnancy for low-income families, including for working families whose jobs pay so little that they meet income eligibility. Because information on employment during pregnancy is rarely collected, we know little about the extent to which working families rely on Medicaid to pay for prenatal care and childbirth.

Methods. We used 2020–2022 birth certificate data from Alabama, one of the few states that collects parental employment on the birth certificate. We defined working parents as those with employment listed on the birth certificate and working families as those in which at least one parent worked. We conducted a descriptive analysis of working families whose delivery was paid by Medicaid. In Alabama, pregnant people are eligible for Medicaid if they have a household income below 146% of the federal poverty level.

Results. We included 139,659 working families, among whom 56% had two working parents and 44% had one working parent. Overall, 41% of working families had a delivery paid by Medicaid. Families with one working parent were more likely to have a delivery paid by Medicaid than those with two working parents (60% vs. 25%). In families covered by Medicaid in which only the father worked, their most common occupations were construction laborer, general laborer, and delivery or truck driver. In families covered by Medicaid in which only the mother worked, their most common occupations were cashier, customer service representative, and nursing assistant.

Conclusions. Medicaid was frequently used to pay for delivery among working families. When employers pay low wages and workers lack affordable private health insurance, Medicaid is an essential resource to ensure that working families can access healthcare during pregnancy.

Other

Fetal vascular malperfusion levels affecting the fetal microvasculature have significant and sex-specific effects on cyto- and chemo-kine levels in newborn dried blood spots. Carolyn Salafia*, Theresa Girardi, Katherine Patterson, Judith van de Water, Dawn Misra,

Background: Fetal vascular malperfusion lesions of the placenta mark areas of endothelial injury. Endothelial injury to the fetal side of the placenta may produce vascular degeneration. Further, fetal vascular malperfusion has been linked to the risk of future neurodevelopmental impairment. We sought to identify changes in levels of cyto- and chemo- kine levels in newborn dried blood spots associated with fetal vascular malperfusionin a unique population of 1809 newborns in a hospital with universal mandated placental examination.
Methods: From 2010-2016, all placentas had full surgical pathology examination by a single pathologist as per hospital mandate. Fetal vascular malperfusionwas modeled as binary (when at least one lesion was identified) with subtypes of the fetal placental pathology also explored: avascular villi (villi with no blood flow or blockage of flow); stromal karyorrhexis (destructive fragmentation of the stromal cell). Among a random subsample of 1,000 male and 1,000 female term births, 1809 NDBS could be retrieved and linked from the New York State Newborn Screening Program. Elution and analysis of dried blood spots were performed using the Bio-Rad 40-plex platform. Levels of 40 cyto- (e.g., interleukin 6) and chemo-kines (e.g., chemokine CCL-21) were measured. Non-parametric analytic methods considered fetal vascular malperfusion and its subtypes as binary. Results with $p<0.05$ were reported.
Results: 7 of 40 analytes were significantly suppressed in male infants and 8 were suppressed in female infants; only 2 analytes were suppressed in both male and female infants. Avascular villi were associated with more suppressed cyto-and chemo- kine levels in females while villi with stromal karyorrhexis were associated with more suppressed analytes in males.
Conclusions: Fetal vascular malperfusion lesions generally affect relatively few villi in the tissue section; however, their apparent impact on newborn serum analytes was substantial. These observations may provide insight into placental programming of lifelong offspring disease.

Pharmacoepidemiology

Bias induced by method of pregnancy identification in studies of prenatal exposures using administrative healthcare data Chae Latour*, Jessie Edwards, Michele Jonsson Funk, Elizabeth Suarez, Kim Bogges, Mollie Wood,

Background: Researchers have typically required a recorded outcome (eg, delivery) to identify pregnancies in insurance claims or electronic health records. This retrospective approach misses pregnancies that received prenatal care but whose outcomes were not recorded (eg, at-home miscarriage), potentially inducing selection bias in effect estimates for prenatal exposures. Prenatal encounters can be used to prospectively identify pregnancies, including those with unobserved outcomes. However, this approach requires methods to address missing data.

Objective: Evaluate bias under two pregnancy identification approaches (retrospective, prospective) across measured and unmeasured sources of missingness.

Methods: We simulated 5,000,000 pregnancies and estimated the total effect of initiating antihypertensives on the risk of preeclampsia. Treatment decreased the risk of preeclampsia, and 20% of pregnancies were missing outcomes. We generated data for scenarios characterized by the effect of treatment on miscarriage and the cause of missingness: 1) a measured covariate, 2) miscarriage, or 3) a mix of both. We then created 3 analytic samples to deal with missing outcomes: observed deliveries, observed deliveries and miscarriages, and all pregnancies. We estimated treatment effects using non-parametric direct standardization.

Results: Bias in risk differences was highest for observed deliveries (range: -0.07, 0.02) and lowest for all pregnancies (range: -0.04, 0.03). Within the latter group, bias decreased as the proportion of missingness due to miscarriage decreased: bias was -0.04 to 0.03 when all missingness was due to miscarriage versus 0.00 when all was due to the measured covariate.

Conclusion: Including all pregnancies removed bias when missingness was due to a measured covariate, but bias remained when missingness was due to miscarriage. However, studies must include all pregnancies to conduct sensitivity analyses of this bias informed by the known extent of missingness.

Pharmacoepidemiology

Patient-provider racial concordance and risk for postpartum opioid dispensation among US military service members, 2017–2023 Celeste Romano*, Clinton Hall, Gia Gumbs, Ava Marie Conlin, Marissa Seamans,

Background: Undertreatment of women's pain, particularly Black women's pain, is prevalent, yet opioids can also be overprescribed, contributing to chronic misuse. This work aimed to assess the association between shared patient-provider race—a factor previously associated with health outcomes—and postpartum opioid dispensation.

Methods: Vaginal and low-risk cesarean deliveries among Black, Hispanic or Latino, and non-Hispanic White US service members at military hospitals, 2017–2023, were identified using TRICARE claims and military personnel records. Deliveries were quasi-randomly assigned an attending provider at time of admission. Eligible postpartum opioid dispensations were written within 1 day of discharge and dispensed within 7 days postpartum. Log-binomial regression was used to estimate crude risk ratios (RRs) and 95% confidence intervals (CIs) overall and by racial group.

Results: Postpartum opioid dispensation occurred among 2.6% (n=346), 2.2% (n=446), and 1.9% (n=190) of Black, non-Hispanic White, and Hispanic or Latino vaginal deliveries, respectively. In contrast, opioid dispensation ranged from 57.2% (n=1531) among non-Hispanic White low-risk cesarean deliveries to 59.2% among Black (n=1605) and Hispanic or Latino (n=1014) low-risk cesarean deliveries. Shared patient-provider race was not associated with opioid dispensation among vaginal deliveries, but risk was slightly attenuated among low-risk cesarean deliveries (RR=0.96, 95% CI: 0.91-1.01); stratified analyses revealed this association was unique to Black patients (RR=0.83, 95% CI: 0.71-0.96).

Conclusions: Postpartum opioid dispensation was rare for vaginal deliveries and occurred among <60% of low-risk cesarean deliveries. Dispensations were slightly more common among Black service members relative to other racial groups, but were less likely to occur if the attending provider also identified as Black. Follow up work is needed to identify possible reasons for differential dispensation patterns.

Pharmacoepidemiology

Racial and Ethnic Disparities in Treatment Retention among Pregnant Individuals with Opioid Use Disorder Heidi Zakoul*, Chih-Wan Grace Lin, Loreen Straub, Sonia Hernandez-Diaz, Brian Bateman, Krista Huybrechts,

Although treatment of pregnant individuals with opioid use disorder (OUD) is crucial for maternal and neonatal safety, treatment discontinuation is known to be high. Racial and ethnic disparities in access to OUD treatment have been described, but it is unclear whether these disparities extend to treatment continuation.

The study objective was to evaluate racial and ethnic disparities in OUD treatment retention among publicly insured pregnancies.

We conducted a population-based cohort study nested in nationwide Medicaid data from 2003-2018. The study population consisted of pregnant individuals who initiated buprenorphine or methadone for OUD during pregnancy, assessed based on prescription fills and administration codes. Race and ethnicity was categorized as non-Hispanic White (White, =reference), non-Hispanic Black/African American (Black), Hispanic/Latino (Hispanic), and other. Treatment discontinuation was defined as a ≥60-day treatment gap. Hazard ratios (HRs) were estimated using Cox proportional hazards regression.

Among 5,801 buprenorphine initiators, 85.1% were White, 4.3% Black, and 4.3% Hispanic. Among 3,498 methadone initiators, the proportions were respectively 75.4%, 9.6% and 8.9%. Buprenorphine initiators who identified as Black were 87% more likely to discontinue treatment compared to those who identified as White (HR=1.87, 95% Confidence Interval [CI]: 1.49-2.35). The HR for Hispanic individuals was 1.24 (95% CI: 0.96-1.60). No difference was observed for the other race category. For methadone initiators, the HR was 1.20 (95% CI: 0.92-1.57) for patients who identified as Black, whereas no differences were observed for the other categories. Results were robust across a range of sensitivity analyses.

We observed disparities in treatment retention among pregnant individuals with OUD, in particular among those who identified as Black. Further investigation of patient, clinician, and system-level factors associated with these findings is warranted.

Pharmacoepidemiology

Antihypertensive Treatment Adherence during Pregnancy by Race and Ethnicity Elyse DiCesare*, Krista Huybrechts, Brian Bateman, Joyce Lii, Loreen Straub,

Chronic hypertension during pregnancy is associated with severe adverse maternal, fetal, and neonatal outcomes, and disproportionately affects Black individuals. Outside of pregnancy, substantial racial/ethnic differences in antihypertensive treatment (AHT) adherence have been reported. Insights into AHT adherence patterns during pregnancy may highlight approaches to decrease disparities in hypertension-related adverse pregnancy outcomes. We aimed to evaluate differences in AHT adherence during pregnancy by race and ethnicity.

Using a US-nationwide sample of publicly insured pregnant individuals (2000-2018), we identified those who initiated recommended AHT (i.e., methyldopa, labetalol, or nifedipine) in the first half of pregnancy. Differences in treatment adherence, defined as >80% days covered in the second pregnancy half, by race and ethnicity were evaluated. Risk ratios (RR) were estimated, adjusting for socio-demographic and medical characteristics. Sensitivity analyses were conducted to assess the robustness of the findings.

Of 16,554 AHT initiators (mean age=29.4 years), 44.6% were Black, 17.1% Hispanic, 31.4% White, and 7.0% of other/unknown race/ethnicity. The proportion of initiators who adhered to treatment was considerably lower for individuals classified as Black (16.8%) compared to other race/ethnicity groups (range: 27.2-28.2%). After adjustment, adherence remained lower for Black as compared to White individuals (RR=0.59 [95% CI: 0.54-0.63]). Findings were consistent across sensitivity analyses.

These findings suggest that AHT adherence throughout pregnancy differs significantly by race and ethnicity among individuals who initiate treatment early in pregnancy. The considerably lower adherence among Black individuals is particularly concerning given that Black individuals with hypertension are at higher risk for adverse pregnancy outcomes. Defining strategies to improve AHT adherence is important to reduce racial disparities in maternal morbidity.

Pregnancy outcomes

HIV Status and Hypertension among Pregnant Women from the STAR Cohort Danielle Carson*, Lauren Collins, Christina Mehta, Seble Kassaye, Aadia Rana, Daniel Westreich, Elizabeth Topper, Maria Alcaide, Anandi Sheth, Angela Bengtson,

Pregnant women living with HIV (WLWH) are at increased risk of hypertension due to factors such as chronic inflammation and antiretroviral therapy. Associations between HIV status and hypertension in pregnancy may vary by race/ethnicity due to disparities in hypertension risk and social determinants of health. Understanding how HIV status correlates with hypertension in pregnancy is essential for improving maternal health outcomes. We used data from the Study of Treatment and Reproductive Outcomes in Women (STAR) cohort, which includes WLWH and women without HIV (WWoH) of reproductive age across the Southeast US, to describe the prevalence of hypertension by HIV status and explore differences by race/ethnicity in pregnant women at study enrollment. Hypertension was defined as systolic blood pressure ≥140, diastolic blood pressure ≥90, or self-report of anti-hypertensive medication use at baseline and included both chronic and gestational hypertension. We estimated the association between HIV status and hypertension prevalence using multivariable log binomial regression. Among 79 pregnant women (58 WLWH; 21 WWoH) included, 72% identified as non-Hispanic Black and 18% as Hispanic. WLWH (median age 37, IQR 32-42) were slightly older than WWoH (median age 32, IQR 26-40) and had higher body mass index (BMI) (WLWH median BMI 33, IQR 27-42; WWoH median BMI 31, IQR 25-39). In unadjusted analyses, the prevalence of hypertension was 9% overall and did not differ by HIV status. All 7 women with prevalent hypertension identified as non-Hispanic Black. After adjustment for age, obesity status (BMI ≥ 30), and ever smoking, HIV was not associated with higher prevalence of hypertension in pregnancy (PR 1.49, 95% CI 0.30, 7.41). Hypertension prevalence in pregnancy did not differ by HIV status in this cohort and was concentrated among non-Hispanic Black women. Longitudinal analyses in STAR will help to clarify if HIV status influences the development of gestational hypertension.

Pregnancy outcomes

Intergeneration recurrence of preeclampsia and gestational hypertension through fathers – role of in-utero exposure and familial predisposition Aditi Singh*, Rolv Skjærven, Sage Wyatt, Liv Grimstvedt Kvalvik,

Background. Hypertensive disorders of pregnancy (HDP), including preeclampsia (PE) and gestational (GH) hypertension, demonstrate strong intergenerational recurrences through the maternal line. However, the paternal contribution has been relatively unstudied. **Methods.** Using the Medical Birth Registry of Norway (1967-2020), we identified 451501 men who fathered their partners' first singleton pregnancies. Relative risks (RR) with 95% confidence intervals (CI) were calculated using log-binomial regression models, adjusted for year of pregnancy, men's age at pregnancy, men's educational status, and partners' age at pregnancy and pre-pregnancy comorbidities. The outcomes were complications in the first pregnancy: preeclampsia, gestational hypertension , placental abruption, small-for-gestational-age 2.5 and stillbirth. **Results.** Men exposed to PE in-utero had higher risks of fathering PE (RR 1.4; 95%CI 1.3-1.5) and GH (RR 1.2; 95%CI 1.1-1.4); while men exposed to GH in-utero had increased risks for PE only (RR 1.2; 95%CI 1.1-1.3). Increased risks were not observed for the other pregnancy complications. Partners with in-utero exposure to HDP had higher risks for HDPs in their own pregnancies, but this was not influenced by the men's in-utero exposure to HDP. Men unexposed to HDP in-utero, born before or after HDPs, had no increased risks of fathering pregnancies with complications. **Conclusion.** Our findings suggest that men exposed to HDP in-utero independently contribute to the occurrence of HDP in their partners' pregnancies. Familial susceptibility does not account for the heightened risk of fathering HDP following in-utero exposure. Furthermore, the increased risk among partners exposed to HDP in-utero was not modified by the men's in-utero HDP status.

Pregnancy outcomes

Low risk cesarean delivery among Black immigrants in the United States, 2005-2022 Safyer McKenzie-Sampson*, Chelse Spinner, Irogue Igbinosa, Ijeoma Iwekaogwu, Elliott Main, Suzan Carmichael,

In the United States (US), Black women have the highest prevalence of cesarean delivery, compared to other racial/ethnic groups. Socioeconomic, hospital-level, and clinical factors do not fully account for increased risk of cesarean among Black women. Past research has found disparities in preterm birth and low birthweight among Black women by nativity; specifically, Black immigrants have a lower risk of adverse birth outcomes than US-born Black women. However, there is less research on whether disparities exist among Black women by nativity for cesarean delivery. This study examines risk of cesarean delivery among low-risk births to non-Hispanic Black immigrants of African and Caribbean origin compared to US-born Black women.

US vital statistics data for nulliparous, term, singleton, vertex deliveries (NTSV) to African-, Caribbean-, and US-born Black women who resided in the US between 2005-2022 (n= 2,446,551) were used to fit Poisson regression models, adjusted for socio-demographic and clinical risk factors, with year and state fixed effects. We computed risk ratios (RR) and 95% confidence intervals (CI) for the risk of NTSV cesarean among African- and Caribbean-born women from the top ten birthplaces compared to US-born Black women.

The overall prevalence of NTSV cesarean was higher for Caribbean- (35%) and African-born (36%) women, compared to US-born Black women (29%). Among the top countries of origin, the prevalence of NTSV cesarean was highest for Ethiopian (40%), and lowest for Somali women (32%). In adjusted regression models, Ethiopian women (RR 1.32 95%CI 1.30, 1.34) had the highest risk of NTSV cesarean, while for Trinidadian (RR 0.95; 95%CI 0.92, 0.98) women it was lowest, compared to US-born Black women.

Our analysis revealed that on average Black immigrants have a higher risk of NTSV cesarean delivery compared to US-born Black women. Further research is needed to understand the factors contributing to the higher risk of cesarean among Black immigrants.

Pregnancy outcomes

Examining the role of work conditions on preterm birth among Black mothers Florence Kizza*, Dawn Misra,

Background: Preterm birth (PTB) contributes significantly to infant mortality and morbidity among Black infants. Prenatal workplace exposures and experiences have rarely been studied among Black women. Our aim was to examine the role of work conditions (work hours, job loss) on the odds of PTB among Black women.

Methods: We used data from the Life Course Influences of Fetal Environments (LIFE) retrospective cohort study of Black women in Metropolitan Detroit, Michigan. We restricted our study to the 695 employed during pregnancy. We used multivariable logistic regression analyses to determine the role of work conditions on the risk of PTB and to adjust for the potential covariates. On a multiplicative scale, we explored effect measure modification for each potential effect modifier (psychosocial factors and experiences of racism) by adding an interaction term to the regression models. Results are presented as odds ratios (OR) and 95% Confidence Intervals (95% CI).

Results: 104(15.0%) of the participants had a preterm birth. In adjusted models, working more than 40 hours per week was positively associated with PTB risk (aOR=1.34; 95% CI: 0.86,2.25). Similarly, women who faced job loss most of the time were at increased risk of PTB (aOR=1.55; 95% CI: 0.32,7.58). However, these associations were not statistically significant. Social support modified the prolonged work hours (> 40 hours/week)-PTB association (interaction p=0.06), such that working for prolonged hours was associated with increased odds of PTB (aOR=1.89; 95% CI:1.05,3.41) among women with low social support.

Conclusion: Our results suggest that working for prolonged hours and job loss may increase PTB rates in Black women. Evidence of interactions between prolonged work hours and social support suggests that impacts are intertwined. Findings highlight the need to develop social and economic policies focused on accommodation reforms that will improve the livelihood of Black pregnant women in the workforce.

Pregnancy outcomes

Association between county-level availability of hospital-based obstetric care and unplanned home birth in the United States, 2018-2021 Grace Joachim*, Claire Margerison,

Background

Rural communities in the United States face many barriers to healthcare, including distance from healthcare facilities. This is especially problematic for pregnant women as labor and delivery units are closed. A potential consequence to this lack of access are unplanned home births (UHBs). While such occurrences account for a small number of births, UHBs are comparatively more dangerous than planned home births and hospital births. Thus, this study will examine associations between county-level availability of hospital-based obstetric (OB) care and UHBs in the United States.

Methods

We used birth certificate data from the National Vital Statistics System and Area Health Resource Files (AHRF) data from 2018 to 2021. AHRF is a dataset from the Health Resources and Services Administration, collected from the American Hospital Association Annual Survey of Hospitals, that compiles data on healthcare related topics, including health facilities, healthcare professions, and population characteristics. We used generalized estimating equations to estimate the association between the continuous number of hospitals that provide OB care in the county of birth and the odds of having a UHB, with occurrence county as the grouping variable.

Results

The analytic sample included 13,905,056 births. In the analytic sample, 0.1% of births were UHBs. In counties with zero hospitals that provided OB care, 13.9% of births occurred in hospitals, while 15.4% of births in such counties were UHBs. After adjusting for mother’s age, education, and race/ethnicity, urbanicity, marital status, parity, and plurality, we found that, for each additional hospital with OB care in a county, the odds of a UHB decreased by 0.99 (95% CI 0.98, 1.00).

Conclusion

We found a small inverse association between the number of hospitals in a county that provide OB care and the odds of a UHB. Future studies will examine if a similar association is seen in counties that have lost hospitals with OB care over time.

Pregnancy outcomes

Assessing the role of intergenerational neighborhood deprivation on birthweight using a state-wide population birth cohort Aaron Lilienfeld Asbun*, Mercedes Bravo, Melissa Fiffer, Pierre Zephyr, Marie Lynn Miranda,

Background:

Research suggests that cumulative disadvantage impacts birth outcomes, but few studies are equipped to examine intergenerational associations. Using 30 years of North Carolina detailed birth records (1990-2019) (n=62,491), we linked births across mothers (G1) to daughters (G2) who themselves subsequently gave birth in NC.

Objective:

Using an index of neighborhood deprivation (NDI) (Messer et al., J Urban Health, 2006), we examine the association between intergenerational neighborhood deprivation and birthweight.

Methods:

Census tract-level NDI was calculated in two time periods. We calculated quintiles of scaled NDI for G1 and G2 births. Census tracts in the top two NDI quintiles were classified as “high NDI” (high disadvantage), and those in the bottom two quintiles were classified as “low NDI” (low disadvantage). Using mixed effects linear regression, we estimated birthweight (g) among G2 mothers using intergenerational NDI as our primary exposure, while adjusting for the G2 mother’s birth outcome at G1 and her demographic characteristics.

Results:

Being born in a low NDI environment and then giving birth in a high NDI environment (low-high) was associated with lower birthweight (-30.4 [95% CI: (-43.9, -16.9)]) compared to mothers who stayed in a low NDI environment from birth (low-low). Being born in a high NDI environment and then giving birth in a high NDI (high-high) environment was associated with lower birthweight (-36.5 [95% CI: (-49.7, -23.4)]) compared to low-low mothers. Further, being born in a high NDI environment but then giving birth in a low NDI environment (high-low) was associated with lower birthweight (-19.4 [95% CI: -31.1, -7.7]), compared to low-low mothers, with attenuated results compared to high-high mothers.

Conclusion:

Intergenerational NDI is associated with birthweight. These results highlight the potential cumulating effects of intergenerational neighborhood deprivation on birth outcomes.

Pregnancy outcomes

Continuous Glucose Monitoring in Twin Pregnancies: Associations with Maternal and Neonatal Outcomes Arsala Khan*, Esra Mucahit, Tenzin Sangmo, Aung Han Win, Vanessa Martinez, Dhruti Patel, Lauren Berube, Todd Rosen, Shauna Williams, Shristi Rawal,

Twin pregnancies present distinct metabolic challenges, such as increased energy demands, resulting in unique glucose profiles. Current screening thresholds for gestational diabetes mellitus (GDM) using a glucose challenge test (GCT) are based on singleton pregnancies, potentially leading to inaccurate risk stratification and suboptimal management in twin gestations. Accumulating evidence suggests that GDM in twin pregnancies may have unexpected protective effects on intrauterine growth restriction, preterm birth, and Apgar scores. This study investigates the associations between continuous glucose monitoring (CGM) metrics in mid-pregnancy and key maternal and neonatal outcomes in twin pregnancies, comparing it to the predictive capacity of GCT. Twelve women with twin pregnancies were enrolled between 16-34 gestational weeks (GW) and asked to wear a blinded FreeStyle Libre CGM sensor for up to 14 days at each visit, for a total of up to 4 visits during the second and third trimesters. Maternal and neonatal outcomes were abstracted from medical records. Only visit 1 data (mean 25.1 ± 6.3 GW), which was available for all 12 participants, were included in the analyses. Higher average glucose levels and variability captured by CGM (mean 24-hour and daytime glucose; high blood glucose index (HBGI), MVALUE) were significantly associated with greater gestational weight gain (GWG) (Pearson’s $r > 0.7$; $p 0.5$; $p 0.8$; $p 0.8$; $p < 0.09$). GCT demonstrated weaker and less consistent associations with these outcomes, suggesting it may be an inadequate marker of glucose dysregulation and adverse outcome risk in twin pregnancies. These findings highlight CGM’s potential in providing a more accurate and nuanced understanding of glucose dynamics and outcomes in twin pregnancies. Larger studies are needed to validate these findings and assess CGM's utility in optimizing pregnancy outcomes.

Pregnancy outcomes

Maternal Mid-Upper Arm Circumference During Pregnancy in Ethiopia: Trends and Associations with Adverse Birth Outcomes Yumin Kim*, Firehiwot Workneh, Nebiyou Fasil, Kalkidan Yibetal, Alemayehu Worku, Yunhee Kang, Nandita Perumal, Parul Christian, Yemane Berhane, Anne CC Lee,

Background: Maternal undernutrition increases adverse perinatal risks, often via intrauterine growth restriction. Mid-upper arm circumference (MUAC) is a proxy for maternal undernutrition, but its predictive value remains unclear. This study examines MUAC trends in pregnancy and the association of different MUAC thresholds with adverse pregnancy outcomes.

Methods: A prenatal RCT in rural Ethiopia enrolled 2,399 pregnant women at <24 weeks gestation (ISRCTN15116516). Anthropometric measurements, including MUAC, were taken at enrollment and follow-up antenatal visits (mean visits: 3.6±1.7). Women who received balanced energy protein supplementation as the trial intervention were excluded from this analysis. A linear mixed-effects model assessed MUAC trends. Regression models evaluated MUAC cutoffs (<23cm, <22.5cm, <22cm) for associations with gestational weight gain (GWG) rate, stillbirth, preterm birth, small-for-gestational-age (SGA, <10th percentile per INTERGROWTH standards), and low birth weight (LBW) in singleton pregnancies, adjusting for maternal age and parity. GWG rate (g/week) was total weight gain divided by weeks between first and last measure.

Results: Among 1,872 women (5,772 observations), 17% had an enrollment MUAC <23cm, 13% had <22.5cm, and 8% had <22cm. MUAC did not significantly change over the gestational period (β= -0.0016, p= 0.23). Low enrollment MUAC was associated with increased odds of LBW, with the highest odds ratio (OR) at the <22cm cutoff (OR= 1.97 [95%CI 1.0 to 3.7] for <22cm, 1.94 [1.1 to 3.3] for <22.5cm, and 1.55 [0.9 to 2.7] for <23cm). Associations with GWG rate and other pregnancy outcomes were not significant.

Conclusions: MUAC remains stable throughout pregnancy, making it a useful indicator of undernutrition, particularly in later gestation as BMI increases. Low MUAC (<22.5 cm) in early pregnancy was associated with LBW, supporting its clinical utility as a screening tool for maternal undernutrition affecting fetal growth.

Pregnancy outcomes

Prenatal Care in a Pandemic: Interrupted Time Series Analysis of COVID-Era US Birth Outcomes Esther Priscilla Ebuehi*, Liwei Chen,

Background: Hypertensive disorders of pregnancy (HDP; chronic hypertension, gestational hypertension, preeclampsia, and/or eclampsia) are strong predictors of adverse birth outcomes (ABOs; preterm birth, low birthweight, and/or small for gestational age) that disproportionately impact women from racial and ethnic minority groups. Prenatal care utilization (PNCU) is declining nationally in the United States, and low PNCU can exacerbate racial disparities.

Methods: Data from the Pregnancy Risk Assessment Monitoring System (Phase 8: 2016-2022) (N=118,087) were applied to investigate whether (1) there is a racial disparity in the association between HDP and ABOs, (2) PNCU moderates the association between HDP and ABOs, and (3) racial disparities in ABOs are explained by PNCU for women with HDP. Weighted multivariable logistic regression models, including nested models, were used to estimate the adjusted odds ratios and 95% confidence interval of ABOs.

Results: HDP prevalence in the general sample was 20.1%, and was highest among Black (24.6%) and Native American women (21.0%). Compared to women with normotensive pregnancies, women with HDP had more than twice the odds of having an ABO *(aOR = 1.64, CI = 1.56-1.73)*. Compared to White women with normotensive pregnancies, Black and Hispanic/Latine women with HDP had 29% and 26% higher odds, respectively, of experiencing an ABO *(Black aOR = 1.29, CI = 1.13-1.47; Hispanic/Latine aOR = 1.26, CI = 1.01-1.47)*. Among women with HDP, these racial disparities in ABO persisted, and adequate-plus PNCU did not mitigate the odds of ABO after sequentially adjusting for maternal race/ethnicity *(Black aOR = 1.45, CI = 1.29-1.64; Hispanic/Latine aOR = 1.22, CI = 1.06-1.41)*.

Conclusion: Racial disparities in adverse birth outcomes persisted, even among women with hypertensive pregnancies who utilized prenatal care the most. Findings from this study can be used to improve access to person-centered prenatal care.

Pregnancy outcomes

Prevalence and racial-ethnic disparities of hemorrhage and its progression to severe maternal morbidity (SMM) Chelse Spinner*, Elliott Main, Shen-Chih Chang, Stephanie Leonard, Irogue Igbinosa, Mahasin Mujahid, Suzan Carmichael,

Hemorrhage, a leading cause of maternal mortality and morbidity in the United States, has contributed directly to rising rates of severe maternal morbidity (SMM), leading to serious short and long-term health consequences. Disparities in the progression of hemorrhage to SMM remain understudied. We hypothesize that marginalized racial-ethnic groups are disproportionately affected by hemorrhage-related outcomes, highlighting the need for targeted research.

We conducted a descriptive analysis using live birth and fetal death certificate data linked with maternal hospital discharge records from California (2016-2021) to examine prevalence and racial-ethnic disparities in i) hemorrhage, among all individuals who gave birth, and ii) SMM, among individuals with hemorrhage. Prevalence rates of each outcome were calculated for the most common racial-ethnic groups (non-Hispanic (NH) White, NH Black, NH Asian, Hispanic, NH Pacific Islander, and NH American Indian) statewide.

Among 2,588,688 deliveries, hemorrhage was observed in 160,227 (6.2%), with hemorrhage due to uterine atony being most common (4.3%). The highest prevalence of hemorrhage was observed among NH Pacific Islander patients (10.5%), while the lowest prevalence was observed among NH White patients (5.6%). Among individuals with hemorrhage, 15.7% progressed to SMM overall, and 5.2% progressed to ntSMM (excluding transfusion-only cases). Progression was highest among NH Black patients (SMM overall: 19.6%; ntSMM: 6.9%) and lowest among NH White patients (SMM overall: 14.2%; ntSMM: 4.6%), while NH Pacific Islander patients had relatively low rates (SMM overall: 17.2%; ntSMM: 5.3%).

Findings indicate a higher prevalence of hemorrhage and its progression to SMM for marginalized racial-ethnic groups. Future research should investigate the difference in risk of hemorrhage and its progression to SMM and address why hemorrhage progresses to SMM more frequently in certain racial-ethnic groups.

Pregnancy outcomes

The role of migration and refugee status on preterm birth in high-Income Countries: A Systematic Review and Meta-Analysis Gizachew Tessema*, Tesfaye Mengistu, Aditi Roy, Bereket Kefale, Jennifer Dunne, Gavin Pereira, Gizachew Tessema,

Background: Accurately estimating the risk of preterm (PTB) among immigrants and refugees' women in high-income countries (HICs) is critical to designing effective strategies to reduce PTB and its far-reaching consequences. This systematic review and meta-analysis synthesised evidence on the risk of PTB among migrant women in HICs.

Method: We searched six databases including Embase, Medline, Scopus, CINAHL, Web of Science and Global Health from inception to November 2024. We conducted an inverse variance-weighted random-effects meta-analysis using Review Manager (RevMan) version 5.3. We estimated pooled OR with 95% confidence intervals for all PTB categories stratified by women's country of origin income classification.

Results: Of 3,516 records retrieved from databases, we included 88 unique studies (75%, n=66 was cohort) conducted in 17 HICs comprising a total of 107,820,220 population. We found that women who migrated from low-income countries had higher odds of overall PTB (pooled OR 1.73 (95%CI: 1.36–2.20) with 2-fold higher odds of very preterm birth (28 – <32 weeks) (pooled OR 2.24, (95%CI: 1.46–3.46)] and moderate/late preterm (32–36 weeks) [pooled OR 2.09, (95%CI: 1.21–3.61)]. Likewise, women who migrated from lower-middle-income countries show increased odds of overall PTB (pooled OR 2.08, (95%CI:1.77–2.44)], with close to 3-fold higher odds extreme preterm birth (< 28 weeks) [pooled OR 2.91, (95%CI: 1.56–5.42)] and 2 times higher odds of moderate/late preterm birth (32–36 weeks)(pooled OR 2.08, (95%CI: 1.39–3.12)].

Conclusions: Our results provide strong population-based evidence on the impact of migration on the risk of PTB among women in HICs. Our study highlights the importance of considering migration and refugee status as screening criteria in clinical settings and public health policy and interventions to reduce PTB incidence and its consequences in these vulnerable groups of women.

No Entries Found

Pregnancy outcomes

Updated reference ranges for normal second trimester growth velocity Elizabeth Williams*, Maddy St. Ville, Zhen Chen, Jessica Gleason, Dian He, John Owen, Roger Newman, Edward Chien, William Grobman, Daniel Skupski, Angela Ranzini, Anthony Sciscione, Jagteshwar Grewal, Cuilin Zhang, Fasil Tekola-Ayele, Katherine Grantz,

Monitoring fetal growth is essential, as deviations from normal growth are associated with adverse outcomes. However, clinical practice currently lacks a universally effective process for identifying pathologic fetal growth. Individualized growth assessment (IGA) has been proposed as an improvement, using second trimester (2T) ultrasound measurements to model individual third trimester (3T) growth potential. A criterion for using IGA is for a fetus to have a “normal” 2T growth trajectory, defined using reference ranges that were established in a small, racially homogeneous cohort (n=119, 88% White). However, these ranges have never been formally re-assessed.

To address this gap, we calculated updated 95% reference ranges for normal 2T growth velocity for head circumference (HC), abdominal circumference (AC), and femur length (FL) using the NICHD Fetal Growth Studies Standard Population (n=1,668). We compared the prior and updated ranges using t-tests and by comparing their 3T IGA classifications.

Compared to prior IGA reference ranges, we observed higher mean velocities and narrower ranges for all three parameters, with statistically significant differences for HC and FL. Applying the updated ranges to the full NICHD Fetal Growth Studies cohort (n= 2,447), 2-3% of fetuses previously identified as having normal 2T growth velocity were reclassified as abnormal. Among these 2-3%, fetuses with slower 2T growth were more likely to be flagged as overgrowing their 3T potential, and fetuses with faster 2T growth were more likely to be flagged as undergrowing their 3T potential using IGA.

This apparent growth disparity between trimesters raises concerns about IGA methods pathologizing potentially healthy “catch-up” growth, calling into question the assumption that 2T growth velocity accurately predicts 3T growth potential. This finding underscores the need for a critical reappraisal of IGA to ensure its validity across diverse populations and growth patterns.

Social determinants of health

The Daily Life Experiences Scale: Factor structure, reliability, and validity for measuring experiences of microaggressions during prenatal care in a sample of Black postpartum women Sarah Haight*, Lisa Miller, Mercedes Price, Dawn Misra, Jaime Slaughter-Acey,

Objective: The Daily Life Experiences (DLE) scale measures experiences of racial microaggressions, defined as everyday actions or comments expressing prejudice or bias. We assessed the factor structure, reliability, and validity of the DLE for Black postpartum women in daily life (DLE-DL) and in prenatal care (DLE-PNC) settings.

Methods: Data were from the LIFE-2 cohort study of Black women delivering in metropolitan Detroit from 2023-2025. The 20-item DLE-DL assessed past year experiences of microaggressions, while the adapted DLE-PNC included 17 of the 20 items in reference to seeking/receiving PNC. Factor structure was determined via exploratory factor analysis. The correlation between the DLE-DL and DLE-PNC was calculated with Pearson's correlation coefficient. Internal consistency was determined via Cronbach's Alpha. Convergent and divergent validity was respectively assessed by comparing the DLE-DL and DLE-PNC to the 9-item Everyday Occurrences of Discrimination scale and 12-item Quality of Prenatal Care Questionnaire-Support and Respect subscale.

Results: Among this sample of 401 postpartum women, the DLE-DL and DLE-PNC were moderately correlated (=0.52) and best measured with a one-factor model that demonstrated modest fit and strong internal consistency (=0.97 for both). Convergent validity with the Everyday Occurrences of Discrimination scale was observed for the DLE-DL (=0.59; p<.01) and DLE-PNC (=0.40; p<.01), indicating the DLE instrument, regardless of setting, successfully measures microaggressions. The DLE-PNC was not necessarily distinct from the Support and Respect subscale of the Quality of Prenatal Care Questionnaire (=0.40; p<.01), but may be capturing the mechanism (experiencing microaggressions) behind perceptions of inadequate support and respect during prenatal care.

Conclusions: The DLE is a reliable and valid tool for measuring Black postpartum women's experiences of microaggressions in daily life and within prenatal care.

Social determinants of health

Avoidable hospitalizations among children by maternal immigration status and admission category: a retrospective birth cohort study of Canadian children born in 1993 – 2017. Rina Lall*, Gabriel Shapiro, Seungmi Yang,

Hospitalizations for ambulatory care sensitive conditions (ACSCs), a group of acute, chronic, and vaccine-preventable conditions, are avoidable with adequate primary care. All immigrants face systemic barriers in accessing health care and utilize primary care less than their native-born counterparts. Factors associated with increased ACSC hospitalizations (e.g., low socioeconomic position, ethnic minorities, lack of health insurance) are also more prevalent among immigrants. However, immigrants are not a homogeneous group. Pre-migratory experiences combined with diverse socioeconomic and ethnocultural backgrounds create a heterogeneous population with distinct needs and health seeking behaviours. Additionally, international migrants in most host countries undergo varying selection and integration according to their migration pathways: economic migrants are chosen for their potential to contribute to the host country's economy, family reunification migrants are admitted to join relatives, and refugees are granted entry on humanitarian grounds. Disaggregating the immigrant population is thus essential to better understand health disparities between immigrants and native-born populations. It is plausible that limited health care access and utilization would translate into hospitalizations for ACSCs among native-born children of immigrants despite being citizens of the host country at birth. Yet, studies on pediatric ACSC hospitalizations are scant and most have addressed those with migrant backgrounds as a single group. This work will examine pediatric ACSC hospitalization rates in a nationally representative retrospective cohort of mother-newborn pairs for approximately 6 million infants born in Canada from 1993-2017. Specifically, we will examine trends by birth year, maternal duration of residence in Canada, and region (province/territory) in avoidable hospitalizations among Canadian-born children, differentiated by their mothers' immigration admission category.

Social determinants of health

Association between maternal residence in an ethnic enclave and adequacy of prenatal care utilization Valerie Martinez*, Asa Bradman, Maria-Elena Young, Andrew Williams, Sandie Ha,

Background: Ethnic enclaves, geographies with a high ethnic concentration, may positively influence health through social networks and culturally competent services. Research on prenatal care adequacy typically focuses on the general populations, but limited data on prenatal care among residents of ethnic enclaves exist.

Objective: This study examined associations between maternal residence in ethnic enclaves and adequacy of prenatal care among Latinas in California.

Methods: This retrospective cohort study analyzed 994,318 Latina births in California (2014-2018) from birth certificate data. Ethnic enclaves were defined as ZCTAs in the ≥66th percentile for three measures: Latino population density (percent of Latino residents), dissimilarity index (Latino and White resident distribution), and isolation index (interaction among Latino residents) from the American Community Survey. Adequate prenatal care utilization (APNCU) index was calculated based on the month prenatal care began, and number of visits adjusted for gestational age; categories were based on the Kotelchuck index: inadequate, intermediate, adequate, and adequate plus. Multinomial logistic regression models estimated odds ratio (OR) and 95% confidence intervals (CI) for the association between ethnic enclaves and APNCU, adjusting for potential confounders.

Results: Compared to non-enclaves, residents of Central American enclaves had higher odds of adequate (OR = 1.13, 95%CI: 1.10, 1.17), and adequate-plus care (OR = 1.05, 95%CI: 1.01, 1.08) relative to inadequate care. In sensitivity analyses where APNCU index was binary, residents of Central American enclaves had 9% higher odds of adequate prenatal care compared to non-enclaves (OR = 1.09, 95%CI: 1.06, 1.11).

Conclusion: Maternal residence in Central American enclaves was associated with improved prenatal care adequacy. Future research should explore mechanisms underlying these associations to inform efforts to improve maternal health equity.

Social determinants of health

Clusters of sociodemographic and socioeconomic factors and preconception folic acid supplementation in the National Birth Defects Prevention Study, U.S. 2004-2011 Julie Petersen*, Eirini Nestoridi, Rashida Smith-Webb, Wendy Nembhard, Jenil Patel, Bailey Wallace, Shannon Evans, Suzan Carmichael, Gary Shaw, Martha Werler, Mahsa Yazdy, Anne Marie Darling, the National Birth Defects Prevention Study ,

Background: Disparities in preconception folic acid (FA)-containing supplement use are well documented. However, limited research has examined the intersection of sociodemographic and socioeconomic factors to identify subgroups in greatest need of intervention.

Methods: Data were from US women who birthed liveborn, nonmalformed infants 2004-2011. Seven women and 19 census tract variables were input in a hierarchical clustering model to define common patterns of sociodemographic and socioeconomic factors and determine whether they correspond with differences in any FA supplement use 1 month before pregnancy. Supplement use was not included in the algorithm.

Results: The algorithm identified 5 clusters (A n=502, B n=1448, C n=1294, D=738, E n=1351). The proportion of women supplementing with FA increased across Clusters A (13.6%), B (25.8%), C (33.2%), D (37.7%), and E (54.0%). As supplement use increased, some patterns emerged. For instance, the following maternal characteristics decreased: age <20 years, less than a high school education, and household income <$10,000; the proportion with census tract crowding index and income:poverty ratio <1 above the median also decreased. Cluster A had the highest proportion of Hispanic women, Clusters C and E were predominantly non-Hispanic White, and Clusters B and D had the most women identifying as non-Hispanic Black and residing in census tracts with a higher than median proportion of Black residents. Cluster A and C individuals resided in census tracts with higher than median proportions of manual workers. The proportion of women who intended the pregnancy was higher in Cluster E.

Conclusion: FA supplement use was consistently lower among clusters that tended to be younger, less educated, and have lower income. These data stress the correlations among social determinants of health and the need to understand barriers and develop interventions in socioeconomically deprived communities.

Substance Use

Agreement between self-reported cannabis use and urine toxicology measures in a population-based pregnancy cohort in Michigan Ban Al-Sahab*, Omayma Alshaarawy, Jean Kerver, Kipling Bohnert, Kennedy Quinn, Audriyana Jaber, Nigel Paneth,

Background: Prenatal Cannabis use may be underreported due to social stigma and fear of legal repercussions. Outside of clinical settings, limited information is available on the validation of self-reported cannabis use among diverse pregnant populations. **Objective:** To assess agreement between self-reported prenatal cannabis use and urine toxicology measures and to determine correlates of non-disclosure of use. **Methods:** Data are from a statewide population-based pregnancy cohort (MARCH- Michigan Archive for Research on Child Health) that is part of the NIH's Environmental influences on Child Health Outcomes (ECHO) program. Pregnant individuals were recruited at their first prenatal visit from 22 sampled clinics in 2017-2023. We calculated sensitivity, specificity, positive predictive values (PPV), negative predictive values (NPV), and Cohen's kappa coefficient as a measure of agreement between self-reported cannabis use and urine toxicology as the criterion standard. **Results:** A total of 606 participants who had completed self-reported data within 30 days of the urine collection date were considered for analysis. Self-reports identified a prevalence of 14.2% for prenatal cannabis use, while urinalysis prevalence was 19.1%. Sensitivity, specificity, PPV, and NPV of self-report were 57.8%, 96.1%, 77.9% and 90.6%, respectively. Cohen's kappa coefficient was 0.598, indicating moderate agreement. Stratified by race/ethnicity, Cohen's kappa coefficient was 0.678 for non-Hispanic Whites as compared to 0.436 for non-Hispanic Blacks. Non-Hispanic Blacks, tobacco non-smokers, and those who reported cannabis use 3-months before pregnancy were more likely not to disclose cannabis use during pregnancy. **Conclusion:** Self-reports can underestimate cannabis use especially among some subsets of the population. Where feasible, researchers should consider using biological samples to obtain more valid estimates of cannabis use.

Substance Use

Cannabis Legalization and Use During Pregnancy: PRAMS 2016-2022 Timothy Michling*, Claire Margerison,

Importance
Recreational cannabis use is increasing rapidly in the United States. Twenty-four states (along three U.S. territories and the District of Columbia) have moved to legalize the commercialization, sale, and use of various recreational cannabis products. Moreover, seventy-four percent of Americans now live in a state where cannabis is legal for recreational use, medical use, or both. Changes in social attitudes and public policies have contributed to increasing belief that cannabis is harmless and decreasing utilization of cannabis use disorder treatment. Previous research has suggested that cannabis legalization may be associated with increased use of cannabis during pregnancy. This study incorporates the heterogeneity of policy enactment across state-level jurisdictions and individual conception data to produce a more recent and robust estimate of the association between recreational cannabis legalization and use during pregnancy.

Objective
This quasi-experimental difference-in-differences analysis seeks to estimate the impact of changes in cannabis legalization on cannabis use during pregnancy.

Methods
This study utilizes data from the Pregnancy Risk Assessment Monitoring System (PRAMS). Participants included 38,318 mothers with a live birth across 8 US states, as well as Puerto Rico. We defined pregnancies as exposed to state-level cannabis legalization if the estimated date of conception occurred after the initiation of cannabis legalization in the mother’s state or territory of residence. In Vermont, this occurred via introduction of legislation, whereas in Montana it occurred through a ballot initiative. We defined pregnancies in states that did not legalize cannabis or that occurred before legalization as unexposed to legalization.

Results
In Vermont, there was a 2-percentage-point (29%) increase in cannabis use during pregnancy attributable to recreational cannabis legalization after adjusting for maternal age, race, education level, marital status, and tobacco use. In Montana, there was a 3.9-percentage-point (53%) increase in cannabis use during pregnancy attributable to recreational cannabis legalization after adjusting for maternal age, race, education level, marital status, and tobacco use. Both findings were statistically significant ($\alpha = 0.05$).

Women’s health

Examining the relationship between high ambient temperatures and reproductive hormone levels in healthy premenopausal women: BioCycle study Kaniz Rabeya*, Neil Perkins, Lindsey Russo, Pauline Mendola, Timothy Canty, Karen Schliep, Nidhi Manchikanti, Carrie Nobles,

Background: Rising temperatures due to climate change have been linked to adverse reproductive health outcomes. While hormones play a critical role in reproductive health, the impact of high ambient temperature on hormone levels has been underexplored. We examined the relationship between ambient temperature and reproductive hormones in healthy premenopausal women.

Method: A prospective cohort study (BioCycle, 2005–2007) enrolled 250 regularly menstruating women (18-44 years) for two menstrual cycles from Buffalo, NY. Daily ambient temperature was averaged across the week (1-7 days) before menses, week (1-7 days) after menses, and 2nd week (8-14 days) after menses. Estradiol (E2), follicle-stimulating hormone (FSH), luteinizing hormone (LH), and progesterone (P4) were measured in serum at 8 time points during the menstrual cycle, including menstruation, mid-follicular phase, and LH/FSH surge. Generalized linear mixed models estimated the association between temperature and hormones overall, by season, and for temperature thresholds ≥ 22°C vs. 85th percentile) adjusting for season, age, and PM2.5.

Result: While we observed a trend of increasing E2 with increasing temperature, E2 decreased above higher temperature thresholds. For example, a 1°C increase in temperature one week before menses was associated with 0.26 pg/mL (95% CI, 0.04, 0.49) higher E2 at menstruation. Conversely, exposure to temperatures ≥ 22°C vs. < 22°C was associated with -13.74 pg/mL (95% CI, -25.66, -1.82) lower E2 at menstruation. The association between E2 and temperature was similar in the mid-follicular phase and LH/FSH surge. Additionally, we observed lower LH and FSH at LH/FSH surge and lower P4 at menses with higher temperatures.

Conclusion: Exposure to high ambient temperatures was associated with consistently lower E2 and modest reductions in LH, FSH, and P4, indicating reproductive hormones may play a role in the impact of high temperatures on women’s reproductive health.

Women’s health

Neighborhood Disadvantage and Menstrual Pain Among Black/ African-American Women

Sydney Carolan*, Ruth Geller, Kristen Upson, Quaker Harmon, Chandra Jackson, Anne Marie Jukic, Ganesa Wegienka, Lauren Wise, Amelia Wesselink,

Dysmenorrhea (severe menstrual pain) affects 16-29% of menstruating individuals. Stress is an established risk factor for dysmenorrhea and neighborhood environment can drive chronic stress; yet, there is little research on neighborhood context and menstrual health. We estimated the association of neighborhood disadvantage with menstrual pain among individuals in the Study of Environment, Lifestyle, and Fibroids. Participants self-identified as Black/ African-American, had an intact uterus, were aged 23-35 years, and lived in the Detroit, MI area in 2010-2012 (n=1693). Participants provided their residential address and data about the severity and impact of menstrual pain in the last year. We calculated a census tract level standardized neighborhood disadvantage score, a measure of disadvantage within the Detroit area, by linking addresses to 2011 American Community Survey data. We excluded participants who had no menses in the past year, or who used medication that could alter menstrual cycle frequency, for a final sample of 883. We fit age-adjusted log-binomial regression models to estimate prevalence ratios (PR) and 95% CIs for associations between neighborhood disadvantage scores (tertiles) and three menstrual pain outcomes: 1) menstrual pain is a “big problem”, 2) menstrual pain interferes “a lot” with daily activities, and 3) missed any days of work or home activities due to menstrual pain. Living in a more disadvantaged neighborhood was associated with a higher prevalence of menstrual pain outcomes. Relative to the lowest tertile, those in the highest tertile of neighborhood disadvantage were more likely to report menstrual pain being a big problem (PR=2.32, CI: 0.84-6.38), menstrual pain interfering a lot with daily activities (PR= 5.36, CI: 1.28-22.43), and missing any days of work or home activities due to menstrual pain (PR=2.02, CI: 0.95-4.30). Neighborhood disadvantage is associated with more severe menstrual pain that adversely impacts quality of life.

Women’s health

Child bereavement and maternal incident hypertension in the Nurses’ Health Study II

Karolina M. Edlund*, Alexandra Hillcoat, Shaili C. Jha, Jae H. Kang, Karestan C. Koenen, Christy A. Denckla,

Background: Cardiovascular disease remains the leading cause of morbidity and mortality among women, and prevention has focused on risk factors such as hypertension. While trauma is a known predictor of women’s cardiovascular health, the impacts of bereavement-related trauma are underexplored. As 12% of US adults experience child loss by age 50 and bereaved mothers bear greater risk of health sequelae than bereaved fathers, pathways linking child loss and hypertension among women warrant investigation.

Methods: Using data from 31,326 women in the Nurses’ Health Study II (Mage in 1989 = 34.53 years [SD = 4.65], 94% White) with a median follow-up of 11 years (IQR = 2), we ran Cox proportional hazards models to explore associations between history of child loss assessed in 2008 and self-reported clinician-diagnosed hypertension thereafter, adjusting for sociodemographic covariates. We excluded individuals if they reported hypertension or myocardial infarction/stroke, used antihypertensives, died, or were lost to follow-up prior to 2008. To explore effect measure modification by psychological sequalae, we fit models stratified by lifetime posttraumatic stress disorder (PTSD) and baseline clinically significant depressive symptoms.

Results: The prevalence of incident hypertension, lifetime PTSD, and clinically significant depressive symptoms was 18%, 10%, and 17%, respectively. Women with a history of child loss exhibited 1.09 (95% CI = 1.05, 1.13) times the adjusted hazard of incident hypertension compared to non-bereaved women. Estimates were elevated among women with a history of PTSD (HR = 1.16 [1.09, 1.22]) or clinically significant depressive symptoms (HR = 1.18 [1.09, 1.27]) relative to those without (HRno PTSD = 1.01 [0.95, 1.07]; HRno depression = 1.04 [1.00, 1.09]).

Conclusion: Women bereaved of a child are at moderately increased risk of incident hypertension. Further investigation is needed into the psychological sequelae of child loss as prevention targets.

Women’s health

Seasonal Variations in Reproductive Hormones: A Comparison of the EAGeR and BioCycle Studies Nidhi Manchikanti*, Pauline Mendola, Karen Schliep, Kaniz Rabeya, Carrie Nobles,

Introduction: Previous research has suggested seasonal changes may influence fertility and pregnancy outcomes, but the mechanisms, particularly hormonal variations, remain unclear. This analysis compares seasonal variations in reproductive hormones—luteinizing hormone (LH), follicle-stimulating hormone (FSH), estradiol (E2), and progesterone (P4)—using data from the EAGeR trial (2006–2012) and BioCycle study (2005–2007).

Method: The EAGeR trial enrolled 1,228 premenopausal women from four U.S. sites (Buffalo, Scranton, Denver, and Salt Lake City) attempting to conceive, measuring urinary hormone levels at three time points per cycle. The BioCycle study included 250 premenopausal women from Buffalo, NY, with serum hormone levels measured at eight time points per cycle. Seasons were categorized as spring (Mar–May), summer (Jun–Aug), fall (Sep–Nov), and winter (Dec–Feb). Hormonal variations across seasons were analyzed using mean (SD) and ANOVA.

Results: In BioCycle, E2 levels peaked in the summer during menstruation, mid-follicular, and late follicular phases while the EAGeR study found no significant seasonal differences in E2. LH levels were highest in spring in BioCycle, particularly during menstruation (mean 4.92 [SD 3.13] vs. mean 3.71 [SD 1.54] ng/mL in fall). In EAGeR, LH was highest in the fall across all phases: follicular (mean 1.37 [SD 1.68] vs. mean 1.17 [SD 1.44] ng/mL in summer), ovulatory (mean 6.02 [SD 9.80] vs. mean 4.30 [SD 7.02] ng/mL in summer), and luteal (mean 0.91 [SD 2.25] vs. mean 0.61 [SD 0.96] ng/mL in). FSH was highest in winter in BioCycle and fall in EAGeR. No consistent seasonal pattern was observed for P4.

Conclusion: Seasonal differences in reproductive hormone levels were observed, with higher LH and FSH levels in cooler months and higher E2 levels in warmer months. These findings emphasize the need for further research to understand hormonal fluctuations and their impact on seasonal reproductive health outcomes.

Women’s health

Education and Nativity on Gestational Diabetes and Hypertension Risk among Asian American Native Hawaiian Pacific Islander women Jared Ortiz-Luis*, Bo Young Park, Ruofan Yao, Joshua Yang,

Objective: Asians and Native Hawaiians and Pacific Islanders (NHPIs) are the fastest-growing racial groups in the U.S., adding to population diversity. Disaggregated data challenge the “Model Minority” stereotype, revealing disparities in education, income, and health outcomes, including maternal health. Gestational diabetes mellitus (GDM), a leading pregnancy complication, is prevalent among Asians & NHPI women, but risk factors across these ethnic groups are poorly understood. This study examines the relationship between maternal ethnicity, education, and nativity on GDM risk among Asian & NHPI women compared to White women in the U.S. We explore how education and nativity interact to influence GDM prevalence within subgroups.

Methods: A retrospective cohort study analyzed 39,341,848 singleton births from the National Vital Statistics System (2011-2021). Maternal race, education, and nativity were primary exposures, categorized into 15 maternal race subgroups and 4 educational levels. Regression models adjusted for confounders, including maternal age, insurance, BMI, prenatal care, and smoking.

Results: Significant ethnic and educational disparities in GDM prevalence were observed. Educational attainment was protective against GDM across ethnic groups. Asian Indian and Vietnamese women had the highest odds of GDM at all education levels (aORs > 3.0 compared to White women). Chinese and Filipino women also had elevated GDM risks (aOR: 2.3–3.4). Foreign-born Asian women had higher GDM rates compared to White women, particularly among those with lower education. The relationship between nativity and GDM prevalence varied significantly across Asian subgroups.

Discussion: Foreign-born women faced higher GDM risks, while higher education reduced GDM risk across ethnicities, albeit less effectively for U.S.-born Asians. These findings highlight the role of socioeconomic factors and emphasize the need for tailored interventions to address maternal health disparities among Asian & NHPI women.

Women’s health

Adherence to Pre-pregnancy Health Guidelines, Socioeconomic Disparities, and Adverse Pregnancy Outcomes Among U.S. Childbearing People with a Recent Live Birth (2016-2022) Julie Petersen*, Kristyne Mansilla Dubon, Rahul Singh, Chad Abresch, Sarah Stone, Kristyne Mansilla Dubon

The American College of Obstetricians and Gynecologists has recommendations to be healthier before pregnancy. We assessed what factors were associated with ability to follow the recommendations individually and cumulatively (“adherence”) and associations between adherence and adverse pregnancy outcomes. Data were from the Pregnancy Risk Assessment Monitoring System (PRAMS) phase 8 (2016-2022, 40 US states/territories, 239,552 birthing persons). For our cumulative measure, non-adherence was defined as not following ≥4 of 9 recommendations assessed in PRAMS. Each state was analyzed individually using the PRAMS weighting scheme. We summarized across states using medians and interquartile ranges (IQR). The worst preconception guideline adherence was for no alcohol 3 months before pregnancy (median 13% adherent) [increased to 84% for non-heavy drinking (<8 per week)], followed by regular exercise (40%), folic acid supplement use (51%), diet or exercise among those with obesity (53%), and dental care (58%). On average, 23% did not adhere to ≥4 of the recommendations. Living in poverty, not married, insured by Medicaid, and having <bachelor’s degree were individually associated with 2x the likelihood of non-adherence. On average, only 50% of non-adherers versus 74% of adherers had a healthcare visit in the year before pregnancy. Non-adherence was most strongly associated with increased risks for inadequate prenatal care (median adjusted RR 2.44, IQR 2.23-2.67) and small-for-gestational age birth (1.24, 1.14-1.35) and on average slightly increased risks for preterm birth (1.09, 1.00-1.16), hypertensive disorders of pregnancy (1.06, 0.96-1.19), and Cesarean section (1.03, 1.00-1.07). Our study highlights how social determinants and healthcare access shape preconception health opportunities and subsequently pregnancy outcomes. Community-based approaches to increase awareness of the recommendations and remove systemic barriers to following pre-pregnancy guidelines are needed.

Women’s health

Racial/Ethnic and Nativity Disparities in Heavy Metal(loid) Exposure and Sources among Women of Reproductive Age in the the US, NHANES 2011-2020 (Final Version) Kiran Kui*, MyDzung Chu,

Background: Exposure to heavy metal(loids) like inorganic arsenic (iAs), cadmium (Cd), and manganese (Mn) are associated with adverse maternal outcomes (e.g, gestational diabetes, infertility) and fetal neurodevelopmental abnormalities. However, little is known about sources of heavy metal(loids) among women of reproductive age, especially across racial/ethnic and acculturation groups.

Objective: Our study assessed cross-sectional associations of heavy metal(loid) sources (diet, smoking, drinking water) with urinary iAs, blood Cd, and blood Mn concentrations among women of reproductive age in the National Health and Nutrition Examination Survey (NHANES), 2011-2020, and compared source distributions by race/ethnicity and acculturation indicators (nativity status, English language proficiency).

Methods: We identified heavy metal(loid) exposures (diet, smoking, drinking water) based on prior literature. Urinary iAs levels were calculated as the total of AsIII, AsV, and their metabolites (MMA and DMA). We performed multivariable generalized linear models to estimate least squares geometric means (LSGM) of urinary iAs, blood Cd, and blood Mn concentrations for each source and race/ethnicity and acculturation subgroups, adjusting for energy intake, age, BMI, selenium, income-to-poverty ratio, and folate (iAs only analyses).

Results: Asian women had the *highest* LSGM of urinary iAs (0.12 µg/g-creatinine [95% CI: 0.11-0.15]), blood Cd (0.39 µg/L [95% CI: 0.37-0.42]) and blood Mn (13.17 µg/L [95% CI: 12.74-13.62]) concentrations than other groups. *Dietary sources (white rice, brown rice, shellfish, fish, [$p=0.001$]),* and *public drinking water sources ($p<0.001$*) were significant predictors of urinary iAs, while *current smoking status ($p<0.001$*) was a significant predictor of blood Cd, with variations by race/ethnicity and acculturation status ($p<0.05$). No measured sources were significant predictors of blood Mn. An acculturation gradient was observed for Asian women: foreign-born non-English speakers had the *highest* LSGMs of urinary iAs and blood Cd and consumption of white rice, brown rice and shellfish, followed by foreign-born English speakers, and then US-born women.

Conclusions: Our study highlights racial/ethnic and nativity disparities in heavy metal(loid) exposures for US women of reproductive age. These findings can be attributed to differences in dietary, drinking water, and smoking patterns across race/ethnicity and acculturation status, indicating that environmental exposure disparities may contribute to disparities in maternal health outcomes.

Women’s health

The effect of daily low dose aspirin use on bleeding patterns. IBIRONKE AJAYI*, MAEGAN BOUTOT, BRIAN WHITCOMB,

Background: The menstrual cycle has been described as a “vital sign” of women’s reproductive health and wellbeing. Abnormal bleeding patterns may indicate reproductive abnormalities or other conditions. Low dose aspirin(LDA) is widely used for disease prevention but increases risk of bleeding. There is limited data evaluating the impact of aspirin on menstrual bleeding and its role as a “vital sign” to provide an evidence-basis for clinical recommendations.

Methods: The Effects of Aspirin in Gestation and Reproduction (EAGeR) trial randomly assigned women aged 18-40 years with history of one or two pregnancy losses to LDA treatment (daily 81mg/day aspirin plus daily 400-mcg folic acid) or placebo (daily 400-mcg folic acid). Daily LDA(81mg). For this analysis, two outcomes were compared by treatment assignment: period bleed days (number of menses bleeding days of any intensity allowing no more than 1 bleed free day to define a consecutive bleeding segment) and total menstrual cycle days of bleeding (including bleeding of any intensity and at any time within the menstrual cycle) from the 2nd cycle (defined as the longest string of bleeding of any intensity between days 20 and 50) of follow up, used for completeness of data recorded by participants in daily diaries.

Results: LDA was associated with minor, non-significant higher period bleed days (p= 0.23). Average total bleeding days among the LDA groups (8.2days, 95%CI= 7.9,8.6) were non significantly higher than that in the placebo group (7.8days, 95%CI= 7.4,8.3).

Conclusion: The results do not indicate a significant effect of daily LDA on menstrual cycle bleeding that would compromise the use of bleeding patterns as a “biomarker”. Due to the modest sample size, limited participant diversity (95% of total participants were white), and the overall healthy study population, further research is necessary to confirm these findings and assess their generalizability across broader populations.

Big Data/Machine Learning/AI

Improving Meningitis Surveillance and Diagnosis with Machine Learning: Insights from São Paulo Audencio Victor Victor*, Audencio Victor Victor,

Introduction: Meningitis, an inflammatory condition of the membranes surrounding the brain and spinal cord, can be caused by various agents. Bacterial meningitis is particularly severe due to its high morbidity and mortality rates. This study aims to develop machine learning (ML) models to classify the aetiology of bacterial meningitis using data from the Notifiable Diseases Information System (SINAN) in São Paulo State, Brazil. **Methods:** Data were collected from the SINAN database, including sociodemographic variables, clinical symptoms, and cerebrospinal fluid (CSF) analyses. Five ML models Random Forest, LightGBM, XGBoost, CatBoost, and AdaBoost were applied to classify meningitis cases into bacterial, fungal, viral, and other types. Models were evaluated using metrics such as AUC-ROC, accuracy, precision, recall, F1-score, and MCC. **Results:** The CatBoost model demonstrated superior performance, achieving an AUC-ROC of 0.95 for binary classification (bacterial vs. non-bacterial) and 0.85 for multiclass classification (Neisseria meningitidis, Streptococcus pneumoniae, and Haemophilus influenzae). XGBoost and LightGBM also showed promising results with AUC-ROC scores of 0.94 and 0.92, respectively, for binary classification. The CatBoost model exhibited high sensitivity 1.00 and reasonable specificity, highlighting its applicability in rapid and accurate meningitis diagnosis. SHAP analysis identified variables such as leukocyte count and the presence of petechiae as influential predictors in the models. **Conclusion:** ML algorithms, particularly CatBoost, XGBoost, and LightGBM, proved highly effective in the differential diagnosis of meningitis, offering a valuable tool for the rapid identification of meningitis types and bacterial serogroups. These techniques can be integrated into public health protocols to improve meningitis outbreak responses and optimize patient treatment.

Keywords: Meningitis, Machine Learning, Differential diagnosis, SINAN, Surveillance, Epidemiology.

Birth defects

Racial and Ethnic Disparities in Mortality among Children with Congenital Heart Defects: A Scoping Review Jenil Patel*, Maria Politis, Elijah Bolin, Lydia Famuyide, Wendy Nembhard,

Background:
Congenital heart disease (CHDs) are the most common congenital anomalies, and mortality vary by race and ethnicity. This scoping review summarizes studies reporting CHD mortality by race and ethnicity, presenting an integrated summary of mortality metrics including rates, in-hospital mortality, and survival.

Methods:
We reviewed peer-reviewed studies from PubMed and Web of Science (1980–2019) reporting mortality among children under age 18 with CHDs by race and ethnicity. Outcome measures included hazard ratios (HRs), odds ratios (ORs), and Kaplan-Meier survival probabilities.

Results:
In total, 18 studies met inclusion criteria, spanning population-based analyses, post-surgical mortality, and survival probability estimates. Among population-based studies, mortality rates for non-Hispanic (NH) White children with CHDs ranged from 0.4 to 9.1 per 10,000 live births, and from 0.5 to 10.0 for NH Black children. Post-surgical mortality studies showed substantial variability, with rates for NH White children with CHDs from 0.2 to 57.0 per 1,000 and from 0.3 to 63.0 per 1,000 for NH Black children. Cox proportional hazard regression models reported HRs indicating higher mortality risks among NH Black and Hispanic children with CHDs compared to NH White children. In-hospital and survival rates in childhood were also disproportionately lower for NH Black and Hispanic children, as shown by ORs and Kaplan-Meier analyses from US states like Florida and Texas.

Conclusions:
Significant racial and ethnic disparities in mortality was consistently reported for children with CHDs, particularly in post-surgical and in-hospital settings. These findings underscore the need for targeted research to understand disparities and improve equitable healthcare access for CHD-affected populations.

Birth defects

Antihypertensive medication use, type of hypertension, and risk of birth defects: Expanded results from the National Birth Defects Prevention Study (1997-2011) and Birth Defects Study to Evaluate Pregnancy exposureS (2014-2021) Alexandra Videll*, Sarah Fisher, Eva Williford, Martha Werler, Paul Romitti, A.J. Agopian, Meredith HOwley,

Our previous analyses of National Birth Defects Prevention Study (NBDPS) data (1997-2011) observed increased risk of certain birth defects associated with maternal first trimester antihypertensive medication use, but uncontrolled confounding by type of hypertension among those diagnosed was a noted limitation. This analysis adds 7 years of data for selected defects and incorporates additional information on type of hypertension (gestational, pre-gestational, or none). We analyzed data from 32,692 mothers of cases and 13,659 mothers of controls who participated in the NBDPS (1997-2011 estimated delivery dates, or EDDs) and the Birth Defects Study to Evaluate Pregnancy Exposures (BD-STEPS; 2014-2021 EDDs). Participants with 2006-2021 EDDs reported hypertension type; we used multiple imputation to impute hypertension type for participants missing this information. We used multivariable logistic regression to estimate odds ratios (OR) and 95% confidence intervals (CI) for the association between self-reported antihypertensive medication use in early pregnancy and 41 specific birth defects, controlling for hypertension type, age at delivery, race/ethnicity, body mass index, parity, pre-gestational diabetes, and study site. We imputed hypertension type for 29.8% of controls and 38.7% of cases. Although we observed elevated ORs for most of the birth defects we analyzed, all CIs except those for anencephaly (OR 2.8, 95% CI 1.3-5.7) and coarctation of the aorta (1.7, 95% CI 1.1-2.6) included 1.0. ORs estimated were generally attenuated compared to our previously published results. These results suggest that type of hypertension may account for some, but not all, of the previously observed associations between antihypertensive medication use and birth defects. Further analysis of the severity of underlying hypertension is needed to more fully understand whether antihypertensive medication use is independently associated with increased risk of birth defects.

Child health and development

Psychosocial influencers of mental health and cognitive abilities in children of MAASTHI cohort in Urban India. Giridhara Rathnaiah Babu*, Siddhartha Mandal, Shwetha Dixit, Deepa R, Debarati Mukherjee, Prashanth N Srinivas, COINCIDE Consortium,

Introduction: Over 182 million children worldwide face risks that jeopardize their healthy development, with India accounting for the highest number (64.3 million) of children developing sub-optimally. The COINCIDE project aims to explore the combined effects of various psychosocial factors on children's cognition and mental health.

Methods: In 985 mother-child dyads within MAASTHI cohort, we assessed maternal mental health, maternal adversity, intimate partner violence (IPV), Family Care Indicator (FCI), Childhood Psychosocial Adversity Scale (CPAS) and the Child-Parent Relationship (CPRS). Children's mental health was assessed using the Strengths and Difficulties Questionnaire (SDQ). Cognitive performance, including fluid intelligence and non-verbal reasoning, was measured using Raven's Coloured Progressive Matrices (RCPM). Ridge regression was implemented to assess the joint effects using the R package ridge.

Results: In children with mean age of 5.35 years, FCI (β = 2.25) and high conflict relationship (β= 1.55) positively influenced cognitive performance. CPAS (β = 0.40) and IPV (β = 0.26) were positively associated with SDQ internalising behaviour, while a high closeness in relationship (β = -0.43) was negatively associated. CPAS (β = 0.52), and high conflict relationship (β = 0.99) showed significant positive associations with SDQ externalising behaviour while high closeness in the relationship (β = -0.37) and maternal depressive symptoms (β = -0.31) had a negative impact.

Conclusion: High-conflict relationships consistently predicted increased behavioural difficulties and lower cognitive performance. Conversely, high closeness in relationships mitigates internalizing and externalising behaviours, suggesting the protective role of a positive parent-child bond. IPV and CPAS significantly contributed to behavioural difficulties, underlining the importance of addressing domestic violence and social stressors in interventions aimed at improving child mental health.

Child health and development

Antenatal corticosteroids and risk of cerebral palsy: A regression discontinuity study Peter Socha*, Jennifer Hutcheon, Erin Strumpf, Jessica Liauw, Myriam Srour, Joseph Ting, Amanda Skoll, Sam Harper,

Background: Antenatal corticosteroids speed up fetal lung development, preventing neonatal respiratory morbidity and mortality. Prior research suggests that corticosteroids may also affect fetal neurodevelopment, including the risk of cerebral palsy. We investigated the effect of antenatal corticosteroids on the risk of cerebral palsy.

Methods: We included all singleton livebirths with a maternal admission for birth between 31+0 (31 weeks, 0 days) and 36+6 weeks gestational age, from 2000 through 2015, in British Columbia, Canada. Practice guidelines recommend antenatal corticosteroids through 33+6 weeks, and we used the corresponding sharp drop in the proportion treated at 34+0 weeks as a natural experiment to estimate the effect of treatment on the risk of a composite of cerebral palsy or death before age two. We defined cerebral palsy using International Classification of Diseases 9 and 10 codes in hospital discharge and physician-billing records through age five, and corrected for misclassification of these codes using external estimates of their sensitivity and specificity. We included death before age two in our outcome because, while cerebral palsy is incident before or shortly after birth, it is not typically diagnosed before age two.

Results: The prevalence of cerebral palsy in our study population was 0.5% (86/15,727). The risk of cerebral palsy or death before age two declined with increasing gestational age at maternal admission for birth, but we did not find convincing evidence of an abrupt change at 34+0 weeks (risk ratio for if guidelines had recommended treatment at 34+0 weeks: 0.54, 95% CI: 0.11 to 2.08). Results were similar using a composite outcome of cerebral palsy or neonatal death or cerebral palsy alone. Findings for all outcomes were consistent across sensitivity analyses.

Conclusions: We did not find evidence that antenatal corticosteroids affect the risk of cerebral palsy, but our results were imprecise and consistent with benefits or harms.

Child health and development

Correlation between maternal respiratory and mental health during pregnancy and infant respiratory symptoms Emily Harville*, Elizabeth Sutton, Elizabeth Norton, Giovanni Piedimonte,

Maternal physical and mental health during and after pregnancy may affect infant physical health and care. Since 2023, the Respiratory Infections in Pregnancy (RIPP) study has been recruiting mother-baby dyads in the Baton Rouge, LA area. Mothers (n=311) reported their symptoms and vaccinations during the third trimester and again at 6 months postpartum, and their infants' respiratory symptoms. Medical records were abstracted for a subset interim analysis (n=45). Maternal mental health was assessed using the Edinburgh Depression Scale, the Generalized Anxiety Disorder-7, and the Prenatal Self-Evaluation Questionnaire for pregnancy-related anxiety. Associations among maternal and infant respiratory health, and maternal mental health before and after pregnancy, were evaluated using correlations and chi-square tests. Participants had a mean age of 27.2 years and were largely Black (173, 55.6%) or White (112, 36.0%), with a high school diploma (133, 42.9%) or higher education (153, 49.4%). Maternal mental health during pregnancy and postpartum were correlated (e.g., for anxiety $r=0.46$, $p<0.01$). Maternal respiratory infections, particularly influenza and COVID-19, were linked to increased levels of depression, anxiety, and pregnancy-related anxiety during gestation. Maternal respiratory infections during pregnancy, especially in the second trimester, were associated with a greater likelihood of infant respiratory infections (OR 2.16, 1.16-4.01) and a higher number of symptoms reported and documented. Maternal anxiety during pregnancy was associated with infant symptoms, but there was no association with depression. There was no association between postpartum mental health and infant respiratory health. Some aspects of maternal mental health during pregnancy were associated with infant respiratory health, whereas postpartum mental health was not. This suggests that pregnancy is a critical window for post-natal respiratory health and shared maternal-infant vulnerability.

Child health and development

Mapping Anemia: The Socioeconomic Terrain in Mali, Burkina Faso, and Nigeria Anam Khan*, Colette Davis, Colette Davis

Introduction:
Childhood anemia remains a critical public health issue in Sub-Saharan Africa, impairing cognitive and physical development. This study examines the prevalence and determinants of anemia among children aged 6-59 months in Mali, Burkina Faso, and Nigeria.

Methods:
Using 2021 Demographic and Health Survey (DHS) data, a cross-sectional analysis was performed on 16,001 children. Anemia severity was categorized as severe, moderate, or mild based on hemoglobin levels. Multinomial logistic regression assessed associations with residence, wealth index, maternal education, and age.

Results:
Anemia prevalence was high across all three countries. In Burkina Faso, children from the poorest households had significantly higher odds of severe anemia (Odds ratio (OR) = 7.18, 95% Confidence interval (CI): 1.86-27.64). In Mali, rural children were more likely to experience moderate anemia (OR = 1.72, 95% CI: 1.34-2.20). In Nigeria, male children had higher odds of severe (OR = 1.31, 95% CI: 1.03-1.66) and moderate anemia (OR = 1.22, 95% CI: 1.10-1.36) compared to females.

Discussion:
The results highlight disparities in anemia prevalence, with rural residence, poverty, and lower maternal education consistently linked to higher severity. These findings underscore the need for targeted interventions focusing on vulnerable populations.

Conclusion:
Addressing childhood anemia in these regions requires strategies that reduce socio-economic disparities, improve nutrition, and enhance healthcare access, contributing to Sustainable Development Goal 2.

Child health and development

Associations of In-Utero Maternal Exposures to Substances and Mood Disorders and Offspring Electroencephalogram (EEG) at Birth Nicolò Pini*, Lynn Chen, J. David Nugent, William P. Fifer, Michael M. Myers, Amy J. Elliott, Seonjoo Lee, Ayesha Sania,

Background: In-utero exposure to substances and maternal mood disorders can adversely affect fetal brain development. We examined the combined impact of exposure clusters on neonatal brain activity, in the Safe Passage Study (PASS).

Methods: We derived clusters of in-utero maternal alcohol (PAE), tobacco (PTE) exposure, and maternal anxiety/depressive symptoms. EEG data from Northern Plains, US, was collected in term newborns at birth (N=824). EEG power was decomposed in delta, theta, low alpha, high alpha, beta, and gamma bands and computed in frontal-polar (FP), polar (PO), temporal (TE), parietal (PA), occipital (OC), frontal-midline (FM), and central-midline (CM) regions. Associations between EEG power and clusters were examined using ANOVA, adjusting for infant sex, hours of life, and gestational age; p-values were corrected via false discovery rate.

Results: Analysis yielded 4 groups: Low-risk (67.8%); low PAE, PTE, and anxiety/depression; Mood+ (26.6%); low PAE and PTE, high anxiety/depression; Smoking+ (5.1%); no PAE, high PTE, and moderate anxiety/depression; and Drinking+ (0.4%); high PAE, no PTE, and high anxiety/depression. We detected differences in low frequencies power (delta and gamma) in frontal (FP, PO, TE), and posterior (PA, OC) regions. In frontal regions, average delta power was higher for the low-risk group compared to mood+ ($1.48\times10\text{-}6\pm5.19\times10\text{-}7$, $p<0.05$) or smoking+ ($3.32\times10\text{-}6\pm1.27\times10\text{-}6$, $p<0.05$) or drinking+ ($6.23\times10\text{-}6\pm2.35\times10\text{-}6$, $p<0.05$) groups. In posterior regions, average delta power was lower in the drinking+ group compared to low-risk ($-6.80\times10\text{-}6\pm-2.35\times10\text{-}6$, $p<0.05$) or mood+ ($-5.94\times10\text{-}6\pm-2.36\times10\text{-}6$, $p<0.05$) or smoking+ ($-5.57\times10\text{-}6\pm-2.47\times10\text{-}6$, $p<0.05$) groups. Similar results were found for average theta power.

Conclusion: Prenatal maternal mood and substance use are differentially associated with EEG activity at birth in the offspring. Future work will focus on investigating the contribution of these factors to the trajectories of brain development.

Child health and development

Maternal Diet Quality during Pregnancy and Early Childhood Cognition in US Cohorts Molly Duncan*, Fang Fang Zhang, Tammy Scott, Thomas Holland,

Objectives: This study aimed to evaluate the role of maternal diet during pregnancy and offspring cognitive functioning during early childhood.

Methods: The study population consisted of 178 mother-child dyads from the Environmental influences on Child Health Outcomes (ECHO) cohort. Dietary data was collected using food frequency questionnaires. Diet quality during pregnancy was assessed using the Healthy Eating Index (HEI), Alternative Healthy Eating Index (AHEI-P), Mediterranean-DASH Intervention for Neurodegenerative Delay (MIND-P), and Mediterranean Diet (MDS-P) for pregnant women. Offspring cognition was assessed using the NIH Toolbox Cognition Battery. Cognitive function was assessed using age-adjusted Total Cognition Composite score for early childhood (ages 3-5 years) and four subscale scores, Dimensional Card Sort Change, Flanker Inhibitory Control and Attention, Picture Sequence Memory, and Picture Vocabulary Tests. Multivariable linear mixed models were used to estimate the associations between maternal diet quality and offspring cognitive functioning scores.

Results: The mean (SD) scores for HEI, AHEI-P, MIND-P, and MDS-P were 70.9(10.2), 86.4(11.8), 8.0(1.4), and 65.6(10.0), respectively. The mean (SD) composite score during early childhood was 105.7(16.3). After adjustment for maternal age, education, household income, marital status, pre-pregnancy BMI, tobacco use during pregnancy, gravidity, delivery method, breastfeeding, child’s sex, race and ethnicity, and birth weight, none of the diet scores were significantly associated with the Total Cognition Composite score or other subscale scores.

Conclusions: Better maternal diet quality during pregnancy, was not associated with Composite or subscale scores in early childhood.

Funding: This research received no outside funding.

Child health and development

Predicting Patent Ductus Arteriosus Patency at 72-hours Postnatal using Clinical Variables Available at Neonatal Intensive Care Unit Admission Sara Conroy*, Chance Alvarado, Samantha Gawrys, Jonathan Slaughter, Erinn Hade, Carl Backes, Mark Klebanoff, Himangini Singh, Eduardo Finol Mark, Joanie Randle, Cara Boyle, Eli Zettler,

Background Patent ductus arteriosus (PDA) is the most common cardiac condition in neonatal patients, and requires an echocardiogram for diagnosis. Prediction at NICU admission of which infants' PDAs are likely to remain open at 72 hours may allow a more beneficial, selective treatment strategy.

Objective To predict PDA patency in <30-week gestation preterm infants between 28-72 hours postnatal using clinical predictors available at neonatal intensive care unit (NICU) admission.

Methods We prospectively consented parents and enrolled 23-296/7-weeks gestation neonates without congenital anomalies. Screening echocardiogram (ECHO) evaluated PDA patency between 48-72 hours postnatal. Multivariable logistic regression models with least absolute shrinkage and selection operator (LASSO) regularization using 10-fold cross validation predicted PDA patency. Performance was assessed with the area under the receiver-operating curve (AUC), sensitivity, specificity, and Brier score. 95% confidence intervals, internal validation, and optimism correction were implemented via bootstrapping with 2000 replicates.

Results Of 526 consented infants, 524 survived to the 48–72 hours screening ECHO and 446 had complete data. The final prediction model included gestational age, birth weight z-score, indomethacin within 48 hours of birth, antenatal steroids, maternal indication for delivery, delivery method, infant mean oxygen and lowest blood pressure in the first 12 hours. The optimism-adjusted model sensitivity for prediction of PDA at 48-72 hours was 0.64 (95% CI: 0.51, 0.86) and specificity was 0.64 (95% CI: 0.44, 0.82). The adjusted AUC for the predicting an open PDA was 0.68 (95% CI: 0.65, 0.75) and the Brier score was 0.19 (95% CI: 0.16 – 0.20).

Conclusions Based on our results, clinical measures at NICU admission did not confidently predict open PDA at 72 hours. Screening echoes for PDA remain an important part of clinical care for severely preterm infants admitted to the NICU.

Child health and development

Clinically Recognized Congenital Cytomegalovirus Infection and the Risk of Neurodevelopmental Disorders Ahhyung Choi*, Timothy Savage, Krista Huybrechts, Sonia Hernandez-Diaz, Brian Bateman, Loreen Straub, Raisa Levin, Yanmin Zhu, Chih-Wan Grace Lin, Yanmin Zhu

Congenital cytomegalovirus (cCMV) can cause sensorineural hearing loss and developmental delays. However, the risk of long-term neurodevelopmental disorders (NDDs) has not been thoroughly evaluated. We aimed to assess the association between clinically recognized cCMV and NDDs.

Using Marketscan (2003-22) and Medicaid (2000-18), infants with cCMV were identified based on ≥1 CMV diagnostic code within 45 days after birth. NDDs included autism, ADHD, learning disorder, speech/language disorder, coordination disorder, intellectual disability, and behavioral disorder. We estimated cumulative incidences and hazard ratios (HRs) of any NDD and individual NDDs comparing infants with vs. without cCMV using Cox models, adjusting for year, region, race/ethnicity, multiples, and other congenital infections. Considering infants with risk factors for NDDs are more likely to be tested for cCMV, leading to a spurious association between diagnosed cCMV and NDDs, we further restricted the analysis to infants tested for cCMV.

Among 23,209,467 infants, 6,445 (3 per 10,000) had a cCMV. The crude cumulative incidence of any NDD at age 8 was 31.3% in infected vs. 13.1% in the uninfected group in MarketScan, and 46.1% vs. 20.8% in Medicaid. The pooled adjusted HR (aHR) was 2.83 (95% CI: 2.78-2.89) and the point estimates of aHRs for individual NDDs ranged from 1.44 (behavioral disorder) to 10.04 (intellectual disability). When restricting to infants tested for cCMV (N=9,445), aHR for any NDD was attenuated but remained elevated (1.58; 1.37-1.78), also for individual NDDs, with the point estimates from 1.28 (behavioral disorder) to 3.24 (learning disorder).

Clinically recognized cCMV is associated with a higher risk of NDDs. The association was partially related to selective cCMV testing. Residual confounding and differential monitoring for NDDs may also affect the estimates. Future studies in populations with universal cCMV and NDD screening would be important to confirm the causal effect.

Child health and development

Associations of neighborhood-level Childhood Opportunity Index and Social Vulnerability Index at birth with sleep quality and duration among adolescents in Project Viva Sheryl Rifas-Shiman*, Izzuddin Aris, Marie-France Hivert, Emily Oken,

Background: Good sleep quality and quantity are important for overall health and well-being. The extent to which physical and social attributes of neighborhoods in early life relate to later sleep health is unclear.

Objectives: To examine associations of neighborhood-level Child Opportunity Index (COI) and Social Vulnerability Index (SVI) at birth with sleep outcomes among adolescents.

Methods: We studied 570 adolescents (median age 19.5y) in Project Viva, a pre-birth cohort. We geocoded their home addresses at birth (1999-2002) and linked the locations to COI (range 1-100, higher scores reflect higher opportunity neighborhoods) and SVI (range 1-100, higher scores reflect more vulnerable neighborhoods). Adolescents self-reported 7-day sleep quality (PROMIS sleep disturbance and sleep-related impairment T-scores, expected median=50) and past month average sleep duration. We examined associations of COI and SVI (5 categories: very low <20% to very high ≥80%) with sleep outcomes using linear regression models adjusted for age, sex, and maternal education, and clustered by census tract.

Results: At birth, 12% lived in areas with very low COI and 48% very high; 36% lived in areas with very low SVI and 14% very high. Mean (SD) sleep duration was 7.2 (1.1) h/d. Very high v. very low COI, and very low v. very high SVI, are associated with 26 min/d (95%CI 7, 46) and 23 min/d (6, 40) longer sleep duration. Very high v. very low COI was associated with lower sleep disturbance (β -1.9 points; 95%CI -3.9, -0.02) and sleep-related impairment (β -2.6; -5.5, 0.3) T-scores. Very low (v. very high) SVI was associated with associated with slightly lower sleep disturbance (β -1.5 points; -3.2, 0.2) and sleep-related impairment (β -2.0; -4.5, 0.5) T-scores, however the 95% CIs crossed the null.

Conclusions: Our results suggest that living in higher-opportunity or lower-vulnerability neighborhoods at birth is associated with slightly better sleep quality and longer sleep duration over a decade later.

Child health and development

Maternal hypothyroidism and subsequent cardiometabolic outcomes in children Lucy Zhao*, Catherine Birken, Jonathan Maguire, Laura Anderson, Sonia Grandi,

Introduction: Maternal health status in pregnancy can influence long-term risk of chronic disease in offspring. We therefore aimed to examine the association between maternal hypothyroidism in pregnancy and cardiometabolic risk (CMR) in children.

Methods: This study used a cohort of mother-child dyads enrolled in The Applied Research Group for Kids (TARGet Kids!), a primary care practice-based research network in Ontario, Canada, linked to administrative health datasets, including hospital visits, laboratory values, and vital statistics. The cohort was restricted to children 3-12 years with ≥1 CMR measure. Exposure was defined by a diagnosis and/or an abnormal lab value occurring 1-year prior to pregnancy up until delivery. CMR was defined as the sum of the age and sex-standardized z-scores for waist circumference, log triglyceride levels, glucose levels, systolic blood pressure (SBP), and HDL. Sex-stratified linear regression models adjusted for, maternal age and sociodemographic characteristics, and the child's age at outcome ascertainment, were used.

Results: A total of 1887 mother-child dyads were included, of which 189 (10%) children were born to mothers with hypothyroidism. Of these, 36% of mothers had subclinical, 9.0% overt, and 55.0% undefined hypothyroidism. The mean age of mothers at delivery was 33.5 years (SD 4.6), and the mean age of children at outcome assessment was 5.5 years (SD 2.4). Male children exposed to hypothyroidism during pregnancy were found to have slightly elevated CMR z-scores (β: 0.08; 95% CI, -0.16, 0.33) compared to unexposed males. This trend was not found in females. When examining individual components of CMR, elevated SBP (β: 1.44; 95% CI, -0.26, 3.14) was found to be the main contributor to the elevated risk in males.

Conclusion: Maternal hypothyroidism in pregnancy may be associated with an increased risk of elevated SBP and LDL in male children. However, these findings warrant further investigation in other cohorts.

Child health and development

Guidance for international growth standards: When, Where, and How to apply international growth standards Eric Ohuma*, Simon Parker, Bancy Ngatia, Linda Vesel,

Infant growth is a commonly used proxy of population health, human capital, and socioeconomic development. Additionally, failure to achieve growth potential is associated with increased risk of mortality and morbidity throughout an individual's life. Therefore, accurate growth assessment using international prescriptive growth standards is a key step towards efficient, accurate, and comparable tracking of progress towards achieving the Sustainable Development Goal 3.2, which aims to reduce preventable newborn and child mortality by 2030. Different growth standards exist and can lead to differences ingrowth estimates due to lack of comparability as a result of how they were constructed, study design, statistical methodology, etc. There is a lack of clear guidance on which growth charts to use when, and for whom. Consequently, growth standards are often applied incorrectly, leading to inappropriate assessment and interpretation of growth trajectories This can alter prevalence estimates for stunting, wasting, and other indicators of non-optimal growth. In light of these challenges, the Guidance for International Growth Standards (GIGS) project has developed guidance and software to facilitate consistent, standardized, and accurate application of child growth based on the international standards from the INTERGROWTH- 21stand WHO Child Growth Standards. This talk will detail guidance from GIGS on when, for whom, and how to apply international growth standards in settings where gestational age data is available. We will first discuss the rationale for the GIGS project, then present case studies of individual infants from a large cohort of moderately low birthweight infants in India, Malawi and Tanzania. We will use scenario-based approach to demonstrate the implication of using/applying existing standards inappropriately and further, provide clear guidance on appropriate application of these international standards based on the GIGS- recommended approach.

Child health and development

Predictors of Neonatal Hypoglycemia: Preliminary analysis towards a risk calculator Sara Cherkerzian*, Carmen Monthe-Dreze, Francesco Prendin, Ayanna Coburn-Sanderson, DelFavero Simone, Tina Steele, Deborah Cuddyer, Rana Abdel-Rahman, Alfonso Galderisi, Andrea Facchinetti, Sarbattama Rimi Sen,

Background. Neonatal hypoglycemia (NH) is associated with later adverse neurodevelopment. Data show that 33% of infants not at-risk develop NH based on blinded research measures and only 50% of screened infants at-risk develop NH. To begin to inform a risk calculator that more accurately predicts NH, this study assessed maternal and neonatal factors associated with NH.

Methods. A preliminary analysis of 22 mother-infant dyads enrolled in the ongoing LAMMBS observational cohort study (anticipated n = 120). Blinded CGM (Dexcom G6) was performed from delivery to discharge and traces were re-calibrated using a validated adjustment algorithm to reconcile for known CGM inaccuracy. Neonates were also screened for NH with POC glucometer and treated per institutional protocol. NH was defined as BG < 45 mg/dL (0-24 hours of life (HOL)) and < 50 (24-48 HOL); recurrent NH (rNH) as ≥ 3 NH episodes. Differences in candidate predictors by hypoglycemia status (NH_POC, NH_CGM, and rNH_CGM) were tested using Fisher's exact or Wilcoxon rank sum tests.

Results. Using CGM data, 9 (40.9%) infants developed NH, 6 (66.7%) of whom had recurrent NH. POC testing only identified 5 (55.6.%) out of the 9 infants with CGM-based diagnosis as having NH. Significant (alpha < 0.05) predictors were as follows: lower maternal education NH_POC, NH_CGM, rNH_CGM), birth length z score (NH_CGM), and Apgar score at 1 minute (NH_POC, NH_CGM, rNH_CGM); higher maternal body mass index (rNH_CGM), last prenatal systolic blood pressure (mean: 36 weeks gestation) (NH_POC, rNH_CGM), glucose tolerance at gestational diabetes screen (NH_POC), and depression (rNH_CGM).

Conclusions. We identified several predictors of NH that by current guidelines are not established NH risk factors, but that together may better reflect the in utero metabolic and postnatal maladaptation factors associated with NH risk and its pathophysiology. Further evaluation within larger cohorts is recommend as the current sample size was small.

Disability status

Receipt and content of perinatal health care by presence and extent of disability, PRAMS 2019 – 2021 Abigail Newby-Kew*, Jonathan Snowden, Anne Valentine, Ilhom Akobirshoev, Monika Mitra, Willi Horner-Johnson,

Background: People with disabilities experience substantial disparities in perinatal health and outcomes that may be impacted by inequities in perinatal health care. This study assesses how receipt and content of perinatal health care varies by extent of disability.

Method: We analyzed 2019–2021 PRAMS data from 22 sites that included the Washington Group Short Set of Questions on Disability (n=43,567). We examined association of extent of disability (none , some difficulty, a lot of difficulty) with pre-pregnancy, prenatal, and postpartum health care using multivariable Poisson regression to calculate state-adjusted prevalence ratios (PRs). Among individuals who received each type of perinatal care, we calculated PRs for types of care content, including topics pertaining to maternal health, pregnancy prevention, and preparing for healthy pregnancy.

Results: Of respondents, 33.9% had some difficulty and 6.6% had a lot of difficulty. Compared to those with no difficulty, respondents with some difficulty were less likely to receive pre-pregnancy care from an OB/GYN (PR = 0.93; 95% CI 0.6, 0.98) or receive a postpartum checkup (PR = 0.98; 95% CI 0.98, 0.99); respondents with a lot of difficulty were less likely to receive pre-pregnancy care from an OB/GYN (PR = 0.86; 95% CI 0.74, 1.00), adequate prenatal care (PR = 0.92; 95% CI 0.90, 0.95), or a postpartum checkup (PR = 0.94; 95% CI 0.90, 0.95).

While respondents with any level of difficulty were as or more likely as those with no difficulty to receive education on maternal health topics and pregnancy prevention, they were less likely to receive care addressing desire for children or preparing for a healthy pregnancy .

Conclusions: Disabled women, particularly those with a lot of difficulty, receive differential perinatal health care. Our findings highlight the need for equitable care that respects the childbearing potential and choices of people with disabilities.

Disability status

Postpartum healthcare utilization and experiences by disability status: Pregnancy Risk Assessment Monitoring System (PRAMS) 2018-2020 Hedda Boege*, Cheryl Stein, Lauren Berube, Rachel Ryan, Andrea Deierlein,

Objective: To examine associations between disability and postpartum healthcare utilization and experiences among persons with a live birth in the United States.

Methods: We used 2018–2020 Pregnancy Risk Assessment Monitoring System (PRAMS) data from 24 sites that included the Washington Group Short Set of Questions on Functioning. Extent of disability was categorized as no difficulty, some difficulty, and a lot of difficulty based on participants' responses to difficulty functioning in six core domains: seeing, hearing, mobility, cognition, self-care, and communicating. Participants reported if they had a postpartum check-up within 4–6 weeks of delivery (yes/no). Among participants with a postpartum visit, they reported receipt of specific health-related questions from a healthcare provider (yes/no). Multivariable Poisson regression with robust standard errors calculated adjusted prevalence ratios (aPR) and 95% confidence intervals (CI) controlling for age, education, marital status, parity, and insurance.

Results: Of 42,729 participants, 59.0%, 34.3%, and 6.7% reported no, some, and a lot of difficulty, respectively. Compared to participants with no difficulty, those with some and a lot of difficulty were more likely to report not having a postpartum checkup (aPR=1.25, 95% CI: 1.13–1.38 and aPR=1.68, 95% CI: 1.44–1.95, respectively). Participants with some and a lot of difficulty were also more likely to report that a healthcare provider did not talk to them/ask them about taking a vitamin with folic acid; healthy eating, exercise, and postpartum weight loss; cigarette smoking; timing of a subsequent pregnancy; birth control methods; emotional or physical abuse; feeling down or depressed; and testing for diabetes (aPR ranged from 1.09 to 1.54).

Conclusion: Findings suggest that persons with disabilities receive suboptimal postpartum care. Research is needed to determine strategies to improve healthcare utilization and experiences for this population.

Disability status

Risks associated with unintended pregnancies among U.S. women with disabilities Willi Horner-Johnson*, Mekhala Dissanayake, Nicole Marshall, Jonathan Snowden,

Background: Pregnancies among women with disabilities are less likely to be intended than pregnancies among women without disabilities. Unintended pregnancies may be associated with greater prenatal health risks and adverse birth outcomes. However, no research to date has examined how risks and outcomes among women with disabilities differ by pregnancy intendedness.

Methods: We analyzed 2011-2019 data from the National Survey of Family Growth, focusing on pregnancies among respondents with disabilities as identified by survey questions on disability status. We used modified Poisson regression to assess the association of pregnancy intendedness (intended, mistimed, unwanted) with delayed entry into prenatal care (after 1st trimester), smoking during pregnancy, preterm birth, and low birthweight. Analyses were adjusted for sociodemographic characteristics (age, race and ethnicity, marital status, education, income as a percentage of Federal Poverty Level), body mass index, and parity.

Results: Risk of delayed prenatal care was significantly higher for pregnancies that were mistimed (adjusted risk ratio [aRR] =1.62; 95% confidence interval [CI]: 1.16, 2.25) or unwanted (aRR=2.06; 95% CI: 1.52, 2.80) compared to intended pregnancies. We found no other significant differences between mistimed and intended pregnancies. However, unwanted pregnancies were associated with greater risk of smoking during pregnancy (aRR=1.27; 95% CI: 1.01, 1.60) and preterm birth (aRR=1.25; 95% CI: 1.08, 1.46).

Conclusions: Women with disabilities with unintended pregnancies are less likely to receive timely prenatal care and may have greater exposure to health risks, such as smoking during pregnancy, which may impact birth outcomes. Greater attention is needed to provision of preconception care and family planning services to help ensure healthy pregnancies and deliveries in this population.

Environment/climate change

Prenatal and postnatal exposure to ambient fine particulate matter (PM2.5) and risk of autism spectrum disorder and attention-deficit/hyperactivity disorder among Medicaid recipients Matthew Shupler*, Xinye Qiu, Krista Huybrechts, Sonia Hernandez-Diaz, Hayon Choi, Michael Leung, Wanyu Huang, Yaguang Wei, Joel Schwartz, Antonella Zanobetti, Marc Weisskopf, Stefania Papatheodorou, Wanyu Huang

Background: Evidence on the association between prenatal and early life exposure to fine particulate matter (PM2.5) and risk of autism spectrum disorder (ASD) and attention-deficit/hyperactivity disorder (ADHD) is conflicting. In particular, studies in low socioeconomic status populations are lacking.

Methods: We created a linked mother-infant longitudinal cohort from the Medicaid Analytic eXtract (MAX) from 2001-2013, with cases of ASD and ADHD identified via ICD-9 codes. Ambient prenatal and postnatal exposure to PM2.5 was assigned via a spatiotemporal pollutant prediction model at the mother's residential ZIP code. Distributed lag non-linear models were used to characterize PM2.5 exposures (prenatal: 0-to-37-week lag; postnatal: 0-to-3-year lag). Cox models were stratified by county and birth year and adjusted for demographics, behavioral risk factors, ambient temperature, season of conception and area-level socioeconomic status (SES).

Results: A total of 1,548,303 births were included. A 10 μg/m3 increase in average weekly prenatal PM2.5 exposure was associated with 1.09 (95% CI: 0.95–1.25) and 1.24 (95% CI: 1.18–1.30) hazard of ASD and ADHD, respectively, at the cumulative lag (0-37 weeks). A 10 μg/m3 increase in average annual postnatal PM2.5 exposure was associated with 1.03 (95% CI: 0.76–1.40) and 0.87 (95% CI: 0.74–1.02) times the risk of ASD and ADHD, respectively, at the cumulative lag (0-3 years).

Conclusion: Low-income children in the US may have higher ADHD risk due to increased prenatal PM2.5 exposure. Although there is a potentially sensitive window of exposure in late pregnancy for ASD, cumulative prenatal and postnatal PM2.5 exposure was not associated with ASD risk.

Environment/climate change

The Influence of Ambient Air Pollution during Folliculogenesis, Endometrial Development, and Spermatogenesis on Fertility: A Study among Patients using Vitrified Donor Oocyte In Vitro Fertilization Audrey Gaskins*, Sarah LaPointe, Jaqueline Lee, Zsolt Nagy, Daniel Shapiro, Howard Chang, Yifeng Wang, Armistead Russell, Heather Hipp,

Air pollution is associated with reduced fertility; however, the independent effects of air pollution exposure during folliculogenesis, endometrial development, and spermatogenesis on human reproduction remains unclear. We investigated the effects of air pollution during critical windows on clinical outcomes of in vitro fertilization (IVF) using patients undergoing vitrified donor oocyte IVF. We included 551 non-identified oocyte donors and 1,353 recipients who underwent 2,533 embryo transfers at Reproductive Biology Associates in Atlanta, Georgia (2008-2019). Daily ambient exposure to air pollutants was estimated using spatiotemporal models linked to residential addresses and averaged over folliculogenesis (90 days before stimulation) and during stimulation in donors, three months and three weeks prior to transfer in recipients, and spermatogenesis (72 days prior to oocyte thaw) in male partners. Multivariable generalized estimating equations were used to estimate adjusted odds ratios (aOR) and 95% confidence intervals (CI) per interquartile range increase in pollutant in relation to clinical IVF outcomes. Higher carbon monoxide (CO) exposure during folliculogenesis (aOR= 0.86 95% CI 0.77, 0.96) and ovarian stimulation (aOR=0.88 95% CI 0.79, 0.98) in donors was associated with lower odds of positive pregnancy test. Higher elemental carbon (EC) exposure during folliculogenesis was associated with lower odds of live birth (aOR=0.87 95% CI 0.79, 0.96) and higher odds of pregnancy loss (aOR=1.16 95% CI 1.02, 1.32). During ovarian stimulation, higher coarse particulate matter (PM10) exposure was associated with lower odds of live birth (aOR=0.90 95% CI 0.80, 1.00) and higher odds of pregnancy loss (aOR= 1.18 95% CI 1.02, 1.36). Among male partners, higher PM10 exposure during spermatogenesis was associated with higher odds of pregnancy loss (aOR=1.45 95% 1.09, 1.92). Air pollution exposures in the recipient were generally not associated with IVF outcomes. In conclusion, preconception air pollution exposures during both folliculogenesis and spermatogenesis may adversely impact IVF outcomes.

Environment/climate change

Preconception, pregnancy, and early childhood exposure to greenspace and risk of neurodevelopmental delays: a national birth cohort study among Medicaid enrollees Hayon Michelle Choi*, Stefania Papatheodorou, Krista F. Huybrechts, Sonia Hernandez-Diaz, Xinye Qiu, Michael Leung, Peter James, Matthew Shupler, Wanyu Huang, Yaguang Wei, Antonella Zanobetti, Christopher J McDougle, Joel Schwartz, Brent Coull, Marc Weisskopf,

Objective: Exposure to greenspace is known to be associated with children's mental health, but its relationship with neurodevelopment has not been explored extensively, especially in socioeconomically disadvantaged populations. This study evaluates the association between preconception, pregnancy, and early childhood exposure to greenspace and neurodevelopmental delays in children enrolled in Medicare.

Methods: This population-based cohort study of 1,841,915 mother-child pairs used the Medicaid Analytic Extract (MAX) from 2001 through 2014 with up to 14 years of follow-up. The association between greenspace and the risk of neurodevelopmental delays was evaluated using a stratified Cox model accounting for individual and area-level confounders. We examined effect measure modification by urbanicity, child's race/ethnicity, and sex. Annual mean exposure to greenspace (Normalized Difference Vegetation Index (NDVI) before, during, and after pregnancy were examined at the maternal residential zip code level. Neurodevelopmental delays (NDD): autism spectrum disorder (ASD), attention-deficit/hyperactivity disorder (ADHD), learning disability, developmental speech or language disorders, developmental coordination disorder, intellectual disability, and behavioral disorder were considered.

Results: Examining the association between preconception, pregnancy, and postnatal exposure to greenspace and NDD outcomes for the children (7 outcomes), resulted in 21 hazard ratios ranging from 0.84 to 1.10. Exposure to greenspace had a protective effect in most NDDs, with the strongest association observed per IQR (0.12) increase in NDVI for preconception exposure and intellectual disability (HR 0.84 [95% CI: 0.74-0.96]), pregnancy exposure and ASD (HR 0.90 [95% CI: 0.83-0.98]), and postnatal exposure for learning difficulties (HR 0.85 [95% CI: 0.77-0.95]) (Figure 1).

Conclusion: Greenspace exposure could benefit the children's neurodevelopment. If the relationships we observe are causal, area-level investments in increasing accessible greenspaces may reduce the population burden of NDDs.

Environment/climate change

Prenatal Poly-and Perfluoroalkyl Substances (PFAS) and Birth Outcomes in Michigan Mothers and Newborns Amy Zhao*, Courtney Carignan, Michael Petriello, Douglas Ruden, Jaclyn Goodrich,

Introduction: Poly- and perfluoroalkyl substances (PFAS) are persistent bioaccumulative chemicals that have been associated with increased risk of adverse birth outcomes. Despite phase-out of legacy PFAS, these chemicals remain ubiquitously present in the environment and are still detected in the majority of the US population. Newer fluorinated chemicals are continuously being introduced as legacy PFAS substitutes. We measured serum PFAS concentrations in pregnant women in Michigan, a state with well-known PFAS contamination, and assessed relationships between PFAS and birth outcomes.

Methods: Our analytic sample included 317 women enrolled in one of two prospective birth cohorts in Michigan as part of the Child Health Advances from Research with Mothers (CHARM) alliance. Concentrations of 13 legacy PFAS were measured in the earliest available pregnancy serum for all participants, with an additional 34 emerging PFAS measured in a subset of participants. Adjusted linear regression models were used to estimate the association between prenatal PFAS concentrations with gestational age and birth weight for gestational age z-scores.

Results: Twelve PFAS were detected in >70% of participants, including the replacement PFAS 6:2 FTS and PFHpS. Legacy PFAS – PFOA, PFOS, PFHxS, and PFNA – were detected in 95-100% of participants. For a 1-unit higher log-normalized concentration of PFOA and PFUnDA, we observed lower birthweight-for-gestational-age z-scores of β = -0.16 [95% CI: -0.29, -0.03] and β = -0.16 [95% CI: -0.29, -0.04], respectively. Sex-stratified analyses revealed significant associations between increasing concentrations of multiple PFAS and lower birthweight-for-gestational-age z-scores among girls (PFOA: β = -0.20 [95% CI: -0.39, -0.01], PFNA: β = -0.22 [95% CI: -0.40, -0.004], PFDA: β = -0.31[95% CI: -0.50, -0.06], PFUnDA: β = -0.21 [95% CI: -0.40, -0.03]) but no significant associations among boys.

Conclusions: Women in Michigan are exposed to legacy and emerging PFAS. Early pregnancy exposure to select PFAS compounds is associated with smaller size at birth, with more pronounced associations in girls.

Environment/climate change

Association Between Labor Readiness and Disaster Preparedness in Women in Hurricane-Prone Areas Courtney Thomas*, Giovanni Piedimonte, Elizabeth Sutton, Emily Harville,

Background: Pregnant women living in hurricane-prone areas face unique challenges as they must prepare for both potential natural disaster and the labor and delivery process. The aim of this study is to assess whether disaster preparedness is a part of labor readiness among pregnant women living in hurricane-prone areas.

Methods: The Prenatal Self-Evaluation Questionnaire (PSEQ) and a disaster preparedness questionnaire were administered to a cohort of pregnant women in southern Louisiana. Labor readiness was categorized into tertiles based on the sum scores from the PSEQ labor readiness subscale. Disaster preparedness was indicated by uptake of at least one preparedness behavior (e.g., prepared a disaster kit, set a meeting place). Logistic regression was used to examine the association between labor readiness and disaster preparedness, adjusting for maternal age, education, partnership status, and employment.

Results: The sample (N= 428) had a mean age of 26.9 years. The majority was Black (59.4%) and White (32.0%). About 47.8% had a high school diploma, and about 43% had some college or obtained a degree. Approximately 85% reported having a partner. The average labor readiness score was 22.58 (standard deviation 5.11). About half (50.9%) engaged in at least one preparedness behavior.

Higher labor readiness scores were associated with an increased likelihood of disaster preparedness (adjusted Odds Ratio (aOR): 1.79, 95% Confidence Interval (CI): 1.37, 2.34). Those employed were also more likely to engage in preparedness behaviors (aOR: 1.5, 95% CI: 0.97, 2.32), while age, education, and partnership status were not associated.

Discussion: The results suggest that, while preparing for labor and disaster are correlated, many pregnant women may not consider disaster preparedness when preparing for labor. In addition to educational interventions, future studies may assess if cognitive load impacts the uptake of important preparedness behaviors in pregnant women.

Environment/climate change

Extreme heat, PM2.5, and risk of preterm birth and low birthweight in Florida, 2000 to 2022 Jessica Broach*, Emily Harville,

Increased exposure to extreme heat and air pollution caused by climate change may have potential effects on birth outcomes, but prior studies are limited and use varying heatwave definitions. The objective of this study is to evaluate the association between days of extreme heat and PM2.5 concentrations and risk of preterm birth and low birthweight, separately. We conducted a retrospective cohort study of 4,514,067 births using birth certificate data obtained from the Florida Department of Health (2000 to 2022). We defined extreme heat as the number of days greater than or equal to the 90th percentile of maximum daily temperature during each trimester. PM2.5 concentrations 28 days before birth date were extracted from the National Aeronautics and Space Administration MERRA-2 dataset based on mother's residential address. Preterm birth and low birthweight were obtained from the birth certificate. We used logistic regression to estimate adjusted risk ratios (aRR) and 95% confidence intervals (CIs). We found positive associations between the number of heatwave days (aRR 1.004, 95% CI 1.003, 1.005), the number of heatwave days when there are more than two consecutive days (aRR 1.004, 95% CI 1.003, 1.005), the number of heatwave days when there are more than three consecutive days (aRR 1.004, 95% CI 1.002, 1.005) and preterm birth during the first trimester. We found inverse associations between the number of heatwave days (aRR 0.979, 95% CI 0.977, 0.981), the number of heatwave days when there are more than two consecutive days (aRR 0.981, 95% CI 0.978, 0.983), and the number of heatwave days when there are more than three consecutive days (aRR 0.982, 95% CI 0.979, 0.985) and low birthweight during the third trimester. As climate change has increasing effects on weather and the environment, this study highlights a need to investigate the temporal and geographic variability of these effects on adverse birth outcomes.

Environment/climate change

Associations of Gestational Air Pollution Exposure with Perinatal Outcomes Adaeze Wosu Nzegwu*, Aisha S Dickerson, Kristin Miller, Adam Szpiro, Alison E Hipwell, Amy J Elliott, Anne Dunlop, Anne Starling, Assiamira Ferrara, Carmen Marsit, Carrie Breton, Christine Loftus, Cristiane Duarte, Cindy T McEvoy, Dana Dabelea, Daphne Koinis-Mitchell, Donghai Liang, Emily Oken, Emily S Barrett, Heather Volk, Irva Hertz-Picciotto, James Gern, Jean Kerver, Joseph B Stanford, Julie B Herbstman, Jun Wu, Kristen Lyall, Leonardo Trasande, Leslie Leve, Margaret Karagas, Nicolò Pini, Rosalind J Wright, Ruby H N Nguyen, Scott Weiss, Susan L Schantz, Thomas G O'Connor, Catherine J Karr, Daniel A Enquobahrie,

Background: Associations between timing of exposure to fine particulate matter (PM2.5) during gestation and perinatal outcomes have been understudied. We investigated associations of timing of gestational PM2.5 exposure with four perinatal outcomes (gestational age at birth (GA), birthweight for gestational age z-scores (BWZ), preterm birth (PTB, <37 weeks), and small for gestational age (SGA, <10th percentile)) in the U.S. Environmental influences on Child Health Outcomes (ECHO) cohort.

Methods: We included 19,108 mother-infant pairs from 51 recruitment sites across the US. PM2.5 exposure was characterized using high-resolution spatiotemporal models across gestation, trimesters 1-3 respectively, early 1st trimester (≤14 days), and late 1st trimester (70-92 days). We used multilevel linear regression (for continuous outcomes) and Poisson regression via generalized estimating equations (for binary outcomes) to estimate the associations of PM2.5 (per 5μg/m^3 increase) with the perinatal outcomes and adjusted for potential confounders. SGA was examined only among term infants. In stratified models, we examined effect measure modification by sex of infant.

Results: Mean GA was 38.8 weeks (standard deviation, SD 1.8), with 1434 (7.5%) infants born preterm; mean BWZ was 0.067 (SD 1.09). Median gestational PM2.5 exposure was 8.37 μg/m^3 (interquartile range, IQR 6.92-9.55). Early 1st trimester PM2.5 exposure was associated with lower BWZ (beta = -0.03, 95% CI -0.06, -0.001) and a higher risk of SGA (risk ratio, RR = 1.06, 95% CI 0.99, 1.14). Inverse associations of PM2.5 exposure (across gestation and late 1st trimester) with BWZ were observed in female infants. Early1st trimester PM2.5 exposure was associated with increased risk of SGA in male infants.

Conclusion: In this multi-site US cohort, PM2.5 exposure early in gestation was associated with lower birthweight for gestational age z-score and higher risk of small for gestational age; sex of infant modified observed associations.

Environment/climate change

Investigating associations among perfluoroalkyl and polyfluoroalkyl substances (PFAS) levels and demographic characteristics within the Extremely Low Gestational Age Newborns (ELGAN) cohort. Kristina Stuckey*, Cailee Harrington, Lauren Eaves, T. Michael O'Shea, Rebecca Fry,

Perfluoroalkyl and polyfluoroalkyl substances (PFAS) are present throughout the environment and accumulate within water, food, and humans. PFAS exposure is associated with higher serum cholesterol, decreased immune function, higher risk of preeclampsia, and lower birth weight. Understanding demographic and social variables associated with higher exposure to PFAS can inform interventions for decreasing exposure. In this study, we investigated associations between socioeconomic and demographic variables and 4 PFAS: perfluorooctanesulfonic acid (PFOS), perfluorooctanoic acid (PFOA), perfluorononanoic acid (PFNA), and perfluorohexanesulfonic acid (PFHxS) among 161 mothers who delivered babies in the Extremely Low Gestational Age Newborns (ELGAN) cohort from 2002-04. PFAS exposure was quantified in maternal blood spots taken during a perinatal window. Demographic variables include insurance type, use of food stamps, marital status, educational status, smoking during pregnancy, and hospital of birth, based on medical records and self-report. We also derived the Centers for Disease Control and Prevention's Social Vulnerability Index (SVI) total percentile, based on reported residence during pregnancy. We assessed differences in PFAS exposure, both dichotomized and continuous, by key demographic variables using Wilcox and Kruskal-Wallis tests. A linear regression model was used to assess the relationship of SVI and PFAS exposure. Use of food stamps was associated with lower levels of PFOA (group mean 0.4428571 ng/ml and 0.1818182 ng/ml) and PFNA (0.471 ng/ml and 0.227 ng/ml) exposure. Increased social vulnerability was associated with lower PFNA exposure (Beta= 0.136, p-value= 0.096). Levels of all 4 PFAS differed based on the hospital of birth. Future analysis will include the incorporation of occupation data as well as investigate potential interactions of these variables.

Environment/climate change

Association between prenatal exposure to chemical and nonchemical stressors and adolescent well-being among extremely low gestational aged newborns (ELGANs) Jenna Frey*, Rebecca C. Fry, T. Michael O'Shea, Lauren A. Eaves,

Humans are exposed to an array of stressors in their built and social environments throughout the life course. Exposure to chemical and nonchemical stressors—particularly during critical windows of susceptibility such as *in utero*—have been separately and jointly associated with adverse health outcomes. Aiming to identify associations between prenatal exposure and adolescent health, we hypothesize that higher levels of negative stressors will be associated with lower levels of well-being and increased internalizing/externalizing behaviors.

Participants in this analysis (N=219) were a part of the Extremely Low Gestational Age Newborn (ELGAN) cohort which is made up of individuals born before 28 weeks of completed gestation in three US regions. Chemical stressors (11 metals/metalloids measured in umbilical cord samples) and nonchemical stressors (SES composite variable including <12 years of educational attainment, Medicaid insurance use, "single" marital status, and food stamp use collected by a maternal interview at birth) were assessed. Three outcomes were measured at age 15. Overall wellbeing was measured through the PROMIS Global health self-report measure and internalizing and externalizing behaviors through the Child Behavior Checklist Youth Self-Report form. Metals were natural log-transformed for normality. Regression models were run for each of the 11 metals and the SES variable for each outcome.

In models adjusted for maternal age at birth and smoking status during pregnancy, the metals were positively associated with overall well-being: zinc (β=2.23, p=0.006), strontium (β=1.68, p=0.003), and barium (β=1.25, p=0.007). Adjusted models showed associations between the SES sum and internalizing behaviors (β=1.29, p=0.05) and the SES sum and externalizing behaviors (β=1.05, p=0.02). Next steps include testing for interaction between chemical and nonchemical stressors and evaluating mixtures effects of coexposure to multiple metals through quantile g-computation.

Fertility and fecundity

The effect of heat, hurricanes, and wildfires on human fertility: A systematic review

Michelle Klawans*, Amelia Wesselink, Kerri Sands, Ana Rosen Volmar, Kaitlyn Lawrence, Gisela Butera, Lauren Wise, Anne Marie Jukic,

The effects of climate change on pregnancy outcomes are documented; however, there is limited assessment of its effects on human fecundity, the biological capacity to conceive and carry a pregnancy. We conducted a systematic review following PRISMA guidelines to investigate how climate change-related exposures impact fecundity. We identified potential articles for inclusion via search of 6 databases using keywords and MeSH terms for publications related to direct measures (e.g., fecundability) and indirect markers (e.g., semen quality, ovarian reserve) of fecundity. Search terms also included climate change-associated exposures (e.g. extreme heat, wildfires, hurricanes, floods). We screened titles and abstracts to identify potentially relevant studies, which then underwent full-text review to determine if they met inclusion criteria. Relevant data was abstracted from included studies and quality was assessed via the JBI Critical Appraisal Checklists. Two independent reviewers completed all steps of the review process, and a third reviewer addressed any disagreements After deduplication, we screened 3,980 studies and conducted full-text review of 50 studies. We identified 26 studies for inclusion, 22 of which were deemed high-quality. Overall, 23 studies assessed the effects of temperature; the remaining studies assess the effects of hurricanes (n=2) and wildfires (n=1). The majority (n=17) studied semen quality as the primary outcome, while fewer investigated fertility treatment outcomes (n=7), fecundability (n=1), and ovarian function (n=1). Half of the studies were conducted in China; the remaining studies were largely conducted in other high-income countries. Future research should focus on 1) understanding the broad impacts of climate change-related exposures, including natural disasters and extreme heat/humidity, 2) exploring female marker of fecundity including time to pregnancy and miscarriage and 3) conducting research in low- and middle-income countries.

Fertility and fecundity

A preconception cohort study of county-level socioeconomic trajectories and fecundability
Sharonda M. Lovett*, Andrea S. Richardson, Erin J. Campbell, Amelia K. Wesselink, Lauren A. Wise, Mary D. Willis,

Background: Place-based trajectories describe changes in socioeconomic characteristics over time within a geographic entity. These trajectories could alter demographic or health behaviors via pathways including differential access to societal resources, higher exposure to environmental stressors, and psychosocial stress, which may influence reproductive outcomes. We characterized county-level socioeconomic trajectories and estimated their association with fecundability, the per-cycle probability of conception.

Methods: We used data from 10,991 U.S. female participants aged 21-45 years in Pregnancy Study Online (PRESTO; 2013-2024). We harmonized six county-level socioeconomic characteristics from the U.S. Census by decade for 1930-2020 (e.g., proportion of Non-White, unemployment, tenure, urbanicity) and linked these data to participants' geocoded residential addresses. Using latent profile analysis, we characterized counties with shared historical characteristics where participants resided. We used proportional probabilities regression to estimate fecundability ratios (FRs) and 95% confidence intervals (CIs), adjusting for age, calendar year of enrollment, and geographic region of residence.

Results: Our latent profile analysis revealed five typologies. Compared with living in counties with high tenure and decreasing racial diversity (RD) during 1930-2020, FRs were 1.11 (95% CI: 1.05-1.18) for counties with moderate tenure and increasing RD and 1.13 (95% CI: 1.04-1.22) for counties with low tenure and increasing RD. Living in counties with decreasing populated clusters and increasing RD (1.10, 95% CI: 0.99-1.21) or high populated clusters and increasing RD (1.09, 95% CI: 0.95-1.25) was elevated, but not appreciably associated with fecundability.

Conclusions: In this preconception cohort study, currently living in counties with increasing RD between 1930-2020, either with moderate or low tenure, was associated with increased fecundability.

Fertility and fecundity

Cycle characteristics with ovulation induction in subfertile women Shahpar Najmabadi*, Karen Johnson, Alexis Timpson, Cassandra Wilson, Jieyu Wang, Jolina Nguyen, Joseph Stanford,

One-third of subfertile women have inconsistent ovulation, associated with irregular menses and subfertility. Ovulation induction (OI) medications can stimulate the release of hormones that trigger follicular development and egg release. This study aims to evaluate the effect of clomiphene and letrozole on ovulatory status, cycle and luteal phase length, and luteal spotting. Participants were 250 women aged ≥18, diagnosed with subfertility, including polycystic ovary syndrome, endometriosis, and other conditions, desiring pregnancy, enrolled in the international Natural Procreative Technology Evaluation and Surveillance of Treatment for Subfertility (iNEST) study. Majority of women were non-Hispanic White (71.6%), aged 30 or more (75.6%) with a mean of 33.5 years (5.2), and had more than 16 years of schooling (66.8%). Menstrual cycle biomarkers (primary outcomes) of 2210 non-conception cycles (14.4% anovulatory) were extracted from women's daily charts. Linear mixed models were used to assess continuous outcomes of cycle and luteal phase length and generalized linear models using Poisson regression with robust variance were used to assess dichotomous outcomes of ovulatory status and luteal spotting, adjusted for age. 178 cycles (8.1%) and 162 cycles (7.3%) included clomiphene and letrozole, respectively. Cycle and luteal phase length of cycles induced by clomiphene compared to cycles without OI were significantly longer: 32.1 days (95% Confidence Interval 30.6, 33.6) vs. 31.0 days (29.9, 32.1); 13.6 days (12.8, 14.3) vs 12.1 days (11.6, 12.6). For cycles induced by letrozole, the luteal phase was significantly longer: 13.2 days (12.4, 14.0) vs 12.2 days (11.7, 12.7), but no significant difference in the cycle length was observed. Cycles with clomiphene had about 5% non-significant higher likelihood of ovulation, while cycles with letrozole had significantly higher likelihood of ovulation, PR 1.13 (1.07, 1.19). There was a non-significant lower likelihood of luteal phase spotting among cycles with either clomiphene or letrozole. A limitation of our analysis is that most cycles had other medications, such as luteal phase progesterone. In conclusion, the impact of clomiphene and letrozole differs for cycle biomarkers associated with ovulation and fecundability in subfertile women.

Fetal loss/stillbirth/infant mortality

Sexual Orientation Disparities in Pregnancy Loss: Mediation by Chronic Hypertension

Colleen Reynolds*, Payal Chakraborty, Isa Berzansky, Brittany Charlton,

Background: Emerging research suggests pregnancies among sexual minorities (e.g., heterosexual with same-sex experience, mostly heterosexual, bisexual, or lesbian individuals) are more likely to end in pregnancy loss (i.e., miscarriage or stillbirth) than among heterosexuals. Chronic hypertension is associated with increased risk of pregnancy loss, but no research has assessed whether hypertension mediates these disparities.

Methods: We pooled data from two cohorts, the Growing up Today Study and Nurses' Health Study 3. Because of likely post-exposure confounding, we estimated interventional mediated effects (interventional pure natural direct effect [iPNDE] and total natural indirect effect [iTNIE]). Baseline confounders included demographics, and post-baseline confounders included marital status, socioeconomic status, health behaviors, chronic health conditions, and medically assisted reproduction.

Results: Among 14,178 pregnancies to completely heterosexual individuals (reference group), the prevalence of chronic hypertension was 6%, and 22% of pregnancies ended in a loss. Among 3,141 pregnancies to heterosexuals with same-sex experience/mostly heterosexuals, hypertension prevalence was 9%, and 25% ended in loss. Among 416 pregnancies to bisexuals/lesbians, hypertension prevalence was 8%, and 34% ended in loss. In complete case analyses, we found no evidence that chronic hypertension mediates disparities in pregnancy loss for heterosexuals with same-sex experience/mostly heterosexuals (iPNDE: 1.13; 95%CI: 0.93–1.37; iTNIE: 1.00; 95%CI: 0.98–1.03) or bisexuals/lesbians (iPNDE: 3.67; 95%CI: 2.14–5.73; iTNIE: 1.00; 95%CI: 0.93, 1.09). Multiple imputation and subgroup analyses are ongoing.

Conclusions: Future research must identify proximal pathways of pregnancy loss disparities to guide policy and clinical practice interventions among sexual minorities.

Fetal loss/stillbirth/infant mortality

Stillbirths and the White / Black Difference in Neonatal Death among Extremely Preterm Births Alison Gemmill*, Tim Bruckner, Allison Stolte, Brenda Bustos,

Background: At all gestational ages in the extremely preterm period (ePTB; < 28 weeks), live-born non-Hispanic (NH) Black infants show relatively lower risk of neonatal death than do NH white infants. Explanations for this survival advantage include higher levels of stillbirth among NH Black persons, which could leave behind hardier members of the conception cohort that survive to birth. We test this "high stillbirth" explanation for the survival advantage by linking fetal death, natality, and neonatal death files by monthly conception cohort. We focus on NH Black singleton ePTB males given their relatively large survival advantage and their presumed high level of fetal selection.

Methods: We retrieved US fetal, birth, and neonatal death records for NH Black and NH white singletons born in the ePTB range (473,472 records in total). We used positive monthly outliers in male relative to female stillbirths in the ePTB range (20 to <28 weeks gestational age) as a gauge of high male stillbirths. Box-Jenkins time-series methods using 288 monthly conception cohorts (January 1995 to December 2018) controlled for patterned confounders affecting both stillbirth and neonatal death.

Results: Time-series methods identified seven months with strong positive outlier values in NH Black male stillbirths. In these "high stillbirth" conception cohorts, NH Black male periviable singleton infants show an even stronger survival advantage (relative to NH whites) (4.2 fewer than expected deaths per 100 live births, 95% Confidence Interval: 1.7, 6.7). Results remain robust to alternative time-series specifications.

Conclusions: Understanding the extent of cohort left truncation, as measured by positive outliers in stillbirth, could assist with interpretation of counterintuitive racial/ethnic patterns in live birth mortality especially during the extremely preterm period.

Fetal loss/stillbirth/infant mortality

Stress and Pregnancy Outcomes: Investigating the Link between Stressful Life Events and Stillbirth Andrew Williams*, Myckynzie Schroeder, Reese Siegle, Dennis Lutz, Myckynzie Schroeder

Background: Since 1990 stillbirths have declined by 33% and now plateaued (approximately 6/1,000 live births). Stress may affect pregnancy loss, and identifying modifiable risk factors is important to reduce risk of stillbirth. The purpose of this case-control study was to examine the association between stressful life events prior to pregnancy and risk of stillbirth.

Methods: Stillbirths(fetal deaths ≥20 weeks of gestation) were drawn from the 2018-2021 Utah Study of Associated Risks of Stillbirth(SOARS). Controls were drawn from 2018-2021 Utah Pregnancy Risk Assessment Monitoring System(PRAMS). PRAMS is an appropriate control source as SOARS uses PRAMS methodology, and both surveys have the same questions regarding maternal factors, and stressors. Participants reported on 13 stressors in the 12 months before delivery(e.g. separated/divorced from husband; lost job), and responses were summed(range 0-13). Stress scores ≥8(sample median) were considered high stress. Cases(n=437) and controls(n=1926) were matched on month and year of delivery. Logistic regression models estimated odds ratio(OR) and 95% confidence intervals(95%CI) for the association between stressors and stillbirth, adjusted for maternal factors.

Results: Cases were older(29.7 years) and more likely to have income< $57,000(53.3%) than controls(28.6 years(p<.01); income< $57,000(48.6%, p<.01)). Regression results suggest high levels of stress were associated with 33% reduced odds of stillbirth(OR:0.67, 95%CI:0.54,0.84).

Conclusion: The “healthy survivor effect” may explain these findings, as women with high levels of stress may also experience pregnancy loss before 20 weeks' gestation. Additional investigations are warranted to better understand the effect of psychosocial stress and pregnancy loss by trimester.

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No Entries Found

Gender and sexual identity

Trauma, post-traumatic stress disorder symptoms, and adverse pregnancy outcomes: sexual orientation disparities in a prospective cohort study Michelle Tam*, Isa Berzansky, Payal Chakraborty, Colleen Reynolds, Kodiak Soled, Sarah McKetta, Cindy Veldhuis, Karestan Koenen, Brittany Charlton,

Background: Sexual minority (SM) individuals are at heightened risk for trauma exposure and post-traumatic stress disorder (PTSD) symptoms, as well as adverse pregnancy outcomes. Yet, little research has elucidated the link between trauma histories, PTSD symptoms, and adverse pregnancy outcomes in this population.

Methods: The Nurses' Health Study 3 is a longitudinal cohort of nurses born on or after January 1, 1965, living in the US or Canada (N= 27,359 pregnancies from 10,086 participants). We estimated person-level prevalence of traumatic events and PTSD symptoms, and pregnancy-level prevalence of adverse pregnancy outcomes (i.e., gestational diabetes, gestational hypertension, pre-eclampsia, preterm birth, low birthweight, macrosomia) across sexual orientation groups (completely heterosexual, heterosexual with same-sex experience, mostly heterosexual, bisexual, and lesbian/gay). Moderation analyses examining adverse pregnancy outcomes across sexual orientation and PTSD/trauma are forthcoming.

Results: Compared to completely heterosexual individuals, mean age at first traumatic event was younger for all SM groups; completely heterosexual individuals were 18.5 years, heterosexual with same-sex experience (16.1 years), mostly heterosexual (15.8 years), bisexual (13.9 years), and lesbian/gay (12.9 years). All SM groups had a higher prevalence of PTSD symptoms— bisexual (74%), lesbian/gay (71%), mostly heterosexual (67%), heterosexual with same-sex experience (58%)—compared to the completely heterosexual group (55%). Pregnancies to lesbian/gay individuals (36%) had the highest prevalence of any adverse pregnancy outcomes, followed by completely heterosexual (30%), heterosexual with same-sex experience (28%), bisexual (27%), and mostly heterosexual (27%).

Conclusions: Future research should investigate mechanisms underlying sexual orientation-related inequities (e.g., discrimination and minority stress) in traumatic experiences, PTSD, and adverse pregnancy outcomes.

Global health

Application and validation of model-based geostatistical methods to estimate spatio-temporal patterns of RMNCH in Mali, West Africa, from 2000 to 2018 Mariame Ouedraogo*, Erjia Ge, Hilary Brown, Diego Bassani,

Background: Statistical advances that leverage existing data to generate high-resolution maps of health indicator coverage represent an important opportunity to monitor and evaluate health programs in conflict-affected settings like Mali. This study applies and validates model-based geostatistical methods to estimate annual patterns of reproductive, maternal, newborn, and child health (RMNCH) service use at Mali's subregional levels from 2000 to 2018.

Methods: This work uses geo-located data from nationally representative surveys and considers key RMNCH indicators: modern contraceptive use, antenatal and postnatal care, assisted childbirth, and childhood immunization. Binomial generalized linear models (GLMs) identified geospatial demographic, economic, and environmental factors associated with these indicators. Empirical variograms and permutation tests confirmed the presence of residual spatial correlation, prompting the extension of the GLMs to include a spatial Gaussian process. Model parameters are being estimated using Monte Carlo Maximum Likelihood (MCML). Estimates with associated standard errors for each indicator will be obtained from the models across a 1 x 1 km grid of Mali from 2000 and 2018. We will quantify the uncertainty around the estimates and produce maps aggregated at subregional decision-making levels. An emerging hotspot analysis will subsequently be conducted to examine spatiotemporal RMNCH patterns.

Results: Preliminary analyses reveal spatio-temporal heterogeneity in RMNCH indicators influenced by key geospatial factors. Geostatistical models are currently being run to better estimate and study this spatio-temporal variability.

Discussion: A more in-depth understanding of spatio-temporal variability in RMNCH service use is essential to optimize resources for health, particularly in a country like Mali, facing competing priorities and socio-political challenges. Lessons can be drawn for other fragile and conflict-affected settings.

Global health

Flooding and elevated prenatal depression in a climate-sensitive community in rural Bangladesh: a mixed methods study Suhi Hanif*, Jannat-E-Tajreen Momo, Farjana Jahan, Liza Goldberg, Natalie Herbert, Afsana Yeamin, Abul Kasham Shoab, Reza Mostary Akhter, Sajal Kumar Roy, Gabriella Barratt Heitmann, Ayse Ercumen, Mahbubur Rahman, Fahmida Tofail, Gabrielle Wong-Parodi, Jade Benjamin-Chung,

Prenatal depression can have lasting adverse impacts on child health. Little is known about the impact of floods on prenatal depression in low- and middle-income countries. We conducted a cross-sectional survey of 881 pregnant women from September 24, 2023 to July 19, 2024 in riverine communities in rural Bangladesh. We recorded participant-reported flooding in the past 6 months, administered the Edinburgh Postnatal Depression Scale (EPDS), and obtained water level data and remote sensing data on distance to surface water. We fit generalized linear and log-linear models adjusting for month, wealth, education, age, and gestational age. We conducted 2 focus group discussions with 20 adult women. 3.6% of compounds were flooded in the past 6 months. Compound flooding was associated with elevated depression (adjusted prevalence ratio (aPR) = 2.08, 95% CI 1.14, 3.51) and thoughts of self-harm (aPR=8.40, 95% CI 4.19, 16.10). Latrine flooding was associated with higher depression (aPR=3.58, 95% CI 1.49, 7.29)). Higher water levels and shorter distances to permanent surface water were significantly associated with mean EPDS scores. Focus groups revealed that domestic violence, inadequate sanitation, gendered vulnerabilities in accessing latrines, childcare difficulties, and food insecurity were key drivers of depression due to floods. Flood preparedness strategies included relocation, storing food, and home modifications. We found flooding, higher water levels, and proximity to water bodies to be associated with prenatal depression in a rural, low-income setting. Inadequate sanitation and hygiene infrastructure were found to be particularly strong drivers of depression.

Global health

Mediators of angiogenesis and inflammation associated with the pathogenesis of preeclampsia and preterm birth in Tanzania: a nested case-cohort study Nandita Perumal*, Alfa Muhihi, Christopher Sudfeld, Kathleen Zhong, Kevin C. Kain, Blair J. Wylie, Said Aboud, José M. Belizán, Gabriela Cormick, Christopher P. Duggan, Honorati Masanja, Mary M. Sando, Pratibha Dwarkanath, John Michael Raj, Tinku Thomas, Anura V. Kurpad, Andrea B. Pembe, Wafaie W. Fawzi,

Background: Preeclampsia and preterm birth affect millions of pregnancies globally. Yet, evidence on the pathogenesis of these conditions from low-resource settings is limited.

Objectives: To estimate the associations of early and late pregnancy biomarkers with risk of preeclampsia and preterm birth in Tanzania.

Methods: We conducted a nested case-cohort study embedded within an individually randomized, non-inferiority trial of daily prenatal calcium supplementation in 11,000 nulliparous pregnant women enrolled at <20 weeks of gestation in Dar es Salaam, Tanzania. An observational cohort of pregnant women (n=1000) not receiving any calcium supplements was also enrolled. Blood samples were collected for a sub-cohort of participants. All preeclampsia cases (n=141) in the sub-cohort and randomly sampled controls (n=1747), with equal probability of selection from 1500 mg, 500 mg, no calcium group, were included. We quantified plasma angiogenic, inflammatory, endocrine, and metabolic biomarkers using Luminex 8-plex assays, enzyme-linked immunosorbent assays, or chemiluminescence. Weighted Cox regression models with robust variance estimation to account for sampling weights of control selection were used to estimate hazard ratios for the risk of preeclampsia or preterm birth as a function of biomarker quartiles (highest Q4 vs. lowest Q1) in early (<20 weeks) and late (32 weeks) gestation, adjusting for confounders and calcium dose.

Results: Early pregnancy placental growth factor (PlGF) was associated with a higher risk of preeclampsia (adjusted hazard ratio [HR] Q4 vs Q1: 4.61, 95% CI: 2.51, 8.46) and preterm birth (HR: 4.67, 95%CI: 2.83, 7.71). In late pregnancy, higher soluble fms-like tyrosine kinase receptor (sFlt1) concentration was associated with the risk of preeclampsia (HR: 3.24, 95% CI: 1.76, 5.95) but not preterm birth. The ratio of sFlt-1/PlGF in late pregnancy was strongly associated with preeclampsia risk (HR: 10.4, 95%CI: 4.86, 22.1), but to a lesser extent with preterm birth (HR: 1.80, 95%CI: 1.04, 3.11). No other consistent associations with other domains of biomarkers were observed.

Conclusions: Angiogenic biomarkers in early pregnancy and their ratios in late pregnancy were most consistently associated with a risk of preeclampsia and preterm birth in this study.

Gynecological health

Preconception Cannabis Use and Total Gestational Weight Gain in a North American Prospective Cohort Lauren Wise*, Krystal Kuan, Alyssa Harlow, Kenneth Rothman, Lisa Bodnar,

Background: The effects of preconception cannabis use on gestational weight gain (GWG) are not well studied.

Methods: We assessed the association between preconception cannabis use and total GWG in a North American prospective cohort of 5,423 females aged 21-45 years who delivered singleton births during 2014-2024. Participants reported their average frequency of cannabis use in the previous 2 months on baseline and bimonthly follow-up questionnaires during preconception. On the postpartum questionnaire, participants reported GWG in 5-lb categories, which we validated against birth records from 7 US states. We converted GWG (kg) to z-scores using gestational age- and BMI-specific charts and defined excess GWG as >1 SD (equivalent to >50 lb at term for normal-weight female). We used log-binomial regression to estimate risk ratios (RRs) for excess GWG and linear regression to estimate mean differences (β) in GWG z-scores by prepregnancy BMI (kg/m2), adjusted for preconception behaviors, SES, race, ethnicity, and medical history.

Results: Mean GWG was 31 lbs (SD: 13.6); 7% and 5% used cannabis <1 and ≥1 time/wk, respectively. Cannabis users were more likely than non-users to be younger, less educated, smoke cigarettes, and report higher perceived stress, depressive symptoms, and prepregnancy BMI. There was moderate agreement between self-reported and birth-record-abstracted GWG (weighted Kappa=0.64, 95%CI: 0.60-0.67). Cannabis use (≥1 time/wk vs. non-use) was associated with a higher risk of excess GWG: RR=1.47, 95%CI: 1.08-2.02 and the β in GWG (lbs) for a 40-wk delivery increased with greater prepregnancy BMI (BMI 18.5-24.9: 2.16, 95%CI: -0.09, 4.47; BMI 25-29: 3.08, 95%CI: -0.31, 6.64; and BMI ≥30: 4.09, 95%CI: 0.11, 8.32).

Conclusions: Preconception cannabis use ≥1 time/week was associated with a clinically-relevant increase in total GWG. The magnitude of the increase was larger among participants with greater prepregnancy BMI.

Gynecological health

Contraceptive use and menstrual health among women of reproductive age Shayesteh Jahanfar*, Moazzam Ali,

Background: Contraceptive methods are well-established in their ability to prevent pregnancy and to increase individual agency in childbearing. Evidence suggests that contraceptive use can also be used to treat adverse conditions associated with menstruation, including abnormal and prolonged uterine bleeding, heavy menstrual bleeding, painful menstruation, endometriosis, uterine fibroids, and premenstrual dysphoric disorders. As contraceptives are already a widely accepted and available clinical regimen for preventing pregnancy, it is critical to explore their additional benefits to menstruating patients.

Objectives: This review investigates the effects of modern contraceptive techniques such as birth control pills, long-acting reversible contraceptives (e.g., intrauterine devices, implants), and condoms on menstrual health.

Search Methods: Over 10 databases from inception until February 2022, with no geographical boundaries, were searched.

Selection Criteria: Study designs were one of the following types to be included: parallel or cluster randomized controlled trials, controlled clinical trials, controlled before and after studies, interrupted time series studies, cohort or longitudinal analyses, regression discontinuity designs, and case-control studies. Additionally, only studies that included a comparison group, using a control group with no contraceptive usage were accepted.

Data Collection: Ten team members screened the papers in pairs with a Kappa score of more than 7. Pairs of authors then independently screened the abstracts (stage 1), and the full papers (stage 2) using Covidence. Conflicts were resolved by discussion and the full papers were divided between the reviewers to extract the data from eligible studies.

Main Results: Hormonal contraceptives are considered a well-tolerated, non-invasive, and clinically effective treatment for abnormal and prolonged uterine bleeding, heavy menstrual bleeding, painful menstruation, endometriosis, uterine fibroids, and premenstrual dysphoric disorders. Our studies investigating quality of life or well-being in women with heavy menstrual bleeding, endometriosis, or uterine fibroids have found improvements in all dimensions assessed.

Authors' Conclusions: Hormonal contraceptives significantly reduce pain, symptom severity, and abnormal bleeding patterns associated with women who suffer from heavy menstrual bleeding, endometriosis, and uterine fibroids. As more new contraceptive methods become available, research on the benefits of different hormonal components and doses on non-reproductive health may provide more guidance for clinical use.

Gendered Language Statement

We recognize the diversity of gender identities among individuals who are capable of and choose to carry pregnancies. Although it is our intent to employ gender-inclusive language where possible in this paper, to remain consistent with the populations referenced in the studies utilized to support our review, the terms "woman/women" and the pronouns "she" and "her" will be employed as appropriate.

Gynecological health

Factors predicting fibroid diagnosis in an integrated healthcare system: an exploratory analysis Susanna Mitro*, Fei Xu, Catherine Lee, L. Elaine Waetjen, Lauren Wise, Eve Zaritsky, Monique Hedderson,

Background: Fibroids are common benign tumors that can cause pain and heavy bleeding, but their etiology is not well understood. We explored predictors of fibroid diagnosis.

Methods: In Kaiser Permanente Northern California's (KPNC) electronic health records, we studied 541,857 female patients aged 18-50. We identified fibroid diagnoses (n=4262) between 1/1/2019 and 12/31/2019. Eligible cases were enrolled in KPNC for 2 years before the diagnosis date in 2019 (before 12/31/2019 for non-cases; n=537,595) with ≥2 healthcare encounters and no prior fibroid diagnosis or hysterectomy. We ascertained and grouped all other diagnoses (n=1866); procedures, tests, and services (n=6137); and medications (n=538 classes) that occurred in the 2-year look-back period, as well as demographics and healthcare utilization. We used Least Absolute Shrinkage and Selection Operator (LASSO) and distributed random forest (DRF) models to identify factors predicting fibroid diagnosis.

Results: The LASSO model selected 934 predictors and the DRF model selected 2676 predictors for fibroid diagnosis. Of the top 100 predictors selected by each model, 31 were identified in common, including age, race, parity, anemia, vaginal bleeding, pregnancy and infertility encounters, and pelvic imaging. The top 250 predictors selected by LASSO were largely related to pregnancy or problems with the uterus, ovaries, and cervix, as well as thyroid disease, bone imaging, head and neck injury and imaging, hypertension, and pain. The top 250 predictors identified by DRF included number of encounters, contraceptives, uterine diagnoses, infections and antibiotics, mental health, respiratory disease, autoimmunity, and pain medications.

Conclusion: Some top predictors of fibroid diagnosis were known risk factors (e.g., age, race, parity), or fibroid symptoms and diagnostic methods (e.g., bleeding, pelvic imaging), but others may suggest underexplored risk factors for fibroid development (e.g., thyroid disease).

Gynecological health

Racial Disparities and Age at Diagnosis in the Association Between Endometriosis and Cardiovascular Disease Risk Chidinma Oli*, shaira kee, Robert Cook,

Background: Endometriosis, a chronic gynecological condition, has been associated with an increased risk of cardiovascular disease (CVD). However, little is known about how this risk varies across racial groups or whether the age at diagnosis of endometriosis affects CVD risk.

Objective: To examine if the relationship between endometriosis and CVD varies by race and whether age at diagnosis of endometriosis is associated with CVD risk.

Methods: We analyzed data from the National Health and Nutrition Examination Survey (NHANES) 1999–2006 for women aged 20–54 years with self-report endometriosis diagnosis and CVD (history of congestive heart failure, coronary heart disease, angina, heart attack, or stroke). Age at endometriosis diagnosis was categorized into 13-29 and 30+ years; race as Non-Hispanic White or Black. We used multivariable logistic regression with stratified analysis to assess the relationship between endometriosis and CVD by race and if age at endometriosis diagnosis predicts CVD risk, adjusting for age, smoking status, and education level.

Results: Among 3,719 women, 320 (10.3%) reported a diagnosis of endometriosis, with an overall CVD prevalence of 130 (3.3%). Women with endometriosis had a significantly higher prevalence of CVD (6.7%) compared to those without endometriosis (2.9%, p 30 years had significantly higher odds of CVD compared to those without endometriosis (aOR = 2.7; 95% CI: 1.4–5.2), while no significant difference was observed for those diagnosed at 13–29 years (aOR = 1.8; 95% CI: 0.8–4.1).

Conclusion: Endometriosis is a stronger CVD risk factor for Black women and when diagnosed in later adulthood, highlighting the need for further research

Gynecological health

A case-control study of environmental chemical exposure and adenomyosis risk Kristen Upson*, Mandy Hall Kwalton, Holly Harris, Sawsan As-Sanie, Victoria Holt,

Adenomyosis, marked by endometrial glands and stroma within the myometrium, can confer debilitating symptoms. As estrogen is central to disease pathogenesis, environmental chemicals that are endocrine disruptive may alter adenomyosis risk. We investigated this hypothesis among female enrollees ages 18-59 of an integrated healthcare system in Washington State. Cases had incident, pathology-confirmed adenomyosis diagnosed 2001-2006 (n=386). We employed two control groups: randomly selected age-matched enrollees with intact uteri ("population controls", n=323) and hysterectomy controls (n=233). Data on occupational and non-occupational exposure to chemical groups were collected by in-person interview. We conducted logistic regression to estimate adjusted ORs and 95% CIs, comparing cases to population and hysterectomy controls. Our data suggested increased adenomyosis risk with ever exposure to epoxy resins (cases vs. population controls: OR 1.8, 95%CI: 0.9-3.6; hysterectomy controls: OR 1.4, 95%CI: 0.7-2.9) and heavy metals (population controls: OR 1.5, 95%CI: 0.8-2.7; hysterectomy controls: OR 2.0, 95%CI: 1.0-4.1). Our data also suggested twice the risk of adenomyosis with lead exposure (population controls: OR 2.2, 95%CI: 0.8-6.3; hysterectomy controls: OR 2.0, 95%CI: 0.6-6.1); lead exposure mostly occurred from non-occupational sources (paint, home renovation, soldering, and stain glass work). The association with mercury exposure was inconsistent (cases vs. population controls: OR 1.1, 95%CI: 0.5-2.3; hysterectomy controls: OR 1.7, 95%CI: 0.7- 4.5). No association was observed with solvent exposure; results were inconclusive for exposure to herbicides, insecticides, fungicides, and rodenticides given few exposed participants. Results from our case-control study suggest that exposure to epoxy resins and heavy metals, particularly lead, are associated with increased adenomyosis risk. Given the exploratory nature of our analysis, further research is warranted.

Gynecological health

Endometriosis diagnosis, severity, and location and serum Anti-Müllerian hormone levels

Michelle Valenti*, Karen Schliep, Madeline Paulson, Rachael Hemmert, C. Matthew Peterson, Melissa Furlong, Zelieann Craig, Leslie Farland,

Introduction: Endometriosis, a chronic, inflammatory condition, is often associated with pelvic pain and infertility. Anti-mullerian hormone (AMH), a marker of ovarian reserve, is associated with time to menopause and has been shown to be lower in those with endometriosis. The purpose of this study was to evaluate the association between incident endometriosis diagnosis, severity, and location with AMH levels measured prior to gynecologic surgery.

Methods: Data was acquired from the Endometriosis: Natural History, Diagnosis, and Outcomes Study, which recruited an operative cohort of women undergoing laparoscopy/laparotomy for any indication. Serum AMH levels (ng/mL) were log transformed and multivariable linear regression models were utilized adjusting for age (continuous and squared), body mass index (BMI), age at menarche, exogenous hormonal contraceptive use, and cigarette smoke exposure. Percent difference and 95% confidence intervals (CI) were calculated.

Results: In our sample (n=348), those with endometriosis (n=156) were slightly younger (32 years SD 6.8) than those without endometriosis (n=192) (33 years SD 7.3). Those with endometriosis had a lower BMI (26.7 kg/m2 SD 7.3 vs. 29.6 kg/m2 SD 9.0) and reported a higher proportion of infertility (41.0% vs. 18.8%) compared to those without endometriosis. Endometriosis diagnosis was associated with lower AMH levels (-20.6%, 95% CI -37.6, 1.0). Compared to those without endometriosis, stage I-II and stage II-IV endometriosis were associated with a 11.1% reduction (95% CI -62.25, -19.93) and 44.7% reduction (95% CI -62.3, -19.9), respectively. Ovarian endometriosis was associated with a 57.8% reduction (95% CI -71.9, -36.5) in AMH levels compared to those without endometriosis.

Conclusion: At surgical diagnosis, moderate to severe (Stage III-IV) and ovarian endometriosis were associated with lower AMH levels. This provides insight into the potential mechanism by which endometriosis may affect infertility.

Health equity

Produce Prescription and Adverse Pregnancy Outcomes: Results from A Pilot Intervention
Fang Fang Zhang*, Chloe Andrews, Emma Noyes, Chenchen Sun, Perrie O'Tierney-Ginn,

Background. Integrating food and nutrition into healthcare through "food is medicine" (FIM) interventions shows significant promise for improving dietary intake and health outcomes, yet few studies have evaluated the potential benefits of FIM interventions for pregnant women. We conducted a pilot study to assess the impact of a produce prescription (PRx) program on pregnancy outcomes.

Methods. Among 40 English-speaking pregnant women aged 18+ years receiving prenatal care at Tufts Medical Center who were screened positive for food insecurity, 22 women between 6-24 weeks gestation participated in the PRx program and received weekly home delivery of locally sourced fresh produce at $35 per week for 16 weeks, coupled with nutrition education materials. Eighteen women who did not participate in PRx served as controls. Adverse pregnancy outcome (APO) was evaluated as a composite score including gestational diabetes, gestational hypertension, pre-eclampsia, preterm birth, and newborns small or large for gestational age. Weight gain during pregnancy was assessed as the weight difference between the initial prenatal visit (<12 weeks) and 32-37 weeks gestation. Linear regression was performed to estimate the difference (β) and 95% confidence intervals (CI) in APO composite score and weight gain between PRx and controls, with multivariable adjustments of maternal age, race and ethnicity, pre-gravid body mass index, and baseline physical and mental comorbidity status.

Results. Twenty-one participants completed the PRx program. Women in PRx had a lower median APO composite score (PRx vs. control: 1 vs. 0) and a lower percentage of having 1+ APOs (47.6 vs. 55.6%) than controls. The median weight gain during pregnancy (lbs) was also lower in the PRx than control groups (13.9 vs. 15.9). However, none of the differences reached statistical significance (all p-values>0.05). After multivariable adjustments, the difference in APO score and weight gain during pregnancy was -0.06 (95% CI: -0.57 to 0.45), and -0.38 (-10.7 to 11.4) lbs, respectively.

Conclusions. A produce prescription program can potentially reduce APOs and gestational weight gain for food-insecure pregnant women. Larger-scale interventions are warranted to further evaluate the impact of FIM interventions on improving maternal and offspring outcomes.

Health equity

Discrepancies in Race and Ethnicity Data: A Comparative Study of Electronic Health Records (EHR) and Self-Reported Data in Postpartum Women M. Angie Almond*, Asma Ahmed, David Kline, Caroline Cochrane, Padageshwar Sunkara, Karen Gerancher, Emily Bunce, Jennifer Ingle, David Stamilio, Elizabeth T. Jensen,

Background: Electronic health record (EHR) data are increasingly used for real-world evidence studies and clinical trial recruitment. Accurate collection of race and ethnicity in EHRs is essential for identifying and mitigating healthcare disparities. However, consistency in terminology and methods for collecting patients' race and ethnicity data is lacking.

Aim: To determine the accuracy of race and ethnicity data in the EHR compared to self-reported data when reporting remote postpartum blood pressure monitoring (rBPM) data from the Systematic Monitoring and Remote Testing of Blood Pressure in Postpartum Women (SMART-BP) randomized control trial (ClinicalTrials.Gov NCT05236725).

Methods: Study participants completed a 5-item, tablet-based demographic survey, including race and ethnicity, with the option to self-select multiple responses. In the intervention arm, the proportions of patients with elevated blood pressure (BP) (>140/90) were compared based on EHR and self-reported race and ethnicity.

Results: Of the 1495 participants, 1473 (98.5%) self-reported race and ethnicity. Discordance was lowest among White patients (10 of 482; 2%) and highest among American Indian or Alaska Native (AIAN) (6 of 6; 100%) and multiracial or multiethnic patients (35 of 44; 80%). In the intervention arm (n=632), 341 (53.9%) patients had elevated BPs. The proportion of participants with elevated BPs was similar across racial and ethnic groups when comparing self-reported and EHR data ($p>0.05$ for all except AIAN).

Conclusion: The accuracy of race and ethnicity data in the EHR varies by group, with multiracial and multiethnic groups being poorly described. While discrepancies did not affect study inferences, small sample sizes for some groups limit evaluation. Providing an opportunity for patients to self-report race and ethnicity may improve data accuracy and analysis of disparities in EHR data.

Infectious disease/COVID

Prenatal and Congenital Syphilis in the US: Characterizing Screening and Treatment

Elizabeth Suarez*, John Christian Hague, H. June O'Neill, Katherine E. Round, David Cole, Nahida Chakhtoura, Juanita J. Chinn, Catherine J. Vladutiu, Judith C. Maro,

Congenital syphilis cases have risen by 1000% since 2011 in the United States (US). Gaps in screening and treatment of syphilis in pregnancy are described only in regional studies, and little is known about recommended rescreening. The objective was to assess trends in syphilis screening and treatment in pregnancy across the US.

Pregnancies were identified in Medicaid (2014-2021) and commercial insurance plans (2010-2023). Syphilis screening and diagnosis were defined using diagnosis and procedure codes during pregnancy and at delivery. First time screening was assessed by trimester and repeat screening was defined as screening in more than one trimester. We examined trends in screening by timing of insurance enrollment (before pregnancy, during the 1st or 2nd trimesters). Treatment with benzathine penicillin G or non-recommended alternative antibiotics was defined using dispensing and administration records.

75.2% of Medicaid-insured pregnancies had evidence of syphilis screening in pregnancy compared to 92.8% of commercially-insured. There was an increase in screening in the Medicaid cohort from 2016-2021 (68% to 81%) and no change in the commercially-insured cohort (90% to 93%). 52% of Medicaid-insured and 82% of commercially-insured were screened in the 1st trimester. Repeat screening more than doubled in the Medicaid (18.3% to 40.3%) and the commercially insured (19.1% to 51.9%) populations. Pregnancies enrolling late in pregnancy were more likely to be screened later but less likely to be screened at any point in pregnancy. About half of syphilis-diagnosed pregnancies had evidence of treatment with benzathine penicillin G (53.4% in Medicaid and 45.1% in commercial insurance) and 5-6% had evidence of alternative antibiotics.

Based on this analysis, syphilis screening in pregnancy in the US is not meeting recommendations and substantial differences are evident by insurance status. Efforts to increase screening and adequate treatment in pregnancy are still greatly needed.

Mental health

Mental Health and Home Pregnancy Testing Behavior Alexandra Sundermann*, Kenneth Rothman, Lauren Wise,

Mental health is integral to pregnancy health, yet little is known about its effect on pregnancy testing behavior among those trying to conceive. In PRESTO (Pregnancy Study Online, 2018–2024), a prospective cohort of individuals planning a pregnancy, participants provided information about mental health and day-specific use of a home pregnancy test, including test results from four days before expected start of menstruation through four days after. We analyzed data from 20,458 pregnancy tests across 6,569 participants. Thirty-two percent of participants reported an anxiety diagnosis and 27% reported a depression diagnosis; 16% of participants reported a diagnosis of both anxiety and depression. Testing was categorized as infrequent (1 test, 34%), moderate (2-3 tests, 35%), or frequent (≥4 tests, 31%). Behavior was further characterized by timing of first test as very early (≥4 days before expected period, 41%), early (1-3 days before expected period, 33%), or expected/late (day of expected period or later, 26%). We use log-binomial regression models to estimate risk ratios and 95% confidence intervals [CI], with adjustment for age, parity, and history of miscarriage. Participants with anxiety were more likely to be very early and frequent testers (adjusted risk ratio [aRR] 1.31, 95% CI 1.20, 1.43). When accounting for a concurrent depression diagnosis, participants with anxiety alone were most likely to be very early and frequent testers (aRR 1.37, 95% CI 1.18, 1.58) compared with participants with anxiety and depression (aRR 1.17, 95% CI 0.99, 1.38) or depression alone (aRR 1.16, 95% CI 0.97 1.41). Among participants who detected pregnancy (n=3,241), those with anxiety were more likely to report additional testing after initial positive test (aRR 1.14, 95% CI 1.07, 1.22). Home testing is one of the first modifiable behaviors of pregnancy, and individuals with anxiety tend to test earlier and more frequently than those without.

Mental health

Trajectories of perinatal depressive symptoms in Black and Latina pregnant individuals
Sara Aghaee*, Lyndsay A. Avalos, Elaine Kurtovich, Ai Kubo,

Over 10% of pregnant individuals experience perinatal depression, with disproportionately high rates among Black and Latina individuals. The literature suggests that perinatal depression is better characterized as trajectories, yet studies on these populations are scarce. This study examines trajectories of perinatal depressive symptoms among Black and Latina individuals in an integrated healthcare delivery system, and their associations with clinical outcomes.

We determined trajectory groups using the Patient Health Questionnaire-9 (PHQ-9), a 9-item depression screener. Total scores range 0-27. Depression severity is characterized as little (0-4), mild (5-9), moderate (10-14), moderately severe (15-19), and severe (20-27). Scores of 10+ are associated with clinical levels of depression. Outcomes included preterm delivery (<37 weeks), low birth weight (<2500 grams), low APGAR scores (0-3, 4-6) and having a c-section. Data were extracted from the electronic health records and research databases.

We examined data from 10,562 pregnancies resulting in singleton live births among Black (22%) and Latina (78%) individuals starting June 2022. We identified 5 trajectory groups using SAS procedure TRAJ: low-stable (23%), mild-stable (45.9%), mild-increasing (13.1%), moderate-stable (13.1%), and moderate-increasing (4.9%). Individuals in the mild-stable (odds ratio: 1.25, 95% confidence interval: 1.04-1.51), mild-increasing (1.35, 1.05-1.172), moderate-stable (1.29, 1.01-1.66) and moderate-increasing (1.45, 1.04-2.01) groups had increased odds of experiencing preterm births compared to those in the low-stable group. Similar associations were found for low birth weight and APGAR scores.

Our findings suggest that having even subclinical levels of depression may be associated with birth outcomes, and that effect estimates vary by severity and trend. Serial depression screenings may be a cost-effective tool for reducing health disparities associated with perinatal depression.

Mental health

The association between migraine and premenstrual syndrome in the Growing Up Today Study Holly Crowe*, Donghao Lu, Janet Rich-Edwards, Kathryn Rexrode, Elizabeth Bertone-Johnson,

Migraine is the most disabling disease of women and girls of reproductive age worldwide. Fluctuations in female sex hormones play a significant role in the pathophysiology of migraine and premenstrual syndrome (PMS). However, the association between these conditions and the role of comorbid depression are unknown. We conducted a cross-sectional analysis of 6,520 female participants in the Growing Up Today Study to determine the association between self-reported ever-diagnosis of migraine and PMS. PMS was assessed in 2013 (mean age= 26) using a modified Calendar of Premenstrual Experiences. To meet criteria for PMS, participants had to report physical and affective symptoms with sufficient severity and impact on functioning, occurring only during specific days of the menstrual cycle. Comorbid depression was assessed using a composite variable of symptoms, diagnosis, or use of antidepressant medications. We used logistic regression to estimate the association between diagnosed migraine and PMS, adjusting for age, race, experience of child abuse, age at menarche and parity. While 34% of participants reported an ever-diagnosis of migraine and 19% reported experiencing PMS, we found no relationship between these conditions overall (OR=0.98, 95% CI:0.86-1.11). We observed a higher prevalence of depression (36% vs. 27%) among individuals with migraine, but depression was unassociated with PMS Stratified analyses showed a positive association between migraine and PMS among individuals with comorbid depression (OR= 1.25, 95% CI: 0.98-1.60) and a negative association between migraine and PMS among individuals without comorbid depression (OR=0.79, 95% CI: 0.66-0.95) (p interaction=.005). Our results suggest that co-occurrence of other mental health conditions may impact the observed association between migraine and PMS.

Mental health

Stimulant treatment for attention-deficit/hyperactivity disorder and risk of first and repeat juvenile criminal offending: a population-based cohort study Timothy Nielsen*, Ralph Nanan, Tony Butler, Natasha Nassar, Alison Poulton,

Background: Children and young adults with Attention-deficit/hyperactivity disorder (ADHD) may be at increased risk of criminal offending due to limited attention and impulse control.

Objectives: Examine the risk of offending among individuals with ADHD, differences in risk between first and repeat offenses, and whether stimulant medications reduce this risk.

Methods: A population-based data-linkage cohort study of individuals born in New South Wales, Australia 1990-2005 and followed until May 2016. Individuals with ADHD were frequency matched on sex, age, and postcode at birth to controls (1:10) without ADHD. Treatment status was defined by longitudinally linked authorization records and proven criminal offenses using court records. First and repeat offenses were examined separately by calculating Hazard Ratios (HR) and 95% confidence intervals (95%CI) using modified Cox regression and Prentice-Williams-Peterson models, respectively.

Results: The cohort included 75,650 individuals with ADHD (147,855 treated and 525,595 untreated person years) and 745,634 controls without ADHD. The risk of a first offense was increased among cases compared with controls and reduced by treatment (Males 10-17 years, untreated HR 2.02 95%CI 1.95-2.10; treated HR 1.52 95%CI 1.41-1.62). The effect estimates for males were reduced for repeat offenses, though treatment remained protective (10-17 years: untreated HR 1.09 95%CI 1.05-1.13; treated HR 0.97 95%CI 0.90-1.04). No association in reoffending was found in females, except treated individuals aged 10-17 years had increased risk (HR 1.26 95%CI 1.02-1.56).

Conclusions: Individuals with ADHD were at increased risk of criminal offending, but stimulant treatment reduced the risk of a first offense. This association was reduced among repeat offenders, with only modest benefit of treatment among males and no association among females. Adequate treatment resources may help keep young people with ADHD out of the criminal justice system.

Methods

A Causal Diagram for Cerebral Palsy: A New International Collaboration Robert Reynolds*, Steven Day, Sandra Hollung, Kate Himmelmann, Gija Rackauskaite, Bernard Dan, Sarah McIntyre, Shona Goldsmith, Nadia Badawi,

Cerebral palsy is the result of a complex set of circumstances, with potentially several major causal pathways and dozens of contributing factors that occur from the prenatal through the post-neonatal periods. In spite of ongoing research into these pathways, a comprehensive view of cerebral palsy's causal mechanisms had not been attempted. We present here a causal diagram for cerebral palsy, in the form of a directed acyclic graph, or DAG. The DAG was developed by an international consortium of researchers, clinicians, and therapists, with input from people with lived experience in cerebral palsy and their caretakers. The DAG includes prenatal, perinatal, neonatal, and post-neonatal factors and events, currently represented by 118 nodes and 286 links. In this presentation we review the process for creating the DAG, show how it can be used as the basis for continued collaboration, share early insights from its structure, and discuss the next steps in its validation and ongoing curation, including how audience members and the broader cerebral palsy research community can participate.

Methods

Time-related biases in the association between maternal injury and preterm birth Asma Ahmed*, Allison Musty, Joseph Rigdon, Jennifer Hutcheon,

Background

Injuries affect 1 in 12 pregnancies and are associated with perinatal complications. Some studies that examined associations between maternal injuries and preterm birth (PTB) reported null or counterintuitive protective effects, especially for 3rd-trimester injuries, likely due to time-related biases. We estimated associations between maternal injuries and PTB while appropriately accounting for time-related biases.

Methods

A retrospective cohort study including all births from Atrium Health Wake Forest Baptist system in 2018-2024. Maternal injuries were ascertained using validated diagnostic codes. PTB was defined as gestational age at delivery <37 weeks. We estimated associations between maternal injuries and PTB via two approaches. We used logistic regression for time-fixed analysis (i.e., injury at any point in pregnancy yes/no and PTB yes/no) and Cox proportional hazards models for time-varying analysis (i.e., time-varying injury exposure definition, restricting follow-up to periods when pregnancies were at risk of PTB).

Results

Among 58897 births, 3.1% experienced maternal injuries, and 11.2% were PTB (12.4% among injured and 11.2% among uninjured). With the time-varying approach, maternal injuries were associated with increased risk of PTB (HR: 1.16 (95% CI: 1.01-1.32), adjusted for sociodemographic, lifestyle, and clinical factors). Trimester-specific analyses showed positive associations for all trimesters, with strongest associations for 3rd trimester injuries (HR: 1.22 (0.92-1.61)). Associations were underestimated in time-fixed analyses, and results for 3rd trimester injuries showed counterintuitive negative associations (HR: 0.74 (0.56-0.97)).

Conclusion

Time-related biases typically underestimate associations between maternal injuries and preterm birth, particularly for 3rd trimester injuries. Rigorous study design and analytical methods that account for time-related biases are crucial in studies investigating adverse outcomes after maternal injury.

Nutrition/obesity

Association between parental body dissatisfaction and child feeding practices in a 2019-2020 statewide sample of Texas parents of second-grade students Kaitlin Brand*, Deanna Hoelscher, Adriana Perez, Raja Malkani,

Introduction: Few studies have examined the relation between parent body size attitudes and child feeding practices in parents of elementary school children. The purpose of this study is to explore the association between parental body dissatisfaction and parent-reported child feeding practices in a diverse statewide population.

Methods: Validated self-reported survey data were collected from the parents of second-grade children (n = 1,083) participating in the 2019-2020 Texas School Physical Activity and Nutrition (Texas SPAN) study. Parental body dissatisfaction was dichotomized as desire to lose weight versus other. Child feeding practices included encouraging children to eat in the absence of hunger, offering sweets as a reward, and limiting snacks. Pearson Chi-square tests of independence were conducted, and three weighted logistic regression models were fit, adjusting for parent/child gender, family food insecurity, child race/ethnicity, parent age, and parent education level.

Results: Parents with body dissatisfaction were less likely to offer sweets as a reward (17% vs 26%, p = 0.009), but there were no differences in encouraging eating when not hungry or limiting snacks. Parents with body dissatisfaction had lower odds of encouraging eating when not hungry (AOR 0.68; 95% CI 0.42, 1.11), offering sweets as a reward (AOR 0.63; 95% CI 0.38, 1.01), and limiting snacks (AOR 0.58; 95% CI 0.29, 1.20) compared to parents without body dissatisfaction, after adjusting for covariates.

Discussion: Findings suggest that, among a racially/ethnically diverse population, parental body dissatisfaction may influence some feeding practices more than others. Further research to understand factors underlying these practices may be warranted.

Nutrition/obesity

Utility of Two Food Frequency Questionnaires to Assess Usual Intake of Docosahexaenoic Acid (DHA) and Eicosapentaenoic Acid (EPA) Among Toddlers Sarah Keim*, Lisa Robinette, Lynette Rogers,

High-quality food frequency questionnaires (FFQ) to estimate usual intake of specific long-chain fatty acids among very young children are lacking. Our objective was to evaluate 2 food frequency questionnaires for measuring DHA and EPA intake among toddlers. In a clinical trial of omega-3 fatty acid supplementation of 377 children ages 12-20 months, usual intake of DHA and EPA were assessed at baseline via caregiver completion of a 7-item FFQ including high DHA and EPA foods (Kuratko, 2013) and the 111-item Harvard semi-quantitative FFQ (2007) designed for adults (Willett, 1985). Red blood cell (RBC) fatty acids were measured in 205 children by gas chromatography. Pearson correlation coefficients estimated correlations among estimates of DHA, EPA, and DHA+EPA intake between the FFQs and with RBC fatty acids. Participant characteristics were examined as potential modifiers of the correlations. Among 372 children with data from both FFQs, estimates of DHA, EPA, and DHA+EPA intake were moderately correlated among FFQs (r ranged 0.62-0.69, all p<.0001). Those correlations were stronger for children of mothers with greater than a high school education and from households with income >$35,000/yr, compared to children of other households. Estimates of DHA and DHA+EPA from both FFQs were weakly correlated with RBC DHA and DHA+EPA (r ranged 0.14-0.15, p ranged 0.03-0.04). Those correlations did not differ by household income for the 7-item FFQ, but for the Willett only children from households with income >$35,000/yr showed correlation. Both FFQs generated estimates of EPA intake that were not correlated with RBC EPA (r ranged 0.07-0.11, p ranged 0.13-0.31). A 7-item FFQ generated estimates of fatty acid intake similar to those generated by the longer Willett FFQ. Estimates from neither FFQ were strongly correlated with RBC fatty acids. Families with low incomes and caregivers with less education may have had difficulty with the lengthy Willett FFQ.

Nutrition/obesity

Central obesity measures in early pregnancy and the risk of hypertensive disorders of pregnancy and postpartum chronic hypertension: A longitudinal cohort study Ana Rosen Vollmar*, Assiamira Ferrara, Monique Hedderson, Amanda Ngo, Rana Chehab, Mara Greenberg, Yeyi Zhu,

Elevated body mass index (BMI) is a risk factor for hypertension. Despite recognized limitations of BMI, which cannot account for body fat distribution, little is known about the role of central (abdominal) obesity in hypertensive disorders of pregnancy (HDP, includes gestational hypertension, pre-eclampsia, eclampsia), or whether certain central obesity measures are more strongly associated with HDP.

We examined associations between central obesity and HDP and new-onset postpartum chronic hypertension (CH) from electronic health records in the PETALS pregnancy cohort (n=3,055), with up to 9.9 yrs (mean 4.8; SD 2.7) follow-up. Height, waist circumference (WC), and hip circumference were assessed at 10-13 wks gestation as pre-pregnancy proxy measures and used to calculate body roundness index (BRI), waist-to-height ratio (WHtR), and waist-to-hip ratio (WHR). We used modified Poisson regression for HDP and Cox proportional hazards models for postpartum CH, adjusted for confounders including pre-pregnancy BMI (ppBMI), and tested for effect modification by ppBMI.

There was a dose-response association between increasing central obesity and HDP risk. The 4th (>5.9) vs. 1st (≤3.34) BRI quartile had a higher risk of HDP (risk ratio [RR] 2.0, 95% CI 1.1-3.8) and postpartum CH (hazard ratio [HR] 4.6, 2.4-9.1). The 4th (≥0.63) vs. 1st (<0.5, no central obesity) WHtR group had a higher risk of HDP (RR 2.1, 1.1-3.9) and postpartum CH (HR 4.4, 2.3-8.5). When ppBMI≥25, BRI and WHtR above vs. below the median had higher risks for HDP (RR for both 1.7, 1.1-2.7) and CH (HR for both 1.8, 1.2-2.8). BRI and WHtR were not associated with HDP or postpartum CH when ppBMI<25. WC and WHR were also associated with HDP and postpartum CH, with smaller effect sizes.

Central obesity measures, especially BRI and WHtR, are risk factors for HDP and postpartum CH independent of BMI. Our findings may inform clinical screening strategies and underscore the value of routine central obesity measurement.

Nutrition/obesity

Grandmaternal body mass index in early pregnancy and risk of childhood sleep apnea in grandoffspring Mia Zhu*, Sven Cnattingius, Louise O'Brien, Eduardo Villamor,

Background: Grandmaternal obesity predicts maternal obesity, a known risk factor for offspring sleep apnea. While grandmaternal nutrition has been associated with grandoffspring cardiometabolic health, grandmaternal obesity has never been studied as a risk factor for grandoffspring sleep apnea.

Objectives: We investigated grandmaternal early pregnancy obesity as a risk factor for grandoffspring sleep apnea in childhood.

Methods: Utilizing Swedish nationwide registers, we compared sleep apnea risks by maternal grandmaternal (F0 generation) early pregnancy body mass index (BMI) categories using hazard ratios (HR) with 95% confidence intervals (CI) among 315,461 singleton live-born grandoffspring (F2 generation). We examined maternal (F1 generation) birth and pregnancy factors as possible mediators. Analysis with paternal grandmaternal early pregnancy BMI was conducted analogously in a subset of 164,095 grandoffspring. To assess whether shared familial factors explained these associations, we estimated sleep apnea risk by maternal and paternal full sisters' BMI among 101,053 and 35,179 grandoffspring, respectively.

Results: There were 1,332 sleep apnea diagnoses over a median follow-up of 4.2 years. Compared with maternal grandmothers (F0) with normal BMI (18.5-24.9) in early pregnancy, adjusted HR (95% CI) of grandoffspring (F2) childhood sleep apnea for grandmaternal BMI categories overweight (BMI 25.0-29.9) and obesity (BMI ≥30.0) were, respectively, 1.23 (1.02, 1.50) and 1.59 (1.15, 2.19). Only 19% of this association was mediated by maternal (F1) obesity. HRs similarly increased with paternal grandmaternal early pregnancy BMI categories, but were weaker in magnitude than those with maternal grandmaternal BMI. Parental siblings' BMI was not related to grandoffspring sleep apnea.

Conclusion: Grandmaternal obesity is positively related to childhood sleep apnea risk in grandoffspring; shared familial factors may not play a major role. Little mediation through maternal BMI suggests an intrauterine influence of obesity on the maternal (F1) generation.

Nutrition/obesity

Maternal egg consumption during pregnancy and birth outcomes Xiaozhong Wen*, Fatima Mohammed, Khadija Nadeem, Akashpreet Grewal, Todd Rideout,

Objectives: To examine the associations of overall egg intake during pregnancy and different components of eggs/different preparation methods with birth outcomes.

Methods: Data from a U.S. cohort of 1,119 mother-infant dyads in the Infant Feeding Practices Study II were analyzed. In late pregnancy, mothers reported the frequency and portion size of their consumption of egg-related products in the past month, including total eggs, whole eggs, egg whites, egg substitutes, eggs with fat, and egg salads. We used multivariable logistic and linear regression models to examine associations of egg consumption with binary (i.e., preterm, small-for-gestational-age [SGA], large-for-gestational-age [LGA]) and continuous (i.e., gestational age, birth weight, and birth length) birth outcome, respectively, adjusting for socio-demographics, pregnancy-related characteristics, and the Healthy Eating Index.

Results: Maternal total egg consumption was marginally associated with a lower risk of SGA birth. Pregnant individuals who consumed eggs 1-2 times per week tended to have a lower risk of SGA (6.6% vs 13.4%; confounder-adjusted odds ratio or aOR, 0.50 [95% confidence interval or CI, 0.25-1.02]; P-value=0.056), compared to those who never consumed eggs. One egg/week increment in total egg consumption corresponded to 0.93 (95% CI, 0.86-1.00) times lower risk of SGA birth. When examining specific egg foods, the results for whole egg consumption were similar to those for total egg consumption. Pregnant individuals who consumed eggs with fat 2+ times per week had a significantly lower risk of SGA (7.3% vs 10.0%; aOR, 0.46 [95% CI, 0.23-0.91]; P-value=0.025), compared to those who never consumed eggs with fat. The risk of SGA birth decreased with consuming eggs with fat, and aOR was 0.90 (95% CI, 0.82-0.99; P-value = 0.038) per one egg/week increment in consumption of eggs with fat. However, there were no significant associations between egg consumption during pregnancy and other birth outcomes.

Conclusions: High consumption of eggs with fat, possibly total eggs and whole eggs, was associated with a lower risk of SGA birth. No such associations were found for egg whites, egg substitutes, or egg salads.

Nutrition/obesity

Postpartum Weight Retention and Mortality Over 50 Years of Follow-up Yajnaseni Chakraborti*, Sunni L. Mumford, Edwina H. Yeung, Katherine L. Grantz, Pauline Mendola, James L. Mills, Ellen C. Caniglia, Colleen M. Brensinger, Cuilin Zhang, Enrique F. Schisterman, Stefanie N. Hinkle,

Background: Unhealthy weight gain is associated with a higher risk of mortality. Childbearing may further contribute to this risk through postpartum weight retention (PPWR), a potential yet unexplored mechanism. This study examined the link between interpregnancy weight change (IPWC)—a proxy for PPWR, and mortality over 50 years post-pregnancy in a diverse cohort.

Methods: In participants with ≥2 pregnancies (n=8165) from the prospective Collaborative Perinatal Project (U.S., 1959-1966), the exposure was IPWC, the difference between self-reported pre-pregnancy weight at the 1st and 2nd CPP pregnancies. IPWC was examined as quintiles with the median quintile as the reference. Vital status through 2016 was obtained through linkages with the National Death Index and Social Security Death Master File. Missing data were imputed 10 times. All-cause mortality was modeled using discrete Cox proportional hazard models, weighted for potential selection bias. Secondary analyses examined pre-pregnancy body mass index (BMI)-specific IPWC quintiles. Models were adjusted for 1st CPP pregnancy demographics, reproductive history, and medical conditions.

Results: The median follow-up was 54 years [inter-quartile range (IQR): 47-56]; 41.7% (n=3405) of the participants died. The median IPWC was 0.91 kg [IQR:-0.45, 3.63]; 56.3% (n=4593) of the participants had a net weight gain. Compared to those with IPWC between 0 and 1.8 kg (quintile 3), the adjusted all-cause mortality hazard ratios (HRs) and 95% confidence intervals (CIs) were: 1.01 (0.89-1.15) IPWC ≤-1.4 kg; 0.87 (0.76-0.99) for IPWC between -1.4 and 0 kg; 1.06 (0.93-1.21) for IPWC between 1.9 and 4.5 kg; and 1.13 (0.99-1.29) for IPWC ≥4.5 kg. Further, among those with pre-pregnancy BMI of 18.5-24.9 kg/m2, IPWC ≥ 4.5 kg was linked to higher HR of 1.20 (1.02-1.42).

Conclusion: Modest postpartum weight retention may raise mortality risk, and further studies are needed to identify strategies to support healthy postpartum weight goals.

Nutrition/obesity

Preconception diet and pregnancy outcomes: The PrePARED Consortium Emily Harville*, Lixuan Ji, Yuanhan Yu, Janaki Sundaresan, Ke Pan, James Shikany, Daniela Sotres-Alvarez, Gita Mishra, Erica Gunderson,

Objective To assess whether preconception adherence to dietary recommendations is associated with healthy pregnancy.

Methods We harmonized data on 17714 participants from 5 cohorts in the Preconception Period Analysis of Risks and Exposures influencing health and Development (PrePARED) consortium according to the Fédération International de Gynécologie et d'Obstétrique (FIGO) nutrition checklist score. Linear risk models used the total diet quality score as a predictor of composite healthy pregnancy/infant outcomes (no gestational diabetes or hypertensive disorders [HDP], vaginal birth, full-term, appropriate weight for gestational age), adjusting for demographics, smoking, and energy intake. Results were combined using a mixed model with random effects for study and weighted by the inverse of the variance.

Results In the Australian Longitudinal Study of Women's Health, greater adherence to FIGO recommendations was associated with a higher likelihood of healthy infant outcome (β [risk difference]=0.008, SE 0.007, per recommendation met). In Coronary Artery Risk Development in Young Adults, contrary to hypothesis, higher FIGO scores were associated with a lower likelihood of good pregnancy/infant outcome (β=-0.022, SE 0.006). FIGO scores were not appreciably associated with composite outcomes in the California Teachers Study, Hispanic Community Health Study, or Pregnancy Study Online. Pooled results did not indicate an association between FIGO score and outcomes (composite healthy pregnancy/infant: β=-0.004, SE 0.011), with the exception of an inverse association with preterm birth (β=-0.061, SE 0.057). In individual cohorts, inverse associations were also observed for cesarean section and HDP.

Conclusion Overall results did not show strong associations between preconception adherence to FIGO recommendations and pregnancy/infant outcomes, although some associations varied by cohort.

Nutrition/obesity

Preconception multivitamin supplementation and the risk of multiple gestations Anne Marie Darling*, Eirini Nestoridi, Mahsa Yazdy, Martha Werler,

Background: Preconception supplementation with folic acid-containing multivitamins is recommended for the prevention of neural tube defects and other pregnancy-related complications. Studies have inconsistently reported that preconception use of multivitamins containing folic acid is associated with an increased risk of twin or higher multiple pregnancies. Our objective was to examine this association using United States population-based data.

Methods: We used data from control participants in the National Birth Defects Prevention Study (NBDPS) and the Birth Defects Study to Evaluate Pregnancy exposureS (BD-STEPS) to evaluate the association between multiple gestations and supplement use. Participants self-reported supplementation use during the 1 month prior to conception. We modeled the association between supplement use and multiple gestations using modified Poisson regression adjusting for potential demographic and clinical confounders. We computed bounds to quantify potential selection bias resulting from restriction of the cohort to live births only.

Results: Among 13,813 pregnancies conceived between 1996-2011 (NBDPS) and 2012-2022 (BD-STEPS), 358 (2.6%) were multiple gestations. After adjustment for potential confounders including use of assisted reproductive technology, we observed no association between multiple gestations and supplement use during 1 month prior to conception (RR 0.86, 95% CI 0.67-1.10). Quantitative bias analysis suggested these results may be biased downward somewhat, however, if fetal survival is associated positively with preconception supplementation and inversely with multiple gestation.

Conclusion: Our results do not support a causal effect of preconception folic acid-containing multivitamin supplements on the occurrence of multiple gestations even in the context of fetal survival bias.

Nutrition/obesity

Associations of mode of delivery with early initiation of breastfeeding and duration of exclusive breastfeeding in a cohort of generally healthy Bangladeshi infants Miranda Loutet*, Charles Keown-Stoneman, Huma Qamar, Lisa Pell, Masum Billah, Shafiqul Alam Sarker, Diego Bassani, Daniel Roth,

Introduction:
With global rates of caesarean section (C-section) increasing substantially over the past decade, it is important to re-examine the relationship between mode of delivery and breastfeeding. Here, we aimed to estimate the association between mode of delivery and 1) early initiation of breastfeeding within one hour of birth (EIBF) and 2) exclusive breastfeeding duration (EBD).

Methods:
We estimated associations between mode of delivery and breastfeeding outcomes from a cohort study of 1926 infants enrolled 0-4 days of life and followed for 6 months conducted from November 2020 to September 2022 in Dhaka, Bangladesh. Adjusting for known confounders, modified Poisson regression was used to estimate relative risks (aRR) for EIBF and Cox proportional hazard models to estimate hazard ratios (aHR) for EBD. Mediation by skin-to-skin contact immediately after birth (SSC) and effect modification by breastfeeding support were also assessed.

Results:
Infants born by C-section were less likely to initiate breastfeeding early compared to those born vaginally (aRR:0.15, 95% confidence intervals (CIs):0.12, 0.20). SSC did not mitigate the negative effect of C-section delivery on EIBF (among infants born by C-section aRR:0.37 (95%CI:0.21, 0.67) for EIBF among those with SSC compared to without and among infants born vaginally aRR:1.4 (95%CI:0.79, 2.5)). Mode of delivery did not affect EBF (aHR:0.89, 95%CI:0.79, 1.0). Receiving breastfeeding support within two days postpartum increased EBD among infants born by C-section infants versus vaginally (aHR:0.87, 95%CI:0.77, 0.99), but no effect among those who did not receive support (aHR:0.99, 95%CI:0.79, 1.2).

Conclusions:
Infants born by C-section were less likely to initiate breastfeeding early compared to those born vaginally, but no difference in duration of exclusive breastfeeding. Further research is needed to understand context-specific practices related to C-sections and SSC to promote EIBF and exclusive breastfeeding.

Nutrition/obesity

Association Between Cardiovascular Health Status in Adolescence and Adulthood Using Life's Essential 8 Annabelle Ng*, Natalie Boychuk, Teresa Janevic, Katharine McCarthy, Katharine McCarthy

The American Heart Association's Life's Essential 8 (LE8) emphasizes behavioral risk reduction to promote cardiovascular health (CVH) across the lifecourse. CVH transitions from adolescence to adulthood have been less studied using this framework. We investigated the prospective association between CVH status in adolescence and adulthood using indicators of LE8. Individuals in the National Longitudinal Study of Adolescent and Adult Health interviewed in 1996 (ages 12-19) and 2016-18 (ages 34-43) without youth-onset diabetes were included. Adolescent CVH was calculated using 5 health behaviors of LE8: diet, physical activity, smoke exposure, sleep and body mass index. Adult CVH also included blood sugar, lipids and blood pressure measures. CVH scores were categorized into terciles using LE8 criteria. We estimated associations between adolescent CVH and the likelihood of poor vs. intermediate or optimal adult CVH using generalized estimating equations controlling for repeated measures and sociodemographic factors. We tested for interaction by sex and calculated population attributable risk. Individuals interviewed at both time points were included (N=2,025). The prevalence of those with poor (29.1% to 32.3%) and intermediate CVH (57.4% to 61.5%) increased between adolescence and adulthood, while optimal CVH decreased (13.5% to 6.2%). Poor adolescent CVH was associated with 2.1 (95% confidence interval (CI) 1.5, 3.1) times the risk of maintaining poor CVH in adulthood. Intermediate adolescent CVH was not associated with poor adult CVH (adjusted risk ratio (aRR) 1.1, 95% 0.8, 1.5), and optimal adolescent CVH demonstrated a protective association (aRR 0.4, 95% CI: 0.2, 0.6). No evidence of interaction by sex was observed. Increasing the prevalence of optimal adolescent CVH would reduce the risk of poor adult CVH by 23.3%. Findings underscore the association between adolescent and adult CVH and support early optimization through behavioral risk reduction strategies.

Nutrition/obesity

Daily Step-Count and Sleep Metrics Across Pregnancy: An Observational Analysis of the LEAP Cluster Randomized Controlled Trial Bethany Hallenbeck*, Sylvia Badon, Fei Xu, Charles Quesenberry, Monique Hedderson,

Background: Although some studies have found a positive association between self-reported physical activity (PA) and sleep quality, the relationship between objectively measured step count, an intuitive method of measuring PA, and sleep quality during pregnancy has been underexplored. This analysis aims to investigate the daily associations between step count and sleep quality, using wearable devices, across trimesters of pregnancy. **Methods:** Participants (N=358) with pre-pregnancy overweight or obesity in the intervention arm of an mhealth randomized controlled trial wore a Fitbit or Apple Watch from ~8 weeks until the end of the pregnancy. Devices tracked daily PA (step count) and sleep metrics, including time spent in light sleep, deep sleep, REM sleep, total sleep duration, and sleep efficiency. We estimated daily associations between step count and sleep metrics with mixed effects models, adjusting for age, marital status, gestational age, parity, race and ethnicity, and pre-pregnancy BMI. We additionally stratified by trimester. **Results:** There were no associations in the first trimester. Participants averaged 5,795 steps per day. In the second trimester, each additional 1,000 daily steps were associated with 15 minutes shorter total sleep duration [95% CI (CI) -21.7, -8.7], 12 minutes shorter light sleep (CI -15.1, -8.8), 5 minutes longer deep sleep (CI 3.8, 6.9), and 7 minutes longer REM sleep (CI 4.7, 8.6). In the third trimester, the relationships were similar, with 16 minutes shorter light sleep (CI -20.4, -12.0), 6.5 minutes longer deep sleep (CI 4.5, 8.7), and 10 minutes longer REM sleep (CI 7.1, 12.5). There were no associations between step count and sleep efficiency in our study sample. **Conclusions:** These findings suggest that increasing step count may prolong nightly deep and REM sleep, thus improving sleep quality, in mid- to late-pregnancy, even when sleep duration is shorter.

Obstetric health

Among Women with prior Gestational Diabetes, rural women have higher postpartum diabetes screening rates than urban women: Observations from North Dakota (2017-2021)

Andrew Williams*, Juliana Antwi, Asma Husna, Kilyn Parisien, Rylee Bergeron,

Background: Gestational diabetes mellitus (GDM) increases risk for future type 2 diabetes (T2DM) and other cardiometabolic disease. As such, postpartum diabetes screening is critical for women with prior GDM, as it may help prevent or delay the onset of future disease. A higher prevalence of T2DM among rural populations and disparities in access to healthcare may affect screening rates. This study aimed to evaluate the difference in postpartum diabetes screening rates between rural and urban women in North Dakota (ND) who had GDM in their most recent pregnancy.

Methods: Data from the 2017-2021 ND Pregnancy Risk Assessment Monitoring System (PRAMS) were analyzed. Women with a history of GDM in their most recent pregnancy were included in the study (weighted n= 3523). GDM and subsequent diabetes screening in the postpartum period was self-reported. Rural-urban county of residence was based on the 2013 National Center for Health Statistics' Urban-Rural Classification Scheme for Counties. Logistic regression estimated odds ratios (OR) with 95% confidence intervals (CI) for the association between rural residency and postpartum diabetes screening, controlling for demographic and healthcare-related factors.

Results: Rural residing women made up 48% of the sample, and 52% of the sample were urban residing women. Analysis suggests that among women with GDM in their most recent pregnancy, rural residents are twice as likely (OR:2.18, 95%CI: 1.05,4.52) to be screened for diabetes in the postpartum period than urban residents in ND.

Conclusion: Rural residents in ND are more likely to receive postpartum diabetes screening after GDM compared to urban residents. This observation may reflect differences in healthcare access, provider practices, or patient engagement in rural versus urban settings. Further investigation is needed to understand the underlying causes of this disparity and to ensure equitable postpartum care for all women, regardless of residence.

Obstetric health

Growth velocity evidence of adaptive growth in dichorionic twins versus singletons using 3D ultrasound Jessica Gleason*, Zhen Chen, Elizabeth Williams, Dian He, Roger Newman, William Grobman, Anthony Sciscione, Daniel Skupski, Angela Ranzini, John Owen, Wesley Lee, Magdalena Sanz Cortes, Luis Goncalves, Jimmy Espinoza, Robert Gore-Langton, Seth Sherman, Mary D'Alton, Edward Chien, Sabrina Craigo, Cuilin Zhang, Fasil Tekola-Ayele, Katherine Grantz,

Twin fetal growth trajectories are similar to those of singletons until 32 weeks (w), when average estimated fetal weight (EFW) is progressively smaller for twins. Differences in soft tissue parameters, such as fractional thigh volume (TVol), emerge earlier, at 15w, and persist throughout gestation. Whether patterns of growth velocity differ between twins and singletons is an unanswered question that may provide insight into twin growth mechanisms.

Using serial ultrasound measurements from 306 twin fetuses and 2,559 singletons, we calculated growth velocity for EFW, TVol, and its lean (FLTVol) and fat (FFTVol) components, as difference in measurement between visits (up to 6) divided by number of weeks between visits. We modeled velocity for each parameter for twins and singletons using mixed effects models with cubic functions, comparing weekly adjusted means up to 37w.

Twin EFW was 2.6-4.8 g/w slower at 15-16w, but faster than singletons between 18-29w, peaking at 15.3 g/w (95% CI 11.7, 18.9) faster at 25w. As observed in prior work, average twin growth became slower than singletons starting 32w (10.8 g/w, CI 2.2, 19.4) and remained slower through 37w (40 g/w, CI 22.8, 57.2). Growth patterns for TVol and its components were markedly different between twins and singletons. Twin TVol growth velocity was relatively flat compared to singletons, characterized by a sharp decrease in twin FLTVol velocity from 33 (1.4 cm3/w) to 37w (0.8 cm3/w), when singleton FLTVol increased (1.9-2.1 cm3/w). Twin FFTVol also remained relatively constant (1-1.4 cm3/w) while singleton growth accelerated from 29-37w (1-2.5 cm3/w).

Twins demonstrate different patterns of growth velocity than singletons, with faster EFW velocity in the 2nd trimester but slower velocity in the 3rd. Additionally, twin lean tissue growth slowed in the 3rd trimester while fat tissue growth slowly increased, a pattern that may provide insight into adaptive growth mechanisms in a constrained intrauterine environment.

Obstetric health

Association between patient race and ethnicity and stigmatizing and positive language in the hospital birth admission clinical notes Veronica Barcelona*, Ismael Ibrahim Hulchafo, Jihye K. Scroggins, Sarah E. Harkins, Hans Moen, Michele Tadiello, Kenrick Cato, Anahita Davoudi, Dena Goffman, Janice James Aubey, Coretta Green, Maxim Topaz,

Language used in clinical documentation can reflect and perpetuate biases, potentially contributing to health disparities. Stigmatizing language has been associated with poorer quality of care, yet this work has not been done in obstetric settings. We conducted a cross-sectional study analyzing electronic health records from patients >20 weeks gestation admitted for birth at two metropolitan hospitals in the Northeastern United States between 2017-2019 (N=18,646). Patient race and ethnicity were categorized into mutually exclusive groups as the primary study exposure. Study outcomes were stigmatizing and positive language from our previously identified categories. We used our well-performing natural language processing algorithm to identify examples from free-text clinical notes, and logistic regression for analyses. Compared to White patients, Black patients had significantly higher odds of having stigmatizing language documented overall (Adjusted Odds Ratio [aOR]=1.23, 95% Confidence Interval [CI]=1.10, 1.37) and in all stigmatizing language categories, after adjustment for confounding variables. Black patients also had higher odds of positive language documentation overall (aOR=1.19, CI=1.06, 1.34). Hispanic patients had lower odds of language documented in the difficult patient category (aOR=0.91, CI=0.82, 1.00) and lower odds of positive language overall (aOR=0.85, CI=0.77, 0.93). Asian patients had lower odds of language documented in the marginalized identities category (aOR=0.72, CI=0.31, 1.01) and the power/privilege category (aOR=0.69, CI=0.56, 0.86). There are notable disparities in how stigmatizing and positive language is documented across different racial and ethnic groups in labor and birth clinical notes. This study presents an opportunity for clinician education to interrupt bias that may be present in clinical documentation to reduce the use of stigmatizing language.

Obstetric health

Evolution of small and large-for-gestational age rates between 2010 and 2022 – a population based study in 22 European countries Alice HOCQUETTE*, Theopisti Kyprianou, Petr Velebil, Luule Sakkeus, Marzia Loghi, Irisa Zile-Velika, Kari Klungsoyr, Ivan Verdenik, Oscar Zurriaga, Marianne Philibert, Jennifer Zeitlin, Jennifer Zietlin

Introduction: Identification of small and large-for-gestational-age (SGA/LGA) births is used to screen for growth anomalies and provide targeted care to mitigate risks of poor perinatal and child outcomes. Their use for perinatal health monitoring remains to be evaluated. The aim of this study is to describe the evolution of SGA and LGA rates and evaluate its correlation with stillbirth and neonatal mortality, in Europe.

Methods: We used data on all singleton births from 24 to 42 completed weeks of gestation in 2010 and from 2014 to 2022 from 22 countries in the Euro-Peristat network (N=26,985,583). Each country applied the same algorithm to define SGA (birthweight for gestational age and sex <10th percentile) and LGA (>90th percentile) based on GROW charts, customized for each country, and exported aggregated data tables for ecological analyses. We then described trends over time within each country using linear regression models. Correlation between SGA and LGA rates, and with extended perinatal mortality (stillbirth or neonatal death) was evaluated using Spearman's weighted coefficients.

Results: Rates of SGA and LGA births ranged from 8.8% to 13.4% and from 9.5% to 14.1% respectively. For all countries, there was a decrease in SGA rates (range: -3.7 to -0.6) and an increase in LGA rates (0.1 to 3.1) over the study period. Changes in SGA and LGA rates were strongly and inversely correlated (coefficient = -0.89, 95%CI [-0.98 ; -0.69]). However, differences over time in SGA and LGA rates were not correlated with differences in extended mortality rates (-0.03 [-0.61;0.72] and 0.27 [-0.25;0.80] respectively).

Conclusion: SGA rates declined over the past decade in Europe in tandem with increasing LGA, but there was no impact on perinatal mortality rates. Although these indicators are valuable at the individual level for screening purposes, they may not be appropriate for monitoring fetal growth pathologies over time at the country level.

Obstetric health

Increased Risk of Obstetric Anal Sphincter Injuries Among Women with Female Genital Mutilation/Cutting: Evidence from a Nationally Representative U.S. Cohort Emma Stirling-Cameron*, Chelsey Perry, Jocelyn Stairs,

Background: Female genital mutilation/cutting (FGM-C) is known to affect over 230 million females worldwide. FGM-C refers to any procedure involving partial or complete removal of external female genitalia, or injury to the genital organs for non-medical reasons. FGM-C can contribute to obstetric complications during childbirth. Despite a growing need for management of FGM-C in obstetric settings in the United States (US), gaps in literature remain around best practices for FGM-C management.

Objective: The objective of this study was to assess the association between FGM-C and obstetric and anal sphincter injury (OASIS) among pregnant people delivering in-hospital in the US.

Methods: We conducted a population-based, retrospective cohort study of pregnant individuals delivering singleton fetuses in the US using the National Inpatient Sample (NIS) database (2016-2019, inclusive). Multivariate logistic regression models were used to estimate the odds ratio (OR) for the association between FGM-C and OASIS.

Results: During the study period, 2,923,864 delivery-related discharges were captured, representing an estimated 14,871,844 singleton deliveries nationwide using the NIS complex survey design. A total of 1,007 (0.03%) females were diagnosed with FGM-C and 39,730 with OASIS (1.4%) during the study period. After adjusting for potential confounders, deliveries among females affected by FGM-C had 2.82 times the odds of sustaining OASIS (95%CI 2.04–3.90). Females affected by FGM-C were significantly more likely to experience episiotomy (17.8% vs 4.4%), operative delivery (e.g., forceps, vacuum, 6.5% vs 4.1%), and postpartum hemorrhage (7.2% vs 3.2%).

Conclusion: FGM-C is associated with an increased odds of OASIS compared to deliveries where FGM-C was not present. There is an urgent need to inform US clinical practice guidelines and to undertake future research on protective interventions to reduce OASIS in birthing females affected by FGM-C.

Obstetric health

Postpartum remote blood pressure monitoring (rBPM) for mitigation of disparities related to pregnancy-associated hypertension disorders: Disproportionate adherence to rBPM

Elizabeth Jensen*, M. Angie Almond, Licza Lobo, Asma Ahmed, David Kline, Caroline Cochrane, Padageshwar Sunkara, Karen Gerancher, Jennifer Ingle, Emily Bunce, David Stamilio,

Background: Postpartum is a period of increased susceptibility for maternal morbidity and mortality resulting from hypertensive disorders of pregnancy (HDP). Lower socioeconomic status (SES), and racial and ethnic minoritized groups disproportionately experience increased risk for adverse consequences from HDP. Current guidelines for and adherence to postpartum care are insufficient for identifying and treating postpartum HDP.

Aim: Implement and evaluate adherence to remote blood pressure (rBP) monitoring among a racially, ethnically, and socioeconomically diverse postpartum population and evaluate differences in adherence according to patient demographic attributes.

Methods: Using data collected from a randomized control trial (Systematic Monitoring and Remote Testing of Blood Pressure in Postpartum Women – SMART-BP; ClinicalTrials.Gov NCT05236725) (n=1495), we examined differences in adherence to the rBP monitoring intervention. Adherence was defined according to the number of days rBPs were documented through 21 days postpartum. Crude differences in days of adherence according to each demographic factor were estimated using generalized linear models.

Results: Overall, the mean (SD) days of adherence was 7.98 (7.42). Those without a college degree (v. college degree or higher) had significantly fewer days of adherence (b: -4.9; 95% CI: -6.2, -3.7). Those identifying as Black (v. White) (b: -4.3; 95% CI: -6.0, -2.7), Hispanic (v. non-Hispanic) (b: -2.0; 95% CI: -3.4, -0.6), having a non-English primary language (b: -2.6; 95% CI: -4.1, -1.0), and single marital status (v. married) (b: -5.9; 95% CI: -7.3, -4.4) had fewer days of rBPs documented.

Conclusion: In this intervention designed to mitigate disparities in HDP management, we observed differences in adherence to rBP monitoring, with reduced adherence to rBP monitoring among populations at higher risk of developing HDP. Evaluation of approaches to support postpartum individuals in their use of rBP is warranted.

Obstetric health

Gestational Age-Specific Z-scores: A tool to enhance screening for hypertensive disorders in pregnancy and reduce adverse outcomes? Briana DeStaffan*, Muriel Tafflet, Marie-Aline Charles, Barbara Heude, Wen Lun Yuan,

Context: Maternal blood pressure (BP) varies greatly in pregnancy due to physiological changes, yet these dynamics are underutilized in clinical practice. BP variability in pregnancy is a critical indicator of future cardiovascular morbidity, including hypertensive disorders of pregnancy (HDP), which are associated with adverse outcomes for both mother and child. This study evaluates the association between gestational age-specific BP Z-score thresholds and HDP, in comparison to the conventional BP threshold for gestational hypertension.

Methods: Repeated systolic BP (SBP) measurements and HDP diagnoses were extracted from the obstetric records of 1,557 women without chronic hypertension or HDP history in the French EDEN birth cohort. Gestational age-specific SBP Z-scores (from 3 to 42 weeks) were generated using GAMLSS, accounting for BP's dynamic in pregnancy. Mean SBP Z-score before 20 weeks was categorized as: <1, [1,2), and ≥2 SD, and compared with mean SBP</≥140 mmHg. Sensitivity and specificity of each threshold were assessed. Adjusted logistic regressions evaluated associations with HDP (gestational hypertension, preeclampsia).

Results: Prevalence of HDP was 4.8% (n=75). SBP ≥140mmHg was associated with increased risk of HDP (OR[95%CI]: 5.9[2.4–13.6]). SBP Z-score ≥2 (which included 97% of women ≥140mmHg) and SBP Z-score between 1–2 SD were both associated with an increased risk of HDP (respectively: 9.0[3.4–21.2] and 2.3[1.2–4.3], ref: <1SD). While SBP ≥140 mmHg yielded low sensitivity (0.14) and high specificity (0.98), SBP Z-score ≥1SD increased sensitivity (0.41), with specificity=0.87.

Conclusion: Gestational age-specific Z-scores enable increased sensitivity in identifying women at increased risk for HDP from early gestation, prior to diagnosis. Further analyses will use net reclassification indices to evaluate Z-score classification ability, including additional perinatal outcomes.

Occupational

Occupational racial segregation and income in the pregnant workforce Candice Johnson*, Claire Margerison, Danielle Gartner, Dawn Misra,

Introduction. In the U.S. workforce, some occupations are racially segregated, with minoritized workers concentrated in jobs that may be lower paid, more physically or psychologically demanding, or expose workers to chemical and physical hazards. These low-quality jobs may be associated with adverse pregnancy outcomes, contributing to racial disparities in these outcomes. Yet, little data exist quantifying racial segregation in the pregnant workforce.

Methods. We used 2020–2022 birth certificate data from Alabama—one of few states collecting occupation on the birth certificate. In this preliminary analysis, we focused on comparing only Black and White pregnant workers (93% of Alabama's pregnant workforce). Segregation was quantified as the ratio of the proportion of Black workers in the occupation to the proportion of Black workers in the total population; ratios <1.0 indicate more White workers than expected, and >1.0 more Black workers than expected. We limited to occupations with >500 workers to improve stability of estimates. U.S. Department of Labor data provided estimated wages in Alabama for each occupation.

Results. Among the 41 included occupations, segregation ratios ranged from 0.2 to 2.2. The three occupations with the lowest ratios (predominantly White) were pharmacist, healthcare diagnostic technician, and nurse practitioner. Those with the highest ratios (predominantly Black) were factory assembler, customer service representative, and laborer. Based on wage statistics, the three occupations with the lowest ratios had median annual wages between $76,940 and $131,880; those with the highest ratios between $36,170 and $38,810.

Conclusions. Occupations predominantly held by Black pregnant workers pay substantially less than those predominantly held by White pregnant workers. Given that low income is a risk factor for adverse pregnancy outcomes, occupational segregation is a plausible mechanism by which racial disparities in these outcomes could arise.

Omics

Prenatal Stress and DNA Methylation Profiles in Blood and Placenta: An Exploratory Analysis from the Maternal Stress Study in Detroit Homegnon Antonin Ferreol Bah*, Ian Loveless, Albert M. Levin, Andrea E. Cassidy-Bushrow, Jennifer K. Straughen,

Background: Prenatal stress poses significant risks to fetal development, with potential short- and long-term health implications for offspring. DNA methylation may mediate these associations. This analysis sought to examine the association between prenatal stress and methylated CpG sites and differentially methylated regions (DMRs) in DNA isolated from two relevant biospecimens – placenta and maternal blood.

Methods: Data are from the Maternal Stress Study, which recruited 203 African American women in the second trimester of pregnancy from February 2009 to June 2010. In a subset of participants, DNA methylation was measured using the Illumina Infinium MethylationEPIC BeadChip in archived DNA from venous blood collected in the second trimester (N=74) and placental tissue collected after delivery (N=17). Maternal stress was measured with the Perceived Stress Scale (PSS); higher scores indicate higher perceived stress. Linear regression was used to test the association between each CpG site M-value and PSS score adjusting for cell type composition and maternal age. Models examining blood DNA methylation were additionally adjusted for pre-pregnancy BMI whereas models examining placental DNA methylation were additionally adjusted for gestational age at delivery, batch, and infant sex. DMRs were identified using the combp method. P-values accounted for multiple testing using the Benjamini and Hochberg false discovery rate (FDR) approach. Significant regions were annotated to genes using ChIPseeker.

Results: PSS score was not associated with CpG sites in either blood- or placenta-based DNA methylation analyses. In blood-based DNA methylation models, stress was associated with methylation in one DMR (FDR-adjusted p-value < 0.05), AXL. In contrast, two DMRs (GPR135 and CDKL3) were statistically significant in the placental models.

Conclusion: These findings highlight distinct DMRs important for cell signaling and regulation associated with prenatal stress.

Keywords: placenta; DNA methylation; Maternal Stress

Other

Is altered placental branching growth associated with cyto- and chemo-kine levels in newborn dried blood spots? Carolyn Salafia*, Katherine Patterson, Theresa Girardi, Judith van de Water, Dawn Misra,

Background: In a community-based cohort with mandated universal placental examination 2010-2016, we assessed alterations in placental branching associated with newborn chemo- and cyto-kines in a random subsample of 1000 male and 1000 female term births. Branching of the placental vasculature is a prerequisite to efficient and healthy function of the placenta. Alterations in the branching pattern can occur if the villi (blood vessels in the placenta) maturation is (prematurely?) accelerated. This can be measured based on decreased villous packing density. Newborn cyto- and chemo-kine levels may indicate immunological health. We hypothesized that D-VPD would impact levels of cyto- and chemo- kine levels in newborn dried blood spots.
Methods: Placentas had full surgical pathology examination as per hospital mandate. A single pathologist diagnosed decreased villous packing density subjectively, with the pathologist blinded except for gestational age. Among a random subsample of 1,000 male and 1,000 female term births, 1809 sets of dried blood spots could be retrieved and linked from the New York State Newborn Screening Program. Elution and analysis were performed using the Bio-Rad 40-plex platform. . Levels of 40 cyto- (e.g., interleukin 6) and chemo-kines (e.g., chemokine CCL-21) were measured. Non-parametric analytic methods considered decreased villous packing density as binary with results at $p<0.05$ reported in this exploratory analysis.
Results: C6kine/CCL21, ENA78CXCL573, Gro-beta/CXCL2, IL2, MCP3/CCL7, MIP1alpha/CCL3, SDF1alpha/BCXCL12, and GCP2/CXCL6 ($p<0.05$) were reduced in both male and female infants with decreased villous packing density. Fractalkine/CX3ClL1, MIG/CXCL9, TNFalpha (each $p<0.01$), IL6, MCP4/CCL13, MDC/CCL22 (each $p<0.05$) were decreased only in females with decreased villous packing density, and in males with decreased villous packing density, IL10, MCP1/CCL2 were decreased ($p<0.05$).
Conclusions: Decreased villous packing density showed numerous, significant and uniformly suppressive effects on newborn serum analytes. Many effects were common to both sexes, but 4 were unique to females, with 2 unique to males.

Pharmacoepidemiology

A Prospective, Registry-based, Observational Study to Assess Maternal, Fetal, and Infant Outcomes following Exposure to Rimegepant: The Migraine Observational Nurtec Pregnancy Registry (MONITOR) Sarah C. MacDonald*, Kristin Veley, Ronna L. Chan, Janet R. Hardy, Reem Masarwa, Courtney G. Norris, Rong Yang, Esther Straghan, Kofi Asomaning,

Background: The Migraine Observational Nurtec Pregnancy Registry (MONITOR) is an ongoing study evaluating the safety of rimegepant use during pregnancy. It is a Pfizer-sponsored post marketing requirement of the US FDA and a Category 3 commitment to the EMA.

Methods: This study includes 2 cohorts of pregnant participants with migraine: rimegepant-exposed and rimegepant-unexposed. The registry was initiated on 23 September 2021 and aims to enroll 390 participants in each cohort over 10 years. Data are collected at enrollment, end of the second trimester, pregnancy outcome, and 4 and 12 months after delivery (following a livebirth). Interim results from the first 3 years are presented.

Results: As of 31 January 2024, 357 participants were enrolled, and 145 had available pregnancy outcome data (59 exposed; 86 unexposed). Among live births with first trimester exposure (51 exposed; 81 unexposed), major congenital malformations were observed in 1 exposed (2.0% [95% CI: 0.0-10.4]) and 2 unexposed participants (2.5% [0.3-8.6]). Other outcomes, including stillbirth (0.0% [0.0-6.1] exposed vs. 2.3% [0.3-8.1] unexposed), spontaneous abortion (1.9% [0.0-10.1] vs. 6.0% [2.0-13.5]), preeclampsia (11.9% [4.9-22.9] vs. 7.0% [2.6-14.6]), gestational hypertension (5.1% [1.1-14.1] vs. 9.3% [4.1-17.5]), gestational diabetes (11.9% [4.9-22.9] vs. 7.0% [2.6-14.6]), preterm birth (15.8% [7.5-27.9] vs. 12.0% [5.6-21.6]), small for gestational age (4.4% [0.5-15.1] vs. 5.0% [1.0-13.9]), and minor congenital malformations (5.2% [1.1-14.4] vs. 1.2% [0.0-6.7]) occurred in similar proportions across cohorts, with wide confidence intervals. No participants had an elective termination or eclampsia. Few pregnancies had available infant follow-up data.

Discussion: The current data have not identified any rimegepant-associated safety signals. Risks were similar to that expected in the pregnant migraine population. Additional data will continue to be collected to further evaluate potential risks.

Pharmacoepidemiology

A Retrospective Cohort Database Study to Evaluate the Safety of Rimegepant Exposure During Pregnancy Sarah MacDonald*, Elena Rivero-Ferrer, Elizabeth J. Bell, Jessica Franklin, Janet R. Hardy, Andrea V. Margulis, Ryan Seals, Rong Yang, John Seeger, Esther Straghan, Kofi Asomaning,

Background: Rimegepant is an oral drug to prevent and treat migraine. This Pfizer-sponsored study aims to assess the safety of rimegepant in pregnancy. It is a post marketing requirement of the US FDA and a Category 3 commitment to the EMA.

Methods: Health insurance claims data from the Optum Research Database (US) beginning Mar 16, 2020 and extending for ~7 years are used. A cohort of rimegepant-exposed pregnancies with migraine and 2 rimegepant-unexposed cohorts ('primary comparator' with migraine; 'secondary comparator' without migraine) were followed for pregnancy outcomes. Interim results are presented.

Results: As of August 2023, there were 48, 4,857, and 222,049 completed pregnancies in the exposed, primary comparator, and secondary comparator, respectively. Among livebirths with first trimester exposure (16; 1,781; 123,981), the prevalence of major congenital malformations was 6.3% (95% CI: 1.1-28.3), 5.4% (4.4--6.5), and 5.2% (5.1-5.4). The prevalences of spontaneous abortion (58.3% [44.3-71.2], 28.6% [27.3-30.0], 23.0% [22.8-23.1]), preterm birth (29.4% [13.3-53.1], 19.1% [17.7-20.7], 12.9% [12.7-13.1]), and small for gestational age (17.6% [6.2-41.0], 5.3% [4.5--6.2], 5.1% [5.0-5.2]) were higher in the exposed, however CIs were wide. Other outcomes had similar prevalences across cohorts (stillbirth: 0.0% [0.0, 7.4]; 0.6% [0.4-0.9], 0.5% [0.5-0.6]; elective termination: 6.3% [2.1-16.8], 9.6% [8.7-10.5], 8.3% [8.2-8.4]; preeclampsia/eclampsia: 8.3% [3.3--19.6], 9.0% [8.2-9.8], 5.7% [5.6-5.8]).

Discussion: These interim results reflect a small number of exposed pregnancies with short follow-up. Rimegepant-exposed pregnancies tended to be accrued near the end of the reporting period, which may have led to an observed higher proportion of exposed pregnancies ending before reaching term (e.g. spontaneous abortions, preterm births). A larger sample size will facilitate the multivariable analyses that are planned for the final report to further evaluate these risks.

Pharmacoepidemiology

Comparative effectiveness and safety of labetalol and nifedipine for the treatment of chronic hypertension during pregnancy Stephanie Leonard*, Sara Siadat, Krista Huybrechts, Elliott Main, Mark Hlatky, Brian Bateman,

Clinical guidelines for treatment of chronic hypertension in pregnancy recommend labetalol and nifedipine as first-line agents. We used a target trial framework to evaluate the comparative effectiveness and safety of labetalol (an alpha/beta blocker) versus nifedipine (a calcium-channel blocker) in treatment of chronic hypertension in pregnancy. Study data for individuals with live- and stillbirths were sourced from the U.S. MerativeTM Marketscan® Database of commercial insurance claims for 2007 to 2022. The primary effectiveness outcome was a composite of preeclampsia with severe features or eclampsia, medically indicated preterm birth, placental abruption, or stillbirth. The primary safety outcome was infant born small-for-gestational age. We used log-binomial regression models to estimate associations between the treatment and outcomes, using stabilized inverse probability of treatment weights to adjust for confounding by year, gestational age at treatment initiation, maternal age, region, comorbidities, and other medications. The study included 6,784 pregnant individuals with chronic hypertension who initiated labetalol or nifedipine treatment during the first 20 weeks of pregnancy. Of these, 5,553 (82%) used labetalol and 1,231 (18%) used nifedipine. The composite effectiveness outcome occurred in 42% of births exposed to labetalol and 43% of births exposed to nifedipine. The safety outcome occurred in 13% of births exposed to labetalol and 12% of births exposed to nifedipine. Comparing nifedipine with labetalol, the adjusted risk ratio (RR) was 1.03 (95% confidence interval (CI): 0.96, 1.11) for the composite effectiveness outcome and 0.98 (95% CI: 0.82, 1.16) for the safety outcome. These results, using a cohort nested in nationwide healthcare utilization data, suggest that labetalol and nifedipine have comparable effectiveness and safety when used for the treatment of chronic hypertension during pregnancy.

Pharmacoepidemiology

Screening for Pediatric Safety Alerts Following Antipsychotic Treatment Initiation using a Tree-Based Scan Statistics Approach Loreen Straub*, Shirley Wang, Kelly Fung, Helen Mogun, Massimiliano Russo, Georg Hahn, Krista Huybrechts,

Antipsychotics (APs) are commonly prescribed to children. While pediatric studies have provided evidence on adverse events for widely used APs (i.e., aripiprazole, olanzapine, quetiapine, risperidone, ziprasidone), safety information on newer APs (i.e., asenapine, brexpiprazole, cariprazine, lurasidone, paliperidone) remains sparse.

Using tree-based scan statistics (TBSS) to screen a broad range of outcomes, we evaluated whether known associations for common APs could be identified, and whether previously unrecognized adverse effects associated with newer APs would be detected.

We identified children initiating APs (with quetiapine as the reference) within two large US health insurance databases 2000-2021. Leveraging the Multi-Level Clinical Classification tree which groups diagnosis codes into higher-level concepts, we scanned for incident outcomes within six months of AP initiation. Relative risks (RRs) were estimated with propensity score fine-stratification for confounding adjustment. A p-value threshold of <0.1 was used to define statistical alerts.

The number of exposed children ranged from 534 (cariprazine) to 664,967 (risperidone). Compared to quetiapine (N=286,192), multiple elevated risks, consistent with previous evidence, were identified for common APs, including endocrine, cardiovascular, hematologic, metabolic, neurologic and immunologic conditions. Among newer APs, no signals were detected for asenapine and brexpiprazole. For cariprazine, one alert for viral disease (RR=2.6) was found. Lurasidone was associated with metabolic, urinary, pituitary and platelet disorders (RR range 1.4-24.9), and paliperidone with extrapyramidal and pituitary disorders and allergies (RR range 1.8-18.0).

The detection of known associations supports TBSS' feasibility for pediatric drug safety surveillance. Continued monitoring of the newer drugs as more data accrue, in-depth assessment of clinical plausibility and replication in independent data sources remains essential.

Pharmacoepidemiology

Trends in Utilization of Chronic Asthma Medications among Publicly Insured Children in the US: 2003 to 2020 Celeste Ewig*, Nicole Smolinski, Almut Winterstein,

Recent advances in our understanding of asthma treatments have led to additional considerations during clinical decision making. How these updates have affected utilization patterns of chronic asthma medications in pediatric patients with asthma remain uncharacterized. We aimed to describe the utilization of chronic asthma medications among publicly insured pediatric patients 2 to <18 years old with persistent asthma across relevant time periods of change.

We used Medicaid Analytic eXtract (MAX) and Transformed Medical Statistical Information System Analytic Files (TAF)national claims database. Individuals with persistent asthma defined as 1 hospital admission, or 3 outpatient visits with an asthma diagnosis identified from diagnosis codes, and a dispensing for a chronic asthma medication obtained from National Drug Codes, were identified within each calendar year The study period was divided into 3 periods: 2003 to 2008 (T1, FDA warnings for salmeterol in 2006 and montelukast in 2008), 2009 to 2014 (T2, post FDA warnings) and 2015 to 2020 (T3, post-approval of several biologic therapies). In each period, the proportion of pediatric patients with a dispensing of long-acting beta-agonists (LABA), montelukast, and asthma biologics was assessed using disproportionality analysis.

Our study included 1,953,516 pediatric patients (median age =6.7 years [IQR 4.3-10.2]). Males accounted for 59.9% of the population. The study population increased from 2003 to 2020 (T1=430,536, T2=591,941, and T3=820,179 individuals). Notable changes across time were observed in the proportion of the individuals using montelukast (T1=36.0% vs T3=33.1%, $p<0.001$), LABA (T1=2.5% vs T3 = 0.04%, $p<0.001$) and biologics (T1=0.1% vs T3=0.6%, $p<0.001$).

Although montelukast continues to be used by approximately a third of pediatric patients with persistent asthma, decline in utilization of LABA and increase in use of biologics appears to reflect advances in knowledge and uptake of newer therapies.

Pharmacoepidemiology

Comparison of 4 algorithms to prospectively identify pregnancies in electronic health record data Jacob Kahrs*, Chase Latour, Megan Delgado, Madison Ponder, Elizabeth Suarez, Sharon Peacock-Hinton, Baijun Zhou, Lauren Kucirka, Mollie Wood,

Background: Multiple approaches exist to identify pregnancies in electronic health record (EHR) data, but it is unclear how algorithm variation affects identified cohorts.

Objective: Evaluate 4 algorithms to identify pregnancies using EHR data from a single health system (2014-2023).

Methods: We identified groups of encounters with ≥1 pregnancy outcome diagnosis/procedure code or ≥1 abortion dose specific order for mifepristone or misoprostol, within 30-days of each other. Outcomes were assigned based on 1 of 4 algorithms (A1, A2, A3, A4): A1 used a hierarchy of outcome type; A2 prioritized information type (procedures > diagnoses > orders) then outcome type; and A3 and A4 prioritized information type (delivery procedures > non-delivery procedures > diagnoses > orders) then outcome type. Conflicting abortion codes were categorized as spontaneous abortion (A3) or unspecified abortion (A4).

We then identified pregnancies by indexing patients at their first eligible prenatal encounter and looked forward for an outcome, if available. Last menstrual period (LMP) was estimated using outcome dates and available codes. We compared the 4 cohorts by evaluating overall proportion of outcome types and overlapping pregnancies within a person.

Results: The algorithms identified 232,025-232,080 pregnancies, 60.7% with observed outcomes. Algorithms matched on both LMP and outcome date for 99.6%-99.9% of pregnancies. However, there was disagreement on which outcomes were assigned: A1 had more stillbirths and multiple live births compared to A2, A3, and A4 (897 and 2029 vs. 711-742 and 1485-1486, respectively), resulting in fewer uncategorized deliveries. A1 and A4 had more spontaneous abortions than A2 and A3 (13270 and 13663 vs. 12825 and 13004, respectively), resulting in fewer unspecified abortions.

Conclusions: These approaches are robust for identifying overlapping pregnancies, but algorithm choice impacts the observed prevalence of delivery and abortive outcomes.

Policy

Economic evaluation of detection, treatment, and prevention interventions for perinatal mood and anxiety disorders: a systematic literature review Lizheng Shi*, Sabrina Alam, Emma McNeill, Man Tang, Rong Rong, Brian Christman, Abigail Gamble, Qing Li, William Hillegass, Janice Hall, Xu Xiong, L Wright, Man Tang

Introduction

An estimated 15 – 21% of women are impacted by perinatal mood and anxiety disorders (PMADs). The purpose of this systematic review was to synthesize the evidence on the economic impact of interventions for the detection, treatment, and prevention of PMADs.

Methods

Seven databases (i.e. PubMed, EconLit) were searched to identify studies matching the inclusion criteria (last search date: 12th March 2024). Two blinded reviewers independently screened each reference on Covidence. The Consolidated Health Economic Evaluation Reporting Standards were used to assess reporting quality and the Consensus on Health Economics Criteria checklist was used to appraise the risk of bias. This review followed the PRISMA guidelines and is registered on PROSPERO (CRD42024528777).

Results

The search identified 3,409 references. After deduplication, 1,610 unique titles and abstracts were screened, of which 55 full texts were assessed for eligibility. Twenty-four articles met the inclusion criteria and were included in this review. Studies were from the United Kingdom (n=8), the United States (n=7), Australia (n=4), Canada (n=3), Singapore (n=1), or other (n=1). Studies included clinical trials (n=12), model-based (n=11), and cohort (n=1) designs. Characteristics of study participants (N=194,438) included those with general deliveries (n=185,605), low risk of depression (n=2,608), primiparous pregnancies (n=1,210), low socioeconomic status (n=1,093), high risk of depression (n=1,015), and diagnosed depression (n=209). The interventions focused on treatment [T] (n=12), prevention [P] (n=9), and detection [D] (n=4). Eighteen (75%) [8P, 7T, 2D, 1T+D] studies reported being cost-effective; 6 (25%) [4T, 1 P, 1D] were not cost-effective.

Discussion

Interventions to address PMADs are economically viable and may lead to improved maternal mental health outcomes. Cost-effectiveness of such interventions could be impetus for policy decisions allocating future funding or resources to address mental health conditions in pregnant and postpartum populations. Future reviews are needed to examine equity considerations in the implementation of such programs.

Policy

Impact of Paid Family Leave Policies on Postpartum Depression in the US: A State-Level Policy Analysis Using PRAMS Data Laura Drew*, Xueshi Wang, Claire Margerison,

Nearly 13% of people with a recent live birth experience postpartum depression (PPD), which can negatively affect maternal and child health outcomes. While the Family and Medical Leave Act provides eligible workers with unpaid leave, there is no federal requirement for private-sector employers to provide paid family leave (PFL), which is linked to improvements in maternal mental health. Recently, several states have implemented PFL policies; however, the impact of PFL on PPD across multiple states and over time has not been examined. Therefore, we used 2012-2022 PRAMS data to test the hypothesis that PFL policies reduce PPD. We categorized five states with PFL policies into four cohorts based on PFL implementation year: Rhode Island (2014), New York (2018), Washington and D.C. (2020), and Massachusetts (2021), and created a series of control states based on complete data availability. We conducted heterogeneous difference-in-difference (HDID) analyses to examine the average treatment effect on the treated (ATET), which measures the effect of the policy on those who were treated (i.e., individuals exposed to PFL policy). The HDID method extends the traditional DID framework by allowing the treatment effects to vary across different groups and time, which is crucial for studying PFL policies given their staggered rollout. We found each additional year of exposure to a state-level PFL policy was associated with a larger reduction in self-reported PPD. In RI and NY, PPD significantly reduced by an average of 2 percentage points; however, there was no significant change in PPD in MA, WA, or DC.

Policy

Maternal Health Following the 2021 Texas Six-Week Ban on Abortion Erinn Hade*, Benjamin Stockton, Ayushi Bommireddipalli, Mia Charifson, Aurora Scotti, Shilpi Mehta-Lee, Linda Kahn,

Background: As an indicator of the potential impact on maternal morbidity of abortion restrictions and bans following the U.S. Supreme Court Dobbs decision in June, 2022, we aimed to analyze outcomes of the Texas laws that went into effect nine months earlier, on September 1, 2021 (Texas Senate Bills [SB] 4 and 8) that restrict access to abortion-inducing medication and early abortion procedures after six weeks of gestation.

Methods: We used electronic health record data from the Epic Corporation's Cosmos platform to investigate maternal health outcomes for pregnancies that began between January 2017 and June 2023 across participating institutions in Texas. Outcomes included miscarriage, depression diagnosis, pregnancy-related hypertension, hemorrhage, cesarean delivery, and sepsis. Interrupted time series methods based on Poisson autoregressive models estimated the impact of the ban measured as cumulative excess incidence (95% confidence interval), compared with predicted counts without the ban, adjusted for the impact of the COVID-19 pandemic through model averaging as well as for demographics.

Results: In the year prior to the ban, corresponding to the COVID-19 pandemic, morbidity rates were increasing. Compared with pregnancies that began prior to SB4 and SB8, we identified an increase in miscarriage (808 events, 95% CI: 162, 2024) for pregnancies potentially affected by the laws (beginning between July 2021 and June 2023). Cesarean deliveries decreased by 2810 (227 to 6277). For all other outcomes, there was no notable change in cumulative excess incidence, or the estimates had wide confidence intervals.

Conclusions: In Texas, markers of maternal morbidity that were increasing during the COVID-19 pandemic did not appear to improve in the second half of 2021 and beyond, after abortion restriction laws went into effect. In fact, rates of miscarriage increased further. Future work to investigate these outcomes in other states following the Dobbs decision is critical.

Pregnancy outcomes

Calcium supplementation during pre-pregnancy and early pregnancy among women at high risk of preeclampsia: a per-protocol analysis of a randomized trial Kyle Busse*, Long Khuong, Gabriela Cormick, Stefanie Hinkle, José Belizán, Enrique Schisterman, Sunni Mumford, Ellen Caniglia,

Calcium supplementation is recommended from 20 weeks' gestation for prevention of preeclampsia. Potential benefits of supplementation before 20 weeks' gestation are less clear. A randomized trial of pre-pregnancy and early pregnancy (<20 weeks) calcium supplementation showed no significant reduction in recurrent preeclampsia (intention-to-treat [ITT] risk ratio [RR]=0.80; 95% confidence interval [CI] 0.61-1.06); however, roughly half of participants took fewer than 80% of expected tablets. Our objective was to estimate the per-protocol effect of pre-pregnancy and early pregnancy calcium supplementation on risk of recurrent preeclampsia in that trial.

This was a secondary analysis of a randomized trial of 500mg daily calcium pre-pregnancy through 20 weeks' gestation on risk of recurrent preeclampsia among 1355 parous women in South Africa, Zimbabwe, and Argentina. Adherence was assessed by pill count every 12 weeks. The parametric g-formula was used to estimate the per-protocol effect of calcium supplementation vs. placebo ≥5 days/week on risk of preeclampsia. Bootstrapping was used to estimate 95% CI. Multiple imputation was used for missing values.

Of the 1355 women, 331 of 678 in the calcium group and 320 of 677 in the placebo group had a pregnancy. Of these, 298 in the calcium group and 283 in the placebo group had a pregnancy beyond 20 weeks' gestation. The percentage of women with adherence ≥5 days/week was 59% in the calcium group and 60% in the placebo group. When adhering ≥5 days/week, the incidence of preeclampsia was 10.5% and 14.9% in the calcium and placebo groups, respectively (RR=0.70 [95% CI 0.44-1.06]). For every 100 women, supplemental calcium ≥5 days/week until 20 weeks' gestation resulted in 4 fewer cases of preeclampsia (risk difference=−4.4 [−9.7-0.6]).

The per-protocol effect suggests that calcium supplementation ≥5 days/week until 20 weeks' gestation may reduce risk of preeclampsia, but, like the ITT effect, it was not statistically significant.

Pregnancy outcomes

Placental tissue metals levels and newborn morphometry in a modern birth cohort in Brooklyn NY. Carolyn Salafia*, Rachel Coyte, Theresa Girardi, Katherine Patterson, Dawn Misra,

Objectives: Last–century industry left a toxic footprint on New York City boroughs, including Brooklyn. In a community-based hospital population with universal placental pathology examination, we compared levels of a variety of placental tissue metals to newborn morphometry.
Methods: In a community-based cohort with mandated universal placental examination delivered 2010-2016, we selected 1000 male and 1000 female newborns born at term. Formalin fixed paraffin embedded villous tissue was punched from their archived tissue blocks and extracted for 10 metals (Al, Cd, Cr, Cu, Fe, Mn, Pb, Se, Sr, Zn) with PerkinElmer DRC II ICP-MS. Gestational age in days, and birth weight, length and head circumference were extracted from the medical record. Metals levels were not normally distributed. The data were stratified by infant sex; Spearman's correlations considered $p<0.05$ significant.
Results: Gestational age at delivery was uncorrelated with any metals levels. In males, few correlations were seen. Birthweight was negatively correlated with , and birth head circumference percentile was correlated positively with Sr, and negatively with Se. By contrast, in females, birth length and length percentile were positively correlated with cadmium, chromium, and copper, Birth weight percentile was correlated positively with chromium and negatively with Fe. Birth head circumference and its percentile were correlated negatively with Fe. Fe also showed negative correlations with birthweight percentile. Finally birth length and its percentile were each positively correlated with Mn.
Conclusion: Last-century metal toxicants show sex-specific effects on newborn growth measures, with 12 significant correlations in female infants (affecting birth weight, length and head circumference) but only 4 in male infants (confined to effects on head circumference).

Pregnancy outcomes

Maternal inflammation during the second trimester of pregnancy with adverse birth outcomes: a prospective cohort study Wanqing Xiao*, Sichi Zhu, Zhugu Huang, Ziyin Lyu, Xutao Li, Qingqun Lyu, Yashu Kuang, Xueling Wei, Dongmei Wei, Jinhua Lu, Jianrong He, Xiu Qiu,

Background: The distinct characteristics of maternal inflammation related to perinatal health have not been fully demonstrated. This study aimed to explore the associations between maternal circulating inflammatory profile during the second trimester of pregnancy and a series of adverse birth outcomes.

Methods: The present study included 1567 singleton pregnant women form the Born in Guangzhou Cohort Study conducted in Guangzhou, China. Peripheral blood samples of women were obtained at the second trimester and serum concentrations of 17 inflammatory indicators were determined using the Bio-Plex Pro Human Cytokine Assay. Adverse newborn outcomes were collected through electronic medical records at birth and within the first week after birth. We used logistic, Poisson and generalized linear regressions to assess the impact of inflammatory indicators during pregnancy on different outcomes.

Results: The proportions of preterm birth, small for gestational age (SGA), low birth weight (LBW), neonatal asphyxia and hyperbilirubinemia were 4.3%, 6.6%, 3.9%, 1.1% and 12.6%, respectively. Maternal circulating level of log2-transformed IL-7 was positively associated with preterm birth (adjusted odds ratio (OR) 1.58, 95% confidence interval (CI) 1.03, 2.41). Higher level of log2-transformed IL-2 was correlated to increased LBW risk (adjusted OR 1.48, 95% CI 1.09, 2.02) and decreased birth weight Z-score (adjusted β -0.06, 95% CI -0.11, -0.01). Higher log2-transformed IL-7 concentration (adjusted OR 1.80, 95% CI 1.14, 2.86) may increase LBW risk, while log2-transformed IL-15 was positively related to SGA (adjusted OR 1.39, 95% CI 1.02, 1.91). There were no significant associations of maternal inflammatory indicators with neonatal asphyxia or hyperbilirubinemia**.**

Conclusions: Maternal inflammation during the second trimester of pregnancy could influence fetal and newborn health.

Pregnancy outcomes

Psychological demands of work and risk of preterm birth among Black women Florence Kizza*, Danielle Gartner, Xiaoyu Liang, Laurel Harduar Morano, Dawn Misra,

Background: Preterm birth (PTB) is a leading cause of infant morbidity and mortality. While many risk factors for PTB have been extensively studied, the risks of the work environment during pregnancy is less understood. In this study, we examined the role of psychological demands in the work environment on PTB odds among Black women.

Methods: A cohort study of Black women in Baltimore (2001-2004) collected interview and medical record data. Focusing on the 429 employed, psychological demands of the prenatal work environment (Karasek Job Demands and Control subscale) were assessed comparing the top quartile compared to the bottom 3. Single-scale items were also analyzed (yes/no). Log-binomial regression models controlled for confounders, and interaction effects were tested on a multiplicative scale ($p<0.10$). Social support, stress, and depressive symptoms moderators were modeled as top quartile vs. bottom 3 quartiles of each scale except depressive symptoms (Center for Epidemiologic Studies scale16).

Results: Among employed women, 16.6% experienced PTB. Women who reported high psychological job demands had higher odds of PTB (adjusted prevalence ratio=1.82; 95% confidence interval:1.20,2.76). High social support buffered (interaction $p=0.01$) and high depressive symptoms amplified ($p=0.02$) the relationships between high psychological demands and PTB. No single scale items were associated with PTB but we found support for effect moderation. Depressive symptoms amplified the relationships between working very hectic jobs and PTB ($p=0.02$). Social support buffered the relationship between working very hard and PTB ($p=0.03$). The association between working long periods with intense concentration and PTB was amplified by stress ($p=0.02$) and buffered by social support ($p=0.09$).

Conclusion: Black women whose work involves psychologically demanding activities are at elevated risk of PTB with evidence of interactions with other predictors for PTB.

Pregnancy outcomes

Proximity to Concentrated Animal Farming Operations and Risk of Preterm Birth Pauline Lim*, Bo Park, PhD, Ruofan Yao, MD, MPH,

Objective: To evaluate the risk of preterm birth associated with close proximity to concentrated animal farming operations (CAFO).

Methods: This was a retrospective cohort analysis using the California Department of Health Care Access and Information (HCAI) linked birth file combined with Concentrated Animal Farming Operations (CAFO) database linked by zip code. Close proximity to CAFO was defined as primary dwelling zip code within 5 miles radius of CAFO. Outcome of interest was preterm delivery (PTD) and preterm premature rupture of membrane (PPROM). Multivariate logistic regression analysis was used to estimate the effect of CAFO exposure on PTD and PPROM.

Result: 3,098,578 women were included in analyses, of which 343,781 live within 5 miles radius of a designated CAFO. Compared to individuals living remote from CAFO, those who live within close proximity to CAFO were at higher risk of PTD (11.0% vs 9.4%, adjusted Odds Ratio (aOR) 1.14 [95% confidence interval (CI) 1.12 – 1.15]). Similarly, individuals living within close proximity to CAFO also experienced higher risk of PPROM (4.1% vs 4.2%, aOR 1.08 [95% CI 1.06 – 1.10]).

Conclusion: Living within close proximity to CAFO increases the risk of PTD and PPROM. The underlying etiology require further investigation.

Pregnancy outcomes

Maternal injuries during pregnancy and adverse perinatal complications Allison Musty*, Elizabeth T. Jensen, David Stamilio, Asma M. Ahmed,

Background

Maternal injury affects 6-8% of pregnancies and is associated with perinatal complications. Variation of associations by injury characteristic is underexplored. We estimated associations between maternal injury and adverse maternal outcomes.

Methods

In a retrospective cohort study using electronic health record data at Atrium Health Wake Forest Baptist (2018-2024 births), we identified maternal injury using ICD-10-CM diagnosis codes. Injury was stratified by mechanism (transport accident, fall, other unintentional, intentional), trimester, location (abdominal, non-abdominal), and severity (severe: Abbreviated Injury Scale≥2). Time-varying Cox proportional hazards models estimated associations between injury and severe maternal morbidity (SMM), stillbirth, cesarean delivery, and placental abruption, identified using ICD-10-CM diagnosis and procedure codes. Follow up spanned 20 weeks gestation to outcome occurrence, delivery, or 43 days postpartum for SMM. Models adjusted for demographics and clinical factors.

Results

Among 58897 deliveries, 3.1% had maternal injury. SMM, stillbirth, cesarean delivery, and placental abruption affected 4.6%, 0.2%, 35%, and 0.3%, respectively. Injury was associated with increased risk of cesarean delivery (hazard ratio [HR] 1.09, 95% CI 1.01-1.18), especially from falls (HR 1.21, CI 1.04-1.41), and placental abruption (HR 2.74, CI 1.50-4.99), especially from transport accidents (HR 3.33, CI 1.46-7.61). Second trimester, severe, and abdominal injury increased risk of these two outcomes (e.g., severe injury cesarean risk: HR 1.53, CI 1.29-1.81 v. non-severe: HR 1.01, CI 0.92-1.11). Maternal injury was not associated with SMM or stillbirth.

Conclusions

Maternal injury was associated with increased risk of cesarean delivery and placental abruption, particularly for second trimester, severe, and abdominal injury. These findings may inform post-injury clinical care management, focusing on pregnancies most at risk for these outcomes.

Pregnancy outcomes

Socioeconomic variations in caesarean section rates in Europe Marianne Philibert*, Lucy Smith, Liili Abuladze, Jennifer Zeitlin,

Objective: To investigate whether the cesarean section (CS) rate is higher among socioeconomically disadvantaged populations in Europe, as observed for other perinatal outcomes such as preterm birth and perinatal mortality.

Methods: National-level routine data on births ≥22 weeks of gestation were collected using a common protocol in 20 European countries from 2015 to 2021. We calculated the CS rate (births by CS/total births) by socioeconomic status (SES). SES was measured by maternal educational level (primary/lower secondary, upper secondary, postsecondary) in 15 countries or, when unavailable, parental occupation (1 country) or area-based deprivation (4 countries), harmonised into three groups (low, medium, high). We derived relative risks (RR) and assessed time trends by SES group. For selected countries, we collected additional data to conduct analyses using age-adjusted rates.

Results: The SES gradient varied by country, with highest CS rates in the most disadvantaged group (e.g. Luxembourg: 34.1%, 33.0%, 29.7%, Italy: 35.6%, 33.3%, 31.6, low, medium and high SES, respectively) or in the most advantaged group (e.g. Scotland 33.5%, 34.1%, 36.2% and Ireland: 30.7%, 33.9%, 36.0%). In some countries, rates were similar by SES (e.g. France and the Netherlands). RR for low versus high SES ranged from 0.74 (95%CI: 0.71-0.78) to 1.15 (95%CI: 1.12-1.18). The RR in low versus high SES areas was no longer less than 1 in Scotland after adjustment for maternal age (unadjusted RR=0.93 (95%CI: 0.91-0.94)/adjusted RR=1.03 (95%CI: 1.02-1.04)). SES gradients were also accentuated in Italy (unadjusted RR=1.13 (95%CI: 1.12-1.13)/adjusted RR=1.25 (95% CI: 1.24-1.25), meaning that the strong contrast between these two countries remained. Time trends in CS differed across countries, but were generally similar by SES group.

Conclusion: There are marked variations in the SES gradient of CS between countries, which raise questions about differences in obstetric practices in Europe.

Pregnancy outcomes

Examining the role of neighborhood level indices in predicting spontaneous preterm birth

Daniel Kuhr*, Nicola Tavella, Zahava Michaelson, Raina Kishan, Nicole Parkas, Rebecca Cohen, Chelsea DeBolt, Helen Feltovich, Kimberly Glazer,

Objective: Cervical length (CL) is a limited predictor of spontaneous preterm birth (sPTB). We examined whether measures of the neighborhood environment, which reflect structural determinants of pregnancy outcomes, improve prediction of sPTB compared to CL alone.

Study Design: This was a retrospective cohort study of 1857 patients and each of their gestations with 1) delivery at a tertiary, urban academic hospital between January 2013-August 2023 and 2) at least one transvaginal CL at 16w0d-24w6d gestational age (GA). The primary outcome was sPTB. CL was abstracted from ultrasound images. Medical history, GA at delivery, progesterone therapy, and cerclage placement were abstracted from the medical record. We ascertained neighborhood structural and social determinants of health (SDOH) from the Index of Concentration at the Extremes (indicator of racial-economic segregation, ICE) and Child Opportunity Index (neighborhood resources, COI), based on patient address and 2020 census tract. We used logistic regression to predict the probability of sPTB in models with 1) CL only, 2) CL plus neighborhood indices, and 3) CL, neighborhood, and individual characteristics. We compared model discrimination using the area under the receiver operating characteristics curve (AUC). Analyses were performed in R version 4.4 (24 April 2024).

Results: 1857 patients yielded 1916 pregnancies that met inclusion criteria. 14.4% of pregnancies had a prior sPTB. 6.4% of pregnancies ended in sPTB. Decreased CL was associated with increased odds of sPTB in all models. A model with CL only achieved an AUC of 0.69 and 0.70 with neighborhood indices. Including individual covariates increased the AUC to 0.77.

Conclusions: Inclusion of the ICE and COI neighborhood indices did not improve sPTB prediction among individuals who underwent CL screening. Research should explore additional, diverse SDOH indicators alongside individual clinical characteristics to identify those at highest risk of sPTB.

Pregnancy outcomes

Temporal trends in rate of pregnancy, live birth, and gestational outcomes in an integrated health care delivery system in Northern California, 2012-2023 Shalmali Bane*, Shalmali Bane, Fei Xue, Susanna Mitro, Heather Forquer, Jennifer Baker, Catherine Lee, Mara Greenberg, Michael Kuzniewicz, Monique Hedderson,

Monitoring birth rates allows for tracking population growth, economic and environmental impact, and the provision of healthcare services, especially for reproductive health. While long-term declines in the US birth rate are observed, pregnancy rates are challenging to quantify. We describe trends in pregnancy rate, live birth rate, and gestational outcomes other than birth.

Using data from an integrated health care delivery system (2012-2023), we calculated temporal trends in unadjusted and adjusted pregnancy rate and live birth rate per 1000 women aged 15-44, overall and stratified by age and race/ethnicity (N= 700,159). We used Poisson regression models, adjusted for age and race/ethnicity, to estimate the overall percentage change. Secondary outcomes included live birth, stillbirth, ectopic pregnancy, molar pregnancy, spontaneous abortion, and therapeutic abortion.

From 2012-2023, the adjusted pregnancy and live birth rate declined -10.2% (95% CI: -10.9, -9.5) and -13.8% (95% CI: -14.6, -13.0), respectively. Teen births and pregnancies declined over time (pregnancy rate: 23 in 2012 vs.10 in 2023, per 1,000 women aged 15-19 years), while rates increased among older individuals (26 in 2012 vs. 28 in 2023 per 1,000 women aged 40-44 years). Pregnancy and birth rates declined over time for most racial and ethnic subgroups. Black individuals had higher pregnancy rates and lower birth rates relative to other subgroups. The adjusted rates of livebirths and spontaneous abortion decreased by 4.3% (-5.2, 3.4) and 2.4% (95% CI -4.2, -0.6), respectively. Other gestational outcomes also declined while the rate of therapeutic abortions increased over time by 27.3% (95% CI: 24.7, 29.9).

In an integrated health care delivery system, live birth and pregnancy rates have declined mirroring national data. The greater decline in live birth rate vs. pregnancy rate may be explained by the higher rate of therapeutic abortion as the rates of other gestational outcomes declined over time.

Monitoring birth rates allows for tracking population growth, economic and environmental impact, and the provision of healthcare services, especially for reproductive health. While long-term declines in the US birth rate are observed, pregnancy rates are challenging to quantify. We describe trends in pregnancy rate, live birth rate, and gestational outcomes other than birth.

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From 2012-2023, the adjusted pregnancy and live birth rate declined -10.2% (95% CI: -10.9, -9.5) and -13.8% (95% CI: -14.6, -13.0), respectively. Teen births and pregnancies declined over time (pregnancy rate: 23 in 2012 vs.10 in 2023, per 1,000 women aged 15-19 years), while rates increased among older individuals (26 in 2012 vs. 28 in 2023 per 1,000 women aged 40-44 years).

Pregnancy and birth rates declined over time for most racial and ethnic subgroups. Black individuals had higher pregnancy rates and lower birth rates relative to other subgroups. The adjusted rates of livebirths and spontaneous abortion decreased by 4.3% (-5.2, 3.4) and 2.4% (95% CI -4.2, -0.6), respectively. Other gestational outcomes also declined while the rate of therapeutic abortions increased over time by 27.3% (95% CI: 24.7, 29.9).

In an integrated health care delivery system, live birth and pregnancy rates have declined mirroring national data. The greater decline in live birth rate vs. pregnancy rate may be explained by the higher rate of therapeutic abortion as the rates of other gestational outcomes declined over time.

Pregnancy outcomes

Using neighborhood-level indices to discriminate small for gestational age birthweight among racial and ethnic groups Raina Kishan*, Daniel Kuhr, Nicola Tavella, Zahava Michaelson, Nicole Parkas, Rebecca Cohen, Chelsea DeBolt, Helen Feltovich, Kimberly Glazer,

Objective: To examine the performance of publicly available neighborhood-level indices of structural and social determinants of health (SSDOH) in the prediction of small for gestational age (SGA) by race-ethnicity.

Study Design: We conducted a priori secondary analysis of a retrospective cohort study on preterm delivery among singleton births at a tertiary, urban academic hospital from January 2013-August 2023. Our primary outcome was SGA, defined by birthweight ≤10th percentile for gestational age (GA), using Intergrowth-21st growth curves. Medical history, sociodemographics, delivery GA, and birthweight were abstracted from medical records. Neighborhood SSDOH included the Childhood Opportunity Index, Social Vulnerability Index, and Index of Concentrations at the Extremes, determined by patient address and 2020 census tract. We used logistic regression with neighborhood indices and individual covariates (age, insurance, body mass index, hypertension) to predict SGA, overall and within Black, White, and Hispanic subgroups. We compared model discrimination using area under the receiver operating characteristics curve (AUC). Analyses were performed in R version 4.4.

Results: Among 1916 births, 19.6% were to individuals who identified as Black, 36.5% Hispanic, 27.9% White, and 16.0% another race-ethnicity. SGA incidence was 10.1%(n=149) overall and 13.0% among Black, 10.6% among Hispanic, and 8.0% among White births. A model with all three neighborhood indices had AUC=0.49 in the full cohort, and AUC=0.58 in Black, 0.60 in Hispanic, and 0.51 in White patients. Additional inclusion of individual-level covariates increased AUC to 0.62 (overall) and 0.76 (Black patients), 0.65 (Hispanic patients), and 0.69 (White patients).

Conclusions: Neighborhood-level indices alone were poorly predictive of SGA in racial groups. Discrimination improved when neighborhood SSDOH measures were combined with readily ascertained individual predictors, particularly among Black and White births.

Pregnancy outcomes

The impact of the COVID-19 pandemic on gestational diabetes risk: Did immigrants fare worse? Natalie Boychuk*, Bohao Wu, Katherine McCarthy, Teresa Janevic,

Gestational diabetes (GDM) is a common pregnancy complication with profound implications for future cardiometabolic risk. In New York City (NYC), immigrants are at higher risk of GDM, but the impact of the COVID-19 pandemic on GDM risk is unclear. We examined trends in GDM risk by month before and after onset of the COVID-19 pandemic and assessed if associations varied by nativity. We conducted an interrupted time series analysis of births to women without pre-pregnancy diabetes in NYC between January 2017-December 2021 using linked NYC birth record and hospital discharge data (n=402,025). We obtained maternal characteristics from the birth record. GDM was ascertained if indicated on either the birth or hospital record. Births were classified as pre-(January 2017-February 2020) or post-onset (May 2020-December 2021) of pandemic. We excluded births in March-April 2020. We constructed unadjusted and adjusted log binomial regression models and stratified by nativity. Half (50.7%) of women were foreign-born. GDM prevalence overall was 11.4%. After COVID onset, GDM risk increased by 5.3 per 100 deliveries (95% Confidence Interval [CI]: 3.7-7.0); this pattern persisted after adjusting for education, insurance, and parity (post vs. pre difference= 5.6, 95% CI: 4.0-7.2). Increases in GDM risk in the post-onset period were greater in foreign-born (post vs. pre= 8.3, 95% CI: 5.7-10.9) compared to US-born women (post vs. pre=3.4, 95% CI: 1.4-5.4). After the initial large increase, GDM risk decreased only slightly after the onset of COVID-19 by 0.08 percentage points per month (95% CI: -0.11, -0.04); this change was more pronounced in foreign-born (-0.14, 95% CI: -0.19, -0.09,) than US-born women (-0.03, 95% CI: -0.07, 0.01). GDM risk increased during the COVID-19 period, with marked disparities by nativity. While this trend appears to be receding, additional research is needed to understand the ongoing impact of COVID-19 on cardiometabolic health disparities in pregnancy.

Pregnancy outcomes

Clomiphene citrate dose and reproductive and perinatal outcomes in fresh autologous in vitro fertilization cycles, United States, 2004-2021 Sheree Boulet*, Michael Davies,

Clomiphene citrate (CC) is associated with increased risk for adverse perinatal outcomes; however, the effects of dose have not been elucidated. We conducted a population cohort study of 21,004 fresh, autologous in vitro fertilization (IVF) embryo transfer cycles that were performed in US fertility clinics between 2004 and 2021 and used CC for ovulation induction. We created 4 categories of total CC dosage (<500mg, 500-749mg, 750-999mg, and ≥1000mg) and used robust Poisson regression models to estimate adjusted risk ratios (aRR) and 95% confidence intervals (CI) for the association between dose and biochemical pregnancy, clinical intrauterine pregnancy, spontaneous abortion, stillbirth, live birth, multiple birth, and preterm delivery. Models adjusted for age, parity, prior assisted reproductive technology cycles, infertility diagnosis, race/ethnicity, and body mass index (BMI). Race/ethnicity and BMI were multiply imputed. The median total CC dose was 500mg, with 4,476 cycles (21.3%) using <500mg, 14,241 (67.8%) using 500-749mg, 1,517 (7.2%) using 750-999mg, and 770 (3.7%) using 1000mg or greater. After adjustment, rates of spontaneous abortion were higher for patients using 500-749mg and 750-999mg, relative to those using <500mg (11.8% vs 10.3%, aRR 1.12, CI 1.02-1.25 and 14.4% vs 10.3%, aRR 1.38, CI 1.18-1.62, respectively). There was a 3-fold increased rate of stillbirth for the ≥1000mg group compared with the <500mg group; however, the estimate was imprecise due to small sample size (0.7% vs 0.2%, aRR 3.30, CI 0.88-12.39). Multiple birth risk was approximately 40% higher for all CC dosage categories compared with the <500 mg group. Our findings highlight the need to further investigate sources of variability in patient response to CC to inform individualized dosing strategies and the importance of applying clinical strategies to avoid multiple births and associated adverse outcomes when CC is used for ovulation induction.

Pregnancy outcomes

Adverse childhood experiences, migraine, and adverse pregnancy outcomes among teenage mothers in Peru Yinxian Chen*, Lee Peterlin, Sixto Sanchez, Marta Rondon, Bizu Gelaye, Diana Juvinao-Quintero

Teenage mothers are susceptible to adverse pregnancy outcomes. Adverse childhood experiences (ACEs) are prevalent among teenage mothers and may contribute to these outcomes. Our team has found that ACEs are comorbid with migraine, a risk factor for adverse pregnancy outcomes. We aimed to assess the individual and joint association of ACEs and migraine with adverse pregnancy outcomes. We used data from 819 Peruvian teenage mothers (aged 14-18 years) from the Teen Pregnancy Outcomes, Maternal and Infant Study. Mothers having 4+ ACEs were considered high ACEs. Migraine was classified based on the International Classification of Headache Disorders-III beta criteria. Adverse pregnancy outcomes included preterm birth (gestational age at birth <37 weeks, PTB) and low birth weight (infant birth weight <2500 grams, LBW). We first assessed the individual association of high ACEs and migraine with PTB and LBW separately using logistic regression models. For the joint association, we included high ACEs, migraine, and ACEs*migraine in the model. After addressing confounding, the odds ratio (OR) of PTB was 2.25 (95% confidence interval: 1.25, 3.95) for high ACEs and 1.80 (1.01, 3.13) for migraine. The OR of LBW was 2.64 (1.46, 4.67) for high ACEs and 1.34 (0.73, 2.47) for migraine. The OR of PTB for joint exposure to high ACEs and migraine was 2.36 (0.92, 6.06), and the OR of LBW was 2.05 (0.74, 5.64). Imprecisely, high ACEs and migraine negatively interacted in multiplicative (PTB: β= -1.05 [-2.33, 0.16]; LBW: β= -1.13 [2.50, 0.14]) and additive scales (PTB: relative excessive risk due to interaction [RERI]= -1.89 [-5.01, 1.24]; LBW: RERI= -2.31 [-5.52, 0.90]). Our findings suggest that high ACEs and migraine may be individual and compounding risk factors for PTB/LBW among teenage mothers. The attributes of the negative interaction should be examined to understand the patterns of comorbidity of ACEs and migraine in adverse pregnancy outcomes.

Pregnancy outcomes

Risk factor differences that may explain Black-white racial disparities in preterm birth in Omaha, Nebraska, 2015-2022 Julie Petersen*, Kathleen Angell, Chad Abresch, Corrine Hanson, Ann Anderson Berry, Kathleen Angell

The March of Dimes' preterm birth (PTB, <37 weeks') grades for Nebraska and Omaha are D- and F, respectively. Black birthing people are more likely to have a PTB than their white counterparts. We investigated whether differences in PTB risk factor (RF) patterns among Black vs white people in Omaha may explain the PTB racial disparity. People who gave birth at Nebraska Medicine (most comprehensive regional health network) 2015-2022 reported sociodemographic/socioeconomic, behavioral/lifestyle, and reproductive/medical history RF. Medical records were abstracted for pregnancy details. Risk ratios (RR) estimated the PTB association with race and established RF using binomial regression. Two joint RF measures were modeled: (1) a counter of the number of RF and (2) latent classes (LC) using LC analysis. Of the 106 participants identifying as Black, 19.2% experienced a PTB, compared with 14.0% of the 460 white participants (both higher than U.S. average; crude RR 1.31, 95% CI 0.82, 2.09). Individual RF that most strongly attenuated the race-PTB association were PTB history, BMI, preeclampsia, weight gain, age, hypertension, and substance use. Among white and Black individuals 17.6% and 32.3%, respectively, had ≥6 RF. Having ≥6 RF was associated with 18.8x PTB risk compared with 0-1 RF. Using a 4 LC model, classes 1 (comorbidities/pregnancy complications/obesity), 2 (substance use/anxiety/depression/public insurance), and 3 (substance use/underweight/weight gain less than recommended/public insurance) were associated with 11x, 10x, and 3.3x PTB risk, respectively, compared with 4 (older/private insurance/more weight gain than recommended). When adjusting for RF counter or LC, the race-PTB association attenuated substantially (0.94 (0.60, 1.48) and 1.07 (0.68, 1.68), respectively). Despite the modest sample size, these findings provide preliminary support that differences in PTB RF patterns, likely driven by structural inequities, may explain racial disparities in Omaha.

Pregnancy outcomes

Adolescent Cardiovascular Risk Trajectories and Later Life Maternal Morbidity Annabelle Ng*, Natalie Boychuk, Teresa Janevic, Katharine McCarthy,

Nearly one-third of U.S. pregnancy-related deaths are attributable to poor cardiovascular health (CVH). Less is known about how CVH risk progresses from adolescence to young adulthood to influence pregnancy health in later life. We estimated the relative risk of gestational diabetes (GDM) and hypertensive disorders of pregnancy (HDP) among individuals in midlife by their cardiovascular risk in adolescence and young adulthood. Data were drawn from the National Longitudinal Study of Adolescent and Adult Health, where waves I-II corresponded to ages 11-19 years (adolescence), wave III ages 18-26 (young adulthood), and wave V ages 33-43. The final sample was 1,095 birthing individuals who completed all follow-up assessments and did not have pre-pregnancy diabetes. CVH risk was assessed using an adapted Life's Essential 8 scale, categorized into low, medium and high risk. Ever experiencing a pregnancy complication was self-reported in wave V. Risk of GDM and HDP was estimated using log binomial regression adjusting for maternal and sociodemographic characteristics. We found that those with high vs. low CVH risk in adolescence had 2.4 times (95% CI: 1.4, 4.2) the risk of future GDM. No association was observed among those with moderate vs. low CVH risk (adjusted risk ratio (aRR) 1.2, 95% CI: 0.70, 2.0). We found a small increased risk of HDP among those with high (aRR 1.2, 95% CI: 0.8, 1.7) or moderate adolescent CVH risk (aRR 1.2, 95% CI: 0.9, 1.6) vs. low risk but confidence intervals were inclusive of the null. The highest incidence of GDM was observed among those who maintained high risk status between adolescence and young adulthood (34.9% GDM), relative to those who stayed low (8.3%) or moderate risk (10.7%) over time, or who were high risk and reduced their risk to low (16.7%) or moderate (17.8%). Findings support the potential of prevention efforts targeting CVH risk trajectories in adolescence to offset maternal morbidity later in the lifecourse.

Pregnancy outcomes

Sex-specific effects of psychosocial stress on prenatal iron regulation Rebecca Campbell*, Konstantina Tsintsifas, Jessica Britt, Andrew Franklin, Greg Mil, Lauren Keenan-Devlin, Ann Borders, Amy Crockett,

Background: Inadequate fetal iron stores impair neurodevelopment in utero and in infancy. Prenatal maternal iron deficiency is common and may compromise fetal iron. When and how the fetus is affected are not well understood.

Objective: We aim to characterize relationship among maternal prenatal psychosocial stress and maternal and neonatal anemia by fetal sex.

Methods: This is a secondary analysis of a randomized trial of group prenatal care. Patients completed validated psychosocial questionnaires including stressful life events (adapted from PRAMS) and depression symptoms (Center for Epidemiologic Studies, CESD). Maternal 2nd (T2) and 3rd trimester (T3) anemia (hemoglobin (Hb) <10.5 and 11 g/dL, respectively) and neonatal Hb were the main outcomes. Adjusted log Poisson and linear regression models were used.

Results: N=2,047 trial participants (87%) had at least 1 Hb measured prenatally. Of those, 68% had at least 2 Hbs during pregnancy and 18% had a neonate with Hb measured at <7 days of age. Prevalence of anemia was 27% and 51% in T2 and T3, respectively. Prenatal stressors were associated with T3 but not T2 anemia. Elevated depression score (CESD ≥12) was associated with 11% (prevalence ratio:1.11, 95% confidence interval: 1.0-1.2) greater prevalence of T3 anemia. One and 2+ life stressors (vs. 0) were associated with 13% (1.13, 1.02-1.26) and 19% (1.19, 1.01-1.39) greater T3 anemia prevalence, respectively. Neither maternal stress nor T2 anemia was associated with neonatal Hb, while T3 anemia was associated with 0.86 g/dL (-1.6, -0.08) lower Hb among female neonates only.

Conclusions: Maternal T3 anemia is sensitive to maternal stressors and predicts neonatal Hb; female neonates may be more affected. Psychosocial stress and fetal sex may be important considerations for a holistic risk profile of prenatal anemia.

Pregnancy outcomes

Leptin levels in mid-pregnancy and risk of preeclampsia Hilary Dolstad*, Sheryl L. Rifas-Shiman, Marie-France Hivert, Emily Oken, Izzuddin M. Aris, Jessica Faulkner,

Background: Preeclampsia, defined as new-onset hypertension with proteinuria or end organ dysfunction after 20 weeks gestation, affects 2-8% of pregnancies. Preeclampsia increases the risk of fetal complications and maternal cardiovascular disease. Prior studies have demonstrated that leptin, a peptide hormone, is elevated in preeclampsia. This association, however, may be confounded by common biological factors of elevated leptin and preeclampsia including body mass index (BMI) and chronic hypertension, and many studies have not controlled for these factors.

Methods: Our study included 1504 women enrolled in early pregnancy. The exposure was leptin level in plasma collected in mid-pregnancy (mean gestational age 28 weeks), which we categorized into tertiles. The primary outcome was preeclampsia during that pregnancy, which we assessed from medical records. We used multivariable logistic regression models to assess the association of leptin tertiles with the development of preeclampsia, adjusting for confounders including pre-pregnancy BMI, history of hypertension, age, race and ethnicity, and parity.

Results: Mean (SD) age at enrollment was 32.2 (4.9) years, pre-pregnancy BMI was 24.8 (5.4) kg/m2, and leptin was 23.3 (14.3) ng/mL. There were 2 (0.4%) cases of preeclampsia among participants with leptin levels in the first tertile, 20 (4%) in the second tertile, and 29 (6%) in the third tertile. Higher leptin levels during mid-pregnancy were associated with higher odds of preeclampsia, which remained significant after controlling for confounders. Specifically, compared to the lowest tertile of leptin, the likelihood of preeclampsia was higher in the those with leptin levels in the second tertile (OR 7.8, 95% CI 1.8, 33.8) and third tertile (OR 7.9, 95% CI 1.7, 35.6).

Conclusions: Our findings show an association between leptin levels during mid-pregnancy and the risk of preeclampsia, independent of maternal BMI, chronic hypertension, race and ethnicity, and parity.

Pregnancy outcomes

Identification and Characterization of Pregnancy Episodes and Outcomes Using EHR Data from an Integrated Healthcare Delivery System in Louisiana Rong Rong*, Man Tang, Yilu Lin, Abigail Gamble, Nahed ElHassan, Xu Xiong, Jeffrey Shaffer, Mahip Acharya, Bradley Martin, Janice Hall, Daniel Fort, Lizheng Shi,

Leveraging electronic health records (EHR) provides unique opportunities for advancing maternal health research, which relies on accurate identification and characterization of pregnancy episodes and outcomes. However, extracting reliable clinical pregnancy-related information from EHR remains challenging due to its inherent complexity. Existing algorithms were predominantly developed for administrative claims databases. Additionally, limited studies have explored pregnancy outcomes in the Deep South, a region disproportionately affected by adverse maternal health outcomes. This study aimed to identify pregnancy episodes and outcomes in a cohort of women from Louisiana. We utilized EHR for pregnancy-related encounters at an integrated healthcare delivery system between July 6, 2015, and June 24, 2024. Seven pregnancy outcomes were identified: live birth, stillbirth, spontaneous abortion, elective abortion, ectopic pregnancy, abnormal products of conception, and unknown outcome. These outcomes, along with their respective dates, were extracted using a comprehensive set of diagnosis and procedure codes and then validated through a hierarchical, iterative algorithm incorporating minimum allowable time intervals between adjacent episodes. Pregnancy episodes were delineated by assigning a prenatal window based on the outcome date and maximum pregnancy duration. A total of 121,466 pregnancies were identified among 89,349 participants, with 67,187 (75.2%) experiencing a single pregnancy, 15,527 (17.4%) having two, and 6,635 (7.4%) having three or more pregnancies. This led to an average of 1.36 pregnancies per participant. Live births were the most common outcome (69.2%), followed by spontaneous abortion (13.3%), delivery of unknown outcome (11.1%), elective abortion (3.1%), abnormal products of conception (2.0%), ectopic pregnancy (0.7%), and stillbirth (0.6%). This study provides a highly adaptable framework for inferring pregnancy episodes and outcomes from EHR data.

Science Communication and Media

Participants' experiences with report-back of environmental exposure results in two pregnancy cohorts Katherine Franz*, Alina McIntyre, Casey Mullen, Jennifer Liss Ohayon, Katerine E. Boronow, Julia Green Bondy, Tamarra James-Todd, Carmen Milaros Velez Vega,

Background

Exposure to endocrine disrupting chemicals such as phthalates and phenols is associated with negative health impacts. Understanding perinatal exposures is especially important. However, limited research has explored report-back of research results within this population. Return of results to participants advances community-based participatory research principles, and digital tools for data communication and visualization have simplified implementation of report-back for researchers. We engaged health practitioners in report-back to two pregnancy cohorts and assessed outcomes.

Methods

162 participants were recruited from the Puerto Rico Testsite for Exploring Contamination Threats (PROTECT) and the Environmental Reproductive and Glucose Outcomes (ERGO) cohorts to receive report-back on perinatal exposures. Personal reports were generated with the Digital Exposure Report-Back Interface (DERBI). Pre- and post-surveys assessed feelings, knowledge and behaviors, and semi-structured interviews with a subset of 32 participants further explored the report-back experience.

Results

Participants felt highly satisfied, respected, and empowered, and mild to moderately worried before and after report-back. Over half reported surprise about their results. Environmental health knowledge increased slightly following report-back, and about 45% of participants reported changes in product usage. Interviews showed that participants generally found their results to be relevant, despite limitations to individual actionability and a lapse in time between sample collection and receiving results.

Discussion

This study provides new insights about returning exposure results to pregnancy cohorts. Our findings underscore the benefits of report-back overall and support expansion of the practice within this population. Report-back considerations from this study can also inform future practices across populations.

Social determinants of health

Understanding the impact of county immigration climate on birthweight among immigrant birthing people across restrictive and supportive federal and state immigration policy climates Kaitlyn Stanhope*, Margot Moinester,

Goal: While a growing body of work shows impacts of state policies on immigrant health, only limited research examines local climates. Our goal was to quantify the effect of county immigration policy climate on birthweight and determine whether the effect was modified by overarching state or federal climate among foreign-born birthing people, 2012-2020.

Methods: We used data from the U.S. restricted use natality files, 2012 to 2020, linked to county- and state-level characteristics using resident county and birth year. We create a joint exposure based on the presence of a 287g agreement with Immigration Customs Enforcement and/or sanctuary policy active in the county at the time of delivery. We fit multivariable linear models including random effects for state, parity, age, insurance, race/ethnicity, year, county rurality, poverty, percent foreign-born, percent unemployed, percent with a high school education, and percent of households below federal poverty level. We examined potential effect modification by state climate (measured using the Immigration Policy Climate score, in quartiles) or federal climate (Obama’s (2012-2015) vs. Trump’s presidency (2016-2020)) by including multiplicative interaction terms.

Results: We included 6,033,418 births to foreign born birthing people. Living in a county with a sanctuary policy was associated with increased birthweight compared to a county without a sanctuary policy, both without and with a 287g policy in place (adjusted beta: 3.4, 95% confidence interval: (1.5, 5.2); 6.9, (3.9, 9.9), respectively). The estimates were stronger during the Trump presidency. There were not differences by state climate.

Conclusions: These results do not support the hypothesis that county climates can buffer against restrictive state or federal climate. However, they do support the role of counties in impacting immigrant health, possibly uniquely through passing inclusively policies in otherwise restrictive state and federal climates.

Social determinants of health

Association of life course social integration with fecundability Molly Hoffman*, Collette Ncube, Lauren Wise,

Background: Social isolation is increasing among U.S. adults and has been associated with adverse health, but the association between social integration and fecundability is not well known.

Methods: We examined the association between life course social integration and fecundability in Pregnancy Study Online (PRESTO), a preconception cohort study of U.S. and Canadian females aged 21-45 years (2013-2024). Eligible participants completed a supplemental questionnaire (SQ) on life course psychosocial factors at baseline (N=8,771). We assessed social integration with an adapted 8-item version of the Berkman-Syme Social Network Index (SNI) during childhood (<18 years) and adulthood (≥18 years) on the SQ. Summed SNI scores were categorized as <5 (socially isolated) and ≥5 (socially integrated). We estimated fecundability, the per-cycle probability of conception, from bimonthly follow-up questionnaires. We used inverse probability-weighted proportional probabilities models to estimate fecundability ratios (FR) and 95% CIs, accounting for confounding and selection bias.

Results: A majority of participants were socially integrated during at least one life stage (97%). Compared with social isolation, being socially integrated during any life stage was associated with increased fecundability (FR=1.35, 95% CI: 1.07-1.69). The association was similar for social integration during childhood (FR=1.32, 95% CI 1.22-1.43), but was notably stronger for social integration during adulthood (FR=1.47, 95% CI 1.21-1.78).

Conclusions: Social integration may have positive effects on fecundability, particularly during adulthood.

Social determinants of health

Using the Future of Families & Child Wellbeing Study to Test for Racial Disparities in Maternal Telomere Length Brittney Boakye*, Rebecca Fix, PhD,

Introduction: The weathering hypothesis postulates that socioeconomic disadvantage and chronic stress lead to accelerated biological aging, particularly in Black women. Telomere length can serve as an indicator of biological aging. This study examined the association between socioeconomic status, psychosocial factors, and telomere length among mothers. Methods: The Future of Families and Child Wellbeing Study (FFCWS) Dataset was used to explore the relationship between maternal race and telomere length with a sample size of 2,984 mothers. The primary outcome variable was log-transformed telomere length, reported in kilobases (kb). Predictor variables were race, age, sociodemographic variables (education, poverty level) and psychosocial variables (maternal stress, maternal depression, social support, child's mother and biological father relationship). Multivariable linear regression was used to estimate the association sociodemographic and psychosocial variables had with telomere length. Models were also stratified by race. All analyses were performed using SPSS version 29.0.2.0. Results & Discussion: Results depict a statistically significant association between race and telomere length, where Black mothers have significantly longer telomere lengths than White mothers (B=0.064, p-value=<0.001). Mothers who completed high school had significantly longer telomere lengths than those who did not complete high school (B=0.054, p-value=.036). Linear regression findings on sociodemographic associations with telomere length, including racial differences, were inconsistent with previous literature. Future research is needed to explore associations among Black women in a more nationally representative sample that considers resilience.

Social determinants of health

Impact of maternal neighborhood measures and psychosocial stressors on mitochondrial DNA copy number and telomere length in maternal and cord blood Ixel Hernandez-Castro*, Sheryl L. Rifas-Shiman, Danielle M. Panelli, Anna R. Smith, Li Yi, Izzuddin M. Aris, Henning Tiemeier, Mandy B. Belfort, Farah Qureshi, Diane R. Gold, Marie-France Hivert, Emily Oken, Andres Cardenas,

Background:

Neighborhood and individual-level stressors can influence oxidative stress and inflammation during pregnancy, potentially altering cellular disease pathway biomarkers like mitochondrial DNA copy number (mtDNAcn) and telomere length (TL). The exact mechanisms linking early life and prenatal stressors to long-term health outcomes remain understudied.

Objective:

To evaluate adjusted associations of prenatal maternal neighborhood and individual-level psychosocial stressors with mtDNAcn and TL in maternal and cord blood.

Methods:

We assessed neighborhood measures based on residence during pregnancy using the Child Opportunity Index (COI) and Social Vulnerability Index (SVI) [range: 0-100] in the Project Viva study (n=415–917). We also evaluated maternal Adverse Childhood Experiences (ACEs), administered during a mid-life follow-up, and the Personal Safety Questionnaire (PSQ), administered mid-pregnancy. We measured mean relative mtDNAcn and TL in second trimester maternal blood and cord blood.

Results:

Participants residing in areas of very high opportunity (COI score ≥80) during pregnancy relative to very low opportunity (≤20) had lower maternal mtDNAcn (B= -0.09, 95% confidence interval (CI): -0.17, -0.02), while those residing in areas of very high vulnerability (SVI score ≥80) relative to very low vulnerability (≤20) had higher maternal mtDNAcn (B= 0.06, 95% CI: 0.01, 0.12). Participants living in areas with moderate opportunity (COI score 40-60) when compared to very low opportunity (≤20) had higher cord blood TL (B= 0.39, 95% CI: 0.0002, 0.78). Individual-level stressors were not related to the biomarkers.

Conclusions:

Our findings suggest that neighborhood stressors during pregnancy are associated with maternal mtDNAcn and fetal TL, key biomarkers of oxidative stress and cellular aging. These results provide important insights into the potential mechanistic pathways linking early-life neighborhood stressors to long-term health outcomes.

Social determinants of health

Associations of subjective socioeconomic status before and during pregnancy with prenatal eating behaviors Julia Bittner*, Tonja R Nansel, Stephen E Gilman, Zhen Chen, Culin Zhang, Mary Chong, Fabian Yap, Jerry Kok Yen Chan, Kok Hian Tan, Shiao-Yng Chan, Yap Seng Chong, Johan Gunnar Eriksson, Peter Gluckman, Michael Meaney, Bobby K Cheon,

Background: Perceiving that one's socioeconomic status (SES) is lower than others' (low "subjective SES") may lead people to prefer high-calorie foods and consume larger portions, independent of their actual SES. Whether these perceptions operate similarly among pregnant people is unknown, leading us to investigate the association of low subjective SES with prenatal eating behaviors. **Methods:** We analyzed data from the Singapore Preconception Study of Long-Term Maternal and Child Outcomes (S-PRESTO). Women reported subjective SES before pregnancy and in each trimester (range: 1-10, n=100). We plotted participants' subjective SES scores during the study and calculated areas under the curves to measure cumulative experiences of subjective SES from preconception to each trimester. Eating outcomes included: food cravings/aversions (yes, no; trimester 1), changes in amount of food consumed since becoming pregnant (more, same, less; trimester 1) or since the previous trimester (trimesters 2, 3), and reasons for eating more (more hungry, other; trimesters 1-3) or less (nauseated, other; trimester 1). Ordinal and binary logistic regressions were used to estimate associations of subjective SES with eating outcomes adjusting for ethnicity, work status, education, parity, age, and depression. Effect modification by education (<college, >college) was conducted. **Results:** Mean subjective SES was similar during preconception (mean: 5.9 [SD: 1.4]) and pregnancy (trimester 1: 5.8 [1.5]; trimester 2: 5.9 [1.5]; trimester 3: 6.0 [1.4]). Subjective SES was not associated with any outcome. Those with a college degree were more likely to report eating more between trimesters 1 and 2 due to hunger (OR: 3.75, 95% CI: 1.01, 13.86). **Discussion:** Subjective SES was not associated with eating behaviors in this sample. Dietary goals may outweigh the impact of subjective SES during pregnancy, or these behaviors may be more strongly related to physiological than psychological aspects of pregnancy.

Social determinants of health

Exploring associations between social and migration characteristics and risk of gestational diabetes using an intersectional MAIHDA approach Teresa Janevic*, Natalie Boychuk, Frances Howell, Bohao Wu, Sandra Albrecht, Sandra Echeverria,

Immigrant mothers experience a higher incidence of gestational diabetes (GDM) compared to their U.S.-born counterparts, but it is unknown why. Immigrants are often treated as a monolithic group, yet this group is comprised of individuals with unique social and migration characteristics which intersect to reflect their lived experience. We conducted an intersectional multilevel analysis of individual heterogeneity and discriminatory accuracy (I-MAIHDA) analysis to characterize inequities in GDM between intersectional strata of immigrant women. We used linked 2015-2021 New York City birth and hospital data. We selected first births within our study timeframe of foreign-born mothers (n=255,462). We ascertained social and migration characteristics, including 9 regions of birth, time in the US (<10 yrs/>10yrs), education (<high school, high school, ≥college), and age at delivery (≤ 30, > 30), then combined them into 108 unique strata. GDM was ascertained jointly from birth and hospital records. We fit a two-level random effects logistic regression model, with 108 social strata as level 2, and individuals as level 1. Strata (n=108) were defined as combinations of migration characteristics. Overall, 13.2% of deliveries were complicated by GDM. The predicted risk of GDM within strata ranged from 4.6% to 37.3%. The strata explained 9.6% of the variance in GDM. After including strata components as fixed effects, the between-strata variance attributable to interaction effects was 0.9%. The five highest risk strata were all comprised of South Asian immigrants. However, there was a consistent pattern within regions of higher risk for women with lower education, aged >30 yrs and longer duration in the US. For example, Central Americans residing in the US >10 years with 30 yrs had a predicted risk of GDM of 22.9%. Our intersectional approach debunks the notion of a monolithic foreign-born group and reveals a diverse risk of gestational diabetes.

Women’s health

Reproductive trajectories from menarche to menopause: identifying patterns and differences by childhood maltreatment Kaitlyn Stanhope*, Audrey Gaskins, Erica Gunderson, Catherine Kim, Cora Lewis,

Objective: Few studies to date have considered holistic methods to capture the reproductive life course, largely relying on single indicators. By identifying unique trajectories of reproductive events over the reproductive years we can improve the understanding of how early life experiences impact reproductive outcomes. The goal was to identify unique trajectories of reproductive events across the life course and to explore whether socioeconomic position in early life (parental educational attainment) or childhood maltreatment determine trajectory membership.

Methods: We used data from the Coronary Artery Risk Development in Young Adults (CARDIA) study on all female-bodied participants (n = 2800). We included self-reported reproductive events (complicated pregnancies (with a hypertensive disorder of pregnancy, preterm birth, cesarean delivery, and/or gestational diabetes), uncomplicated pregnancies, irregular menses, and birth control use) and coded each for each year of the reproductive life course (individual determined from reported date of menarche to menopause or loss-to-follow-up). We fit group-based trajectory models and used model fit to identify optimal trajectories. We determine associations with self-reported childhood physical or emotional maltreatment using polytomous logistic regression models controlling for baseline age, parental educational attainment, and race as potential confounders.

Results: We identified three unique trajectories of reproductive events (1: (n = 1,161); 2: (n=498); 3: (n = 1,128)). Group 1 had the youngest age at first pregnancy (mean 19.8, (standard deviation 4.7), 2: 29.29, (6.3), 3: 26.72, (6.2)) Any reported childhood maltreatment was associated with membership in group 1 (adjusted odds ratio: 1.49, 95% confidence interval (1.15, 1.93) versus group 2. Trajectories were similar by baseline obesity status.

Conclusion: Childhood maltreatment is associated with a pattern of earlier childbearing.

Women’s health

Pregnancy Testing Behavior in a Prospective Cohort of North American Pregnancy Planners Alexandra Sundermann*, Anne Marie Jukic, Kenneth Rothman, Lauren Wise,

Home pregnancy testing is linked to timing of pregnancy detection and, subsequently, lifestyle modifications and eligibility for study entry in cohorts of pregnancy health. Yet, little is known about the timing and frequency of home pregnancy testing among individuals who are trying to conceive. In PRESTO (Pregnancy Study Online), a prospective cohort study of North American preconception pregnancy planners (2018-2024), participants reported day-specific information about whether they tested for pregnancy and the result of each test from four days before the day of expected menstruation through four days after. We analyzed data from the first cycle after enrollment, which included 20,458 individual tests across 6,569 unique participants. The median number of home pregnancy tests used was two (inter-quartile range [IQR]: 1, 4); 9% of participants reported testing every day within the queried range. Forty percent of participants reported testing more than four days before their expected period, whereas 26% waited to test until the day of their expected period or later. Almost half of participants had at least one positive pregnancy test (49%, n=3,241) and 60% of participants with a positive result repeated testing at least once (median number of positive tests: 2; IQR: 1, 4). We observed a range of pregnancy testing intensity, with some participants testing only once and others testing every day, even after a positive test. Participants with a history of miscarriage were more likely to be early, frequent testers compared with their counterparts (risk ratio adjusted for maternal age and parity 1.26, 95% confidence interval 1.14, 1.39). Young maternal age and increasing parity were also associated with earlier initiation of testing and more frequent testing. A deeper understanding of real-world home pregnancy test behaviors will inform quantitative assessment of biases related to timing of study entry in early pregnancy cohorts.

Women’s health

Navigating reproductive hormones and autoimmune disorders Kayleigh Easey*,

Compared to males, females have a higher prevalence of autoimmune disorders, where the body’s defence system can attack its own cells. It has also been shown during pregnancy that symptoms of certain autoimmune disorders are often lessened. During pregnancy, many important biological and physiological changes occur to protect both the pregnant person and growing fetus, particularly in relation to changes in hormone expression.

The relationship between how reproductive hormones can impact autoimmune disorders therefore requires further investigation. Using the cohort study the Avon Longitudinal Study of Parents and Children (ALSPAC) (n=14,541), we investigate how reproductive hormones and events are related to common autoimmune disorders. Using a longitudinal birth cohort enables us to investigate associations within both pregnant individuals as well as intergenerationally within offspring. Here we investigate and will present results of associations between reproductive events and hormones (such as oestrogen) and common autoimmune disorders (such as multiple sclerosis and rheumatoid arthritis). By analysing data from multiple timepoints and events, we will present results of changes shown across the life-course. This research aids in casual inference of biological differences between autoimmune disorders, highlighting contributing and modifiable pathways to disease.

Women’s health

Association between Maternal Adverse Childhood Experiences (ACEs) and Mother-Father Relationship Quality Rosemary Adaji*, Dawn Misra, Jamie Slaughter-Acey,

Background: The quality of mother-father relationship significantly impacts perinatal outcomes. Yet, factors that shape this relationship remain underexplored. Maternal adverse childhood experiences (ACEs) can have lasting effects on health and adult social relationships, including the relationship with the father of the baby (FOB). Previously, we found that fathers with higher ACEs scores reported higher conflict with the mother of their baby. Understanding how maternal ACEs shape the mother-father relationship could provide valuable insights for interventions aimed at improving family dynamics and perinatal outcomes.

Objective: This study explored the association between maternal ACEs and the quality of mother-father relationship, indicated by levels of conflict.

Methods: Data were from 348 self-identified Black women aged 18-45 years in the Life-course Influences on Fetal Environments 2 (LIFE-2) birth cohort study. Participants completed questionnaires during postpartum hospitalization. ACEs scores (0-10, yes/no) were summed and grouped as: no ACEs (referent group, 0 scores), low ACEs (median score, 1), and high ACEs (>median score, 2-10). Conflict with FOB (5-item scale, scores 5-25) was dichotomized into low conflict (≤10, median), and high conflict (>10) as the outcome. Logistic regression was used to obtain crude estimates.

Results: Compared to women with no ACEs, the odds of reporting high conflict were 0.82 (95% confidence interval (CI): 0.46-1.48) for the low ACES group, and 1.67 (95% CI: 1.02-2.69) for the high ACES group, based on crude estimates.

Conclusion: Mothers with higher ACEs are more likely to experience higher conflict with their FOB. This finding underscores the importance of understanding how social environments influence relationship dynamics and ultimately perinatal outcomes. Future analysis will explore pathways linking maternal ACEs to mother-father relationship quality.

Women’s health

Association between Gestational Weight Gain and Type 2 Diabetes Mellitus after Gestational Diabetes: A Longitudinal Study Bohao Wu*, Natalie Boychuk, Katharine McCarthy, Luciana Vieira, Teresa Janevic,

Background: Gestational diabetes (GDM) influences life-course type 2 diabetes (T2DM). Gestational weight gain (GWG), a well-known risk factor for GDM, has an unclear link to T2DM after GDM. We estimated the association between GWG and T2DM after GDM.

Methods: Using linked New York City birth, hospital discharge, (2009-2011) and NYC A1c Registry data (2009-2021), we identified GDM cases from birth or hospital discharge data. We excluded women with pre-pregnancy diabetes. Pre-pregnancy BMI and GWG was obtained from the birth record. We used CDC GWG categories: inadequate, recommended, or excessive. T2DM was ascertained as two A1c results ≥6.5% after 12 weeks postpartum. We used Cox proportional hazards models to estimate the association between GWG and cumulative incidence of T2DM after GDM, adjusting for maternal age, race/ethnicity, pre-pregnancy body mass index (BMI), education, nativity, parity, and gestational age at delivery. We also explored interaction between GWG and pre-pregnancy BMI.

Results: Among n=13,099 women with GDM at baseline, the 12-year cumulative incidence rate of T2DM after GDM was 20.4%. Inadequate GWG relative to recommended GWG was associated with a modest increased risk of T2DM after GDM (aHR=1.12, 95% CI 1.01-1.24), while excessive GWG was not (aHR=0.97, 95% CI 0.88-1.06). We did not find an interaction between pre-pregnancy BMI and GWG, with associations for inadequate GWG and T2DM after GDM similar across BMI categories: (underweight: aHR=1.63, 95% CI 0.55-4.86; healthy weight: aHR=1.14, 95% CI 0.94-1.37; overweight: aHR=1.11, 95% CI 0.93-1.34; obesity: aHR=1.09, 95% CI 0.93-1.27)

Conclusion: GWG in women with GDM showed little association with later risk of T2DM. However, women with inadequate GWG had a slightly higher risk of T2DM after GDM compared with those with recommended GWG. Strengthened postpartum metabolic monitoring may be considered for women with inadequate GWG for early detection and intervention.

Women’s health

The Impact of a Randomized Controlled Trial on Postpartum Physical Activity among Hispanic Women Kathryn Wagner*, Susan Park, Bess Marcus, Penelope Pekow, Milagros Rosal, JoAnn Manson, Barry Braun, Lisa Chasan-Taber,

Physical activity (PA) during pregnancy is associated with reduced risk of developing pregnancy complications which in turn, increase the risk of long-term adverse health outcomes that disproportionately affect Hispanic women. Hispanic women are also less likely to meet American College of Obstetricians and Gynecologists (ACOG) guidelines for PA in pregnancy as compared to non-Hispanic White women. However, few lifestyle interventions have targeted Hispanic women or those with overweight or obese BMI.

Proyecto Mamá was a randomized controlled trial of a lifestyle intervention among Hispanic women with overweight or obese pre-pregnancy BMI in Western Massachusetts (2014-2020). Women were randomized to a Lifestyle Intervention (LI, n=74) or Health and Wellness (HW, n=74) comparison arm in early pregnancy. The LI was based upon theoretical models and used a low-cost, high-reach strategy focused on healthy diet and increased PA. Active intervention occurred early pregnancy through 6 months postpartum with follow-up through 12 months. PA was assessed via the Pregnancy Physical Activity Questionnaire and PA self-efficacy was assessed via the Self-Efficacy for Physical Activity Questionnaire.

In intent-to-treat analyses, women in the LI arm performed significantly more household/caregiving (31.3 MET-hrs/wk, 95% CI: 4.0, 58.6), sports/exercise (3.4 MET-hrs/wk, 95% CI: 0.3, 6.4), and light intensity PA (22.7 MET-hrs/wk, 95% CI: 0.3, 45.1) through 12 months postpartum, compared to the HW arm. Additionally, women in the LI were 2.2 times more likely to meet ACOG PA guidelines through 12 months postpartum (OR=2.2, 95% CI: 1.3, 3.6) compared to the HW arm (LI: 45.4% vs. HW: 29.6%). Women in the intervention arms did not differ across other PA domains, intensities, or PA self-efficacy.

A low-cost, high-reach lifestyle intervention among Hispanic women with overweight or obesity had a beneficial impact on PA, including meeting the ACOG PA guidelines, through one year postpartum.

Women’s health

Association of Preterm Delivery Phenotypes with Subsequent Type 2 Diabetes Risk: Findings from Nurses’ Health Study II Xiaoyu Che*, Karolina Edlund, Kathryn Rexrode, Jackie Liu, Jennifer Stuart, Janet Rich-Edwards,

Introduction:
Preterm delivery (PTD) is a known maternal health risk factor, but its association with type 2 diabetes mellitus (T2DM), especially across PTD phenotypes, is unclear.
Objective:
To examine the relationship between clinical PTD phenotypes and T2DM risk.
Methods:
Parous Nurses’ Health Study II participants without pre-pregnancy T2DM (n=70,403) were followed for incident T2DM from delivery through 2019. Pregnancy history was retrospectively reported in 2009. PTD was classified as spontaneous preterm labor (sPTL), preterm premature rupture of membranes (pPROM), medically indicated PTD (miPTD), or nonphenotyped PTD (insufficient information). Physician-diagnosed T2DM, reported biennially since 1989, was confirmed following American Diabetes Association criteria. Cox proportional hazards regression models evaluated (1) first pregnancy PTD phenotype and subsequent T2DM and (2) PTD history before age 40 and later T2DM, adjusting for sociodemographic factors, prepregnancy behaviors, and adverse pregnancy outcomes.
Results:
6,217 (8.8%) developed T2DM during follow-up (up to 55 years, median:36 years). miPTD (n=390) in the first pregnancy increased T2DM risk only within 10 years after delivery (hazard ratio[HR]:3.54, 95% confidence interval[CI]:1.66–7.56). Nonphenotyped PTD (n=4,094) increased T2DM risk within 10 years (HR:1.96, 95% CI:1.23–3.10) and 11–30 years (HR:1.27, 95% CI:1.12–1.44), but not beyond 30 years. Neither sPTL (n=1,019) nor pPROM (n=701) were associated with T2DM. For PTD history before age 40, nonphenotyped PTD showed a modest association with T2DM that was robust to covariate adjustment (HR:1.17, 95% CI:1.07-1.27), while the miPTD association was attenuated.
Conclusion:
miPTD was associated with the highest T2DM risk within 10 years after delivery, while nonphenotyped PTD showed modest risk. PTD phenotyping is valuable for assessing long-term health risks, but improved phenotyping is needed to understand mechanisms and inform interventions.

Women’s health

Associations between depression symptoms and vaginal microbiome composition in a racially diverse cohort of pregnant women in North Carolina Andrea Chalem*, Chantel Martin, Anna Maria Siega-Riz, Nancy Dole, Patricia Basta, Myrna Serrano, Jennifer Fettweis, Michael Wu, Shan Sun, John Thorp Jr, Gregory Buck, Anthony Fodor, Stephanie Engel,

Background: Maternal stress during pregnancy has been associated with prevalence of bacterial vaginosis (BV), a vaginal infection characterized by gram negative bacteria overgrowth. Vaginal microbiota composition in pregnancy is linked to BV and preterm birth risk. Few studies have examined the relationship between mental health and the vaginal microbiome in pregnancy.

Objective: Evaluate associations between depression and vaginal microbiota composition using cross-sectional data from a racially diverse cohort of 534 pregnant participants in central North Carolina.

Methods: Participants at 24 to 29-weeks’ gestation were enrolled from 1995 to 2001. Self-reported depression symptoms were obtained at baseline using the Center for Epidemiologic Studies Depression Scale. Vaginal microbiota composition was obtained with 16S rRNA sequencing and clustered into 3 vagitypes according to predominant species: Lactobacillus crispatus, (41%) Lactobacillus iners (46%), and BV-mix (13%). We used multivariable log-binomial regression, stratified by race and adjusted for age and education, to estimate prevalence ratios (PR) for BV-mix vagitype among those with elevated depression symptoms.

Results: Proportions of participants with BV-mix vagitype were similar among Black and White women (13% vs. 12%), but a higher proportion of Black women reported elevated depression symptoms (41% vs. 32%). White participants with elevated depression symptoms were 3.09-times (95% CI 1.68-5.67) more likely to present with BV-mix than L. crispatus or L. iners, when compared to those without elevated depression symptoms. No association was observed among Black participants (PR=1.01, 95% CI 0.47-2.19, interaction p-value: 0.03).

Conclusion: Perinatal depression was associated with microbiota compositi on, but only in White participants. More research is needed to understand the social and behavioral context that could explain observed, racially stratified associations between depression and vagitype.

Women’s health

Associations of Prepregnancy Body Mass Index and Gestational Weight Gain with Breastfeeding Rebecca McAdams*, Janet Catov, Jill Demirci, Lisa Bodnar,

Background: The links between maternal prepregnancy body mass index (BMI) and gestational weight gain (GWG) on breastfeeding outcomes remain underexplored. This study aimed to determine these associations, which can inform interventions to optimize breastfeeding.

Methods: We used data from the Nulliparous Pregnancy Outcomes Study: Monitoring Mothers-to-be-Heart Health Study. Pregnant women were prospectively followed from 6-13 weeks’ gestation to a median of 3 years postpartum, when breastfeeding information was collected by self-report via a phone call. Total GWG (kgs) was converted to gestational age-standardized z-scores and then categorized as <-1, -1 to 1, or >1 standard deviation (SD). Outcomes were breastfeeding status (yes or no) for any breastfeeding and exclusive breastfeeding. We used multivariable logistic regression to determine the association between BMI, GWG, and their interaction on breastfeeding outcomes, adjusted for race/ethnicity, education, and other confounders.

Results: The final sample included 6,495 mothers. Mothers were most commonly normal weight (55%) or overweight (22%) before pregnancy, and gained on average 14.8 kgs (SD=6.9) and a z-score of 0.05 (SD=0.96) during pregnancy. Over 88% ever breastfed, and of those, 56% breastfed for >6 months. Of the 79% who exclusively breastfed, 31% did so for >6 months. The adjusted odds of ever breastfeeding were significantly lower among individuals with overweight (Odds Ratio (OR) 0.55; 95% CI 0.41, 0.74), or obesity (OR 0.45; 95% CI 0.34, 0.60) compared with normal weight mothers. Women with obesity were half as likely as normal weight women to exclusively breastfeed (OR 0.51; 95% CI 0.41, 0.63). Women whose weight gain z-score was <-1 SD were less likely than those whose weight gain z-score was -1 to 1 SD to have ever breastfed (OR 0.63; 95% CI 0.41-0.98). There was no interaction between prepregnancy BMI and GWG for any breastfeeding outcome.

Discussion: Individuals with a high prepregnancy BMI or excessive GWG may benefit from interventions to optimize breastfeeding.

Conclusion: Prepregnancy BMI and GWG are potentially modifiable risk factors of breastfeeding. Addressing these factors through preconception and prenatal care could enhance breastfeeding outcomes, benefitting maternal and child health.

Women’s health

Exposure to Per- and polyfluoroalkyl substances (PFAS) and Maternal Distress: Findings from the Danish National Birth Cohort Pengfei Guo*, Onyebuchi Arah, Cecilia Ramlau-Hansen, Zeyan Liew,

Background Females are nearly twice as likely to develop mood disorders compared with males, with incidence peaking during pregnancy and postpartum. Per- and polyfluoroalkyl substances (PFAS), widespread endocrine-disrupting chemicals, may dysregulate stress response and exacerbate maternal distress. Epidemiological evidence is lacking regarding PFAS exposure and maternal perinatal distress.

Methods Using data from 3759 pregnancies in the Danish National Birth Cohort (DNBC), we examined associations between plasma concentrations of six PFAS (median: 8 weeks of gestation) and maternal distress. The mothers reported distress related to the perinatal period that they had experienced at gestational week (GW) 30 and 6 months postpartum in computer-assisted telephone interviews. The instrument was derived from the Symptoms Checklist-92 and the General Health Questionnaire 60. We studied the total distress and the sub-domains (anxious, depressed, or stressed) using the 90th percentile score as a high-risk threshold. We conducted log-binomial regression model to estimate the adjusted risk ratios (RR) by doubling increase of plasma PFAS (ng/ml), accounting for potential confounding and selection bias with inverse probability weighting.

Results A doubling increase in plasma perfluorooctanoic acid (PFOA) was associated with higher risks of anxiety (RR=1.45, 95% CI: 1.27-1.65), depression (RR=1.33, 95% CI: 1.13-1.57), and stress (RR=1.19, 95% CI: 1.03-1.38) at GW 30, resulting in a 26% elevated risk (95% CI: 1.12-1.41) for total distress. Multiple PFAS were consistently linked to more depressive symptoms 6 months postpartum.

Discussion Gestational PFAS exposure, particularly PFOA, was associated with worsened distress symptoms during pregnancy and postpartum. These findings suggest PFAS may exacerbate perinatal mental health risks, warranting public health measures to reduce exposure. Further research is needed to explore biological mechanisms and long-term health implications.