



# Annual Meeting Abstract Book

2017  
Seattle, WA

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EPIDEMIOLOGIC RESEARCH  
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**2016-2017**

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# Plenary Session 1

P1.1

Reproductive, Perinatal & Pediatric Epidemiology: An Established Field with Consequence

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Epidemiology and reproductive, perinatal and pediatric epidemiology, more specifically, had a humble origin in working to advance the health and well-being of the many populations we serve. Our research often focuses on vulnerable population subgroups such as fetuses, pregnant women, children, and young adults. In the past year, the Society for Epidemiologic Research celebrated its 50th anniversary, and this year the Society for Pediatric and Perinatal Epidemiology (SPER) and the Division of Intramural Population Health Research (DIPHR) at NICHD are celebrating their 30th and 50th anniversaries, respectively. In honor of these latter two anniversary celebrations, this talk will provide a brief overall of our profession's accomplishments and offer perspectives for turning discoveries into health for all people.

P1.2

Vitamin D and anovulation in women with proven fecundity

Sunni Mumford,\* Dan Kuhr, Lindsey Sjaarda, Keewan Kim, Ukpebo Omosigho, Robert Silver, Neil Perkins, Tiffany Holland, Enrique Schisterman

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**Background:** Vitamin D supplementation is associated with normalized menstrual cycles in women with polycystic ovary syndrome (PCOS). However, the relationship between vitamin D concentrations and ovulatory function in healthy women with proven fecundity is unknown. **Methods:** A cohort of 1,228 women attempting pregnancy, aged 18-40 years, with regular menses, 1-2 previous pregnancy losses, and no diagnosed history of infertility or PCOS who were enrolled in the Effects of Aspirin in Gestation and Reproduction Trial, was assessed in this secondary analysis. Preconception 25(OH)D3 concentrations were measured from serum samples collected at the baseline (pre-pregnancy) visit. Daily urine samples were collected during the first two menstrual cycles of follow-up, with anovulation determined by an absence of a rise in urinary luteal pregnanediol-glucuronide. A repeated-measures log-binomial regression model estimated the risk ratio (RR) and 95% confidence intervals (CI) of anovulation per cycle, adjusted for age, body mass index, race, smoking, income, exercise, season, and treatment arm. **Results:** Over 47% of the women in this study had sufficient vitamin D levels ( $\geq 30$  ng/mL). Among women with sufficient vitamin D, 13% of cycles were anovulatory compared to 16% of cycles in women with insufficient levels ( $p=0.08$ ). Yet, in adjusted models, vitamin D was not associated with anovulation (RR 1.04, 95% CI 0.95, 1.14 per 10 ng/mL increase; RR 1.03, 95% CI 0.82, 1.30 for  $<30$  ng/mL versus  $\geq 30$  ng/mL). **Conclusions:** We observed that vitamin D concentrations were not associated with the risk of anovulation among women with proven fecundity. These data suggest that the potential effect of vitamin D on fertility may not be relevant among healthy, fecund women, or alternatively, may not be mediated through ovulation.

### P1.3

Association of higher androgen and anti-Müllerian hormone with fecundability: a study of a PCOS-related characteristics in fecund women attempting pregnancy

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Polycystic ovary syndrome (PCOS) is the most common cause of infertility in women but the impact of its characteristic endocrine features in healthy women is uncertain. The current aim was to examine if rates of anovulation, pregnancy incidence, time to pregnancy, and pregnancy loss were associated with higher testosterone (T) and/or anti-Müllerian hormone (AMH) in healthy women with proven fecundity. A prospective cohort study was conducted as a secondary analysis of the Effects of Aspirin in Gestation and Reproduction randomized trial (2007-2012, ClinicalTrials.gov, NCT00467363). Participants were healthy, eumenorrheic women ages 18-40 with a history of 1-2 prior pregnancy losses, 0-2 prior live births, and no known PCOS or infertility, attempting spontaneous pregnancy for up to six menstrual cycles. Women were categorized by baseline T and AMH serum concentrations; the highest quartile for each was “high” and remaining quartiles were “low,” forming four groups: low T/low AMH (n=742), low T/high AMH (n=156), high T/low AMH (n=157), and high T/high AMH (n=143). Log-binomial regression models estimated risk ratios (RR) and 95% confidence intervals (CI) for anovulation, hCG-detected and clinical pregnancy, and pregnancy loss, relative to low T/low AMH. Discrete Cox proportional hazard regression models estimated fecundability odds ratios (FOR) relative to low T/low AMH. All models adjusted for age, BMI, and current smoking. Women with high T/high AMH had greater anovulation (RR 1.58, 95%CI 1.04, 2.41) compared to low T/low AMH. However, incidence of hCG-detected and clinical pregnancy, pregnancy loss, and time to pregnancy were not different in any group relative to low T/low AMH. A continuum of mild inefficiency in reproductive function may be related to higher T and AMH in women with normal menstrual cycles, but perturbations linked to greater sporadic anovulation did not translate to significantly altered time to pregnancy or pregnancy loss risk in healthy women.

### P1.4-S

First trimester bleeding and fetal growth

Alaina Bever, Sarah Pugh, Sungduk Kim, Roger Newman, Edward Chien, William Grobman, Deborah Wing, Hanyun Li, Paul Albert, Katherine Grantz\*

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Meta-analyses suggest that vaginal bleeding (VB) is associated with a greater frequency of fetal growth restriction (FGR) although data are heterogeneous. Less is known about the relation of VB with individual fetal biometric measures or the gestational timing of its impact. Our objective was to assess the relationship between first trimester VB and fetal growth trajectories in 2,334 non-obese, healthy, low-risk women enrolled in the NICHD Fetal Growth Study-Singletons. Longitudinal measures of fetal head circumference (HC), abdominal circumference (AC), and femur length (FL) were obtained in up to 6 study visits, and estimated fetal weight (EFW) was computed (Hadlock, 1985). The duration of VB was self-reported via questionnaire at enrollment (10w0d to 13w6d) and categorized for analysis as 0, 1, 2-4, >4 days. Fetal growth curves were created from linear mixed models with cubic splines and significance among groups was evaluated with global and pairwise weekly comparisons beginning at 14 weeks, with adjustment for maternal age, weight, height and parity, and racial/ethnic group. In 2,321 women with complete ultrasound and bleeding data, 412 (17.7%) reported first trimester VB, of whom 43.2% bled for 1 day, 31.5% for 2-4 days, and 25.2% for >4 days. Compared with no bleeding, women with 2-4 days of VB demonstrated minimal increases in HC at 14 weeks, AC at 14-15 weeks, and FL from 14-17 weeks, and a reduction in AC from 34 to 39 weeks (weekly  $P<0.05$ ); > 4 days of VB was associated with similar patterns and magnitudes although mostly not statistically significant. For women with 2-4 days of VB compared with no bleeding, EFW was 3g larger from 14 to 15 weeks, but 78-114g smaller from 35 to 38 weeks (weekly  $P<0.05$ ). In a healthy cohort of singleton pregnancies, first trimester VB was associated with smaller AC and EFW late in pregnancy without differences in HC or FL, a pattern of asymmetrical fetal growth restriction commonly associated with placental dysfunction.

P1.5-S

A Longitudinal Study of Plasma Acylcarnitines and Risk of Gestational Diabetes in a Diverse Cohort

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Abnormal levels of acylcarnitines may be indicative of impaired beta-oxidation and mitochondrial dysfunction, and have been implicated in disrupted glucose homeostasis. However, prospective and longitudinal data on the roles of acylcarnitines in the development of gestational diabetes (GDM) is lacking. We prospectively investigated individual and subclasses of acylcarnitines in relation to subsequent GDM risk in a case-control study within the NICHD Fetal Growth Studies-Singleton cohort. A total of 107 GDM cases confirmed by OGTT results and 214 non-GDM controls matched on age, race/ethnicity, and gestational week (GW) at blood draw were included in the study. We measured levels of 28 acylcarnitines using plasma samples collected through pregnancy at GW 10-14, 15-26, 23-31, and 33-39. We further derived scores of short-, medium- and long-chain acylcarnitines for each participant by chain length (i.e. carbon chains  $\leq 7$ , 8-14, and  $\geq 16$ , respectively). Adjusted odds ratio (OR) and 95% confidence interval (CI) for GDM risk were estimated using conditional logistic regression adjusted for pre-pregnancy body mass index (BMI) and other risk factors. Long-chain acylcarnitines during both first and second trimester were significantly and positively associated with subsequent GDM risk. At GW 10-14, the adjusted OR of GDM comparing the highest vs. lowest quartile was 2.52 (95% CI: 1.15-5.51) (P for trend=0.004). Corresponding adjusted OR at GW 15-26 was 3.31 (95% CI: 1.33-8.21) (P for trend=0.003). No significant associations were observed for short- or medium- chain acylcarnitines. In conclusion, we demonstrated that a metabolomics signature of increased level of long-chain acylcarnitines in early and mid-pregnancy was associated with subsequent GDM risk, and further highlighted the potentially differential roles of acylcarnitines of various chain lengths in GDM development.



#### SP1.1-S

Physical Activity and Risk for Endometriosis and Uterine Fibroids: Findings from the Endometriosis, Natural History, Diagnosis, and Outcomes (ENDO) Study

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Physical activity has been described as the “polypill” for many chronic diseases, but its effect on gynecologic pathology is unclear. We examined the link between exercise and incident diagnosis of endometriosis and prevalent uterine fibroids. 473 premenopausal women undergoing laparoscopy regardless of indication were enrolled and completed the International Physical Activity Questionnaire (IPAQ) at baseline. Surgeons captured post-operative gynecologic diagnoses using gold-standard methodology. We calculated adjusted relative risks (aRR) of endometriosis and fibroids by IPAQ physical activity level controlling for age, race, income, education, BMI, gravidity, marital status, and serum cotinine. 42% of women had an endometriosis diagnosis; 16% had fibroids. 18% had low, 36% had moderate, and 46% had high levels of physical activity. No associations were found among women with moderate (aRR: 1.06 [95%CI: 0.61, 1.95] or high (aRR: 1.11 [95%CI: 0.65, 1.88]) vs low physical activity and endometriosis. Similarly, a null effect was found for moderate (aRR: 0.83 [95%CI: 0.47, 1.43] or high (aRR: 0.74[95%CI: 0.42, 1.31]) vs low physical activity and fibroids. There were no significant associations between metabolic equivalent (MET) min/wk sitting, walking, moderate activity, and total physical activity and endometriosis or fibroids. Vigorous activity was inversely linked with fibroids at 640–1080 MET min/wk vs <640 MET min/wk: aRR: 0.53 (95%CI: 0.28, 0.99); but no clear dose response was found: aRR: 0.97 (95%CI: 0.59, 1.6) for 1081–2400 MET min/wk and aRR: 0.56 (95%CI: 0.25, 1.36) for > 2400 MET min/wk vs <640 min/wk (P-trend=0.18). While overall physical activity does not appear to be associated with endometriosis or fibroids, vigorous activity may play a role in reduced fibroid risk. Future research capturing physical activity both at the time of diagnosis and historically is needed to better understand the causal role that exercise may play in gynecologic pathology.

#### SP1.2

Do prior gynaecological procedures increase risk of placenta accreta?

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Background: Placenta accreta, (and increta and percreta) involve abnormal adherence of the placenta to the myometrium. Although usually associated with prior caesarean, evidence of accreta among nulliparous women suggests other factors may increase risk. This study aimed to evaluate the effect of prior invasive gynaecological procedures on risk of placenta accreta. Methods: Population-based data linkage study including all primiparous women birthing in New South Wales, Australia, between 2003 and 2012. Data were from linked birth and hospital admissions, with a minimum lookback period of two years. Placenta accreta was identified through an ICD-10AM-specific diagnosis code. Prior invasive procedures included curettage and evacuation, hysteroscopy, biopsy and excision, gynecological laparoscopy with instrumentation. Modified Poisson regression was used to determine the effect of the number of prior gynecological procedures on risk of placenta accreta. Relative risks (RR) with 99% confidence intervals are presented. Results: Placenta accretas (n=865) were identified among 381,499 deliveries (22.7/10,000). Among women with placenta accreta, 152 (17.6%) had undergone at least one procedure, compared to 33,094 (8.7%) among women without placenta accreta (p<0.001). After adjustment for demographic and pregnancy factors there was a dose response between number of prior surgeries and subsequent accreta development: for 1 procedure RR was 1.5 (CI 1.1-2.0), for 2 procedures RR 2.7 (1.7-4.4), and for ≥3 procedures RR 5.1 (99% CI: 2.7-9.6). Conclusion: Women with a history of prior invasive gynecological procedures were more likely to develop placenta accreta. These insights may be used to inform management of pregnancies with a history of gynecological procedures.

#### SP1.3-S

The impact of neighborhood deprivation on gestational weight gain by maternal pre-pregnancy body mass index and race/ethnicity

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Background: Gestational weight gain (GWG) outside the recommended ranges puts women at higher risk for pregnancy complications and adverse birth outcomes. Environmental factors including neighborhood deprivation may influence GWG. Our study 1) examined the impact of neighborhood deprivation on GWG, 2) identified if the association varied by pre-pregnancy body mass index (BMI) and 3) determined if the association varied by race/ethnicity. Methods: The American Community Survey was used to create a deprivation index that was merged to Florida vital statistics for 2006 to 2014. Neighborhood deprivation was measured by census tract across Tampa, Orlando, Jacksonville and Miami. Bivariate analyses were conducted to examine GWG and neighborhood deprivation by maternal characteristics. Multilevel logistic regression modeling was performed to determine the association between level of neighborhood deprivation and GWG. Interaction terms were tested to determine if results varied by pre-pregnancy BMI and race/ethnicity. Results: After adjusting for maternal characteristics, mothers living in the most deprived neighborhoods had a 31% increased risk of inadequate GWG (OR=1.31, 95% CI=1.27-1.34) and were protected against excessive GWG (OR=0.95, 95% CI=0.93-0.97) compared to women living in the least deprived neighborhoods. No difference in inadequate GWG was observed between obese mothers from least and most deprived neighborhoods while obese mothers from least deprived neighborhoods had a 14% increased risk of excessive GWG (OR=1.14, 95 %CI=1.09-1.19). Women in the most deprived neighborhoods had a higher risk of inadequate GWG across all race and ethnic groups while only Non-Hispanic White women had a higher risk of excessive GWG. Conclusion: Neighborhood deprivation is an important risk factor for GWG that varies by maternal characteristics. Supporting women's health throughout the lifespan is essential to achieving healthy pregnancy outcomes.

#### SP1.4

Maternal Cerebrovascular Complications in Relation to Placental Abruption: A Population-Based Cohort Study

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Background: Cerebrovascular diseases from apoplexia cerebri, or with hemorrhage- or ischemia-related etiologies reflect dysfunction of the hemostatic system. Uteroplacental ischemia and hemorrhage are the underlying hallmarks of abruption. If so, similarities in the underpinnings between abruption and cerebrovascular complications would suggest increased risks of cerebrovascular mortality and morbidity in women whose pregnancies are complicated by abruption. Methods: We performed a prospective cohort analysis to examine the risks of mortality and morbidity from cerebrovascular complications in relation to abruption among women that delivered in Denmark (1978-2010). To identify women with cerebrovascular complications and deaths, the National Patient and Causes of Death registries were linked to the Danish Birth Registry. We fit Cox proportional hazards regression models to estimate hazards ratio (HR) and 95% confidence interval (CI) of cerebrovascular outcomes in relation to abruption, following adjustments for delivery year, parity, education, and smoking. Results: The median (interquartile range) follow-up in the non-abruption and abruption groups was 15.9 (16.0) and 16.2 (13.5) years, respectively among 828,289 women (13,231,559 person-years of follow-up). Rates of cerebrovascular mortality were 0.8 and 0.5 per 10,000 person-years among women with and without abruption, respectively (HR 1.6, 95% CI 0.9, 3.0). Abruption was associated with increased risks of cerebrovascular morbidity from all 3 etiologies of the same magnitude. The risks of cerebrovascular mortality and morbidity were increased when abruption was associated with delivery at <34 weeks, or when accompanied by ischemic placental disease. Conclusions: This study suggests that cerebrovascular complications may have its first manifestations in pregnancy. Disruption of the hemostatic system due to uteroplacental ischemia and hemorrhage may portend shared etiologies between abruption and cerebrovascular complications.

#### SP1.5

##### Metabolomics Signatures Associated with an Oral Glucose Challenge in Pregnant Women

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**Background and objectives:** The oral glucose tolerance test (OGTT), widely used as a gold standard for gestational diabetes mellitus (GDM) diagnosis, provides a broad view of glucose pathophysiology in response to a glucose challenge. We conducted the present study to evaluate metabolite changes before and after an oral glucose challenge in pregnancy; and to examine the extent to which metabolites may serve to predict GDM diagnosis in pregnant Peruvian women (N=100) attending prenatal clinics (mean gestation 25 weeks). **Methods:** Serum samples were collected immediately prior to and 2-hours after administration of an 75-g OGTT. Targeted metabolic profiling was performed using a LC-MS based metabolomics platform. Changes in metabolite levels were evaluated using paired Student's t tests and their change patterns were examined at the pathways levels. Multivariate regression procedures were used to examine metabolite pairwise differences associated with subsequent GDM diagnosis. **Results:** Of the 306 metabolites detected, the relative concentration of 127 metabolites were statistically significantly increased or decreased 2-hours after the oral glucose load (FDR corrected p-value <0.001). We identified relative decreases in acylcarnites, fatty acids and diacylglycerols pathways while relative increases were noted in bile acids pathways. In addition, we found that C58:10 triacylglycerol ( $\beta=-0.08$ , SE=0.04), C58:9 triacylglycerol ( $\beta=-0.07$ , SE=0.03), adenosine ( $\beta=0.70$ , SE=0.32), methionine sulfoxide ( $\beta=0.36$ , SE=0.13) were significantly associated with GDM diagnosis even after adjusting for age and BMI. **Conclusions:** We identified alterations in maternal serum metabolites, representing distinct cellular and metabolic pathways including mitochondrial dysfunction and fatty acid metabolism, in response to an oral glucose challenge. These findings offer novel perspectives on the pathophysiological mechanisms underlying GDM.

# Plenary Session 2

## P2.1-S

Associations of autism spectrum disorder with residential air pollution exposure in a large Southern California pregnancy cohort  
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**Background:** Autism spectrum disorder (ASD) prevalence has increased over several decades. Recent research suggests that ASD may occur in association with regional and near-roadway air pollution exposures. We evaluated the associations of ASD risk with prenatal exposure to regional air pollutants, including particulate matter (PM)  $\leq 2.5$   $\mu\text{m}$  in aerodynamic diameter (PM<sub>2.5</sub>),  $\leq 10$   $\mu\text{m}$  (PM<sub>10</sub>), nitrogen dioxide (NO<sub>2</sub>), and ozone (O<sub>3</sub>). **Methods:** We retrospectively identified a cohort of children born in Kaiser Permanente Southern California (KPSC) hospitals between 1995 and 2009 (n=294,637) from electronic medical records. Birth certificate addresses were geocoded and used as the residential locations where birth-year annual average exposure to PM<sub>2.5</sub>, PM<sub>10</sub>, NO<sub>2</sub>, and O<sub>3</sub> were estimated by inverse distance weighting to the network of Southern California monitoring stations, and distances to major roadways and freeways were calculated. ASD diagnosis was defined based on ICD-9 diagnostic codes from  $\geq 2$  separate KPSC hospital visits. Relative risks of ASD were estimated by hazard ratios (HRs) using Cox regression models adjusted for potential confounders. **Results:** There were 2414 children with a diagnosis of ASD by age 5. After adjusting for birth year, maternal age, parity, education, household income, race/ethnicity, history of comorbidities, child sex, and KPSC medical centers, HRs associated with increase per interquartile range of the distribution of each pollutant were 1.18 (95% confidence interval [CI], 1.05-1.34) per 8.74  $\mu\text{g}/\text{m}^3$  PM<sub>2.5</sub>; 1.10 (95% CI, 1.00-1.21) per 11.3  $\mu\text{g}/\text{m}^3$  PM<sub>10</sub>; 0.95 (95% CI, 0.85-1.07) per 11.9 ppb NO<sub>2</sub>; and 0.79 (95% CI, 0.71-0.88) per 10.8 ppb O<sub>3</sub>. No associations of residential distance to major roadways and freeways were observed. **Conclusion:** Prenatal exposure to PM<sub>2.5</sub> and PM<sub>10</sub>, were associated with risk of ASD in children from a large, prospectively analyzed birth cohort in Southern California. Inverse associations with O<sub>3</sub> merit further investigation.

## P2.2

Mid-pregnancy unconjugated estriol and its association with childhood ADHD symptoms  
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Low levels of mid-pregnancy serum unconjugated estriol (uE3) have been associated with adverse pregnancy outcomes, even in the absence of chromosomal anomalies. There is speculation that unexplained low uE3 ( $< 10$ th percentile) may also be associated with adverse neurodevelopmental outcomes, but evidence to date is scant. To address this issue, we examined the association between unexplained, low uE3 (15-22 weeks' gestation) and childhood ADHD symptoms using data from the Pregnancy Outcomes and Community Health (POUCH) Study. We included children whose mothers had available uE3 data and completed the Conners' Parent Rating Scales (CPRS) (N=766: children's ages: 3-9 years). The CPRS yields age- and sex-referenced T-scores for two dimensions of attention problems (inattention, hyperactivity) and an index reflecting the combination of these dimensions (ADHD Index). Using separate general linear models, we investigated whether low uE3 ( $< 10$ th percentile:  $< 0.7$  multiples of the median (MoM)) was associated with each ADHD symptom dimension. Low uE3 was associated with higher hyperactivity and ADHD Index scores (mean difference=3.9, 95%CI 0.4, 7.4; mean difference=3.6, 95%CI 0.8, 6.4, respectively). Findings were unattenuated following adjustment for maternal body mass index and socio-demographics, maternal hypertensive disease, birth outcomes, and maternal symptoms of psychopathology at the child survey. Findings also persisted after applying clinically-informed behavioral symptom cutoffs (hyperactivity: aOR=1.9, 95%CI 1.2, 3.1; ADHD composite: aOR 1.8, 95%CI 1.1, 3.1). Unexplained, low uE3 levels at mid-pregnancy may be associated with higher levels of childhood ADHD symptoms. If replicated, research is needed to determine whether associations: 1) include neurodevelopmental disorders beyond ADHD, and 2) are explained by prenatal, antepartum, and/or postnatal factors associated with low uE3 levels.

### P2.3-S

#### Prenatal Urinary Triclosan Concentrations and Neurodevelopment Taylor Etzel\*

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**Background:** Triclosan is an antimicrobial chemical used in some consumer products. Triclosan exposure is ubiquitous among pregnant women, and prenatal exposure may reduce the levels of thyroid hormones important for neurodevelopment. **Objectives:** We examined the association between prenatal triclosan exposure and children's neurobehavior at three years of age. **Methods:** We measured triclosan in urine samples collected at ~12 weeks of gestation in 794 Canadian women enrolled in a prospective pregnancy and birth cohort study (MIREC) from 2008-2011. Around 3 years of age, children's cognitive abilities were assessed using the Wechsler Primary and Preschool Scale of Intelligence-III (WPPSI-III) and two scales of the Behavior Rating Inventory of Executive Function-Preschool (BRIEF-P). Parents reported children's behavior using the Behavior Assessment System for Children-2 (BASC-2) and Social Responsiveness Scale-2 (SRS-2). We used multivariable linear regression to estimate the covariate-adjusted association between prenatal urinary triclosan concentrations and neurobehavioral outcomes, as well as sex-specific associations. **Results:** Triclosan was not associated with SRS-2 or BRIEF-P scores, and child sex did not modify these associations. A 10-fold increase in triclosan concentration was associated with better scores for WPPSI-III picture completion ( $\beta: 0.2$ ; 95% CI: 0, 0.5), BASC-2 externalizing problems ( $\beta: -0.5$ ; 95% CI: -1.1, 0), and BASC-2 hyperactivity ( $\beta: -0.6$ ; 95% CI: -1.2, -0.1); these associations were not modified by child sex. However, child sex modified several other associations with BASC-2 scores (TCS x sex p-values  $\leq 0.1$ ). A 10-fold increase in triclosan was associated with a 1 point (95% CI: -1.9, -0.2) better somatization score in girls, but no association among boys. **Conclusions:** In this cohort, prenatal urinary triclosan concentrations were weakly associated with some aspects of neurodevelopment, but not in the hypothesized direction.

### P2.4-S

#### Neonatal Jaundice in Association with Autism Spectrum Disorder Christina Cordero\*

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**Background:** Neonatal jaundice is the most common complication in the neonatal period and has been inconsistently associated with autism spectrum disorder (ASD). Neonatal jaundice can be indicative of high bilirubin levels that can damage the developing brain, and merits further investigation in association with ASD. **Methods:** We analyzed data from the Study to Explore Early Development, a multi-site, case-control study. Children born from 2003-2006 were enrolled at 2 to 5 years of age. Developmental assessment in the clinic was used to classify children into three groups based on presence of ASD (n=697), a wide-range of non-ASD developmental delays or disorders (DD; n= 886), or non-ASD controls (POP; n=978). Neonatal jaundice was identified from neonatal medical records and maternal interviews. Hyperbilirubinemia was classified using the Bhutani nomogram to identify bilirubin levels in the 95th percentile, when available in the medical record. We examined the associations between neonatal jaundice and case status (ASD and DD relative to POP) using multivariable logistic regression models to obtain odds ratios adjusted (aOR) for sex, race/ethnicity, site, maternal age, maternal education, maternal diabetes, plurality, and parity. **Results:** From a sample of 2,561 children, we identified 1,239 with neonatal jaundice. Of infants born  $\geq 35$  weeks gestation, 88 were classified as having hyperbilirubinemia. Our results showed interaction between gestational age and neonatal jaundice. Neonatal jaundice was associated with both ASD and DD among children born  $< 35$  weeks (ASD aOR=3.05 (95% CI 1.00, 9.25)) and 35-37 weeks gestation (ASD aOR=1.83 (95% CI 1.05, 3.19)), but not  $\geq 38$  weeks (ASD aOR=0.97 (95% CI 0.76, 1.24)). Similar results were observed with hyperbilirubinemia. **Conclusions:** Further studies are needed to investigate the role of timing and severity of neonatal jaundice in association with ASD and DD in preterm children, appropriately accounting for interaction by gestational age.

## P2.5-S

Maternal use of acetaminophen and attention-deficit/hyperactivity disorder in offspring: A negative exposure control analysis  
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**Background:** Acetaminophen (paracetamol) is a first-line pain and fever medication recommended for pregnant women. Recent European birth cohort studies linked pregnancy use of acetaminophen with higher risk of neurobehavioral disorders in childhood. This association has not been assessed in a US population. Evidence to help rule out uncontrolled confounding would strengthen the argument for causality of the link. **Methods:** We examined the association between maternal regular use of acetaminophen and diagnosis of attention-deficit/hyperactivity disorder (ADHD) in 33,635 children of the Nurses' Health Study (NHS) II cohort, born between 1988-2006. Acetaminophen use was prospectively queried in biennial questionnaires. Child's ADHD diagnosis was reported in 2013. We estimated the effect of maternal regular acetaminophen use at the time of the pregnancy on ADHD risk in offspring, and compared that with acetaminophen use 3-5 years before or after the pregnancy as negative control exposure periods. Generalized linear models were used to estimate odds ratios (OR) and 95% confidence intervals (CI) adjusted for measured potential confounding factors. **Results:** Maternal acetaminophen use at the time of the pregnancy was positively associated with ADHD risk in the offspring (OR=1.11 95% CI 0.99-1.23); the association was stronger in analyses restricting to children whose mothers were pregnant with them at the time they responded to the questionnaire (OR=1.38 95% CI: 1.04-1.83). Acetaminophen use 3-5 years before or after the pregnancy was not associated with ADHD. In addition, no consistent patterns were found for maternal regular use of aspirin and other pain or fever medications at the time of the pregnancy and child ADHD risk. **Conclusions:** Our findings strengthen the evidence suggesting pregnancy exposure to acetaminophen may be causally related with ADHD in the offspring, and specifically provide evidence that time-invariant factors like maternal genetics, chronic illnesses or familial/social factors do not account for this association.

## Student prize-S

Thyroid hormones and menstrual function in a longitudinal cohort of premenopausal women

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**Background:** The relationship between thyroid function and female reproductive physiology is complex. Previous studies have reported that hyperthyroid and hypothyroid women are more likely to experience menstrual irregularities compared with euthyroid women, but the mechanisms for this are not well understood. In a prospective cohort study of 93 premenopausal women, we characterized the relationship between subclinical thyroid hormone concentrations and prospectively collected menstrual function outcomes among euthyroid women. **Methods:** Between 2004-2014, premenopausal women not lactating and not currently taking hormonal medications were recruited to participate in a study that measured menstrual cycle function. Thyroid hormones (thyroid-stimulating hormone, total and free thyroxine (T4) and triiodothyronine) were measured in serum before the menstrual function study began. Women collected first morning urine every day for three menstrual cycles and completed a daily diary with information on bleeding. Estrogen and progesterone metabolites (estrone-3-glucuronide (E13G) and pregnanediol-3-glucuronide (Pd3G)) and follicle-stimulating hormone were measured in the urine and adjusted for creatinine (Cr). **Results:** Total T4 was positively associated with Pd3G and E13G. Women with higher (vs. lower) total T4 had greater luteal phase maximum Pd3G (Pd3G=11.7  $\mu$ g/mg Cr for women with high T4 vs. Pd3G=9.5 and 8.1  $\mu$ g/mg Cr for women with medium and low T4, respectively) and greater follicular phase maximum E13G (E13G=41.7 ng/mg Cr for women with high T4 vs. E13G=34.3 and 33.7 ng/mg Cr for women with medium and low T4, respectively ( $p<0.01$ )). **Conclusions:** Subclinical levels of circulating thyroid hormones were associated with subtle differences in menstrual function outcomes in a sample of healthy women.

# Plenary Session 3



### P3.1

Pre-discharge and early infancy growth in relation to overweight or obesity at age 14 in very low birth weight infants  
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**Background:** Rapid growth in early life is associated with childhood obesity, but it is not known whether this association applies to very low birth weight infants (VLBW), for whom rapid growth is encouraged during infancy. In this study we examined the rate of growth during infancy in relation to overweight or obesity during adolescence among individuals born with VLBW. **Methods:** Study participants (n= 128) were recruited from a regional perinatal center, identified from singleton, consecutive births at VLBW ( $\leq 1500$  grams) between 1992 and 1996. Participants comprise an on-going prospective cohort study of VLBW. We examined catch up growth (z-score change  $>0.67$ ) and catch down growth (z-score change  $> -0.67$ ) relative to no change in z-score (change between  $-0.67$  and  $0.67$ ) for head circumference, length and weight from birth to discharge and discharge to 12 months corrected age in relation to overweight or obesity at age 14. Measurements at birth, discharge and 12 months corrected age were obtained from medical records. Height and weight were measured at age 14 with a standardized approach. Z-scores were calculated from Fenton infant growth standards and WHO child growth standards. Generalized linear models (log link, binomial distribution) were used to estimate relative risks for overweight/obesity (adjusted for breastfeeding, and also maternal education and race for post discharge growth). Pre-discharge associations were also adjusted for gestational age at birth. **Results:** Pre-discharge growth was not associated with overweight or obesity. Catch-up growth in weight, post-discharge, was associated with an increased risk of overweight or obesity (aRR: 1.7; 95% CI: 1.1, 2.7) at age 14 years. **Conclusion:** Catch up growth in weight in infancy, post-discharge, in VLBW infants, relative to no change in z-score, may be associated with increased risk for overweight or obesity in adolescence. Moderating VLBW infant growth may reduce risk of overweight or obesity.

### P3.2

Is the association between pregnancy weight gain and fetal size causal? Re-examining the association using a sibling comparison design

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Observational cohort studies have consistently shown that maternal weight gain in pregnancy is positively associated with fetal size, but it is unknown if the association is causal. The objective of this study was to investigate the causal effect of pregnancy weight gain on fetal growth using a sibling comparison design to control for unmeasured confounding by genetic and shared environmental or lifestyle factors. Our study population included 44,457 infants (21,680 women) whose electronic medical records were contained in the Stockholm-Gotland Obstetrical Database, 2008-2014. Pregnancy weight gain was standardized into gestational age-specific z-scores. Fetal size was classified as birthweight in grams (adjusted for sex and gestational age), and as small- and large-for-gestational age birth (SGA and LGA; birthweight  $<10$ th or  $>90$ th percentile, respectively). Sibling comparison analyses were conducted using multivariable linear fixed effects models for birthweight and hybrid logistic fixed effects models for SGA/LGA birth. Results were compared to conventional regression analyses. An interaction term between weight gain z-score and early pregnancy body mass index (BMI) allowed the effect of weight gain to vary by BMI. For all three fetal size outcomes, point estimates from sibling comparison analyses were modestly attenuated compared with point estimates from the conventional analyses, but confidence intervals all overlapped (e.g., adjusted difference of +89g [83-96g] per 1 z-score increase in the sibling comparison vs. +97g [95% CI: 92-101g] per 1 z-score increase in weight gain in the conventional approach; adjusted risk ratios for SGA of 0.79 [0.73-0.84] vs. 0.70 [0.67-0.73], respectively for a woman with BMI of 25). These findings were consistent across the range of BMIs. Our findings suggest that the previously-observed association between pregnancy weight gain and fetal size has minimal confounding by unmeasured genetic, environmental, or lifestyle factors.

### P3.3-S

The role of preterm birth and fetal growth as joint mediators of the relationship between maternal smoking and neonatal death.  
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An intermediate variable lies on the causal pathway between exposure and outcome. Most methods for mediation analyses focus on estimating the role of a single mediator when calculating direct/indirect effects. When multiple mediators operate on the same causal path, estimating direct/indirect effects separately can lead to incorrect conclusions about the sum of the mediated effects. Estimating a single joint mediated effect to assess the contributions of additional mediators avoids this problem. Our study objective was to assess the role of preterm birth (PTB) and small-for-gestational age (SGA) as joint mediators of the effect of maternal smoking during pregnancy on neonatal death, using singleton live births and fetal deaths ( $n=14,733,834$ ) from the 2007-2010 US Vital Statistics birth cohort linked birth/infant death and fetal death datasets. Self-reported maternal smoking during pregnancy was categorized as non-smoker vs. smoker. GA was categorized as term ( $\geq 37$  weeks) vs. PTB ( $< 37$  weeks) and SGA was defined as live birth-based (standard) or non-customized ultrasound-based. The total effect of maternal smoking on neonatal death (death within 28 days of birth) was estimated with a log-binomial regression model. Natural direct (NDE) and indirect effects (NIE) were estimated using inverse probability weights (IPWs). Informative censoring by fetal death was addressed using IPWs in all models. The total effect of maternal smoking was  $RR=1.35$  (95% CI: 1.31-1.39). With PTB as a single mediator, the NDE of maternal smoking was  $RR=1.16$  (95% CI: 1.12-1.21) and the NIE was  $RR=1.22$  (95% CI: 1.17-1.26). With SGA as an additional mediator, the NDE was  $RR=1.07$  (95% CI: 1.03-1.11) and the NIE was  $RR=1.33$  (95% CI: 1.29-1.38). Results suggest that the proportion of the total effect mediated is increased when PTB and SGA are considered as joint multiple mediators. Future analyses will include exposure-covariate interactions in the models.

### P3.4

Purposeful definition of infant rapid weight gain and the inclusion of confounders in predictive models increases its use as a screening tool for childhood obesity  
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Infant rapid weight gain (RWG) is defined as an increase in weight-for-age z-score (WAZ)  $> 0.67$ , and has been identified as a potentially useful predictor of childhood obesity. However, RWG is specified inconsistently. Much of the relevant research uses the Centers for Disease Control and Prevention (CDC) growth references rather than the currently recommended 2010 World Health Organization (WHO) growth standards to measure RWG, and the age intervals used to measure change vary. We used data from  $n=38,515$  singleton, live term births in Kaiser Permanente Northwest HMO members from 1996-2012 to address these concerns. The prevalence of RWG differed significantly (Exact McNemar's significance probability  $< 0.05$ ) between growth references (CDC v. WHO) for three key age intervals: 0-6 months (31.8% v. 21.2%), 6-12 months (3.4% v. 17.1%) and 0-12 months (19.9% v. 27.0%). The prevalence also differed by age interval within each growth reference (Cochran's Q tests,  $p < 0.05$ ). Simple logistic regressions, modeling RWG as a predictor of obesity at 36 months of age (BMI  $\geq 95$ th percentile using the CDC growth references recommended for children  $> 24$  months) for the subset of children with follow-up data ( $n=13,424$ ) showed RWG as a statistically significant independent variable within each model regardless of RWG specification, although none performed as a strong screening tool. Using the preferred WHO growth standard to define RWG, the area under the ROC curve was highest for the 0-12 month age interval (0.64). No other models exceeded this finding. Adding potential confounders (race, ethnicity, birth weight and pre-pregnancy maternal BMI), increased the area under the ROC curve for this model from 0.64 to 0.77, with pre-pregnancy maternal BMI as the primary contributor. Purposeful definition of infant RWG and the inclusion of confounders in predictive models improves the validity of RWG as a screening tool for childhood obesity.

## SP2.1

### Attention-Deficit Hyperactivity Disorder Medication Use During Pregnancy and Risk for Birth Defects - United States, 1997-2011

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**Background:** Attention-deficit hyperactivity disorder (ADHD) is a neurodevelopmental disorder affecting individuals across the lifespan, including an estimated 10 million adults. Given increasing diagnosis and treatment of ADHD, rates may be increasing among pregnant women. Little is known about ADHD medication safety during pregnancy. **Analysis objectives** were to assess prevalence of overall ADHD medication use (i.e., psychostimulant and non-stimulant medications) at any time during pregnancy and estimate associations between early pregnancy use (one month before through third month of pregnancy) and specific birth defects. **Methods:** We analyzed data from the National Birth Defects Prevention Study (1997–2011), a U.S. population-based multicenter case-control study. Birth defects surveillance systems were used to identify cases (n=32,000); controls were randomly-sampled live-born infants without major defects representing the same geographic regions (n=11,892). Mothers of cases and controls completed a computer-assisted telephone interview. We calculated prevalence of ADHD medication use anytime during pregnancy and used logistic regression to estimate the association between early pregnancy ADHD medication use and 14 birth defects. For gastroschisis, we adjusted for maternal age. **Results:** Overall, 0.2% of women reported any ADHD medication use during pregnancy, and 20 control mothers and 65 case mothers reported early pregnancy use. Early pregnancy ADHD medication use was associated with gastroschisis (odds ratio [OR]: 3.24; 95% confidence interval [CI]: 1.32–7.92), omphalocele (OR: 3.99; 95% CI: 1.18–13.47), and transverse limb deficiency (OR: 3.23; 95% CI: 1.10–9.49) in infants. **Conclusions:** ADHD medication use during pregnancy was rare, but early use was associated with 3 of 14 birth defects investigated. Additional research is needed to confirm observations and help clinicians provide appropriate counseling to women of reproductive age who use ADHD medications.

## SP2.2

### Benzene and Congenital Anomalies in Oklahoma Children, 1997-2009

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**Introduction:** In Oklahoma, the infant mortality rate due to congenital anomalies was the second highest in the US with 178 deaths per 100,000 live births from 2007-2013. As the natural gas industry has proliferated in this region, concerns about the potential health effects of benzene have increased. While benzene is known to affect the central nervous system, the effects on the developing fetus are unclear. **Methods:** We conducted a retrospective cohort study to evaluate the association between ambient benzene concentrations and the prevalence of congenital anomalies among 646,024 children born in Oklahoma from 1997–2009. We defined benzene exposure using estimates from the Environmental Protection Agency's 2005 National-Scale Air Toxics Assessment for the census tract of the birth residence. We used modified Poisson regression with robust standard errors to calculate prevalence proportion ratios (PPR) between quartiles of benzene exposure and any anomaly, neural tube defects, cardiovascular defects, and cleft lip/palate adjusted for maternal education and tobacco use. **Results:** We observed a modest increased prevalence of any anomaly among those exposed to the 2nd (0.33-<0.57 µg/m<sup>3</sup> PPR: 1.04, 95% CI: 1.00, 1.08), 3rd (0.57-<0.87 µg/m<sup>3</sup> PPR: 1.07, 95% CI: 1.03, 1.11), and 4th (≥0.87 µg/m<sup>3</sup> PPR: 1.08, 95% CI: 1.04, 1.12) quartiles of benzene concentrations compared to the 1st (<0.33 µg/m<sup>3</sup>). When examining specific anomalies, we observed an increased prevalence of cardiovascular anomalies among those with benzene exposures in the 3rd (PPR: 1.09, 95% CI: 1.02, 1.17) and 4th quartiles (PPR: 1.16, 95% CI: 1.09, 1.23) compared to the 1st quartile. We observed no association for neural tube defects or cleft lip/palate. **Discussion:** Our findings of increased cardiovascular anomalies among those residing in areas with higher ambient concentrations of benzene suggests that further investigation into specific sources of benzene exposure, including natural gas wells, is warranted.

### SP2.3

#### Association between Income Inequality, Structural Racism, and Preterm Birth Rates in Large US Counties

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Previous research suggests that structural racism—namely, the systemic exclusion of people of color from opportunities such as employment and education—may contribute to differences in health outcomes between Black and White Americans. Notably, one recent paper found significant associations between state-level indicators of structural racism and income inequality on the odds of small-for-gestational-age birth. Our analysis investigates whether these associations hold for preterm birth rates at the county level. Our sample consisted of 2010-2014 data for US counties with a population of 250,000 or more (n=1192). Using US Census Bureau data, we employed county-level Gini coefficients to measure income inequality and assessed structural racism using the ratios of Blacks to Whites who were (a) employed and (b) had a bachelor's degree or higher. Each indicator was dichotomized at the median, whereby counties that fell below the median (or above for Gini coefficients) were assigned to the high inequality group for that year. County-level preterm birth rates were obtained from the Centers for Disease Control. Generalized estimating equations models were used to quantify the associations between education, employment, and income inequality and preterm birth rates, while controlling for maternal health, demographic, and socio-economic differences. Consistent with prior research, our results indicate modest joint effects of structural racism and income inequality on preterm rates in areas where levels of both are high. However, these effects were present only for births to Black women. Our models predict that counties with high levels of both education and income inequality will have more preterm births (beta=0.44, 95% confidence interval=0.15-0.72) to Black non-Latina women each year than counties with low levels of both or just one type of inequality. Results were similar for counties with both high employment and income inequality (beta=0.38, 95% CI=0.13-0.63).

### SP2.4-S

#### Maternal and Child Polymorphisms in the Aryl Hydrocarbon Receptor Pathway and Birthweight in the Seveso Second Generation Health Study

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Introduction: 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) and other environmental chemicals are proposed to interfere with fetal growth via altered activity of the Aryl Hydrocarbon Receptor (AhR) pathway which regulates myriad biological and developmental processes including metabolism of xenobiotics. Genetic variation in the AhR pathway is an important driver of susceptibility to low birthweight in Japanese children exposed in utero to smoking. Little is known about genetic susceptibility in the AHR-pathway in relation to birth outcomes in populations of European ancestry and in interaction with other chemical exposures. Methods: The Seveso Women's Health Study (SWHS), initiated in 1996, is a cohort of 981 Italian women exposed to TCDD from an industrial explosion in the summer of 1976. In 2014-2016, we enrolled post-explosion offspring of the SWHS in the Seveso Second Generation Health Study. We genotyped mothers (n=407) and their children (n=478) in 58 single nucleotide polymorphisms (SNPs) from 7 candidate genes in the AHR-pathway. We measured TCDD concentrations in maternal serum. Birthweight was obtained from maternal report and confirmed with birth records in a subsample. We used multivariate generalized estimating equations (GEE) to model the associations between individual SNPs and child birthweight. Results: In preliminary analyses, we found 12 SNPs across four genes to be significantly associated with birthweight. One SNP (AHR, rs2066853), a known functional missense mutation, was associated with the largest reduction in birthweight, in models separately examining the mother and the child's genotypes [(adj-β=-205.1, 95% CI -324.3, -85.9) and (adj-β=-114.0, 95% CI -244.0, 15.9), respectively]. We will present analyses of gene-dioxin and polygenic associations with birthweight. Conclusions: We found that certain variants in xenobiotic metabolizing genes are associated with birthweight in Europeans. Next we will determine if there are gene-environmental interactions.

## SP2.5

Preoperative infections may reduce the risk of postoperative infections after surgical repair of hypospadias

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Hypospadias is a frequently occurring birth defect in boys, which needs surgical repair in the majority of cases. However, complication rates after hypospadias repair are substantial (up to 50%). Several factors have been studied for possible effects on the occurrence of postoperative complications, but the effects of preoperative illnesses in the weeks just before surgery are unknown. The aim of this retrospective cohort study was to determine the associations between preoperative medical conditions that are not severe enough to postpone surgery and short-term postoperative complications after hypospadias repair in children. Data were collected from the medical files of 681 boys with anterior or middle type hypospadias, who had initial one-stage repair between 1983 and 2012 in the Radboud university medical center, The Netherlands. The associations between medical conditions, such as common cold, fever, and ear infection within two weeks prior to surgery and postoperative complications, such as urethrocuteaneous fistula, wound dehiscence or infection, and urinary tract infection within two months and one year after surgery were analysed using multivariable logistic regression analyses. Of the 681 boys, 22.0% had a preoperative illness and 14.5% had a short-term postoperative complication. Contrary to expectation, children with a preoperative medical conditions developed fewer complications within two months or one year after surgery than children without preoperative medical conditions (OR 0.5, 95%CI 0.3-0.9 and OR 0.7, 95%CI 0.4-1.1). These reduced risks could for the most part be attributed to associations between preoperative and postoperative infections both within two months and one year (OR 0.4, 95%CI 0.1-1.0 and OR 0.3, 95%CI 0.1-0.9). Several hypotheses have been put forward to explain the observed protective effect on the occurrence of postoperative infections. However, independent replication of the results is needed before firm conclusions can be drawn.

# Plenary Session 4

#### P4.1

Risk of childhood cancers among children born with non-chromosomal major structural birth defects: A systematic review and meta-analysis

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One of the strongest risk factors for childhood cancer is being born with a chromosomal abnormality. However, the relationship between non-chromosomal birth defects and childhood cancer is less clear. We conducted a systematic review of studies evaluating the risk of cancer among children with non-chromosomal major structural birth defects. We searched 4 journal article databases for articles that included original estimates of the association between any birth defect (or at least one type) and childhood cancer (or at least one type). Eligible studies included a comparison group of infants without birth defects, and clinical verification of outcomes. Two authors independently performed eligibility review and abstraction. Of 2497 non-duplicate articles, 7 met eligibility criteria. There were 22 combinations of birth defects and cancers for which an estimate of the association was reported by at least 2 studies. Using random effects meta-regression, the summary hazard ratio (HR) for any non-chromosomal birth defect and any childhood cancer was 1.72 (95% CI 1.26, 2.18). The largest HRs for specific types of birth defects and any cancer were observed for anophthalmia/microphthalmia (HR=7.29; 95% CI 1.31, 13.28), respiratory defects (HR=4.11; 95% CI 2.55, 5.68) and central nervous system defects (HR=3.53; 95% CI 1.55, 5.51). The largest HRs for any birth defect and specific types of cancer were observed for germ cell tumors (HR=3.32; 95% CI 1.20, 5.44), neuroblastoma (HR=2.83; 95% CI 1.58, 4.08), and lymphoma (HR=2.20; 95% CI 1.22, 3.18). Our results indicate that children with a non-chromosomal major structural birth defect are more likely to develop cancer than children without these conditions. Larger studies are needed to identify associations between specific types of birth defects and specific cancers, which may inform our understanding of shared etiologies and improve cancer screening strategies for at-risk children.

#### P4.2-S

Distribution by week and trimester of onset among pregnant women, US Zika Pregnancy Registry, 2015- 2016

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Zika virus (ZIKV) infection during pregnancy can cause microcephaly and other brain abnormalities. The US Zika Pregnancy Registry (USZPR) began receiving data on pregnancies with laboratory evidence of possible ZIKV infection in early 2016 – most case reports have been travel associated. We assessed the distribution of possible ZIKV infections by week during 2016 and estimated the trimester of infection for cases reported to USZPR using symptom onset date, and if onset was missing or the woman was asymptomatic, earliest date of ZIKV RNA detection via RT-PCR in maternal blood or urine. Serologic tests for ZIKV are less useful for establishing timing of infection if a woman is asymptomatic or symptom onset is not reported. Among 1292 pregnancies with possible ZIKV infection reported to USZPR from US states and the District of Columbia, 526 women were symptomatic and/or had maternal ZIKV RNA detected. Among these reports, 363 had sufficient information to assess week of infection (symptom onset or specimen collection date). Since February 2016, the number of infections ranged from 1-18/week (median 6) with the greatest number occurring the week of July 7, 2016. For women with estimated date of delivery reported (n=340), median gestational age at ZIKV infection was 16 completed weeks (range -3–40 weeks); 44% (n=150) of infections occurred in the periconceptional period or first trimester, 40% (n=136) in second trimester, and 16% (n=54) in third trimester. Analyzing gestational age at ZIKV onset contributes to further understanding the epidemiology of ZIKV infection during pregnancy. Understanding when ZIKV infections occur during the calendar year even among travel-associated cases may inform planning needs related to increased monitoring and specialized care of pregnant women and their exposed offspring.

#### P4.3

##### Life-course Neighborhood Deprivation and Neonatal Mortality in California

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**BACKGROUND:** While neonatal mortality has declined nationwide, racial-ethnic disparities persist. Neighborhood socioeconomic characteristics across the maternal life-course have been related to preterm birth and low birth weight, but have not been examined in relation to neonatal mortality. **METHODS:** California birth cohort files for singleton births from 1997 to 2011 were linked to birth and newborn screening records of mothers born in California since 1982. Addresses from both generations were geocoded for 110,074 white, 48,841 black, and 253,082 Hispanic mothers. The marginal risk and risk difference (RD) for neonatal mortality per 1,000 accounting for confounders was estimated for each race ethnicity under various permutations of early life and adult exposure to high neighborhood deprivation, defined as the upper quartile of a standardized deprivation index. **RESULTS:** White mothers experiencing high early-life and high adult neighborhood deprivation had increased neonatal mortality compared to low life-course neighborhood deprivation (RD=2.2 [95% confidence interval (0.1, 4.2)]). Black mothers experiencing upward or downward neighborhood mobility had the highest overall risks of neonatal mortality (6.6 and 7.1 per 1,000, respectively), although not statistically significantly different from low life-course neighborhood deprivation (RD=2.0 [-0.2, 4.3] and RD=2.9 [-0.3, 5.5], respectively). Neonatal mortality was lower for first generation (3.0 per 1,000) than later generation Hispanic women (3.5 per 1,000), but varied little by life-course neighborhood deprivation. Under low life-course neighborhood deprivation, the black-white disparity in neonatal mortality was reduced by 46% compared to the observed disparity. **CONCLUSION:** Patterns of exposure to neighborhood deprivation across the life-course may partially explain the black-white disparity in neonatal mortality.

#### P4.4-S

##### The role of gestational age in the association between opioid maintenance therapy and neonatal abstinence syndrome

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**Background** Pregnant women treated with methadone as opioid maintenance therapy are more likely than women treated with buprenorphine to deliver preterm ( $\leq 37$  weeks gestation). Preterm birth is associated with less risk of neonatal abstinence syndrome (NAS). We sought to assess the role of gestational age as a mediator of the relationship between in utero exposure to methadone and NAS compared with buprenorphine. **Methods** We studied 716 women receiving methadone or buprenorphine as opioid maintenance therapy at Magee Womens Hospital (2013-2015). We implemented inverse probability weighted marginal structural models to isolate the role of preterm birth and estimate the total association and controlled direct effects of treatment on NAS. Weights accounted for confounding by maternal age, race, insurance, parity, delivery year, marital, employment, hepatitis c, and smoking status. We performed a secondary mediation analysis using the generalized product method to triangulate results. **Results** Approximately 57% of the cohort were treated with methadone, and 20% delivered preterm. The incidence of NAS was higher in methadone exposed infants (65 vs 49%), and term compared with preterm births (64 vs 36%). For every 100 live-born infants born to mothers treated for opioid dependence there were 13 excess cases of NAS among infants exposed to methadone compared with buprenorphine [adjusted risk difference (adjRD)=13, 95% CI: 5.7, 21]. Among term births, this increased to 17 excess cases of NAS in methadone- compared with buprenorphine-exposed [adjRD=17 (95% CI: 9.3, 24)]. This represents an estimated 25% increase in the association among term deliveries. Findings were similar on the relative scale and using the generalized product method. **Conclusion** Our results suggest that increased risk of NAS associated with methadone use versus buprenorphine in pregnancy is stronger in term deliveries. This emphasizes the utility of buprenorphine in a clinical setting aimed at decreasing NAS.



# Plenary Session 5

P5.1-S

A prospective study of pre-pregnancy intakes of folate and B vitamins and the risk of gestational diabetes  
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Objective: Folate and B vitamins are essential nutrients and play key roles in DNA and protein synthesis and homocysteine metabolism. Animal studies have related these nutrients to glucose metabolism. We aimed to prospectively examine associations of pre-pregnancy intakes of folate and B vitamins with risk of gestational diabetes (GDM). Method: We conducted a prospective cohort study of women in the Nurses' Health Study II (1991-2001), with a singleton pregnancy lasting longer than 6 months. Those with prior GDM, a prior diagnosis of T2DM, cardiovascular disease, or cancer were excluded. Pre-pregnancy folate and B vitamins intake was assessed through validated food frequency questionnaire. Log-binomial models with generalized estimation equations were used. Results: During 10 years of follow-up, 801 incident GDM cases were identified out of 14,878 singleton pregnancies. After multivariate adjustment, women in the lowest quartile of dietary total folate intake had a 59% higher risk of GDM (RR=1.59, 1.22-2.07, p trend=0.004), compared with women in the highest quartile of total folate intake. The inverse association was mainly due to folate from supplements and fortified cereals. A similar inverse association was observed for vitamins B2 and B6. Women in the lowest quartiles of vitamins B2 and B6 had a 33% (95% CI 5, 69%) and 31% (95% CI 3, 65%) higher risk of GDM compared to women in the highest quartile of intake. Results were robust among subgroups of women with natural pregnancies, women without a history of infertility, married women not currently using hormonal contraception, women younger than 40 years old when got pregnant, and only first eligible pregnancies. Conclusions: Contrary to previous studies, we found that lower pre-pregnancy folate and vitamins B2, and B6 intakes were associated with elevated risk of GDM. Our study highlights the potential importance of adequate folate and Vitamin B intakes among women in reproductive age for the prevention of GDM.

P5.2-S

Marginal Structural Models for Analyzing the Causal Effects of Social Support on Antepartum Depression  
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Objective: To assess the causal effects of hypothetical interventions on low social support prior to and during early pregnancy on antepartum depressive symptoms in late pregnancy. Methods: In 2012-2014, pregnant women (N=3,336) were recruited into a prospective cohort study during their first prenatal care visit (mean, 9 weeks gestation) in Lima, Peru. A follow-up interview was conducted during late pregnancy (26-28 weeks gestation). Social support satisfaction score and number of available support providers were measured using the Sarason Social Support Questionnaire-6 (SSQ-6); depressive symptoms were measured using the Edinburgh Postnatal Depression Scale (EPDS). Marginal structural models were fitted using inverse probability-of-treatment and censoring weights to assess the association between exposure to low social support and depressive symptoms in late pregnancy, after accounting for time-independent and time-dependent confounding. Results: Persistent low social support satisfaction (adjusted Odds Ratio, aOR=1.42, 95% Confidence Interval, CI 1.01-2.00) and low number of support providers (aOR=1.74, 95% CI 1.21-2.49) before and during early pregnancy were associated with increased odds of depressive symptoms in late pregnancy. The odds of experiencing depressive symptoms in late pregnancy were not significantly increased among women who reported low social support before and high social support during early pregnancy (low satisfaction: aOR = 0.94, 95% CI 0.73-1.21; low number of support providers: aOR=1.04, 95% CI 0.79-1.36). Conclusion: Our study reinforces the buffering effect of social support during pregnancy and underscores the need for future prenatal interventions targeted at providing adequate and effective social support to prevent depression in late pregnancy.

P5.3-S

Gestational weight gain and severe maternal morbidity  
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Suboptimal gestational weight gain increases the risk of many conditions that contribute to severe maternal morbidity, yet the direct association between these two factors has not been formally evaluated. We linked hospital administrative and chart abstraction data to develop this retrospective cohort of 90,305 singleton pregnancies delivered at 20-42 weeks gestation in Pittsburgh, PA (2003-2012). Severe maternal morbidity was defined as the presence of any of the ICD-9 disease or procedure codes outlined by the Centers for Disease Control and Prevention, intensive care unit admission, or prolonged length of stay (> 6 days for vaginal delivery and 11 days for Cesarean). Total gestational weight gain was standardized for gestational age and body mass index (BMI) into z-scores using locally-derived charts. BMI stratified, multivariable logistic regression models were used to test the association between gestational weight gain z-score category (<-1, -1 to +1, and >+1 standard deviation (SD)) and severe maternal morbidity adjusting for age, race/ ethnicity, parity, and other confounders. The risk of severe maternal morbidity was 2.3/100 delivery hospitalizations (95% confidence interval (CI): 2.2, 2.4), and increased as BMI rose from normal weight (1.9/100) to grade 3 obesity (4.6/100). Gestational weight gain z-score >+1 SD was associated with the highest unadjusted risk of severe morbidity (3.0/100) and -1 to +1 SD with the lowest (2.1/100). In normal weight women, a weight gain z-score >+1 SD (corresponding to >23kg at 40 weeks) was associated with an increased risk of severe maternal morbidity compared with z-score -1 to +1 SD (adjusted odds ratio 1.3 [1.1, 1.6]), but z-scores <-1 SD were not associated. Z-score was not related to severe maternal morbidity in any other BMI group. These results suggest that higher gestational weight gain may increase the risk of severe maternal morbidity among normal weight women, but may not be associated in other BMI groups.

P5.4

Human papillomavirus vaccination in pregnancy and adverse pregnancy outcomes  
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Background: The Department of Defense encourages service members, 26 years of age or younger, to receive the human papillomavirus (HPV) vaccine. Although this vaccine is not recommended in pregnancy, inadvertent vaccination may occur during late-recognized pregnancies. The objective of this study was to assess whether active duty U.S. military women who received the HPV vaccination during pregnancy, compared with those who did not receive the HPV vaccine during pregnancy, are at increased odds of adverse maternal outcomes. Methods: The study population included active duty U.S. military women aged 18-28 years who had at least one pregnancy between 2006 and 2010. Pregnancies and adverse outcomes were identified using medical codes in administrative medical records. Exposure to the HPV vaccine during pregnancy was ascertained from personnel immunization records. Multivariable survival analyses were used to estimate hazard ratios and 95% CIs for pregnancy loss, preeclampsia, and preterm labor among pregnancies exposed to the HPV vaccine versus those not exposed. Models were left truncated at the start of pregnancy care and right censored at the time of outcome. Results: The study population included 40,000-50,000 pregnancies, depending on the outcome assessed. Overall, approximately 2% of pregnancies were exposed to the HPV vaccination. Most exposed women were vaccinated before 4 weeks of pregnancy. Although preliminary results appear to indicate no increased risk for adverse outcomes in exposed pregnancies, analyses are ongoing. Conclusion: These preliminary findings provide reassurance that inadvertent HPV vaccination in pregnancy is not associated with adverse maternal outcomes. Still, to more fully explore this issue, continued efforts focus on determining the best approach for calculating length of pregnancies that did not end in a live birth and analyzing these outcomes of interest.

P5.5

Is 40 the New 30? Age-period-cohort effects in pre-existing and pregnancy-associated disease in primiparous women in the United States.

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**Introduction:** The rate of severe maternal morbidity/mortality has increased over time in the United States (US), and much of this increase has been attributed to advanced maternal age. While the average age at first birth has steadily increased in the US, relatively little attention has been paid to temporal changes in maternal health status. **Methods:** Deidentified data on primiparous women delivering a singleton liveborn infant in 1989, 1994, 1999, 2004, 2009, and 2014 were obtained from the US Natality Files (n=6,857,185). Maternal age was categorized into 5 year increments, and age-period-cohort effects in the prevalence of pre-existing medical conditions (i.e., chronic hypertension, pre-existing diabetes) and the incidence of pregnancy-associated diseases (i.e., pregnancy induced hypertension (PIH), eclampsia, gestational diabetes (GDM)) were examined. **Results:** While the prevalence of pre-existing conditions increased with maternal age, a higher rate of disease was seen over time in all age groups. From 1989-2014, the prevalence of chronic hypertension increased from 0.32% (0.30-0.35) to 0.56% (0.53-0.60) in 15-19 year olds and from 2.00% (1.84-2.16) to 2.66% (2.55-2.77) in 35-39 year olds. Consequently, 30-34 year olds delivering in 2014 (1.67%, 1.62-1.72) had the same prevalence of chronic hypertension that 35-39 years olds had in 1999 (1.68%, 1.57-1.80). Similar patterns were observed for PIH, GDM, and pre-existing diabetes; however, the opposite pattern was seen for eclampsia, which decreased in all groups over time. **Conclusion:** Women are increasingly entering pregnancy with poorer health and developing pregnancy-associated conditions at higher rates, suggesting factors other than advanced maternal age contribute to the increased rates of adverse pregnancy outcomes. Though maternal age is an important consideration, greater attention needs to be paid to the role of maternal health status when investigating temporal changes in adverse obstetric events.

# Poster Session A

PA001-S

Physical Activity and Risk for Endometriosis and Uterine Fibroids: Findings from the Endometriosis, Natural History, Diagnosis, and Outcomes (ENDO) Study

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Physical activity has been described as the “polypill” for many chronic diseases, but its effect on gynecologic pathology is unclear. We examined the link between exercise and incident diagnosis of endometriosis and prevalent uterine fibroids. 473 premenopausal women undergoing laparoscopy regardless of indication were enrolled and completed the International Physical Activity Questionnaire (IPAQ) at baseline. Surgeons captured post-operative gynecologic diagnoses using gold-standard methodology. We calculated adjusted relative risks (aRR) of endometriosis and fibroids by IPAQ physical activity level controlling for age, race, income, education, BMI, gravidity, marital status, and serum cotinine. 42% of women had an endometriosis diagnosis; 16% had fibroids. 18% had low, 36% had moderate, and 46% had high levels of physical activity. No associations were found among women with moderate (aRR: 1.06 [95%CI: 0.61, 1.95] or high (aRR: 1.11 [95%CI: 0.65, 1.88]) vs low physical activity and endometriosis. Similarly, a null effect was found for moderate (aRR: 0.83 [95%CI: 0.47, 1.43] or high (aRR: 0.74[95%CI: 0.42, 1.31]) vs low physical activity and fibroids. There were no significant associations between metabolic equivalent (MET) min/wk sitting, walking, moderate activity, and total physical activity and endometriosis or fibroids. Vigorous activity was inversely linked with fibroids at 640–1080 MET min/wk vs <640 MET min/wk: aRR: 0.53 (95%CI: 0.28, 0.99); but no clear dose response was found: aRR: 0.97 (95%CI: 0.59, 1.6) for 1081–2400 MET min/wk and aRR: 0.56 (95%CI: 0.25, 1.36) for > 2400 MET min/wk vs <640 min/wk (P-trend=0.18). While overall physical activity does not appear to be associated with endometriosis or fibroids, vigorous activity may play a role in reduced fibroid risk. Future research capturing physical activity both at the time of diagnosis and historically is needed to better understand the causal role that exercise may play in gynecologic pathology.

PA002

Do prior gynaecological procedures increase risk of placenta accreta?

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Background: Placenta accreta, (and increta and percreta) involve abnormal adherence of the placenta to the myometrium. Although usually associated with prior caesarean, evidence of accreta among nulliparous women suggests other factors may increase risk. This study aimed to evaluate the effect of prior invasive gynaecological procedures on risk of placenta accreta. Methods: Population-based data linkage study including all primiparous women birthing in New South Wales, Australia, between 2003 and 2012. Data were from linked birth and hospital admissions, with a minimum lookback period of two years. Placenta accreta was identified through an ICD-10AM-specific diagnosis code. Prior invasive procedures included curettage and evacuation, hysteroscopy, biopsy and excision, gynecological laparoscopy with instrumentation. Modified Poisson regression was used to determine the effect of the number of prior gynecological procedures on risk of placenta accreta. Relative risks (RR) with 99% confidence intervals are presented. Results: Placenta accretas (n=865) were identified among 381,499 deliveries (22.7/10,000). Among women with placenta accreta, 152 (17.6%) had undergone at least one procedure, compared to 33,094 (8.7%) among women without placenta accreta (p<0.001). After adjustment for demographic and pregnancy factors there was a dose response between number of prior surgeries and subsequent accreta development: for 1 procedure RR was 1.5 (CI 1.1-2.0), for 2 procedures RR 2.7 (1.7-4.4), and for ≥3 procedures RR 5.1 (99% CI: 2.7-9.6). Conclusion: Women with a history of prior invasive gynecological procedures were more likely to develop placenta accreta. These insights may be used to inform management of pregnancies with a history of gynecological procedures.

PA003-S

The impact of neighborhood deprivation on gestational weight gain by maternal pre-pregnancy body mass index and race/ethnicity

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Background: Gestational weight gain (GWG) outside the recommended ranges puts women at higher risk for pregnancy complications and adverse birth outcomes. Environmental factors including neighborhood deprivation may influence GWG. Our study 1) examined the impact of neighborhood deprivation on GWG, 2) identified if the association varied by pre-pregnancy body mass index (BMI) and 3) determined if the association varied by race/ethnicity. Methods: The American Community Survey was used to create a deprivation index that was merged to Florida vital statistics for 2006 to 2014. Neighborhood deprivation was measured by census tract across Tampa, Orlando, Jacksonville and Miami. Bivariate analyses were conducted to examine GWG and neighborhood deprivation by maternal characteristics. Multilevel logistic regression modeling was performed to determine the association between level of neighborhood deprivation and GWG. Interaction terms were tested to determine if results varied by pre-pregnancy BMI and race/ethnicity. Results: After adjusting for maternal characteristics, mothers living in the most deprived neighborhoods had a 31% increased risk of inadequate GWG (OR=1.31, 95% CI=1.27-1.34) and were protected against excessive GWG (OR=0.95, 95% CI=0.93-0.97) compared to women living in the least deprived neighborhoods. No difference in inadequate GWG was observed between obese mothers from least and most deprived neighborhoods while obese mothers from least deprived neighborhoods had a 14% increased risk of excessive GWG (OR=1.14, 95 %CI=1.09-1.19). Women in the most deprived neighborhoods had a higher risk of inadequate GWG across all race and ethnic groups while only Non-Hispanic White women had a higher risk of excessive GWG. Conclusion: Neighborhood deprivation is an important risk factor for GWG that varies by maternal characteristics. Supporting women's health throughout the lifespan is essential to achieving healthy pregnancy outcomes.

PA004

Maternal Cerebrovascular Complications in Relation to Placental Abruption: A Population-Based Cohort Study

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Background: Cerebrovascular diseases from apoplexia cerebri, or with hemorrhage- or ischemia-related etiologies reflect dysfunction of the hemostatic system. Uteroplacental ischemia and hemorrhage are the underlying hallmarks of abruption. If so, similarities in the underpinnings between abruption and cerebrovascular complications would suggest increased risks of cerebrovascular mortality and morbidity in women whose pregnancies are complicated by abruption. Methods: We performed a prospective cohort analysis to examine the risks of mortality and morbidity from cerebrovascular complications in relation to abruption among women that delivered in Denmark (1978-2010). To identify women with cerebrovascular complications and deaths, the National Patient and Causes of Death registries were linked to the Danish Birth Registry. We fit Cox proportional hazards regression models to estimate hazards ratio (HR) and 95% confidence interval (CI) of cerebrovascular outcomes in relation to abruption, following adjustments for delivery year, parity, education, and smoking. Results: The median (interquartile range) follow-up in the non-abruption and abruption groups was 15.9 (16.0) and 16.2 (13.5) years, respectively among 828,289 women (13,231,559 person-years of follow-up). Rates of cerebrovascular mortality were 0.8 and 0.5 per 10,000 person-years among women with and without abruption, respectively (HR 1.6, 95% CI 0.9, 3.0). Abruption was associated with increased risks of cerebrovascular morbidity from all 3 etiologies of the same magnitude. The risks of cerebrovascular mortality and morbidity were increased when abruption was associated with delivery at <34 weeks, or when accompanied by ischemic placental disease. Conclusions: This study suggests that cerebrovascular complications may have its first manifestations in pregnancy. Disruption of the hemostatic system due to uteroplacental ischemia and hemorrhage may portend shared etiologies between abruption and cerebrovascular complications.

PA005

Metabolomics Signatures Associated with an Oral Glucose Challenge in Pregnant Women

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**Background and objectives:** The oral glucose tolerance test (OGTT), widely used as a gold standard for gestational diabetes mellitus (GDM) diagnosis, provides a broad view of glucose pathophysiology in response to a glucose challenge. We conducted the present study to evaluate metabolite changes before and after an oral glucose challenge in pregnancy; and to examine the extent to which metabolites may serve to predict GDM diagnosis in pregnant Peruvian women (N=100) attending prenatal clinics (mean gestation 25 weeks). **Methods:** Serum samples were collected immediately prior to and 2-hours after administration of an 75-g OGTT. Targeted metabolic profiling was performed using a LC-MS based metabolomics platform. Changes in metabolite levels were evaluated using paired Student's t tests and their change patterns were examined at the pathways levels. Multivariate regression procedures were used to examine metabolite pairwise differences associated with subsequent GDM diagnosis. **Results:** Of the 306 metabolites detected, the relative concentration of 127 metabolites were statistically significantly increased or decreased 2-hours after the oral glucose load (FDR corrected p-value <0.001). We identified relative decreases in acylcarnites, fatty acids and diacylglycerols pathways while relative increases were noted in bile acids pathways. In addition, we found that C58:10 triacylglycerol (=0.08, SE=0.04), C58:9 triacylglycerol (=0.07, SE=0.03), adenosine (=0.70, SE=0.32), methionine sulfoxide (=0.36, SE=0.13) were significantly associated with GDM diagnosis even after adjusting for age and BMI. **Conclusions:** We identified alterations in maternal serum metabolites, representing distinct cellular and metabolic pathways including mitochondrial dysfunction and fatty acid metabolism, in response to an oral glucose challenge. These findings offer novel perspectives on the pathophysiological mechanisms underlying GDM.

PA006

Prevalence of Selected Birth Defects among Stillborns in the National Birth Defects Prevention Study by Maternal

Race/Ethnicity

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**Background:** Research shows race/ethnicity variation in the prevalence-at-livebirth of birth defects and risk of stillbirth. However, it is unclear if the prevalence of birth defects among stillbirths varies by race/ethnicity. Racial/ethnic differences in prevalence of birth defects among stillborns may partially explain racial/ethnic disparities in prevalence-at-livebirth of birth defects and mortality rates in children with birth defects. We assessed if risk of selected birth defects among stillborns varied by race/ethnicity. **Methods:** We used National Birth Defects Prevention Study data on 28,839 liveborn and 544 stillborn children with birth defects born October 1997–December 2011. Pregnancy outcomes were obtained from ten participating state birth defects surveillance systems which collected data from medical record abstraction and vital records. Rate ratios (RR) and 95% confidence intervals (CI) for rate of stillbirth occurrence for non-Hispanic (NH) black and Hispanic women compared to NH-white women were estimated from multivariable Poisson regression models for selected defects, defect categories and overall. **Results:** Overall, compared to NH-white women, NH-black and Hispanic women had an increased rate of stillbirths with any birth defect (RR=1.6; 95%CI: 1.3, 2.1 and 1.8; 95%CI: 1.5, 2.2, respectively). NH-black women had increased rates of stillbirths with neural tube defects (NTDs) (RR=1.6; 95%CI: 1.0-2.5), oral clefts (RR=2.7 95%CI: 1.2-6.0), gastroschisis (RR=2.4; 95%CI: 1.0-5.8), omphalocele (RR=2.5; 95%CI: 1.0-6.2) or limb defects (RR=2.7; 95%CI: 1.1-6.6) compared to NH-white women. Hispanic women had statistically significant increased rates of delivering a stillborn with NTDs (RR=2.0; 95%CI: 1.5-2.8), orofacial clefts (RR=3.7; 95%CI: 2.0-6.5) or gastroschisis (RR=3.0; 95%CI: 1.6-5.6) compared to NH-white women. **Conclusions:** Compared to NH-whites, NH-black and Hispanic women have increased rates of delivering a stillborn with a birth defect.



PA007

Predicting the number of birth defects potentially associated with congenital Zika virus infection during the 2016-2017 Puerto Rico Zika virus outbreak.

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Zika virus (ZIKV) Infection during pregnancy is a cause of congenital microcephaly and brain abnormalities. During the ZIKV outbreaks in the Americas, more pregnant women have been infected in Puerto Rico than in any other US jurisdiction. To inform planning for pediatric care and services, we modeled the number of birth defects that may occur among fetuses/infants congenitally exposed to ZIKV in Puerto Rico, and compared it to the baseline prevalence of birth defects. We used Monte Carlo simulation and uncertainty distributions to estimate the number of birth defects potentially associated with ZIKV infection (brain abnormalities with or without microcephaly, neural tube defects and other early brain malformations, eye abnormalities, and other central nervous system consequences). Model parameters based on published data included 5,900-10,300 ZIKV pregnancies in 2016; 4-8% prevalence of birth defects potentially associated with ZIKV infection; 3% baseline prevalence of any birth defect in Puerto Rico. Given the high level of uncertainty in the model parameters, we present interquartile ranges (IQRs) as primary results. We predict that 420 (330-550 IQR) fetuses/infants may have birth defects associated with congenital ZIKV infection from mid-2016 to mid-2017 ZIKV outbreak in Puerto Rico. In the absence of a ZIKV outbreak, 940 (910-960 IQR) fetuses/infants are expected to have any birth defect in Puerto Rico each year. Accounting for both the baseline prevalence of all birth defects in Puerto Rico and those we predict will be attributable to ZIKV infection during pregnancy, we estimate a total of 1360 (1260-1490 IQR) fetuses/infants, from mid-2016 to mid-2017, will have a birth defect in Puerto Rico. Congenital ZIKV infection may result in a 46% increase in the total number of fetuses and infants with birth defects in Puerto Rico. These modeled estimates provide a starting point to plan for increased services to provide care for affected infants and families.

PA008-S

Prevalences of selected structural birth defects among women with preeclampsia and other hypertensive disorders

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**Background:** To explore a potential common etiology for preeclampsia and selected birth defects, we examined prevalences of a variety of birth defects among women with hypertensive disorders including mild and severe preeclampsia. Prevalences were estimated alone and in combination with diabetic disorders, which are known to be associated with hypertensive disorders and birth defects. **Methods:** Data came from singleton live births in California, 2007-2011, including maternal and infant demographics from birth certificates and clinical detail from delivery hospitalization records. We examined 11 birth defect groups readily recognizable at birth (e.g., spina bifida, tetralogy of Fallot, cleft palate). Hypertensive disorders were divided into mutually exclusive groups: preexisting hypertension, gestational hypertension, mild preeclampsia, severe preeclampsia/eclampsia, and preeclampsia superimposed on preexisting hypertension. Prevalences and prevalence ratios (PR) with 95% confidence intervals (95% CI) for each birth defect group by each hypertensive group were calculated along with odds ratios (OR) and 95% CI for independent and joint effects of hypertensive and diabetic disorders for each birth defect. **Results:** The prevalence of each birth defect was higher among offspring of women with preexisting and preeclampsia superimposed on preexisting hypertension and severe preeclampsia/eclampsia compared to those without hypertensive disorders. Odds of many of the studied birth defects among offspring of women with only a hypertensive disorder were significantly increased compared to women with neither a hypertensive nor diabetic disorder (ORs 1.37-2.77) and highest among women with both a hypertensive and diabetic disorder compared to those with neither (ORs 1.80 – 6.21). **Conclusion:** Our results add support to the hypothesis that there may be a common etiology of preeclampsia and certain birth defects and diabetes may contribute.

PA009

Utility of Capture-Recapture Methodology to Estimate Prevalence of Congenital Heart Defects Among Adolescents in Eleven New York State Counties: 2008-2010

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Congenital heart defects (CHDs) are the most common birth defects in the United States, and the population of individuals living with CHDs is growing. Though CHD prevalence in infancy has been well characterized, better prevalence estimates among children and adolescents in the United States are still needed. In this study, we used capture-recapture (CR) methods to estimate CHD prevalence among adolescents residing in 11 New York counties. 2008-2010 Statewide Planning and Research Cooperative System (SPARCS) hospital inpatient records, SPARCS outpatient records, and medical records provided by six pediatric congenital cardiac clinics were used to identify adolescent CHD cases. Bayesian hierarchical log-linear modeling accounting for dataset dependencies and heterogeneous catchability was used to estimate the number of adolescent CHD cases in our 11-county region. Prevalence was calculated using data from the 2010 Census. A total of 2,537 adolescent CHD cases were captured in our three data sources. Forty-four cases were identified in all data sources, 283 cases were identified in two of three data sources, and 2,210 cases were identified in a single data source. The final model yielded an estimated total adolescent CHD population of 3,845, indicating that 66% of the cases in the catchment area were identified in the case-identifying data sources. Based on 2010 Census estimates, the estimated adolescent CHD prevalence was estimated to be 6.39 CHD cases per 1,000 adolescents (95% confidence interval: 6.18-6.60). Future research incorporating additional data sources may improve capture-recapture estimates in this population.

PA010

Proximity to pediatric cardiac specialty care for adolescents with congenital heart defects

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Many individuals with congenital heart defects (CHD) discontinue cardiac specialty care in adolescence, putting them at increased risk for adverse health outcomes. Geographic barriers may contribute to cessation of care. Using a New York population-based, 11-county CHD surveillance system documenting healthcare encounters in 2008-2010, we characterized proximity from residential address to the nearest licensed pediatric cardiac specialty care facility among adolescents aged 11-19 years with CHD. Addresses were geocoded using ArcGIS and the New York State Street and Address Maintenance Program, a statewide address point database. One-way drive and public transit time from residence to nearest facility were calculated using R packages gmapsdistance and rgeos with the Google Maps Distance Matrix application programming interface. Multivariate linear regression using generalized estimating equations was used to predict travel time by region, urban/rural status and census tract poverty level. We identified 2522 adolescents with 3058 corresponding residential addresses and 12 pediatric cardiac specialty care facilities, all in urban areas. The median drive time from residence to facility was 18.3 minutes, and drive time was 30 minutes or less for 2475 (80.9%) addresses. In multivariate regression, predicted drive time was highest for rural western addresses in high poverty census tracts (67.3 minutes) and lowest for southeastern addresses in high poverty census tracts (12.9 minutes). Public transit was available for 2301 (75.2%) residential addresses, and median public transit time (53.1 minutes) was ~3.3 times the median drive time (16.3 minutes). The difference between median drive and public transit times was smallest in southeastern New York and largest in rural western New York. Future research is needed to determine how travel time and public transit availability influence continuity of care among adolescents with CHD.

PA011-S

Associations Between Disinfection By-Product Exposures and Gastrointestinal and Genitourinary Birth Defects

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**Background:** Some epidemiological studies suggest that disinfection by-product (DBP) exposures are associated with an increased risk of congenital anomalies, although evidence for associations between specific DBPs, including the more toxic brominated DBPs, and gastrointestinal defects (GIDs) and obstructive genitourinary defects (OGDs) is limited. **Objective:** To examine associations between GIDs and OGDs and exposure to DBPs during pregnancy, including four DBP summary measures of trihalomethanes (THM4), brominated trihalomethanes (THMBr), haloacetic acids (HAA5), and the sum of THM4 and HAA5 (DBP9). **Methods:** A case-control study (10:1 matching by week of conception) was conducted in Massachusetts towns with complete quarterly 1999–2004 DBP data. We calculated adjusted odds ratios (aORs) of OGDs (ICD9 753.2, 753.6), hypospadias (ICD 752.61) and rectal and large intestinal atresia/stenosis (ICD9 751.2) in relation to town-level weight-averaged first trimester DBP concentrations based on residence at birth. Common confounders across these outcomes included parity, income, gestational diabetes, chronic hypertension, prenatal care, and source water and disinfection combinations. The final models included adjustment for other DBP surrogates (HAA5 or THM4) with the exception of the DBP9 models. **Results:** We detected an exposure-response relationship between OGDs and THMBr tertiles (aOR= 1.97, 95%CI: 1.19-3.25; aOR=2.26, 95%CI: 1.36-3.74) but saw little evidence of associations for THM4, HAA5 and DBP9 quintiles. No associations were detected between hypospadias and any of the DBP exposure metrics. Although not statistically significant, we saw some elevated aORs (range: 1.13-2.32) for THMBr quintiles and rectal and large intestinal atresia/stenosis; no exposure-response was evident. **Conclusion:** Our preliminary results suggest that there may be associations between THMBr and some OGDs and GIDs. Future research will include examination of individual THM and HAA species.

PA012

Exposure to phthalates is associated with lipid profile in peripubertal Mexican youth

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**Aim:** To investigate associations of in utero and concurrent exposure to bisphenol A (BPA) and phthalates with lipid profile during peripuberty among 248 youth in the Early Life Exposure in Mexico to ENvironmental Toxicants (ELEMENT) Project, an ongoing Mexico City pre-birth cohort. **Methods:** We measured BPA and 9 phthalate metabolites (monoethyl phthalate [MEP], mono-n-butyl phthalate [MnBP], mono-isobutyl phthalate [MiBP], monobenzyl phthalate [MBzP], mono-3-carboxypropyl phthalate [MCP], mono-2-ethylhexyl phthalate [MEHP], mono-2-ethyl-5-hydroxyhexyl phthalate [MEHHP], mono-2-ethyl-5-oxohexyl phthalate [MEOHP], mono-2-ethyl-5-carboxypentyl phthalate [MECPP]) in maternal urine at up to three time points during pregnancy (geometric mean of prenatal concentrations represents “in utero exposure”), and in the child’s own urine at 8-14 years (“concurrent exposure”). Using linear regression models that accounted for child age, sex, and specific gravity, we examined relations of urinary BPA and phthalate concentrations with serum lipid profile during peripuberty according to serum levels of total cholesterol, low-density lipoprotein (LDL), triglycerides, and high-density lipoprotein (HDL). **Results:** While in utero exposure was not associated with lipid profile, higher concurrent levels of MCP, MEP, and DBP corresponded with lower total cholesterol and LDL in boys. For example, an interquartile range increment in MCP corresponded with 7.4% (95% CI: 2.0%, 12.8%) lower total cholesterol and 12.7% (3.8%, 21.6%) lower LDL. In girls, higher urinary levels of DEHP metabolites (calculated as the molar sum of MEHP, MEHHP, MEOHP, and MECPP) correlated with lower LDL (-7.9% [-15.4%, -0.4%]). **Conclusions:** Our findings indicate that concurrent phthalate exposure may be related to a more favorable lipid profile during peripuberty. Additional longitudinal research is needed to determine whether these associations persist beyond adolescence.

PA013

Is age of menarche among school girls related to academic performance?

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**Background:** There is strong evidence that the mean age of menarche has declined over the last few decades in developed and developing countries. This is of a major concern because of its enormous public health implications. **Objectives:** This study aimed to estimate the age of menarche in Kuwait and investigate the association between menarcheal age and academic performance among high school girls in Kuwait. **Methods:** A cross-sectional study was conducted on 775 randomly selected female high school students from private and public high schools in all governorates in Kuwait. Data on age of menarche were collected by self-administered questionnaire from the students, while data on academic performance were extracted from students' academic records. **Results:** Of 907 students we selected, 800 (88.2%) responded. The mean age of menarche was 12.33 (95%CI: 12.18-12.49) years. There was no evidence for significant association between age at menarche and students' academic performance before or after adjusting for potential confounders. **Conclusion:** The estimated age of menarche among contemporary girls in Kuwait is similar to that in industrialized countries. Early menarcheal age is unlikely to lead to adverse behavior that may affect academic performance in our setting.

Heinz Berendes award winner-S

Risk of Dementia in Adults with Congenital Heart Disease: A Population-Based Cohort Study

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**Background:** Several known risk factors for dementia have been associated with congenital heart disease (CHD). We examined the dementia risk in CHD adults to that of the general population. **Methods:** In a cohort study, we used medical registries covering all Danish hospitals to identify CHD patients diagnosed between 1963 and 1982. Subjects were followed from January 1st 1981, age 30 years, or date of first CHD registration (index date for matched members of the comparison cohort) until hospital-diagnosis of dementia, death, emigration, or end of study (December 2012). For each CHD patient, we identified 10 individuals from the general population utilizing the Danish Civil Registration System, matched on sex and birth year. We computed cumulative incidences and hazard ratios (HRs) of dementia, adjusted for sex and birth year. Analyses were repeated after restricting the comparison cohort to individuals with hospital-diagnosed chronic disease (asthma, chronic obstructive pulmonary disease, and diabetes). **Results:** The cumulative incidence of dementia was 4% by age 80 years in 10,632 adults with CHD (46% male). The overall HR comparing CHD adults with the general population cohort was 1.6 (95% CI: 1.3-2.0). The HRs did not vary by gender (male 1.6; 95% CI: 1.1-2.3, and female 1.7; 95% CI: 1.3-2.2). The HR among individuals without extracardiac defects was 1.4 (95% CI: 1.1-1.8). The HR for mild CHD was (1.6; 95% CI: 1.2-2.2), moderate CHD (1.2; 95% CI: 0.7-2.1), and severe CHD (2.0; 95% CI: 1.1-1.3). The HR for early onset dementia (<65 years of age) was 2.6 (95% CI: 1.8-3.8) and 1.3 (95% CI: 1.0-1.8) for late onset. The HR comparing CHD survivors to individuals (n=10,084) with a chronic disease was 1.0 (95% CI: 0.8-1.3). **Conclusion:** The dementia risk was increased in CHD adults compared with the general population, and comparable to that of a chronic disease cohort.

PA015

Early Life Environmental Polybrominated Diphenyl Ether Exposures and Longitudinal Patterns of Child Neurodevelopment  
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Early life environmental chemical exposures may increase the risk of neurobehavioral disorders, but few studies have examined whether chemical exposures alter neurobehavioral trajectories as children age. We used the HOME Study, a prospective birth cohort, to show how linear mixed models can be used to determine if prenatal polybrominated biphenyl ether-47 (PBDE-47) exposure is associated with persistent or time-dependent differences in child neurobehavior. We measured PBDE-47 concentrations in serum samples collected at 16 weeks gestation and repeated measures of aggressive/hyperactive behaviors (n=274, repeats=1,024), mental development (n=291, repeats=752), and IQ (n=219, repeats=373) in children between 1-8 years of age. A 10-fold increase in PBDE-47 concentrations was associated with more aggressive/hyperactive behaviors ( $\beta$ : 2.0; 95% CI: -0.2, 4.2); this association was stable from 2-8 years of age (PBDE-47 x age p-value=0.74). Each 10-fold increase in PBDE-47 was associated with lower mental development ( $\beta$ : -1.3; 95% CI: -3.7, 1.1) between 1-3 years of age; children in the highest PBDE-47 tercile had decrements in MDI as they aged (-1.4 point decrease per year) while children in the 1st tercile had increases in MDI (1.7 point increase per year) (PBDE-47 x age p-value=0.03). Higher PBDE-47 concentrations were associated with lower full scale IQ ( $\beta$ : -4.1; 95% CI: -8.3, 0.1) at 5-8 years of age and these associations persisted between 5-8 years of age (PBDE-47 x age p-value=0.56). We demonstrated that linear mixed models can be used to characterize the relation between early life chemical exposures and longitudinal measures of child neurobehavior to determine if these associations persist or resolve as children age. In this study, elevated prenatal PBDE-47 exposure was persistently associated with more aggressive/hyperactive behaviors and lower IQ scores. Additionally, PBDE-47 had a detrimental association with mental development that strengthened over time.

PA016-S

The association between prenatal alcohol exposure and offspring mental health  
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Background: Intrauterine alcohol exposure has been reported to be associated with negative cognitive and behavioural outcomes in offspring. However, the findings that are available on mild to moderate alcohol use are inconsistent, and focus less on internalising behaviours than externalising behaviours. The current study investigated the association of maternal drinking during pregnancy with child mental health. Methods: Participants were adolescents (n=3,299, mean age=17.5years) from the Avon Longitudinal Study of Parents and Children (ALSPAC). Maternal drinking behaviours were obtained at 18 weeks gestation for the number of days alcohol was consumed in the first trimester. The Clinical Interview Schedule-Revised assessed self-reported child mental health, indicating an ICD-10 diagnosis of depression. Logistic regression was used to investigate associations between gestational alcohol consumption and offspring mental health. Paternal alcohol consumption at 18 weeks gestation was included as a negative control comparison. Results: There was evidence that the number of occasions mothers drank alcohol during their first trimester was associated with offspring depression age 18 (OR for linear trend=1.18, CI=1.01-1.39), but this was attenuated in the fully adjusted model (OR for linear trend=1.11, CI=0.94-1.31). The number of days fathers drank alcohol during the first trimester was not associated with offspring depression (unadjusted: OR for linear trend=0.86, CI=0.72-1.02; fully adjusted: OR for linear trend=0.87, CI=0.73-1.03). Conclusion: Maternal alcohol consumption during pregnancy is associated with offspring depression, but socio-economic and prenatal risk factors may account for this association. Paternal alcohol use during pregnancy is not associated with offspring depression, suggesting that this may not be an appropriate negative control in this context.

PA017

Selective serotonin reuptake inhibitor (SSRI) use in pregnancy and neonatal therapeutic hypothermia for suspected hypoxic ischemic encephalopathy (HIE)

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Background: Neonates exposed to SSRIs are at risk of low Apgar scores and abnormal neurologic examinations. Therapeutic hypothermia is used as a neuroprotective treatment for suspected HIE. Whether SSRIs are associated with an increased risk of suspected HIE that leads to therapeutic hypothermia is not known. Objective: To evaluate the association between prenatal SSRI exposure and therapeutic hypothermia in neonates. Methods: This is a case-control study of singleton deliveries from 2010 to 2016. Cases were neonates who received therapeutic hypothermia for suspected HIE. For each case, we selected the next two deliveries as controls, matched on obstetric provider group, hospital shift (weekday vs. weekend/night/holiday), completed weeks of gestation, and maternal age  $\pm$  3 years. We used conditional logistic regression to calculate the odds ratio (OR) and 95% confidence interval (CI) for SSRI. We considered maternal race/ethnicity, parity, and mode of delivery as potential confounders. Results: We identified 38 cases and 76 controls; all controls were delivered within 6 months of the case. The median maternal age of cases and controls was 33 (interquartile range: 29–35) years and 31 (interquartile Range: 27–33) years, respectively, and race/ethnicity was similar between the groups. Cases were more likely to have been born by operative vaginal (13% vs. 5%) or unscheduled cesarean (40% vs. 13%) delivery rather than spontaneous vaginal delivery (34% vs. 72%;  $p < 0.0001$ ). Prenatal SSRI exposure was noted in 18.4% of cases and 6.6% of controls (OR: 3.2, 95% CI: 0.8–15.0). Though not statistically significant, adjustment for mode of delivery strengthened the association (OR: 4.6; 95% CI: 0.9–29.4). Adjustment for race/ethnicity or parity did not alter the estimate. Conclusion: Prenatal exposure to SSRIs may be associated with suspected HIE in neonates, prompting initiation of therapeutic hypothermia. Larger studies are required to confirm this finding.

PA018

Trivalent inactivated influenza vaccine during pregnancy and risk for adverse infant development

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Despite the demonstrated efficacy of the influenza vaccination in reducing severe influenza infections in pregnant women and their newborns, safety concerns for the fetus remain a barrier to vaccination during pregnancy. We assessed the risk of trivalent influenza vaccination (TIV) during pregnancy on infant development at six months of age. We conducted a multi-site cohort study of pregnant women receiving prenatal care from Kaiser Permanente Northern California (KPNC) and Northwest (KPNW) and followed them and their newborns during the 2010–2011 and 2011–2012 influenza seasons. Information on TIV during pregnancy was ascertained from medical records and self-report (for participants vaccinated outside the health plan). We analyzed 1458 mother-infant pairs in which the mother completed the Ages and Stages Questionnaire-3 (ASQ) for her 6 month infant. No differences were found in early infant development for infants of vaccinated women compared to un-vaccinated women with regard to Communication (93% were on schedule vs. 93%,  $p=0.641$ ) (vaccinated vs. un-vaccinated, respectively), Gross Motor (89% vs. 89%,  $p=0.621$ ), Fine Motor (91% vs. 92%,  $p=0.273$ ), Problem Solving (94% vs. 93%,  $p=.615$ ), or Personal-Social (90% vs. 87%,  $p=0.081$ ) domains. Our findings persisted after adjusting for maternal age and study site. Further, no differences emerged by the timing of vaccination during pregnancy. Our preliminary findings suggest TIV exposure during gestation does not adversely impact early infant development.

PA019

Are there gender assortative patterns in childhood body mass index?

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A number of factors are thought to contribute to the obesity epidemic observed among children. We investigated the gender assortative hypothesis which suggests that mother-daughter associations in body mass index (BMI) are stronger than mother-son associations (and likewise for father-son versus father-daughter associations). This study utilized data from the Maternal-Infant Research on Environmental Chemicals (MIREC) study, in which pregnant women were recruited from 10 Canadian sites between 2008 and 2011. The analysis was restricted to singletons who participated in the MIREC Follow-up Study. Child BMI z-scores were based on World Health Organization references. Parental BMI was categorized as <25 kg/m<sup>2</sup>, 25-<30 kg/m<sup>2</sup>, or ≥30 kg/m<sup>2</sup>, and adjusted mean BMI z-scores of the children were compared across these categories using multiple linear regression. Sons and daughters were analyzed separately, adjusting for confounding factors. Mean age at follow-up was 3.6 years for the 338 daughters and 341 sons included. The mean BMI z-score of both girls and boys increased according to maternal BMI, indicating that the association between mother's BMI category and child BMI z-score did not differ according to sex of the child (interaction p-value=0.27). The association between paternal BMI and the child's BMI z-score differed by the child's sex (interaction p=0.01). In boys, the mean BMI z-score was 0.6, 0.5 and 0.5 respectively, for underweight/normal, overweight and obese fathers. In girls, however, the BMI z-score was 0.2, 0.4 and 0.6 respectively, for underweight/normal, overweight and obese fathers. Our data do not support a gender-assortative hypothesis of early childhood BMI. These data suggest that maternal BMI, possibly through intrauterine factors or maternal-child interactions, may impact early childhood BMI. Continued follow-up of the MIREC cohort will help explain the mechanisms underlying the association of parental BMI and obesity in childhood.

PA020-S

Early-life factors and anti-Müllerian hormone concentrations in a cohort of young African American women

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The pool of primordial follicles that comprise the ovarian reserve is established in utero, and declines after birth until menopause. Exposures that are potentially ovarian toxic or endocrine disruptive during in utero and infant development may alter the ovarian reserve, affecting ovarian function and fertility in adulthood. To examine this relationship, we used data from the Study of Environment, Lifestyle & Fibroids (SELF), a cohort of 1696 African American women ages 23-34 years. A subset of the cohort (n=1600) had measurements of a serum marker of ovarian reserve, anti-Müllerian hormone (AMH), and did not report a prior diagnosis of polycystic ovarian syndrome; 1506 participants completed the Early Life Questionnaire, with 87% of participants receiving assistance from their mothers. We estimated the percent difference and 95% confidence interval (CI) using linear regression, adjusting for age and factors that may alter the measurement of AMH (current hormonal contraceptive use and body mass index). In the cohort subset, the median AMH was 3.13 ng/ml (interquartile range: 1.68-5.22). Participants whose mothers lived or worked on a farm (vs. neither lived nor worked on a farm) when pregnant with the participant had 42% lower AMH concentrations (95% CI: -62, -9). Among participants whose mothers lived in Michigan when pregnant with the participant (n=1238), participants whose mothers lived in Detroit (for at least a month) (vs. not living in Detroit) when pregnant with the participant had 22% lower AMH concentrations (95% CI: -34, -8) and participants whose mothers lived in one city/town when pregnant (vs. lived in 2-3 cities/towns) had 38% lower AMH concentrations (95% CI: -54, -15). We did not observe associations with other pregnancy, birth, or infant feeding factors. Our results indicate that early-life exposures related to location during in utero development may affect ovarian reserve in adulthood.

PA021-S

Rapid repeat pregnancy among women with intellectual and developmental disabilities: A population-based cohort study  
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Rapid repeat pregnancy, defined as a second pregnancy occurring within 12 months of a live birth, is associated with adverse perinatal outcomes including fetal growth restriction, preterm birth, and perinatal mortality. Women with intellectual and developmental disabilities (IDD) face multiple social disparities which may place them at increased risk for rapid repeat pregnancy. Our objective was to compare the risk for rapid repeat pregnancy among women with and without IDD. In a population-based cohort study using linked Ontario (Canada) health and social services administrative data, we identified 2,987 women with IDD and 982,215 women without IDD who had a live birth in fiscal years 2002-2014. The primary outcome was rapid repeat pregnancy following this live birth; we also examined type of subsequent pregnancy (i.e., live birth, fetal death/stillbirth, or induced abortion). Multivariable modified Poisson regression was used to assess risk, adjusted for maternal age, parity, neighbourhood income quintile, rurality, chronic medical conditions, mental illness, and continuity of primary care. Women with IDD were younger, poorer, and more likely to have chronic medical conditions and mental illness than women without IDD. After controlling for confounders, they were at increased risk for rapid repeat pregnancy (4.0% vs. 1.5%; adjusted relative risk [aRR] 1.89, 95% confidence interval [CI] 1.57-2.27), driven by a higher risk for live births (2.4% vs. 0.6%; aRR 2.64, 95% CI 2.09-3.35). Adjusted risks for fetal deaths/stillbirths (1.0% vs. 0.7%; aRR 1.19, 95% CI 0.83-1.72) and induced abortions (0.6% vs. 0.2%; aRR 1.49, 95% CI 0.92-2.40) were non-significant. Rapid repeat pregnancy frequently reflects poor control over individual fertility and lack of access to effective family planning. Women with IDD may require additional support in the postpartum period to initiate appropriate contraception and avoid negative reproductive outcomes.

PA022-S

The relationship of birth weight and adiposity across the life course to semen quality in middle age: results from the Study of the Environment and Reproduction follow-up to the Child Health and Development Studies  
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Background: Adiposity is a potential risk factor for poor semen quality, yet prior studies of body mass index (BMI) and semen quality have been inconclusive and nearly exclusively cross-sectional. Merging longitudinal data from the Child Health and Development Studies birth cohort with cross-sectional data from the Study of the Environment and Reproduction follow-up, we have for the first time explored the relationship of both birth weight and adiposity across the life course to semen quality in middle age. Methods: Using data from 193 men (mean age 43 years), we calculated birth weight for gestational age percentile (bw/ga), weight for age and weight for height percentiles at 4 and 12 months, BMI for age percentile at 4 years, BMI in participants' 20s, 30s and at the time of semen collection, and cumulative measures of child, adult and lifetime adiposity. In regression models, we tested whether each predicted sperm concentration, percent progressive motility, percent normal morphology and a combined subfertility measure based on WHO reference levels. Results: We found a positive association between bw/ga and sperm concentration ( $b=0.02 \times 10^3/\text{mL}$ , 95% CI [0.00, 0.04]), but null or negative associations between child adiposity measures and sperm concentration. Adiposity in adulthood, but not childhood, was positively associated with low percent progressive motility (OR<sub>ovwt20s</sub>=2.58, 95% CI [1.10, 6.01]; OR<sub>obese30s</sub>=3.18, 95% CI [1.05, 9.66]), as were adult cumulative adiposity measures. Cumulative adiposity across adulthood tended to increase odds of low percent normal morphology. Adiposity in adulthood was also associated with higher odds of meeting subfertility criteria for at least 2 of the 3 semen outcomes. Conclusions: The relationship between adiposity and sperm concentration, motility and morphology may vary according to timing and length of exposure. These results reinforce the importance of maintaining a healthy body weight across the life span.



PA023-S

Cycle-specific and daily variation in ambient air pollution and fecundability in a prospective time-to-pregnancy cohort  
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**Introduction:** Both chronic and acute exposures to ambient air pollution are associated with adverse pregnancy outcomes, but the association of air pollution and couple fecundability is understudied. **Methods:** Couples in the Longitudinal Investigation of Fertility and the Environment (LIFE) Study (2005-2009) were prospectively followed until pregnancy or one year of attempting to conceive. Daily air pollution levels at the couple's residence were estimated using modified Community Multiscale Air Quality models. Cycle-specific exposure to criteria air pollutants and constituents of particulate matter (PM)  $\leq 2.5$  microns was assessed as mean exposure in the cycle before or proliferative phase for each observed cycle (n=500). Daily acute exposure was assessed for sensitive windows of the observed cycle (n=440). Discrete-time survival analysis modeled the fecundability odds ratio (FOR). Models were adjusted for multiple pollutants, site, age, race/ethnicity, body mass index, parity, smoking status, income and education. **Results:** Of 500 couples matched to air pollution levels, 347 (69.4%) achieved pregnancy. Cycle-specific exposure to air pollution was not associated with fecundability. However, in acute models, an interquartile range (IQR) increase in ozone the day prior to ovulation and nitrogen oxides eight days following ovulation were associated with reduced fecundability (FOR 0.83, 95% CI 0.73, 0.96 and FOR 0.84, 95% CI 0.71, 0.99, respectively). Conversely, PM  $\leq 10$  microns six days following ovulation was associated with greater fecundability (FOR 1.25, 95% CI 1.02, 1.55). After correction for multiple comparisons, no associations remained significant. **Conclusions:** In the first study to evaluate ambient air pollution and fecundability in the days surrounding ovulation and implantation, we observed some acute effect of exposure during this critical window but no cycle-specific effects were observed. These novel time windows merit further investigation.

PA024-S

Why does U.S. hysterectomy prevalence vary by state?  
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**Background:** Hysterectomy is the second most common surgical procedure among non-elderly US women but large geographic variation in hysterectomy prevalence remains unexplained. **Purpose:** This paper aims to determine if state-level differences in a woman's lifetime prevalence of hysterectomy are more attributable to individual-level demographic predictors of medical need (age and race/ethnicity) and individual socioeconomic status (educational attainment) or state-level contextual factors (i.e., community and policy attributes). **Methods:** We used data from the 2008, 2010, and 2012 Behavior Risk Factor Surveillance System. Aside from these cross-sectional data, there are no nationally representative data to explore this question. Restricting to women ages 18 to 44 years (N=190,196), we fit generalized linear multilevel models to estimate relationships between individual-level factors and hysterectomy, as well as state-level variance in hysterectomy. We also used spatial regression and generalized estimating equations to validate these results. **Results:** Age, race/ethnicity, and education accounted for 11% of the state-level variation in a woman's lifetime prevalence of hysterectomy. After adjustment for individual-level race and age, women with less than a high school diploma have 2.83 (95% CI: 2.63, 3.05) times the prevalence of hysterectomy than women with a college degree (ref). **Conclusion:** Women with less than a college education are more likely to be treated with hysterectomy, indicating a socioeconomic disparity for this invasive, fertility-ending procedure. While we are not able to explicitly account for medical need, we adjusted for relevant predictors of medical need (e.g., age and race). The 89% of state-level variation remaining after adjustment for individual-level demographics suggests that a woman's state of residence may be an important driver of hysterectomy use in the US.

PA025

Predictors of PON1 Enzyme Activities in Human Ovarian Follicular Fluid and Serum

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The importance of high-density lipoprotein (HDL) particles to human reproduction is increasingly recognized, with the anti-oxidant activities of constituent paraoxonase 1 (PON1) possibly being most relevant. We measured PON1 status (activity and Q192R phenotype) in follicular fluid (FF) and serum collected from 171 women undergoing in vitro fertilization (IVF). PON1 activities were measured as both paraoxonase and arylesterase activities. HDL particle size was determined by 1H NMR spectrometry. We used linear regression models with generalized estimating equations, to assess associations between concentrations ( $\mu\text{mol/L}$ ) of natural log transformed HDL particle sizes (nm) with arylesterase (kIU/L) and paraoxonase (IU/L) activities in FF and serum, adjusted for age, body mass index and cigarette smoking. Models were stratified by PON1 Q192R genotype as QQ (n=70), QR (n=73) or RR (n=28). Higher FF arylesterase activity correlated significantly to higher concentrations of large (1.12% to 1.22%;  $P<0.05$ ), medium (1.34% to 1.43%;  $P<0.0001$ ) and small (1.55% to 1.92%;  $P<0.0001$ ) HDLs in all genotypes, although effect sizes varied. The pattern was analogous for FF paraoxonase activity. Medium (1.24%;  $P=0.03$ ) and small (1.24%;  $P=0.005$ ) HDLs correlated to serum arylesterase activity in the QR genotype, but with no association for the QQ or RR genotypes. Furthermore, large HDLs predicted serum paraoxonase activity in the QQ (1.43%;  $P=0.004$ ) and RR (1.80%;  $P=0.03$ ) genotypes, medium HDLs were predictors among QQ (1.21%;  $P=0.01$ ) and QR (1.32%;  $P=0.03$ ) phenotypes and small HDLs predicted paraoxonase activity among QR women (1.27%;  $P=0.01$ ). Overall, higher PON1 enzyme activities were predicted by large, medium and small HDLs in FF, although HDL predictors in plasma varied by phenotype. Our data suggest that PON1 Q192R phenotype plays a more important role in governing PON1 enzyme activities than HDL particle size. These results may have important implications for IVF live birth rates.

PA026

Reproductive history and physical function in early aging: The Bogalusa Heart Study

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1440 CANAL STREET, SUITE 2000 Epidemiology #8318 Background: Reproductive history (including fertility, parity, and complications of pregnancy) has wide-ranging and sometimes permanent effects on the body, via hormonal, biomechanical, and social pathways. In addition, many studies have linked reproductive history to increased adiposity and cardiovascular outcomes, which may also be associated with the aging process. Methods: We studied self-reported reproductive history and markers of physical and cognitive aging in 731 women who participated in the Bogalusa Heart Study. Women reported on each pregnancy, its outcome, associated complications, and whether they had fertility issues. Physical function was measured using the Short Physical Performance Battery (SPPB), which includes tests of balance, gait speed, and chair stands. Logistic and linear regression was used to assess the relationship between reproductive history and each outcome, with adjustment for age at interview, menopausal status, race, smoking, education, and BMI. Age at first pregnancy and parity were added when they were not the outcome under study. Results: Nulliparity was associated with an increased risk of balance issues (aOR 5.59, 2.33-13.43, while high parity (4+) was associated with reduced risk (aOR 0.35, 0.15-0.83). There were no associations of general fertility issues or adolescent pregnancy with functional status. Gestational diabetes was associated with increased risk of poor chair and walk scores. Hypertensive disorders were associated with increased risk of poor walk scores (2.13, 1.10-4.13), though this association was weakened by adjustment for BMI (1.85, 0.93-3.68). Generally, however, adjustment for BMI had little effect. Conclusions: The strongest relationships between reproductive history and markers of aging were found for parity and gestational diabetes. Future studies should investigate whether these represent pathways that are biological, social, or both.

PA027

The Gulf oil spill and infertility: The GROWH Study

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**Background:** In the aftermath of the Gulf oil spill, reports that dolphins are failing to calve added to the already-expressed concerns of community members that the oil spill could have adverse effects on fertility. Both environmental exposures and stress have been associated with reduced fertility. **Methods:** 1164 southern Louisiana women aged 18-45 recruited through prenatal and WIC clinics and community events were interviewed about their experience of the oil spill and fertility, including time to pregnancy (TTP) and periods of attempting pregnancy. 857 women had information on outcomes of at least one pregnancy, and 428 on a pregnancy both before and after the spill. Generalized estimating equations were used to examine the relationship between oil spill exposure (contact with oil, economic/social effects, related trauma) and infertility (time to pregnancy >6 or 12 months, and/or reported fertility issues), with adjustment for age, race, BMI, smoking, and socioeconomic status. Results were compared for pregnancies occurring prior to and after the oil spill, as well as for the time period within two years of the oil spill. **Results:** Fertility issues were equally commonly reported before and after the spill, and were more common with the highest overall oil spill exposure (aOR 1.50, 0.96-2.36; limited to those with data pre- and post-spill, 1.88, 1.19-2.95). TTP > 12 months was also more common in those reporting income loss (aOR 1.44, 1.01-2.07). No other associations were found for other aspects of oil spill exposure (contact with oil, traumatic experiences, litigation) and these outcomes, nor were results stronger for the time period closer to the spill. **Conclusions:** This study does not indicate strong effects of chemical exposure to the oil spill on human fertility.

PA028-S

Vitamin D and bioavailability of androgens in women with proven fecundity

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**Objective:** Results from prior studies have demonstrated mixed results regarding the relationship between 25-OH vitamin D3 (D3) and androgens in patients with polycystic ovary syndrome (PCOS). Additionally, a relationship between D3 and sex hormone binding globulin (SHBG) has been established in premenopausal PCOS patients and in postmenopausal women, but not in healthy premenopausal women. Our objective was to assess the relationship between D3, androgens, and SHBG in a cohort of healthy women with proven fecundity. **Design:** This was a secondary analysis of the EAGeR trial to evaluate the effect of preconception-initiated low dose aspirin on reproductive outcomes. 1228 participants were attempting to conceive, aged 18-40, with 1-2 prior pregnancy losses and no history of infertility or PCOS. **Methods:** Serum D3 and hormone concentrations were measured at baseline. Linear regression was used to evaluate relationships between D3 and AMH, total testosterone (TT), free testosterone (fT), free androgen index (FAI), dehydroepiandrosterone sulfate (DHEAS), SHBG, and urinary estrone-3-glucuronide (E3G) concentrations. Models were adjusted for age, BMI, race, smoking status, income, physical activity, season, and treatment arm. **Results:** D3 concentration was negatively associated with FAI ( $\beta$  -0.01, SER 0.00,  $p=0.009$ ), and positively associated with SHBG ( $\beta$  0.33, SER 0.08,  $p<0.0001$ ), though not with TT, fT, DHEAS or E3G. The association between D3 and SHBG remained and became larger ( $\beta$  0.41, SER 0.10,  $p<0.0001$ ) after additionally controlling for TT and E3G. Analysis comparing D3-insufficient women (D3<30 ng/mL, 53.4%) to D3-sufficient women yielded similar results. **Conclusions:** D3 was associated with SHBG and FAI in healthy, premenopausal women, supporting the hypothesis that D3 may play a critical role in the production of SHBG and, consequently, the bioavailability of androgens. These results may imply that D3 plays a role in androgen homeostasis in healthy women without PCOS.

PA029

Affordability of Fertility Treatments and Multiple Births in the United States  
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**Background** Affordability plays an important role in the utilization of in vitro fertilization (IVF) and non-IVF fertility treatments. Fertility treatments are associated with increased risk of multiple births. Our objective is to investigate the association between affordability of fertility treatments across states and percentage of multiple births due to natural conception, non-IVF fertility treatments and IVF and the association between these percentages and state-specific multiple birth rates. **Methods** State-specific per capita disposable personal income and state-specific infertility insurance mandates in 2013 were used as measures of affordability. Maternal age-adjusted percentage of multiple births due to natural conception, non-IVF fertility treatments and IVF were estimated for each state using birth certificate and IVF data. Scatter plots and regression analysis were used to explore associations between state-level measures of affordability, percentage of multiple births due to natural conception and fertility treatments, and state-specific multiple birth rates. **Results** In 2013, age-adjusted contributions of natural conception, non-IVF fertility treatments and IVF to multiple births in U.S. were estimated to be 58.2%, 22.8% and 19.0%, respectively. States with greater affordability of fertility treatments were associated with higher percentage of multiples due to IVF ( $\beta \approx 0.0006$ ,  $p < 0.001$ ) and lower percentage due to natural conception ( $\beta \approx -0.0004$ ,  $p = 0.01$ ). Higher percentage of multiples due to IVF ( $\beta \approx 0.0497$ ,  $p < 0.001$ ) and lower percentage due to natural conception ( $\beta \approx -0.0311$ ,  $p < 0.001$ ) were associated with higher state-specific multiple birth rates. **Conclusion** Affordability of fertility treatments may be associated with state-specific multiple birth rates. State policies on insurance coverage of fertility treatments may have the potential to influence the multiple birth rate.

PA030-S

Anti-Müllerian hormone (AMH) patterns throughout gestation in uncomplicated pregnancy  
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Anti-Müllerian hormone (AMH) is a protein that regulates ovarian sensitivity to FSH and LH in folliculogenesis. AMH is well established as a biomarker of ovarian reserve and may also have utility in predicting pregnancy outcomes. Few studies have described AMH levels in pregnancy and among those that have, most have used cross-sectional study designs and are limited to participants seeking fertility treatment. We conducted a small prospective study to characterize the AMH concentration trajectory during pregnancy. We recruited  $n=30$  women with normal, singleton pregnancies, aged 18-35 years, with BMI between 18-40 kg/m<sup>2</sup>, and without pre-existing disease. Blood samples were collected at 5 prenatal visits. AMH was measured using immunoassays. We used parametric tests, repeated measures ANOVA, to estimate gestational age specific means and standard deviations, and along with non-parametric tests, Friedman's test, to compare AMH over gestation. We observed decreasing AMH levels across gestation ( $P$ -value  $< 0.0001$ ); at gestational age week 10, average AMH was 3766 (standard deviation (SD)= 387.5) pg/dl and at week 36 was 1319 (SD=338.7) pg/dl. The intraclass correlation coefficient for AMH was 0.67 (95% CI: 0.52, 0.79) reflecting between- and within-subject AMH variability. The significance of differences in the decline of AMH over gestation is unclear. Future studies evaluating AMH throughout pregnancy that also assess gravid health and pregnancy outcomes are warranted.

PA031

: Examining healthcare provider attitudes regarding effectiveness of combined oral contraceptives for women with history of gastric bypass  
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Bariatric surgery is a common treatment for severe obesity among women of reproductive age. Clinical practice guidelines recommend avoiding pregnancy for 12-18 months after surgery, which may require use of effective contraception. Malabsorptive procedures may decrease the effectiveness of combined oral contraceptives (COCs). We analyzed weighted survey data collected during 2013-14 from a national sample of providers from publicly-funded health centers (Title X, non-Title X) and office-based physicians (n=2086). Providers were asked how effective they considered COCs for women with malabsorptive procedures compared to healthy women (more effective, equally effective, less effective, do not know). Multinomial logistic regression was used to calculate adjusted odds ratios (aOR) and 95% confidence intervals (CI) to identify characteristics associated with considering COCs as effective (responded “more” or “equally effective”) or uncertainty (responded “do not know”), compared to “less effective.” Most providers were female (61%), physicians (91%), and specialized in obstetrics/gynecology (OB/GYN) or family planning/reproductive health (FP/RH) (60%). About 25% of providers considered COCs as effective for women with malabsorptive procedures and 20% had uncertainty. The odds of uncertainty among primary care providers was significantly greater than among OB/GYN or FP/RH providers (aOR 7.0, 95% CI 1.7-28.7) after adjusting for sex, setting, occupation, and proportion of patients with specific characteristics (e.g., Medicaid insurance). Data did not support meaningful associations between provider or clinic characteristics and considering COCs as effective. Substantial proportions of providers who deliver family planning services consider COCs as effective or have uncertainty about the effectiveness for women with a history of malabsorptive procedures. Continued education is needed to inform providers of U.S contraceptive guidelines for women in this population.

PA032-S

Factors Associated with Provision of Depot Medroxyprogesterone Acetate (DMPA) to Adolescents among U.S. Health Care Providers  
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Background: Depot Medroxyprogesterone Acetate (DMPA) is a safe contraceptive method for adolescents and more effective at preventing pregnancy than other methods commonly used by adolescents (e.g. condoms). Understanding provider attitudes and practices concerning DMPA for adolescents is crucial to address barriers to contraceptive access among adolescents. Methods: We analyzed weighted survey data from providers of publicly-funded health centers (Title X, non-Title X) and office-based physicians (n=1,951). Multivariable logistic regression was used to estimate adjusted odds ratios (aORs) and 95% confidence intervals (CIs) to identify factors associated with infrequent provision of DMPA to adolescents (not often or never). Results: While nearly all providers (95%) considered DMPA to be safe or very safe for adolescents, 34% reported infrequent provision of DMPA to adolescents. Compared with Title X providers, non-Title X providers (aOR=7.82, CI=4.48, 13.66) and office-based physicians specializing in obstetrics/gynecology (aOR=5.09, CI=2.51, 10.34), family medicine (aOR=12.65, CI=5.31, 30.12), and adolescent health (aOR=7.12, CI=2.36, 21.44) had increased odds of infrequent provision. Other factors associated with infrequent provision included time since completion of clinical training ( $\geq 15$  vs.  $< 5$  years aOR=2.98, CI=1.11, 7.99) and not considering DMPA to be safe for adolescents (aOR=20.3, CI=4.17, 99.13). Providers reported that client preference for another method (54%) and provider concerns about side effects (31%) were the most common reasons for infrequent provision. Conclusion: Despite high provider confidence in the safety of DMPA for adolescents, one in three providers reported infrequent provision. Although this is likely explained in part by patient preferences, provider education about DMPA safety, effectiveness, and provision may help to ensure adolescents have access to the full-range of contraceptive methods, including DMPA.

PA033

Associations of cord blood metabolites with newborn anthropometry and cord blood hormones in Project Viva  
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**Aim:** To identify cord blood metabolites associated with birth size, and to examine associations of these compounds with cord blood hormones implicated in growth and metabolism. **Methods:** Among 126 participants in Project Viva, a U.S. pre-birth cohort, we used an untargeted mass spectrometry approach to quantify metabolites in cord blood. After excluding 103 xenobiotic metabolites, we used principal components analysis (PCA) to consolidate the remaining 606 compounds into principal components ("factors"). Next, we identified metabolite factors associated with gestational age- and sex-standardized birthweight z-score (BW/GA) after Bonferroni's correction. Finally, we examined relations of the BW/GA-associated factors with cord blood insulin, leptin, adiponectin, insulin-like growth factor (IGF)-1, IGF-2, and IGF binding protein 3 (IGFBP-3) using linear regression models that accounted for mother's race/ethnicity, delivery mode, and infant sex and gestational age at birth. In models for IGF-1 or IGF-2, we additionally adjusted for IGFBP-3. **Results:** Mean BW/GA was  $0.27 \pm 0.98$  z-scores. Approximately half of the infants were male (52.4%) and white (57.1%). Of the 6 factors retained from PCA, one was associated with higher BW/GA: Factor 5, which was comprised of metabolites involved in amino acid (spermidine, aspartate) and RNA (inosine 5-monophosphate, adenosine 5-monophosphate, cytidine 5-monophosphate) biochemical pathways. In multivariable analysis, Factor 5 was related to higher cord blood leptin (1.49 [95% CI: 0.28, 2.70] ng/mL) and IGF-1 (3.34 [0.20, 6.49] ng/mL). **Conclusions:** Amino acid metabolites and compounds on RNA biochemical pathways in cord blood are associated with larger size at birth, as well as higher leptin and IGF-1.

PA034

Associations of weight- and length-derived anthropometric indicators with body composition at birth and 5 months: The Healthy Start Study

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**Objective:** To examine associations of weight-for-age (WFAZ), weight-for-length (WFLZ), and body mass index (BMIZ) z-scores with fat mass (FM), % fat mass (%FM), and fat-free mass (FFM) measured by air-displacement plethysmography during the first 5 months of life. **Design:** Using prospectively-collected data from 1,027 infants in the Healthy Start Study, an ongoing Colorado pre-birth cohort, we used multivariate regression to evaluate relations of the z-score indicators with body composition at birth, 5 months, and with change ( $\Delta$ ) during follow-up. In addition, we directly compare the utility of  $\Delta$  in each z-score indicator as a proxy of adiposity gain according to  $\Delta\%$ FM using multivariate analysis of variance (MANOVA). **Results:** At birth, all three derived indicators were more strongly associated with FFM than FM. For example, each unit of WFAZ corresponded with 0.342 (95% CI: 0.331, 0.351) kg FFM, as compared to 0.121 (0.114, 0.128) kg FM ( $p < 0.0001$ ), with similar trends observed for WFLZ and BMIZ. By 5 months, WFLZ and BMIZ were more strongly associated with FM than FFM, whereas WFAZ was similarly related to the two components of body composition. When we examined change in anthropometry from birth to 5 months,  $\Delta$ WFLZ and  $\Delta$ BMIZ were more strongly related to  $\Delta$ FM than  $\Delta$ FFM; however, a direct comparison of all three z-score indicators using a MANOVA revealed that  $\Delta\%$ FM was most strongly associated with  $\Delta$ BMIZ. Each 1 unit increment in  $\Delta\%$ FM corresponded with 0.110 (0.099, 0.122) units BMIZ, as compared to 0.091 (0.082, 0.101) units WFAZ (pairwise difference,  $p < 0.0001$ ), and 0.097 (0.085, 0.110) units WFLZ (pairwise difference,  $p < 0.0001$ ). **Conclusions:** Weight- and length-based indices are poor surrogates for newborn adiposity. However, at 5 months, WFLZ and BMIZ are suitable proxies of adiposity, and  $\Delta$ BMIZ is the best indicator of fat accrual during the first 5 postnatal months.

PA035-S

Urban African-American and non-Latina White mothers' unhealthy pregnancy-related behaviors: fathers matter  
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**Background:** Paternal non-involvement is associated with increased rates of preterm birth, low birth weight and infant mortality. The mechanisms underlying this association are unclear. **Objective:** Determine the extent to which paternal non-involvement is a risk factor for unhealthy pregnancy-related behaviors among urban African-American and non-Latina White women. **Methods:** Stratified and multivariable logistic regression analyses were performed on an Illinois transgenerational dataset with appended US census income information of infants (born 1989-1991) and their mothers (born 1956-1976). Using infants' birth certificates, paternal involvement was categorized as non-involved (unmarried with father unnamed), partially involved (unmarried but father named) or involved (married). Unhealthy pregnancy-related behaviors included inadequate prenatal care, cigarette smoking and pregnancy weight gain <15 pounds. **Results:** In Cook County, 56.7% of births to African-American mothers (N=40,214) had non-involved fathers compared to 6.6% of births to White mothers (N=32,014),  $p<0.01$ . Among African-Americans, the adjusted (controlling for maternal age, education, parity, smoking status and neighborhood income) odds ratio (95% confidence interval) of inadequate prenatal care usage, cigarette smoking and low pregnancy weight gain for non-involved (compared to involved) fathers were 2.1 (2.0-2.3), 2.5 (2.3-2.7) and 1.2 (1.0-1.3), respectively. Among Whites, the adjusted odds ratio of inadequate prenatal care, cigarette smoking and low pregnancy weight gain for non-involved (compared to involved) fathers were 4.5 (3.9-5.1), 2.0 (1.8-3.2) and 1.8 (1.4-2.3), respectively. **Conclusions:** A greater proportion of births to African-American (compared to White) mothers have non-involved fathers. Paternal non-involvement is a risk factor for maternal unhealthy pregnancy-related behaviors in both races. These findings have public health relevance to the racial disparity in adverse birth outcome.

PA036

Genetic risk burden for low birthweight in diverse ancestral populations: implications for global variations in incidence of low birthweight

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Incidence of low birthweight shows considerable global regional variation, ranging from 6-8% in Europe and North America to 14-18% in Africa and Asia. Given the known influence of genetics on birthweight, we hypothesized that the burden of birthweight lowering genetic variants is different among ancestrally diverse populations. Genotype data were extracted from phase 3 of the 1000 genomes project for 2504 participants from 26 global populations grouped into five super-populations: Africans (AFR), Admixed Americans (AMR), East Asians (EAS), Europeans (EUR), and South Asians (SAS). The genetic risk burden of low-birthweight (GRB) and the frequencies of 62 single-nucleotide polymorphisms (SNPs) known to influence birthweight in multi-ancestry genome-wide association studies were compared between Europeans and non-Europeans. GRB was calculated as the sum of the number of birthweight-lowering alleles per SNP. GRB for low birthweight was higher in non-Europeans compared to Europeans (AFR (mean difference=3.16; 95% CI 2.64, 3.67), AMR (3.03; 2.35, 3.71), EAS (2.85; 2.30, 3.41), and SAS (1.08; 0.50, 1.65)). The frequency distribution of birthweight-lowering alleles in AFR and EAS was enriched for rare and allele frequency-fixed variants ( $P<0.001$ ) displaying the greatest deviation from expectation of the "common disease-common variant hypothesis". Similar patterns were observed regardless of functional category of SNPs determined by Combined Annotation Dependent Depletion (CADD) scores. For variants with known influence on birthweight and adult cardiometabolic/anthropometric traits (n=19 SNPs), GRB was significantly lower in EAS (-1.24, -1.56, -0.93) and SAS (-0.81; -1.15, -0.48), and higher in AMR (0.50; 0.12, 0.89) compared to EUR. Our findings of parallels between burden of birthweight lowering variants and regional gradients in low birthweight suggest that SNPs and their interaction with environment contribute to population differences in incidence of low birthweight.

PA037-S

Underlying Social Determinants of Perinatal Health: A Closer Look at Low Birthweight Risk at the Intersection of Race and Socioeconomic Disadvantage

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**Background:** Socioeconomic status (SES) is cited as a leading upstream risk factor for low birthweight (LBW), yet wide race gaps in LBW exist even among mothers of higher SES. Few studies adequately measure and compare the distinct aspects of SES most critical to LBW risk. **Methods:** We investigate the race gap in LBW (<2.5 kg) in Wisconsin with the 2012-13 Pregnancy Risk Assessment Monitoring System sample of 3,060, which is weighted using Stata survey procedures to represent the population of new mothers. With staged logistic regressions and subgroup comparisons, we explore the intersection of race and SES factors consequential for LBW. **Results:** We find Non-Hispanic (NH) black (NHB) mothers are 2.1 times as likely as NH white mothers (NHW) to have a LBW infant overall (relative risk [RR] 90% confidence interval [CI]: 1.5-2.7). They are 4.5 (CI: 3.0-6.0) times as likely to not finish high school and 3.4 (CI: 3.0-3.9) times as likely to be at or below the Federal Poverty line (FPL). Education and income account for 67% of the overall race gap in LBW, and a wide race gap seems to persist among high SES mothers (RR=1.9, CI: 1.1-2.7) that we do not observe among low SES mothers (RR=1.3, CI: 0.7-2.0). When stratified by poverty, race gaps in other social factors parallel the patterning of LBW. Among those above the FPL, NHB mothers are 62% more likely to have experienced 3 or more stressful events in the year before childbirth and are 3.4, 3.2, and 4.1 times as likely than NHW mothers to be unmarried, feel unsafe in their neighborhood, and experience discrimination (all RR  $p < 0.01$ ). **Conclusions:** Our results suggest a complex relationship between SES, race, and LBW. Race gaps in LBW are likely driven partially by a disproportionate burden of poverty among NHB communities and additionally can be linked to characteristics indicative of less desirable or stable social circumstances that remain more common for NHB mothers in high SES groups than for their NHW counterparts.

PA038

Preterm birth and small-for-gestational age in singleton in vitro fertilization births using donor oocytes

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Although use of donor oocytes during in vitro fertilization (IVF) has increased over time, information on the association between donor oocytes and perinatal outcomes is limited. We used 2005-2014 National Assisted Reproductive Technology Surveillance System data to examine patterns of fetal growth and preterm birth for liveborn singletons from single gestations after donor oocyte versus autologous oocyte IVF, excluding gestational carriers. We calculated sex-specific 10th percentiles of birthweight for each gestational age (24–42 weeks) and smoothed curves using cubic splines. Infants <10th percentile were considered small-for-gestational age (SGA); those  $\geq 10$ th percentile were non-SGA. Using multinomial regression, we computed adjusted odds ratios (aORs) and 95% confidence intervals (CIs) for associations between SGA preterm, SGA term, and non-SGA preterm and use of donor versus autologous oocytes, stratified by fresh and thawed embryo status and accounting for maternal characteristics and year of birth. During 2005-2014, there were 206,386 singleton births from fresh embryo transfers (87% and 13% from autologous and donor oocytes, respectively) and 85,936 from thawed embryo transfers (84% and 16% from autologous and donor oocytes, respectively). Among fresh embryo transfers, use of donor oocytes was associated with decreased odds of SGA term (aOR 0.81, 0.77-0.86) and increased odds of non-SGA preterm (aOR 1.44, 95% CI 1.37-1.51) compared with autologous oocytes; there was no difference for SGA preterm (aOR 0.97, 95% CI 0.85-1.11). Among thawed embryo transfers, use of donor oocytes was positively associated with SGA preterm (aOR 2.02, 95% CI 1.58-2.58), SGA term (aOR 1.30, 95% CI 1.18-1.45) and non-SGA preterm (aOR 1.48, 95% CI 1.38-1.58). For singleton births, use of donor oocytes in fresh embryo transfers increased the likelihood of non-SGA preterm only, whereas use of donor oocytes in thawed embryo transfers increased the likelihood of both SGA and preterm.



PA039

Placental 11 $\beta$ -HSD2, cord plasma cortisol levels, metabolic and cardiovascular health indices in infants

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**Objective:** Fetal over-exposure to glucocorticoids may “program” cardiometabolic risk. Placental 11 $\beta$ -hydroxysteroid dehydrogenase 2 (11 $\beta$ -HSD2) serves as the barrier to avoid fetal over-exposure to maternal cortisol. We evaluated the unexplored hypothesis that placenta 11 $\beta$ -HSD2 and fetal circulating cortisol levels are associated with cardiometabolic health in early postnatal life, and assessed the impacts of gestational diabetes mellitus (GDM). **Methods:** This was a prospective birth cohort study of 275 mother-infant pairs. Placenta 11 $\beta$ -HSD2, maternal and cord plasma cortisol concentrations were measured. Outcomes included beta-cell function, insulin resistance, blood pressure and carotid intima-media thickness in infants at 1-year. **Results:** There were no significant differences in placenta 11 $\beta$ -HSD2 levels and all observed metabolic and cardiovascular outcomes among 1-y infants of GDM (n=26) and non-diabetic mothers. Cord blood cortisol levels were negatively correlated with beta-cell function indices at birth ( $r=-0.36$ ,  $p<0.01$ ), but not at 1-y of age. Higher placental 11 $\beta$ -HSD2 levels were correlated with lower insulin resistance ( $r=-0.17$ ,  $p<0.01$ ), and lower systolic blood pressure ( $r=-0.16$ ,  $p=0.057$ ) in 1-y old infants. Similar findings were observed after adjusting for maternal and infant characteristics. **Conclusion:** The study is the first to reveal that circulating cortisol and placental 11 $\beta$ -HSD2 levels are associated with cardiometabolic health in early postnatal life in humans.

PA040-S

Cord blood metabolic hormones in relation to insulin sensitivity,  $\beta$ -cell function and skinfold thickness in 1-year old infants  
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**Objective:** The risk of metabolic syndrome related disorders in adulthood may originate from early life. Little is known about perinatal biomarkers related to metabolic health in later life. We sought to uncover whether cord blood metabolic hormones are associated with insulin sensitivity,  $\beta$ -cell function and skinfold thickness in infants. **Methods:** In a prospective singleton pregnancy cohort (n=218), we assessed cord plasma concentrations of metabolic hormones (insulin, IGF-1, IGF-2, leptin, adiponectin and ghrelin) in relation to metabolic health in infants at 1-year of age. The outcomes were homeostasis assessment of insulin resistance (HOMA-IR) and  $\beta$ -cell function (HOMA- $\beta$ ) and skinfold thickness. **Results:** Adjusting for maternal and newborn's characteristics, each SD unit increase was associated with an 11% (1.8-19%) decrease in HOMA- $\beta$  ( $p=0.02$ ) in 1-y old infants for cord blood adiponectin, a 0.54 mm (0.12-0.96) increase in sum of triceps and subscapular skinfold thickness ( $p=0.002$ ) for cord blood insulin, and a 0.47 mm (0.08-0.87) decrease in sum of triceps and subscapular skinfold thickness ( $p=0.002$ ) for cord blood ghrelin, respectively. Cord blood IGF-1, IGF-2, leptin were not related to insulin sensitivity or  $\beta$  cell function in infants. Rapid weight gain ( $DZ>0.5$ ) in the first 3 postnatal months was associated with a 36.4% (6.5-74.7%) increase in HOMA- $\beta$  ( $p=0.014$ ), while rapid weight gain ( $DZ>0.5$ ) in 3-12 months was associated with a 31.7% (5.6-64.4%) increase in HOMA-IR ( $p=0.015$ ). **Conclusions:** The present study is the first to reveal that cord blood insulin, adiponectin and ghrelin are associated with metabolic health indices in infants, while leptin, IGF-1 and IGF-2 are not. Rapid weight gain during early postnatal life may be beneficial for  $\beta$  cell function, but during late postneonatal life may be harmful for insulin sensitivity.

PA041-S

Vitamins A and E concentrations, gestational diabetes mellitus and metabolic health biomarkers in newborns

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**Objectives:** It is unknown whether vitamins A and E may affect metabolic health in early life, and unclear whether these vitamins' levels are altered in gestational diabetes mellitus (GDM). We sought to evaluate whether vitamins A and vitamin E levels are associated with metabolic health biomarkers in newborns, and assess the differences in GDM and non-GDM pregnancies. **Methods:** In a prospective singleton pregnancy cohort (26 GDM, 222 non-GDM), we analyzed maternal and cord plasma concentrations of vitamin E ( $\alpha$ - and  $\gamma$ -tocopherol) and vitamin A (retinol and  $\beta$ -carotene), and their associations with metabolic health biomarkers (glucose-to-insulin ratio, proinsulin-to-insulin ratio, leptin, adiponectin, IGF-I and IGF-II) in newborns. **Results:** There were no significant differences between GDM and non-GDM pregnancies in maternal and cord plasma tocopherols and retinol concentrations,  $\gamma$ -: $\alpha$ -tocopherol ratio and maternal-to-cord plasma ratios of these vitamins.  $\gamma$ -: $\alpha$ -tocopherol ratios were significantly higher in cord vs. maternal plasma ( $p < 0.001$ ). Adjusting for maternal and newborn's characteristics, cord plasma  $\alpha$ -tocopherol was negatively associated with proinsulin-to-insulin ratio and adiponectin,  $\gamma$ -tocopherol was negatively associated with leptin. Cord plasma retinol was positively associated with IGF-I in girls ( $p < 0.001$ ) but not in boys ( $p = 0.65$ ). **Conclusions:** This is the first study revealing that retinol,  $\alpha$ - and  $\gamma$ -tocopherols are associated with metabolic health biomarkers in newborns, and that there appears to be a sex-specific association between retinol and IGF-I. The similar maternal-to-cord blood ratios of tocopherols, retinol and  $\beta$ -carotene in GDM vs. non-GDM suggest that GDM may not affect placental transfers of these vitamins. The higher cord vs maternal plasma  $\gamma$ -: $\alpha$ -tocopherol ratios indicate fetal enrichment of  $\gamma$ -tocopherol.

PA042

Factors associated with the difference between estimated fetal weight at the final prenatal check-up and actual birthweight

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Fetal weight is routinely measured to estimate fetal growth like small-gestational-age infants by ultrasonography at every prenatal check-up in Japan. As a matter of course, the estimated fetal weight (EFW) might be different from actual fetal weight. Although some reports examined the accuracy of EFW, the factor associated with the difference between the final EFW before delivery and actual birthweight was not determined. Therefore, this study aimed to determine these factors from the clinical data from multi-center based study. From three obstetric hospitals, prenatal check-up data of singleton babies from 1021 women were collected. These data included the number of prenatal check-up, maternal age at delivery, maternal pregestational body mass index (BMI), maternal gestational weight gain, duration between the final check-up and delivery, history of delivery, sex of child, birthweight and gestational duration at delivery. Mean number of check-ups during pregnancy was 11.0. Of these women, 494 (48.4%) were primipara. Mean maternal age at delivery was 31.1 years. The mean difference between the final EFW and actual birthweight was 126g. Moreover, the mean duration between the final prenatal check-up and delivery was 4.6 days. Simple and multiple linear regression models were used to determine the factors associated with the difference between the final EFW and actual birthweight. As a result, in the simple regression analysis, longer duration between the final check-up, longer gestational duration, large number of check-ups, large pregestational BMI, large birthweight, multipara and boys were significantly associated with larger difference between the final EFW and actual birthweight. Then, in the multivariable analysis, longer duration between the final check-up and delivery, large gestational weight gain, multipara and boys were significantly associated with larger difference. These results might contribute to improve the accuracy of EFW examination in the future.

PA043-S

Maternal placenta growth factor (PIGF) is positively correlated to cord blood leptin concentrations in infants born small-for-gestational-age  
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**Objective:** Circulating placenta growth factor (PIGF) is a biomarker of placental function. Mothers with low circulating PIGF levels are more likely to deliver small-for-gestational-age (SGA) infants who are at increased risk of metabolic syndrome related disorders in later life. Leptin and adiponectin are important hormones in regulating insulin sensitivity. We sought to assess whether maternal circulating PIGF levels are associated with leptin and adiponectin concentrations in infants born SGA. **Methods:** This was a nested case-control study in a prospective pregnancy cohort - the Integrated Research Network of Perinatology in Quebec (n=2366). Maternal plasma PIGF at the 3rd trimester (32-35 weeks) of gestation and cord plasma leptin and adiponectin were measured. The study included 162 SGA (birth weight <10th percentile) and 162 AGA (25th -75th percentiles) singleton infants matched for ethnicity, smoking status and gestational age. **Results:** SGA newborns had significantly lower maternal PIGF and cord plasma leptin concentrations than AGA infants. Maternal plasma PIGF concentrations were positively correlated to birth weight ( $r=0.35$ ,  $P<0.0001$ ) and cord plasma leptin ( $r=0.14$ ,  $P=0.03$ ) concentrations, but not correlated with adiponectin concentrations. Interestingly, there were differential correlations between maternal PIGF and cord leptin concentrations in SGA ( $r=0.20$ ,  $P=0.03$ ) and AGA ( $r=-0.08$ ,  $P=0.35$ ) infants. Among SGA neonates, those with low maternal PIGF concentrations (<25th percentile) had lower cord blood leptin concentrations (median: 6128.00 vs. 8335.00 pg/ml,  $P=0.01$ ). **Conclusion:** Our study is the first to reveal that maternal PIGF is positively correlated to cord blood leptin in SGA infants. Maternal PIGF may be a biomarker partly reflecting adiposity in fetuses/infants.

PA044

Marijuana use and pregnancy outcome  
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Marijuana (MJ) is the most commonly used illicit substance in the US. Use is increasing among pregnant women, posing a potential risk to the fetus and child. Pregnant women were recruited in 2010-4 to study the association of in utero MJ exposure and child outcomes. MJ was assessed by self-administered questionnaire, chart abstraction and GC/MS/MS analysis of urine; users were positive on any measure. Gestational age was based on LMP and sonography. Multiple imputation addressed missing data. There were 365 single livebirths; 32% of women used MJ. Users were more likely than non-users to use alcohol (25 v 18%), smoke tobacco (65 v 33%), have an unplanned pregnancy (84 v 73%), not have a college degree (96 v 89%); be never-married (90 v 58%), African-American (77 v 55%), homeless (17 v 11%) and physically abused (36 v 30%). They were younger (25.9 v 26.9), of lower pre-pregnant weight (73.8 v 78.6 kg), higher CES-D (17 v 14), trait anxiety (TA, 31 v 29) and stress (PSS, 16 v 14) scores; height (163.2 v 162.6 cm) and everyday discrimination (EDS, 14 v 14) were similar. Preterm (<37 weeks) birth occurred to 36% of users and 41% of non-users (RR 0.9, 95% CI 0.7-1.2; hazard ratio (HR) 0.8, 0.6-1.2); mean gestational ages were 253 and 249 (-4,+12) days. Adjusted (log-binomial and Cox regression for race, education, smoking, homelessness, abuse, CES-D, TA, PSS, EDS, planned pregnancy, marital status, alcohol, prepregnant weight, parity, age) RR for preterm was 0.9 (0.7-1.3); HR was 1.3 (0.8-2.1). Adjusted mean gestation was 4 days (-6, +14) longer for users. Adjusted HR for spontaneous preterm (indicated as a competing risk) was 1.2 (0.7-2.0); adjusted HR for indicated preterm (spontaneous as a competing risk) was 0.3 (0.1-1.1). MJ use was not associated with spontaneous and indicated preterm birth combined. The negative association of MJ with indicated preterm delivery requires replication. Supported in part by Research Grant #6-FY16-160 from the March of Dimes Foundation.

PA045

Preconception cardiovascular risk factors and racial disparities in birth outcomes: the Bogalusa Heart Study  
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**Background:** Racial disparities in birth outcomes are mirrored in cardiovascular health. Recently there have been calls for more attention to preconception and interconceptional health in order to improve birth outcomes, including as a strategy to reduce black-white disparities. **Methods:** As part of a larger study of cardiovascular and reproductive health ("Bogalusa Babies"), female participants were linked to their children's birth certificates for Louisiana, Mississippi, and Texas births from 1982-2009. 3263 women were linked to birth certificate data. Birth outcomes were defined as low birthweight (LBW) [birthweight < 2500 g; preterm birth (PTB), >3 weeks early; small for gestational age (SGA), <10th percentile for gestational age (percentiles based on study population); large for gestational age (LGA) >90th percentile for gestational age]. Cardiovascular measures (blood pressure, lipids, glucose, insulin) at the visit closest in time but prior to the pregnancy was examined as predictors of birth outcomes using logistic models adjusted for covariates. **Results:** Only a few cardiovascular risk factors were associated with birth outcomes. Triglycerides were also associated with higher risk of LBW among whites (aOR 1.05, 95% 1.01-1.09). Higher glucose was associated with a reduction in risk of SGA for black women (aOR 0.85, 95% CI 0.76-0.95), but not whites (p for interaction=0.02). Clear racial disparities were found but they did not change when cardiovascular risk factors were adjusted for. **Discussion:** This analysis does not provide strong evidence for preconception cardiovascular risk being a strong contributor to racial disparities.

PA046

Cervical pathways for racial disparities in preterm births: The Preterm Prediction Study  
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**Background:** Labor involves changes to the cervix, which occur prematurely in many preterm births. Racial disparities in preterm birth are long-standing, but the social and biological mechanisms for these disparities are not clear. **Methods:** Data from the Maternal-Fetal Medicine Unit network Preterm Prediction Study were used to examine the relationship between race and other social factors and cervical properties throughout pregnancy in 2920 women. Outcomes included cervical length, dilation, cervical score (cervical length-internal dilation), and whether membranes protruded, at 22-24 and 26-29 weeks'. Race, education, income, insurance type, and marital status were examined as predictors of the outcomes using linear and logistic regression, adjusted for age, BMI, parity, and smoking. Mediation analysis was used to examine whether a) any social factors explained racial differences in cervical properties, and b) whether cervical properties mediated racial differences in risk for preterm birth. **Results:** Shorter cervical length, especially at visit 1, was associated with black race (adjusted beta -1.56 mm, p<0.01) and lower income (adjusted beta -1.48, p=0.05). External dilation was not associated with social factors, while internal dilation was associated with black race (aOR 2.69 1.43-5.06) and lower education (1.78, 1.03-3.07). Race and marital status were associated with lower cervical score. There was no evidence of mediation of the racial effect on cervical properties by any social factor. Cervical length, dilation, score, and protruding membranes were all associated with preterm birth (p<0.01). Mediation analysis indicated that each of these contributed to <8% of the elevated risk for preterm birth among black women. **Conclusions:** Race, and, to a lesser extent, other social factors are correlated with cervical properties, but this pathway explains only a small proportion of the racial disparity in preterm birth.

PA047

Early and late preterm birth rates among US-born urban women: the effect of father's lifelong socioeconomic position.  
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**BACKGROUND.** There are limited available data on the relation paternal socioeconomic position (SEP) to the birth outcome of US-born women. **OBJECTIVE.** To determine whether father's lifelong low (compared to high) SEP is a risk factor for early (< 34 weeks) and late (34-36 weeks) preterm birth (PTB) among US-born women. **METHODS.** Stratified and multilevel, multivariable binomial regression analyses were performed on an Illinois transgenerational dataset of non-Latino White, African-American, and Mexican-American infants (1989-1991) and their parents (1956-1976) with appended U.S. census income information. The neighborhood income of father's place of residence at the time of his birth and at the time of his infant's birth were used to measure of lifelong SEP. **RESULTS.** In Chicago IL, the PTB rate among infants born to fathers with a lifelong low SEP equaled 13% versus 6.0% for those born to fathers with a lifelong high SEP, relative risk [(RR, 95% (CI)] = 2.3 (2.1-2.6). This disparity was widest for the early PTB component. Infants born to fathers with a lifelong low (compared to high) SEP had a greater percentage of mothers with high risk demographic characteristics ( $p < 0.001$ ). Most striking, the early and late PTB risk associations of paternal lifelong SEP were significant among non-teen, married, college-educated, and White women, respectively. The adjusted (controlling for maternal demographic characteristics) RR of early and late PTB for fathers with a lifelong low (compared to high) SEP equaled 1.4 (1.1-1.9) and 1.2 (1.0-1.4), respectively. 16 % of early PTB were attributable to father's lifelong low (compared to high) SEP. **CONCLUSIONS.** Father's lifelong low SEP is a risk factor for early PTB among US-born urban women independent of commonly cited demographic characteristics. This intriguing phenomenon strongly suggests that policy makers should address the contribution of father's lifelong SEP to our nation's poor international ranking in PTB rates.

PA048

Does maternal exposure to secondhand tobacco smoke during pregnancy increase the risk for preterm or small-for-gestational age births?

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**Background** Exposure to secondhand smoke (SHS) among pregnant women remains problematic due to the damaging effects on the growing fetus. While major risk factors for preterm and small-for-gestational age (SGA) births remain elusive, this study aims to provide a better understanding of the association between SHS and these birth outcomes. **Objective** To examine the relationship between SHS and SGA and preterm births using control non-smoking mothers with singleton deliveries from the National Birth Defects Prevention Study (1997-2011). **Study Design** Preterm births were examined as total (<37 weeks completed gestation), moderate (32-36), and very preterm (< 32). SGA infants were categorized using sex, race/ethnic, and parity-specific growth curves. Term ( $\geq 37$  weeks) and non-SGA infants were the comparison groups. SHS was examined from one month prior to conception through the end of pregnancy and assessed as household, workplace/school, and combined exposures. Logistic regression models, excluding Type I/II diabetics, adjusted for maternal education, race/ethnicity, pre-pregnancy body mass index, and a previous diagnosis of high blood pressure. Interaction was assessed for folic acid intake, alcohol use, maternal age, and infant sex. We also examined risk by different periods of the pregnancy. **Results** Overall, from 8,855 infants, 666 (7.5%) were preterm, 574 (6.5%) moderately preterm, and 92 (1.0%) very preterm. For the SGA analysis, 670 (7.7%) SGA. Risk of preterm birth among mothers reporting SHS exposure in the workplace/school and household was elevated for any preterm birth (adjusted odds ratio (aOR)=1.99; 95% CI=1.13-3.50), and moderately preterm birth (aOR=2.17; 95% CI=1.22-3.88). No evidence for interaction was present, nor differences of risk by month or trimester. **Conclusion** Findings in this analysis point to a moderate association between SHS and preterm birth when women reported multiple exposures to SHS—with no evidence for an association with SGA births.

PA049-S

The association between maternal antibiotic use during pregnancy and small for gestational age (SGA) in the Birth Defects Study

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Antibiotics are frequently prescribed during pregnancy, with the most common indications being respiratory and genitourinary infections. Some studies found reduced infant birthweight following antibiotic use during pregnancy, but others did not. We evaluated the association between maternal antibiotic use and birthweight in 9,724 non-malformed, singleton birth infants from the Slone Epidemiology Center's Birth Defects Study. Small for gestational age (SGA), defined as a birthweight <10th percentile for gestational age and sex using the Fenton Growth Curves, was present in 7.8% of infants. Maternal antibiotic use during pregnancy, captured by interviews of the mother within 6 months of delivery, was reported by 26.9% of mothers; use was slightly higher in non-SGA infants (27.1%) compared to SGA infants (24.6%). Multivariable logistic regression models adjusted for infant sex and several maternal variables: age, pre-pregnancy body mass index (BMI), smoking status during pregnancy, race/ethnicity, and highest parental education level. Compared to infants not exposed to antibiotics during gestation, exposed infants were slightly less likely to be born SGA (adjusted odds ratio (aOR)=0.86; 95% CI: 0.72, 1.03). Models stratified by infant sex indicated a slightly stronger protective effect for females compared to males (females: aOR=0.83; 95% CI: 0.64, 1.09; males: aOR=0.88; 95% CI: 0.69, 1.13). In our study, maternal antibiotic use during pregnancy was associated with a small reduction in risk of SGA. Ongoing work will examine characteristics of exposure such as trimester of use, antibiotic class, and both duration and indication for use.

PA050

Different race/ethnicity-combined couples and birth outcomes in the United States 1989-2013

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As the prevalence of mixed-race/ethnicity couples in the United States (U.S) increases, it is important to understand how both maternal and paternal race/ethnicity as well as the combination influence risk of adverse birth outcomes. Prior work has focused primarily on black/white combinations. Our study investigated associations between multiple maternal/paternal race/ethnicity combinations and fetal growth in the U.S. for the past 2 decades. We used U.S. natality data from 1989 to 2013 for all singleton births to women 15 to 44 years old with available data on maternal age, race/ethnicity, nativity, marital status, education, parity, birthweight and gestational age (n= 90,771,635). We examined the unadjusted prevalence and adjusted odds of low birth weight (<2500 g, LBW) and small for gestational age (<10th percentile, SGA) among 20 maternal/paternal race/ethnicity categories (i.e., all possible combinations of non-Hispanic black (NHB), non-Hispanic white (NHW), Hispanic, and Asian, as well as all combinations where paternal race/ethnicity was missing. In concordance with prior work, black race of either mother or father was strongly associated with LBW and SGA, and missing paternal race was an important risk factor for LBW and SGA. We make a novel contribution, however, by demonstrating that for Asian mothers, NHB or missing (compared to Asian) paternal race were associated with higher odds of LBW and SGA (ORs: 1.06 [95%CI: 1.04,1.09] and 1.09 [95%CI: 1.07,1.11], respectively). However, for Asian mothers, all paternal race/ethnicities including missing conferred lower odds of SGA compared to Asian paternal race (e.g., OR for NHB vs. Asian paternal race: 0.71 [95%CI: 0.70,0.73]). It is well-established that babies born to Asian mothers are constitutionally small. Our findings, however, demonstrate that paternal race/ethnicity may also play an important role. Notably, NHB or missing paternal race increases odds of LBW but decreases odds of SGA for Asian mothers.

PA051-S

Associations of maternal leisure time walking and yoga with offspring birth size

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**Background:** Walking is the most common physical activity performed by pregnant women, and yoga practice during pregnancy is increasing in popularity. While both have been associated with decreased risks of pregnancy complications, associations with offspring birth size, an indicator of newborn health, have been inconsistent. We investigated associations of maternal pre-pregnancy and early pregnancy leisure time walking and yoga practice with offspring birth size overall and by offspring sex. **Methods:** Participants (N=3,687) of the Omega study, a pregnancy cohort study in Washington State (1996-2008), reported leisure time physical activity duration (hours/week) in the year before pregnancy and in early pregnancy. Birth size was abstracted from medical records. Linear regression was used to determine mean differences in birthweight, head circumference, and ponderal index associated with pre-pregnancy and early pregnancy walking and yoga practice. Stratified analyses and interaction terms were used to assess effect modification by offspring sex. **Results:** About a third of women reported leisure time walking and about 10% reported yoga practice pre- or in early pregnancy. Women in the highest tertile for pre-pregnancy (1.4-20 hours/week) or early pregnancy (3.1-24 hours/week) leisure time walking had offspring with 0.8 kg/m<sup>3</sup> greater ponderal index (95% CI: 0.2, 1.4 and 0.2, 1.3, respectively) compared to women who reported no leisure time walking during the same time period. Leisure time walking was not associated with birthweight or head circumference. Yoga practice was not associated with offspring birth size. Associations were similar by offspring sex. **Conclusion:** Maternal leisure time walking may be associated with offspring ponderal index. Future studies confirming this association in diverse populations and investigating mechanisms of this association are warranted.

PA052

Joint effect of perceptions of early-life neighborhood stressors and current stress on preterm delivery among urban African American women

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Stress from multiple sources, across the life-course, may jointly impact preterm delivery (PTD) rates in African American (AA) women. Using data from the Life-course Influences on Fetal Environments Study (2009-2011) of post-partum AA women from Metropolitan Detroit, Michigan (n=1,365), we tested whether the association between perceived stress and PTD was modified by perceptions of early-life neighborhood social control and social disorder. PTD was defined as birth before 37 completed weeks of gestation. To measure exposures, we used Cohen's Perceived Stress scale, as well as valid and reliable scales of perceptions of the social control and social disorder of the neighborhood in which study participants lived at age 10. PTD occurred in 16.4% (n=221) of the sample. We estimated prevalence ratios (PR) and 95% confidence intervals (CI) with log binomial regression models, and included separate interaction terms for perceived stress and each early-life neighborhood measure. We considered  $p < 0.10$  significant for interaction terms. In the overall sample, perceived stress was not associated with PTD rates. However, there was evidence of a joint effect between perceived stress and early-life neighborhood social disorder ( $p$  for interaction = 0.07), such that among women who reported high early-life neighborhood social disorder (n=584), perceived stress was positively associated with PTD (adjusted PR: 1.28; 95% CI: 1.03, 1.61). No association between perceived stress and PTD was observed for women who reported low early-life neighborhood social disorder (n=574) (PR: 0.95, 95% CI: 0.74, 1.20). Early-life neighborhood social control did not modify the association between perceived stress and PTD. Our results suggest that exposures from early-life neighborhood stressors exacerbate the impact of current perceived stress on PTD rates, in AA women. Future mixed methods studies should be able to elucidate the mechanisms of the reported associations.

PA053

The burden of early term birth on adverse infant outcomes

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Maria do Carmo Leal, Ana Paula Esteves-Pereira, Marcos Nakamura-Pereira, Rosa Maria Domingues, Silvana Granado Nogueira da Gama **Objectives:** To estimate the national rate of early term live births in Brazil and to evaluate the effect of birth at 37 and 38 weeks' gestation, as compared to 39 weeks' gestation, on infant outcomes according to precursors of birth (spontaneous or provider-initiated) and the existence of maternal/foetal medical conditions. **Methods:** This was a national perinatal population-based cohort study in 266 maternity services located in Brazil. Participants included 14,447 live newborns from 370/6 to 396/6 weeks' gestation. We examined the association of early-term birth and infant outcomes by non-conditional multiple logistic regressions, adjusting for confounders. **Results:** Early-terms accounted for 35% (95% confidence interval 33.4% to 36.7%) of all live births. Among provider-initiated births in women without maternal/foetal medical conditions, infants of 37 and 38 weeks' gestation, in comparison to those with 39 weeks' gestation, had higher odds of oxygen therapy (OR 3.54, CI 2.05-6.11 and OR 2.33 CI 1.36-4.00), admission to neonatal intensive care unit (OR 2.36, CI 1.31-4.26 and OR 1.87, CI 1.06-3.29), neonatal death (OR 11.01, CI 1.33-91.24 and OR 10.58, CI 1.80-62.14), transient tachypnoea (OR 3.05, CI 1.48-6.30 and OR 2.20, CI 1.10-4.41), hypoglycaemia (OR 7.39, CI 1.83-29.84 and OR 5.27, CI 1.46-19.03), phototherapy (OR 3.76, CI 1.98-7.13 and OR 2.39, CI 1.48-3.86), yet lower odds of breastfeeding up to one hour after birth (OR 0.60, CI 0.35-0.82 and OR 0.83, CI 0.72-0.96) and exclusive breastfeeding during hospital stay (OR 0.72, CI 0.53-0.98 for 37 weeks' gestation). **Conclusion:** A great number of early term births were potentially avoidable in Brazil. Birth at 37 and 38 weeks' gestation increased the risk of most adverse infant outcomes analysed, especially amongst provider-initiated births. Provider-initiated birth in women without medical complications should be avoided before 39 weeks' gestation.

PA054

Neonatal morbidities in late preterm and early term newborn twins in Brazil

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**Introduction** Twins are at increased risk for preterm birth, neonatal morbidity and mortality; however, population-based data from low/middle income countries are limited. **Objectives** To evaluate the effect of twin pregnancy on neonatal outcomes in late preterm (340/6 to 366/6 weeks' gestation) and early term newborns (370/6 to 386/6). **Methods** This was a national population-based cohort study in 266 maternity services located in Brazil. Participants included 10,099 single and 411 twin live newborns from 340/6 to 386/6 weeks' gestation. We excluded stillbirths and gestation of triplets or more. We examined the association of twin pregnancy on neonatal outcomes by non-conditional multiple logistic regressions, adjusting for confounders. **Results** Twins accounted for 3.9% of live newborns from 340/6 to 386/6 weeks' gestation. Among late-preterm's, twins, in comparison to single newborns, had higher odds of small for gestational age (OR 4.2, 95% CI 2.1-8.7), phototherapy (OR 2.7, 95% CI 1.8-4.2) and antibiotic use (OR 1.8, 95% CI 1.1-3.2). Among early-terms, twins had higher odds of small for gestational age (OR 6.8, 95% CI 3.9-11.9), oxygen therapy (OR 2.7, 95% CI 1.3-5.9), admission to neonatal intensive care unit (OR 3.1, 95% CI 1.5-6.5), transient tachypnoea (OR 3.7, 95% CI 1.5-9.2), phototherapy (OR 2.8, 95% CI 1.3-5.9) and antibiotic use (OR 2.2, 95% CI 1.1-4.9). **Conclusion** Although strongly mediated by gestational age, an independent risk remains for twin newborns for several neonatal morbidities, when compared to single newborns. These disadvantages seem to be more prominent in early-term newborns than in late preterms.



PA055-S

Maternal dietary patterns during pregnancy in relation to offspring size at birth: evidence from a British cohort  
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Background Maternal diet during pregnancy has been recognised as one of the major lifestyle factors influencing both fetal growth and long term health. This study aimed to investigate the associations between maternal dietary patterns during pregnancy and offspring size at birth using data from a British prospective cohort of 1,109 low risk pregnant women aged 18-45 years. Methods Dietary intake was reported in a 24-hour recall administered by a research midwife at 14-18 weeks gestation. The 1,770 recall food items were aggregated into 73 food groups and principal component analysis was used to derive dietary patterns. Information on delivery details was obtained from the hospital maternity records. Small for gestational age (SGA) was defined as <10th birth weight centile. Outcomes were related to dietary patterns in multivariable regression models, taking into account known confounders including salivary cotinine as a biomarker of smoking status. Results Four dietary patterns were derived and identified as: 'fruit & wholegrains', 'traditional meat & vegetables', 'vegetables & oils' and 'cheese, pasta & sauce'. Only the first component, characterised by high positive correlations with fruits, and unrefined grains as well as wholegrain and bran breakfast cereal and negative correlations with refined grains, was found to be significantly associated with offspring size at birth, and only so for mothers who entered pregnancy with a healthy body mass index (BMI) (<25 kg/m<sup>2</sup>). For every 1 unit increase in the 'fruit & wholegrains' dietary pattern score, mothers with a pre-pregnancy BMI <25 (kg/m<sup>2</sup>) had 20% lower odds of having an infant born SGA (95% confidence intervals (CI): 0.66, 0.96, P=0.01). Conclusion In this low risk pregnant population, a dietary pattern characterised by high intakes of fruits, and unrefined grains as well as wholegrain and bran breakfast cereal may contribute to reduce the risk of SGA but only so for mothers entering pregnancy with a healthy BMI.

PA056-S

Maternal fatty fish intake prior to and during pregnancy and risk of adverse birth outcomes: findings from a low risk British birth cohort  
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Background Essential fatty acids are vital for fetal growth and development. Fish, in particular fatty fish, are important sources of essential fatty acids. This study aimed to investigate the association between fatty fish consumption before and during pregnancy with preterm birth and size at birth in a British prospective cohort of 1,208 low risk pregnant women aged 18-45 years. Methods Preconception and trimester-specific fatty fish consumption was assessed using self-reported frequency questionnaires. Additional dietary data from multiple 24 hour recalls during pregnancy were used to estimate an average fatty fish portion size. Intake was classified as ≤2 portions/week and >2 portions/week with a no fish category as referent. This was related to size at birth and preterm delivery (<37 weeks gestation), adjusting for known confounders including salivary cotinine as a biomarker of smoking status. Results Over 40% of women reported no fatty fish consumption prior to and throughout pregnancy. Mean intakes were considerably lower than the recommended two portions/week, with the lowest intake observed in the 1st trimester (106 g/week, 95% CI: 98.9, 112.9). In univariable analysis, compared to mothers consuming no fatty fish in trimester 1, mothers consuming up to 2 portions of fatty fish/week as well as >2 portions/week had lower odds of having babies born preterm (odds ratio (OR): 0.5, 95% confidence intervals (CI): 0.3, 1.0 & OR: 0.3, 95% CI: 0.1, 1.1 respectively, P<sub>trend</sub>: 0.05). This association however was attenuated in adjusted analysis (OR: 0.6, 95% CI: 0.3, 1.3 & OR: 0.3, 95% CI: 0.1, 1.3 respectively, P<sub>trend</sub>: 0.2). No association was observed between intakes of fatty fish before or during pregnancy with size at birth. Conclusion There was a low prevalence of fish consumption in this inner-city UK population. Consumption of fatty fish prior to and/or during pregnancy did not influence birth weight or gestational length, when taking into account known confounders.

PA057

Maternal hypertension, antihypertensive medication use, and preterm birth in the National Birth Defects Prevention Study, 1997-2011

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Many women take antihypertensive medications during pregnancy, but maternal and fetal risks are still unclear. We analyzed the relationship between maternal hypertension, antihypertensive medication use, and preterm birth among singleton, non-malformed controls in the National Birth Defects Prevention Study. We defined preterm birth as gestational age less than 37 weeks. We excluded mothers who reported a multiple birth, antihypertensive use for another indication, or had missing hypertension information, leaving 11,200 mothers for analysis. We calculated odds ratios (OR) and 95% confidence intervals to estimate associations between preterm birth, maternal hypertension, and antihypertensive medications. We also calculated hazard ratios (HR) using Cox proportional models to evaluate differences in estimates and precision. When sample size allowed, we adjusted for maternal race/ethnicity, pre-pregnancy body mass index, pre-existing diabetes, and study center. Our sample included 188 (1.8%) women who took antihypertensive medications during pregnancy and 857 (7.8%) women with untreated hypertension; 881 (7.9%) women had a preterm birth. Reported medication classes included centrally-acting antiadrenergics (0.7%), beta blockers (0.6%), ACE inhibitors (0.2%), diuretics (0.2%), calcium channel blockers (0.2%), vasodilators (0.1%), and angiotensin receptor blockers (<0.1%). We found increased risk of preterm birth among women who reported antihypertensive medication use (adjusted OR: 4.80 [3.29, 6.99]; HR: 4.07 [2.94, 5.64]) or untreated hypertension (adjusted OR: 2.09 [1.66, 2.63]; HR: 2.01 [1.62, 2.49]), compared to normotensive, unexposed women. Risk estimates were elevated for all medication classes reported, although the number of exposed mothers was small and confidence intervals were wide. While we did find evidence of a relationship between antihypertensive medication use and preterm birth, we cannot rule out confounding by indication.

PA058-S

Preconception physical activity and sedentary time during adolescence and young adulthood and offspring birthweight  
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Background: While behaviors across the life course influence maternal health and pregnancy outcomes, previous research has focused on maternal behaviors during pregnancy or the periconceptional period. Associations of maternal long-term, preconception patterns of physical activity (PA) and sedentary time (ST) with offspring birthweight (BW), and potential differences by offspring sex, have not been well studied. Methods: Participants (N=1,408) with  $\geq 1$  live birth were identified from the National Longitudinal Study of Adolescent to Adult Health. Group-based trajectory modeling was used to create trajectories of self-reported PA (frequency/wk) and ST (hours/wk) collected at age 15, 16, and 22 years, on average. Weighted regression was used to estimate mean differences, RRs, and 95% CIs in BW, small-, and large-for-gestational age (SGA, LGA) associated with PA and ST. Wald tests were used to test joint significance of all trajectories. Interaction terms were used to assess effect modification by offspring sex. Results: Participants were 24 years old at delivery, on average, and about half were nulliparous. Three distinct trajectories were identified for PA and five for ST. PA trajectories were not associated with offspring BW overall (P=0.66). However, associations differed by offspring sex (P for interaction=0.10 (continuous), 0.008 (LGA)). Among female offspring, participants with high PA at 15-16 years old followed by decreasing PA at 22 years old delivered offspring with 90g greater BW and 1.72 times greater risk of LGA compared to participants with low PA (95% CI: -4, 184 and 0.94, 3.14, respectively). Among male offspring, the same PA pattern was not associated with BW ( $\beta$ =-22, 95% CI: -110, 67; RR=0.69, 95% CI: 0.40, 1.21). PA trajectories were not associated with SGA (P=0.43). ST trajectories were not associated with BW (P=0.85). Conclusion: Associations of maternal patterns of PA in adolescence and young adulthood with offspring BW may differ by offspring sex.

PA059

Maternal perchlorate exposure in pregnancy and altered birth outcomes

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**BACKGROUND:** At high medicinal doses perchlorate is known to decrease the production of thyroid hormone, a critical factor for fetal development. In a large and uniquely exposed cohort of pregnant women, we recently identified associations between environmental perchlorate exposures and decreased maternal thyroid hormone during pregnancy. Here, we investigate whether perchlorate might be associated with birthweight or preterm birth in the offspring of these women. **METHODS:** Maternal urinary perchlorate and serum thyroid hormone concentrations, birthweight, and gestational age were collected in 1,957 mother-infant pairs from San Diego County during 2000-2003, a period when the county's water supply was contaminated with perchlorate. Associations between perchlorate exposure and birth outcomes were examined using linear and logistic regression analyses adjusted for maternal age, weight, race/ethnicity, and other factors. **RESULTS:** Perchlorate was not associated with adverse birth outcomes in the overall population. However, in analyses confined to male infants, log10 maternal perchlorate concentrations were associated with increasing birth weight ( $\beta=143.1$  g,  $p=0.01$ ), especially among preterm births ( $\beta=829.1$  g,  $p<0.001$ ). Although preterm births were not increased overall, perchlorate was associated with male preterm births  $>2500$  g (odds ratio=3.03, 95% confidence interval=1.09-8.40,  $p$ -trend=0.03). Similar associations were not seen in females. **CONCLUSIONS:** This is the first study to identify associations between perchlorate and increasing birth weight. Further research is needed to explore the differences we identified related to infant sex, preterm birth, and other factors. Given that perchlorate exposure is ubiquitous, and that long-term impacts can follow altered birth outcomes, future research on perchlorate could have widespread public health importance.

PA060

Teenage pregnancies and adverse birth outcomes in Suriname: results from Perisur

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**Background:** Teenage pregnancies, a public health problem in both developed and developing countries, are associated with an increased risk of adverse birth outcomes, including stillbirths, preterm birth, low birth weight and low Apgar score. The United Nations Children's Fund states that one in five children is born to a teenage mother and that this occurs at higher rates in developing countries than in developed countries. **Aims:** The aims of the study are to estimate the prevalence of teenage pregnancies in Suriname, to characterize them, and to assess whether teenage pregnancies are associated with an increased risk of adverse birth outcomes. **Methods:** Data on pregnant women and their babies from three hospitals in Suriname were registered in the Perisur database (65% of all births in Suriname in 2013-2014). Perisur implements preventive perinatal interventions in order to improve care for pregnant women and their babies. Analysis was based on 3,004 nulliparous women. Adverse birth outcomes were defined based on four birth outcomes: stillbirths, preterm birth, low birth weight and low Apgar score. Relative risk for adverse birth outcomes were calculated for maternal age subgroups. The association between teenage pregnancies and adverse birth outcomes was studied using multivariate logistic regression analyses and was expressed as an adjusted odds ratio with 95% confidence interval. **Results:** From all nulliparous women 36.3% were teenagers; higher proportions were observed among Indigenous (53.6%) and Maroons (52.4%). The overall prevalence of adverse birth outcomes was 21.6% with higher proportions for women aged  $<15$  (32.8%), 15-19 (23.4%), 35-39 (41.2%) and 40+ (55.6%) years. Compared to women aged 25-29 years, teenagers had an increased risk of adverse birth outcomes (relative risk of 1.7 and 1.3 for women  $<15$  and 15-19 years, respectively). Adjusted for maternal ethnicity teenagers had a 1.3 times increased risk of adverse birth outcomes (odds ratio 1.3; 95% confidence interval 1.1-1.6;  $p=0.008$ ). **Conclusions:** Suriname has a high prevalence of teenage pregnancies. Teenagers are an important target group for health education for prevention of unplanned and unwanted pregnancies. Teenage pregnancies should be monitored adequately in order to reduce the risk of adverse birth outcomes.

PA061

Assessing the impact on reported survival rates of international variation in the classification of deaths at 22 to 26 weeks gestational age (GA)

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High-income countries differ substantially in reported survival rates of infants born near the limit of viability. We hypothesized that active treatment for live-born infants, adherence to "official" criteria of signs of life at birth to classify deaths as stillbirth or a neonatal death, as well as classification of stillbirths as ante- or intra-partum, would explain much of this variation. We calculated number of births by time of death for each completed weeks using national data on births at 22 to 26 weeks gestation from the UK (2014 n=3,264), Japan (2011, n=3,169), the US (2012, n=24,929), Canada (2009-2014, n=7,491), Finland (2010-2015, n=854), Norway (2010-2014, n=933) and at 22 to 25 weeks for Sweden (2011-2014, n=1,034). We compared surviving rate to >28 days calculated using different denominators: all births; births alive at onset of labour; all live births; live births surviving to 1 hour; live births surviving to 24 hours. At 22 weeks, large differences were observed among countries in the percent of births classified as ante-partum stillbirths (20%-30%), intra-partum stillbirths (3%-10%) or live-born (48%-65%). For live births, wide variation in the percentage of live born infants dying before 1 hour (11%-42%) suggested differences in resuscitation practices. All of these differences narrowed with increasing GA and nearly disappeared by 26 weeks. Survival to 28 days varied greatly among countries and changed substantially with the use of different denominators at 22 weeks, but less so at higher gestations. At all GAs, variations were smaller when based on all births or births surviving to 12 hours of life and larger when based on all live births surviving 1 hour, all live births, and births alive at onset of labour. Our findings highlight how classification of births and deaths and resuscitation practices for babies born near the limit of viability can affect reported survival rates, especially for births at 22 weeks. (author 1 and 2 contributed equally)

PA062-S

Differential impacts of diabetes in pregnancy on perinatal and postneonatal mortality in Canadian First Nations and Non-Aboriginal infants

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**Objectives:** It is not known whether pre-gestational and gestational diabetes mellitus (PGDM, GDM) may have differential impacts on offspring's survival in Aboriginal vs. non-Aboriginal populations. We sought to assess the associations of PGDM and GDM with perinatal and postneonatal mortality in First Nations (a high-risk population for PGDM and GDM) and non-Aboriginal populations in Quebec, Canada. **Methods:** This was a population-based birth cohort study of 15 090 First Nations and 217 760 non-Aboriginal singleton infants born in Quebec 1996-2010, with linked data on perinatal and postneonatal deaths up to 12/31/2011. The primary outcomes were perinatal and postneonatal deaths. **Results:** PGDM and GDM were much more prevalent in First Nations (3.9% and 10.7%, respectively) vs. non-Aboriginal (1.1% and 4.8%, respectively) pregnant women. PGDM was more strongly associated with an increased risk of perinatal death in First Nations infants [relative risk (RR) 5.08 (95% confidence interval: 2.99-8.62)] than in non-Aboriginal infants [RR 1.76 (1.17-2.66)]. PGDM was associated with an increased risk of postneonatal death in non-Aboriginal infants [RR 3.46 (1.71-6.99)], but not in First Nations infants [RR 1.16 (0.28-4.77)]. GDM was associated with a marginally lower risk of perinatal death in non-Aboriginal infants [RR 0.72 (0.53-0.98)] only. **Conclusions:** The different associations of PGDM and GDM with perinatal and postneonatal mortality in First Nations (high-risk) vs. non-Aboriginal populations suggest differential impacts on offspring's survival, perhaps due to difference in quality of glycemic control and genetic vulnerability to hyperglycemic toxicity.

PA063

The effect of BMI on gestational age-specific fetal death rates

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**Background:** While high pre-pregnancy body-mass-index (BMI) is a known risk factor for fetal death, the effect of BMI on gestational-age specific fetal death rates has not been adequately studied. **Objectives:** To examine gestational age-specific fetal death rates among women who were underweight ( $<18.5$  kg/m<sup>2</sup>), overweight (25.0-29.9 kg/m<sup>2</sup>), and obese level I (30.0-34.9 kg/m<sup>2</sup>), level II (35.0-39.9 kg/m<sup>2</sup>), and level III ( $\geq 40$  kg/m<sup>2</sup>) as compared with women with normal BMI (18.5-24.9 kg/m<sup>2</sup>). **Methods:** All singleton hospital births at  $\geq 24$  weeks gestation in Washington State, 2004-2013, were included (N=743,630) with data obtained from birth certificates. Cox regression was used to obtain gestational age-specific adjusted hazard ratios (AHR) and 95% confidence intervals (CI) with adjustment for maternal age, parity, assisted conception, and other factors. The proportional-hazards assumption was assessed using Schoenfeld residuals. **Results:** Fetal death rates increased with maternal BMI from 1.8 per 1,000 underweight women to 4.5 per 1000 level III obese women ( $P<0.01$ ). Compared with normal-weight women, fetal death rates were not elevated among underweight women at any gestation. Overweight women had increased fetal death rates at 24-33 weeks (AHR=1.2, CI 1.0-1.4), while level I obese women has higher rates at  $\geq 39$  weeks (AHR=1.9, CI 1.4-2.7). Level II obese women had higher fetal death rates at 24-33 weeks (AHR=1.6, CI 1.2-2.0) and  $\geq 39$  weeks (AHR=2.3, CI 1.5-3.5). Level III obese women had higher fetal death rates at 24-33 weeks (AHR=1.7, CI 1.3-2.3), 34-36 weeks (AHR=1.8, CI 1.2-2.8), and 37-38 weeks (AHR=1.8, CI 1.1-2.9), and sharply elevated fetal death rates at  $\geq 39$  weeks (AHR=3.4, CI 2.2-5.3). **Conclusion:** The risk of fetal death is elevated at 24-33 weeks in overweight and obese level II/III women and at  $\geq 39$  weeks among all obese women. Women with level III obesity have elevated risks of fetal death at all gestational ages, and especially at late gestation.

PA064

Thyroid dysfunction increases the risk of spontaneous abortion among women in Telangana State, India

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**Background:** Spontaneous abortion (SAB) is a common adverse pregnancy outcome, occurring in approximately 15% of pregnancies worldwide. Little is known about pre- and early pregnancy risk factors for SAB, and prospective studies of SAB are sparse. **Methods:** Multivariate logistic regression was used to model maternal demographic, clinical and behavioral factors associated with SAB (pregnancy loss with a gestational age less than 22 weeks) in a prospective cohort study of 1161 reproductive aged married women in Telangana State, India who were recruited pre-conception (72%) or within 14 weeks of gestation (median 7 weeks) and followed through pregnancy loss or term delivery. Adjusted odds ratios (ORadj) and 95% confidence intervals are presented. **Results:** Low first trimester Free Thyroxine 4 ( $T_4 < 0.8$ ; ORadj 4.7, 1.3 - 16.4) was associated with an increased risk of SAB. There were trends of increased SAB among women with first trimester intestinal parasitic infection (ORadj 2.5, 1.0 - 6.5), coffee consumption  $\geq 2$  cups per day (ORadj 2.9, 0.6 - 14.7), or high  $T_4$  ( $>1.8$ , ORadj 1.9, 0.9 - 4.0). BMI, anemia, history of SAB, maternal age and chai consumption were not associated with SAB. **Conclusions:** Early pregnancy thyroid dysfunction, particularly hypothyroidism, increased the risk of SAB among women in a rural to peri-urban region of India. Chai, the most frequently consumed caffeinated beverage in this population, was not associated with SAB. Greater consumption of coffee was associated with an increased risk of SAB, although coffee was not frequently consumed and the relationship was not statistically significant.

PA065

Gestational age of previous pregnancy is a strong risk factor for stillbirth in the next pregnancy  
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**Aim:** To quantify the absolute risk of stillbirth by final gestational length of the previous pregnancy **Background:** Seven studies have been published on stillbirth risk following preterm birth in previous pregnancy and risk ratios ranged from 1.16 to 3.10. Only one study examined stillbirth risk by categorised extent of prematurity in the previous pregnancy. It reported a 5-fold increase in odds of stillbirth. No study has investigated absolute risk of stillbirth by final week of gestation of previous delivery. **Method:** We calculated the proportion of stillbirths by final week of gestational of previous pregnancy for 232,411 women who delivered 585,346 singleton births between 1980 and 2010 in Western Australia, identified from the Midwives Notification System. As the intention was to evaluate the non-independent value of this variable for antenatal risk assessment, estimates were not adjusted. **Results:** There was an exponential increase in stillbirth risk with decreasing week of final gestation of previous. For women with a term birth (from 37 weeks gestation) <1% of their previous births were stillbirths. However, for with preterm birth <28 weeks gestation approximately 4%-9% of their previous births were stillbirths. **Conclusion:** For some ranges of final gestational age of previous pregnancy the stillbirth rate was twice that of sub-Saharan Africa and >13 times the general population rate. For women who previously delivered at 28-36 weeks, which represents a large proportion of the population, the stillbirth rate was on par with the strongest known single risk factors, such as fetal growth restriction. Final gestational week of previous pregnancy has strong potential for preliminary stillbirth risk assessment.

PA066-S

Parental Age and the Risk of Gestational Hypertension and Preeclampsia  
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**Background:** The objective of this study was to determine the joint effect of maternal age (MA) and paternal age (PA) on the risk of gestational hypertension, preeclampsia, and eclampsia in women who delivered on the Texas-Mexico border. **Methods:** A cohort study using birth certificate data from El Paso County, Texas, was conducted. The analysis was restricted to singleton pregnancies from the years 2005-2010. Six parental age exposure categories were created with MA 20-34 years (y) and PA <35 y serving as the referent. A directed acyclic graph was created. Risk ratios (RR) for the composite outcome of gestational hypertension, preeclampsia, or eclampsia were calculated using Poisson regression (with robust variance) and adjusted for parity and other factors. **Results:** A total of 85,114 records were identified with a majority of the mothers being of Hispanic ethnicity (89.2%). The largest category was MA 20-34 y and PA <35 y (n=54,037) while the smallest was MA <20 y and PA ≥35 y (n=68). The incidence of the composite outcome ranged from 2.8% in the MA 20-34 y and PA ≥35 y group to 4.4% in the MA <20 y and PA ≥35 y group. Compared to the MA 20-34 y and PA <35 y group, women in the MA ≥35 y and PA ≥35 y group were more likely to experience the outcome (adjusted RR=1.57, 95% confidence interval: 1.39-1.77, P<0.0001). **Conclusions:** Couples in which both parents are ≥35 years of age should be counseled on the increased risk of gestational hypertension or preeclampsia/eclampsia.

PA067-S

Fat intake during pregnancy and risk of preeclampsia: a prospective study in Denmark

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**Introduction:** Intake of omega-3 fatty acids, such as alpha-linolenic acid (ALA), eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), may decrease the risk of preeclampsia. Previous longitudinal studies support this hypothesis but randomized trials have yielded mixed findings. **Methods:** We prospectively followed 65,220 pregnancies of women participating in the Danish National Birth Cohort between 1997 and 2004. Diet was assessed in the second trimester of pregnancy (gestation week 25) with a food frequency questionnaire (FFQ). Diagnosis of preeclampsia and severe preeclampsia was obtained by linkage with the Danish National Patient Registry. Relative risks (RR) and 95% confidence intervals [95% CI] of preeclampsia and severe preeclampsia for women in increasing quintiles of fat intake were estimated using logistic regression models with generalized estimating equations to account for repeated pregnancies per woman and adjusted for potential confounders. **Results:** Preeclampsia was diagnosed in 1,302 pregnancies (2%), including 301 cases of severe preeclampsia (0.5%). There was a suggestion of a positive association between ALA intake and risk of preeclampsia whereas intake of DHA was inversely related to this outcome. Specifically, the RRs [95 % CI] of preeclampsia comparing women in the top quintile of intake to women in the bottom quintile were 1.20 [0.95, 1.53] for ALA, and 0.67 [0.51, 0.89] for DHA. The corresponding values for severe preeclampsia were 1.71 [1.07, 2.75] for ALA, and 0.46 [0.25, 0.83] for DHA. Furthermore, the RRs [95 % CI] of preeclampsia and severe preeclampsia comparing users to non-users of fish oil supplements were 0.93 [0.74, 1.18] and 0.66 [0.37, 1.19], respectively. **Conclusions:** Higher mid-pregnancy intake of ALA may be related to higher risk of severe preeclampsia while mid-pregnancy intake of DHA, from food sources or supplements, may decrease the risk of severe preeclampsia.

PA068-S

Prevalence of renin-angiotensin system (RAS) blockers exposure during pregnancy and the likely clinical indications: A population-based cohort study in NSW

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**Background:** The fetal toxicity of RAS blockers including angiotensin converting enzyme inhibitors (ACEIs) and receptor blockers (ARBs) in late pregnancy is well established, while evidence regarding their teratogenic effect during early pregnancy is inconclusive. This study examined RAS blocker utilisation during early and late pregnancy and the likely underlying indications, in order to provide information on the extent to which exposure during pregnancy could be avoided. **Methods:** Perinatal data for all women who gave birth in NSW between 2005 and 2012, and who were concessional beneficiaries of prescription medicines were linked to hospital admissions and pharmaceutical dispensing data. For pregnancies during which a RAS blocker was supplied, related diagnoses were identified from the perinatal record and records of hospital admissions for the delivery and the two years prior. **Results:** Among 166,707 pregnancies, 0.1% and 0.1% were exposed to ACEIs and ARBs in early pregnancy respectively. Fewer (0.02% and 0.04%) used these medicines in late pregnancy. During-pregnancy, use of ACEIs decreased over time, while use of ARBs increased. Renal, cardiac and pre-gestational diabetes were found in 2-10% of pregnancies, and the clinical indication was unknown for approximately 12% of pregnancies. For 66% of pregnancies, the only indication was chronic hypertension, which is not an indication for which RAS blocker use during pregnancy is required. **Conclusion:** It is encouraging that RAS use is lower in late pregnancy, the majority of exposure was due to avoidable indications; however, suggests the need for a greater review of medication profiles for women of childbearing age.

PA069

Trends of maternal hypertension in Canada 2004/05-2014/15

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**Objectives:** To present trends on pre-existing and gestational hypertension among pregnant women in Canada. **Methods:** Rates of maternal hypertension (gestational and pre-existing) were calculated and are expressed per 1,000 births (live and stillbirths) in a given place and time using data from the Discharge Abstract Database of the Canadian Institute for Health Information (CIHI-DAD) for the period 2004/05-2014/15. This database contains information on all hospital discharges in Canada (except the province of Quebec). Diagnoses in the database are coded using the International Statistical Classification of Diseases and Related Health Problems, Tenth Revision (ICD-10CA). The rates are calculated based on fiscal years (i.e., April 1 to March 31). **Results:** The overall rates of gestational hypertension decreased between 2004/05 and 2014/15 from 41.3 to 38.2 per 1,000 births. Over the same time period (2004/05 to 2014/15), the rate of preexisting hypertension increased from 4.2 to 5.0 per 1,000 births as well as the rate of preeclampsia from 11.2 to 16.9 per 1,000 births. Rates of eclampsia decreased from 1.0 to 0.4 per 1,000 births. Differences in rates of gestational hypertension were observed across age groups. Higher rates were observed among women 40 years and older. **Conclusions:** The data shows an increase in both pre-existing hypertension and preeclampsia among pregnant women, a slight decreasing trend gestational hypertension and a decline in rates of eclampsia in Canada. The rates of maternal hypertension based on CIHI-DAD may underestimate the actual rates of maternal hypertension in Canada, as all maternal hypertension could not be identified due to limitations of the ICD-10CA codes (i.e. miscoding, unspecified, and Quebec not included). Continued national surveillance of hypertension in pregnancy is needed to better inform and guide prevention efforts as these rates may increase given the trend towards an older and more obese obstetric population

PA070

The role of danger associated molecular patterns and pentraxin-3 in preeclampsia and gestational diabetes mellitus

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Danger associated molecular patterns (DAMPs) are indicators of tissue injury and associated with non-infectious inflammation, which has been implicated in pregnancy complications. However, associations between DAMPs and preeclampsia or gestational diabetes mellitus (GDM) have been conflicting. This pilot study explored the relationship between circulating DAMPs [high mobility group box B (HMGB1) and heat shock protein (HSP) 70], circulating markers of innate immune response [pentraxin-3 (PTX3) and interleukin (IL)-6], maternal characteristics, and pregnancy outcomes. We obtained third trimester plasma samples from PeriBank, which collects data and biospecimens from pregnant women admitted to one of three hospitals in Houston, TX. We obtained a random sample of 100 healthy controls, 50 women with preeclampsia and 50 women with GDM. All women had term singleton pregnancies and no history of chronic conditions. We measured HMGB-1, PTX3, IL6, and HSP70 (pg/ml) by ELISA. Correlation among blood markers, systolic blood pressure (SBP), diastolic blood pressure (DBP), maternal age, glucose, and body mass index (BMI) were examined using spearman correlation. Associations between high levels of blood markers ( $\geq$  75th percentile of the distribution) and pregnancy outcomes were determined by log-binomial regression to estimate PR and 95% confidence intervals after adjusting for BMI, maternal age and smoking. HMGB1 was negatively correlated with SBP ( $r^2=-0.24$ ;  $p=0.001$ ) and DBP ( $r^2=-0.28$ ;  $p=0.0001$ ), PTX3 ( $r^2=-0.35$ ;  $p=0.0001$ ) and IL-6 ( $r^2=-0.36$ ;  $p=0.0001$ ) but positively correlated with HSP70 ( $r^2=0.22$ ;  $p=0.003$ ). Compared to controls, women with preeclampsia had elevated PTX3 (PR 1.5, 95% CI 1.2-1.9) and IL6 (PR 1.4, 95% CI 1.0-2.0) but lower HMGB1 (PR 0.1, 95% CI 0.02-0.3). Women with GDM were similar to controls. These data suggest that oxidative stress and inflammation associated with preeclampsia and GDM do not lead to significant maternal tissue injury or damage.



PA071

Workforce participation and healthy worker biases in U.S. women and men

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**Background.** Healthy worker biases can occur when healthier individuals are more likely to enter or remain in the workforce than less healthy individuals. Societal factors might motivate healthy women of reproductive age to opt out of the workforce to focus on childcare, possibly counteracting the effects of healthy worker biases. The purpose of this study was to examine this possibility in a contemporary U.S. population. **Methods.** We used 2013-2015 data from 55,261 U.S. women and 70,215 U.S. men aged 22-44 years participating in the Gallup-Healthways Well-being Index®. Participants answered questions about work, home, and health. We used logistic regression to estimate adjusted prevalence odds ratios (POR) and 95% confidence intervals (CI) for associations between health and non-participation in the workforce. **Results.** Women and men reporting poor health were more likely to be out of the workforce than individuals reporting excellent health (women: POR 3.7, 95% CI 3.2-4.2; men: POR 6.6, 95% CI 5.7-7.7), suggesting potential for healthy worker bias. For women, the strength of this association was modified by the number of children aged <18 years in the home, with a strong association for women with no children (POR 7.3, 95% CI 5.8-9.1) that decreased as the number of children increased (POR 0.9, 95% CI 0.6-1.5 for  $\geq 4$  children). This effect measure modification was not seen for men. **Conclusions.** These results are consistent with attenuation of healthy worker biases in populations in which healthy women opt out of the workforce to focus on childcare. Therefore, we might expect the magnitude of healthy worker biases to vary with the proportion of women and the proportion of women with young children in the study population.

PA072

A sensitivity analysis to assess bias due to left-truncation in epidemiologic investigations of suspected teratogens

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In nature, those at risk of developing a structural birth defect are all conceptuses. But gestation is a dangerous time for the human embryo, and at most 70% will survive to live birth. It is only these survivors, and (less frequently) prenatally diagnosed stillbirths and terminations, whom we have the opportunity to observe and include in our contemporary case-control investigations of suspected teratogens. Previous scholars have demonstrated that an observed prevalence of structural defects at birth is a function of both the incidence in early gestation and the probability of fetal survival, and that both factors can be a function (independently or synergistically) of the exposure in question. These complex and unknown interrelations impose a challenge to our ability to draw valid causal inferences from observed associations for suspected teratogenic exposures. We propose a novel application of a sensitivity analysis method to evaluate magnitude and direction of bias under a range of reasonable assumptions about the effect of exposure on fetal survival. We begin by constructing a hypothesized randomized trial of a suspected teratogen in which the at-risk group is all conceptuses, and all censoring events (pregnancy loss or birth defect) are observed. We then assign reasonable literature-based probabilities of survival for embryos with and without a structural defect under various conditions (e.g., in the presence or absence of a chromosomal anomaly). The sensitivity analysis treats pregnancy losses as missing data, and yields graphical output that can be used to compare observed results from real data to simulated data mimicking the impossible but ideal scenario in which we could observe all pregnancy losses and ascertain the presence or absence of birth defects among them. We demonstrate the application and interpretation of this method using data from the National Birth Defects Prevention Study, a case-control study of birth defects in the US from 1997 to 2011.

PA073-S

Estimating Gestational Age at Birth from Maternal and Neonatal Anthropometry: the NICHD Fetal Growth Studies

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Accurate assessment of gestational age (GA) at birth is critical for neonatal care. Yet, in developing countries, access to ultrasound is limited. Our objective was to assess the accuracy of GA prediction and preterm birth classification using routine, low-cost measures of longitudinal maternal and cross-sectional neonatal anthropometry. In a US prospective cohort study of 2334 non-obese pregnant women, enrollment GA was determined based on last menstrual period and confirmed by 1st-trimester ultrasound. Maternal mid-upper arm circumference, subscapular skinfold, triceps skinfold, weight, and fundal height (FH) were measured at 6 study visits and abstracted from medical charts. Neonatal abdominal circumference, length, and birth weight were measured after birth at a median (IQR) of 1 (1-2) days. To optimally estimate GA at delivery, we developed three predictor models using combinations of longitudinal maternal and cross-sectional neonatal anthropometry measures. For all predictors, we repeatedly sampled the data to construct training (60%) and test (40%) sets. We used a linear mixed model framework for maternal anthropometric data and added a shared parameter model to incorporate neonatal anthropometry. The prediction error for various combinations of FH with maternal and neonatal anthropometric measures ranged between 1.98 to 2.09 weeks. Longitudinal FH alone predicted GA within 2.09 weeks in the total population with stable prediction accuracy across individual race/ethnicities [Whites (1.98 weeks), Blacks (2.16 weeks), Hispanics (2.21) and Asians (1.87)], and correctly identified 75% of preterm GA's <37 weeks. In scenarios when FH measures began after 20 weeks in the test set, the prediction accuracy improved (2.02 weeks) but when FH measures began after 28 weeks, prediction accuracy decreased (2.30 weeks). Our findings suggest that longitudinal FH measures alone, beginning early in gestation, can predict GA within a margin of error similar that of an ultrasound.

PA074-S

Classification of Medicaid coverage on birth records in Wisconsin, 2011-2012

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Background: In 2011, Wisconsin (WI) implemented the 2003 revised national standard birth certificate that now includes payer. To validate this new measure, we compared correctly classified Medicaid-covered (MA) and misclassified MA births. Methods: We linked WI birth records to the Multi-Sample Person File (MSPF; social services data integrated at the child level) to create three groups: MA indicated on the birth certificate, misclassified MA (MA not on birth certificate but in MSPF), and non-MA. Analyses compared misclassified MA births to MA births and to non-MA births. Chi-square tests and t-tests compared baseline differences; logistic regressions with ORs and 95% CIs tested associations to preterm birth (PT, <37 weeks) and low birth weight (LBW, <2500g). Results: Of 131,330 records linked to MSPF, 38.9% of births were MA, 12.7% misclassified MA, and 48.5% non-MA. By birth records alone, MA covered 28.5% of non-Hispanic white (NHW), 75.1% of non-Hispanic black (NHB), and 72.4% of Hispanic births. After linkage, an additional 12.0% of NHW, 16.6% of NHB, and 12.2% of Hispanic mothers were found to have MA births. Misclassified MA births were more likely to have mothers who were NHW, be more educated, and be married. PT and LBW rates among misclassified MA (10.5%, 8.6%) and MA births (9.7%, 8.1%) differed significantly overall. While odds of PT (OR 1.08, 95% CI 1.03-1.16) and LBW (OR 1.15, 95% CI 1.08-1.23) were greater among misclassified MA births after adjustment, pooling MA and misclassified MA births did not significantly alter outcomes overall or by race. Conclusions: A substantial fraction of MA covered births in Wisconsin were not identified on the birth record, leading to an underestimate of the reach of MA. Though corrected classification of births did not significantly change overall rates of PT or LBW, the differential misclassification of payer by maternal characteristics should be considered when conducting epidemiologic investigations.

PA075-S

A method to impute time to kidney transplant outcomes in the presence of prevalent events in the Chronic Kidney Disease in Children Cohort.

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Kidney transplant outcomes may be determined as the time at which glomerular filtration rate (GFR) <45 ml/min/1.73m<sup>2</sup>, as an indicator of poor transplant prognosis. We aimed to characterize these outcomes after transplant in the Chronic Kidney Disease in Children (CKiD) cohort. For a substantial proportion of children, their first GFR was observed to be below 45 ml/min and this occurred at heterogeneous times after transplant. Using data from 143 children who received a transplant and contributed GFR data, for 24 the time when GFR<45 ml/min was determined by interpolation between two observations above and below this threshold; 18 had a first GFR<45 ml/min and were classified as prevalent events and the remaining 101 participants contributed GFR>45 ml/min. To impute times for the prevalent events, we used a two-stage model approach that may be applied to other settings in which trajectories of biomarkers define events. The first model aimed to determine level of GFR shortly after transplantation (0.25 years) using empirical Bayes estimates of the intercept and slope from linear mixed models with GFR as the dependent variable and time as the independent variable among children who contributed GFR data within 1 year after transplantation. The empirical Bayes estimates provided the estimated levels of GFR at 0.25 years after transplant. Using these data as the outcome and pre-transplant variables as the predictors, we then constructed an imputation model to determine GFR levels among prevalent cases. For 18 prevalent cases, the time when GFR<45ml/min was interpolated from the imputed value at 0.25 years and the first observed GFR<45ml/min. This proposed approach used a combination of observed data, empirical Bayes estimates and imputed values to estimate time to event for all individuals and was less biased compared to a simple cumulative incidence approach which does not account for heterogeneous follow-up time.

PA076

Application of a systematic evaluation protocol to epidemiological studies of phthalate exposure and preterm birth  
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To evaluate the potential health effects of phthalate exposure, the U.S. Environmental Protection Agency's Integrated Risk Information System program developed an epidemiologic study evaluation protocol that included phthalate exposure measurement and outcome-specific considerations for case ascertainment, population selection, confounding, data analysis, and study sensitivity. For preterm birth (PTB), the protocol included evaluation of methods used to estimate gestational duration and timing of study enrollment. We excluded studies using biomarkers in tissues other than urine because these tissue samples can metabolize phthalate diesters from external sources, leading to inaccurate estimates. A systematic literature search identified 11 studies that examined PTB or gestational age relative to urinary phthalate exposure(s). For di(2-ethylhexyl) phthalate (DEHP), 2 nested case-control and 3 cohort studies met the criteria for high or medium confidence based on study quality considerations. The prevalence of PTB ranged from 3-11% in these cohorts. The odds ratios in these 5 studies were 0.62, 1.25, 1.27, and 1.33 (continuous exposure) and 1.9 (dichotomous exposure), with 1 study exhibiting an exposure-response relationship. This consistency across higher quality studies is highly supportive of an association between DEHP and PTB. In 6 other studies, a significant limitation was identified – enrollment occurred during the 3rd trimester, reducing the ability to fully examine PTB. Among these studies, the prevalence of PTB was generally lower, and there was greater heterogeneity of observed results. Inclusion of these 6 studies in a risk assessment could obscure a pattern of association indicative of an increased hazard, and raises the question of how to appropriately weigh the results of low confidence studies in a synthesis of results. Additional studies with multiple exposure measures could improve the quantitative exposure-response characterization for DEHP and PTB. The views expressed in this abstract are those of the authors and do not necessarily reflect the views or policies of the U.S. Environmental Protection Agency.

PA077-S

Breastfeeding after gestational diabetes: Using GIS to explore maternal-infant health program coverage  
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**Introduction.** Gestational diabetes (GDM) rates are increasing in the U.S. Breastfeeding after GDM is not well-understood; there may be hormonal delay of mature milk that is associated with early supplementation and cessation of breastfeeding. It is not well-known if Maternal-Infant Health (MIH) programs reach women with GDM and if programs appear to increase breastfeeding to this group. This study aims to assess county-level rates of GDM in pregnancy and breastfeeding initiation by these women. **Methods.** Existing data from 2010-2013 vital birth records and 2013 births in three county-administered MIH programs in Kalamazoo County, MI were analyzed using basic descriptive statistics, 95% confidence intervals, and spatial methods including the Moran's I spatial autocorrelation test using ArcGIS 10.3.1. **Results.** The percent of births to women with GDM for Kalamazoo County, at 16% (n=1931), was more than triple that for the state of Michigan, at 5% (n=23,164), for the period 2010-2013. In the state of Michigan, considering the 95% confidence intervals, there was no difference between the proportion of women initiating breastfeeding with and without GDM. There was more variability by GDM status for Kalamazoo County mothers; women with GDM were less likely to initiate breastfeeding compared to women without GDM. When women with GDM enrolled in MIH programs, breastfeeding initiation rates were higher (20%) compared to unenrolled women (10%). Census tracts with highest GDM did not correspond with census tracts of highest enrollment of these women by MIH programs. An area with low program enrollment corresponded with a hot spot for women with GDM and not breastfeeding. **Discussion.** Areas of the county with high GDM and low breastfeeding by these mothers are under-enrolled by current MIH programming. These analyses demonstrate the use of GIS to assess outcomes and current public health resources and to identify geographic areas of need in a community.

PA078

Opioid Outpatient Prescription Claims among Pregnant Women, 2013  
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Opioid use during pregnancy has been associated with several adverse neonatal and infant outcomes. To better understand opioid dispensations during pregnancy, we used Truven Health's MarketScan Commercial Claims and Encounters data to examine outpatient prescription claims for opioid-containing medications among women with pregnancies in 2013. We included women 15–44 years old in 2013 on a health insurance plan with prescription drug coverage. Pregnancies were identified using pregnancy-related diagnosis or procedure codes indicating a livebirth or pregnancy loss. We included pregnancies with an estimated date of last menstrual period (LMP) or date of delivery/end of pregnancy in 2013. We then restricted to pregnancies with enrollment from 90 days before LMP to 90 days after the end of pregnancy or who were missing only one month of enrollment during that time period. To capture any dispensations during or around pregnancy (defined as LMP to seven days before date of delivery/end of pregnancy to remove delivery-related dispensations), we searched outpatient pharmacy prescription claims from 2012 to 2014 for opioid-containing medications using national drug codes. Among the 488,887 pregnancies in 2013 that met our inclusion criteria, 10.6% of women filled a prescription for an opioid from an outpatient pharmacy during pregnancy. The most common types of opioids dispensed during pregnancy were hydrocodone (5.7%), codeine (3.6%) and oxycodone (1.8%). Opioid claims varied by time period, with 8.3% filling a prescription in the 90 days before LMP, 5.7% filling in their first trimester, 4.3% in second, and 6.8% in third (excluding the week before delivery/end of pregnancy). In this dataset, approximately 1 in 10 pregnant women filled a prescription for an opioid from an outpatient pharmacy. Because prenatal use of opioids poses recognized fetal risks, more work is needed to understand opioid prescribing patterns to promote responsible prescribing during pregnancy.

PA079-S

Variation in Maternal Comorbidities across Area-Level Socioeconomic Status: A Cross-Sectional Study  
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**Introduction:** Area-level socioeconomic status (SES) has a substantial effect on maternal health. Although the presence of one comorbidity during pregnancy relates to a 6-fold increase in risk of severe maternal complications, the influence of area-level SES on maternal comorbidities has not been examined. **Objective:** To examine the variation in maternal comorbidities across area-level SES. **Methods:** This study used the Discharge Abstract Database that comprised birth data in Alberta between 2005-2007 (n: 120,285). Maternal comorbidities such as pre-eclampsia and multiple gestation were identified using validated case definitions. The Material Deprivation Index, which comprises census reported income, education, and employment and ranges from the least deprived (quintile 1) to the most deprived (quintile 5), was obtained for each dissemination area and linked to birth data. Multilevel logistic regression was used to analyze the data adjusting for maternal age and parity. **Results:** The overall prevalence of comorbidities varied across area-level SES (p-value: 0.028), ranging from 7.02% (95% Confidence Interval (CI): 6.78%, 7.39%) in the least deprived areas to 7.80% (95% CI: 7.49%, 8.12%) in the most deprived areas. The presence of at least one comorbidity (adjusted Odds Ratio (OR): 1.28; 95% CI: 1.18, 1.39), asthma (adjusted OR: 1.83; 95% CI: 1.29, 2.58), drug abuse (adjusted OR: 2.67; 95% CI: 1.95, 3.65), and human immunodeficiency virus (adjusted OR: 3.62; 95% CI: 1.44, 9.11) were all significantly more likely to occur in the most deprived areas. In contrast, multiple gestation (adjusted OR: 0.55; 95% CI: 0.30, 0.98) was significantly less likely to occur in the most deprived areas. **Conclusion:** The occurrence of maternal comorbidities varies across area-level SES. This may put specific SES group at greater risk for severe maternal complications and poor birth outcomes, resulting in an increased burden to the health care system.

PA080-S

Apprehension of a Child at Birth by Child Protective Services and Postpartum Psychological Distress in the Biological Mother: A Longitudinal Population-Based Study  
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**Objectives:** Postpartum psychological distress is a common sequela of childbirth. This study examines whether women whose child was apprehended at birth have different rates of postpartum psychological distress than women receiving other protective or support services and women not involved with child protective services. **Approach:** A cohort of women whose first child was born in Manitoba between April 1, 1998 and March 31st 2014, lived in Manitoba at least two years before and one year after the birth of their first child, and at least 18 years old at the birth of their first child (n = 69,155) was used. Adjusting for a variety of confounders, a logistic regression model determined the adjusted odds ratios (AORs) of being diagnosed with postpartum psychological distress among women with differing levels of involvement with child protective services. **Results:** The adjusted model found that women whose child was apprehended at birth had significantly greater odds of being diagnosed with postpartum psychological distress than women receiving other protection or support services (AOR = 1.60, 95% CI 1.14-2.24) and women not involved with child protection services (AOR = 2.60, 95% CI = 1.93-3.51). Women receiving other protection or support services also had significantly greater odds of being diagnosed with postpartum psychological distress than women not involved with child protection services (AOR = 1.63, 95% CI 1.35-1.97). **Conclusion:** The trauma of having a child apprehended at birth is related to significantly more psychological distress than the stresses of new motherhood. For mothers whose children are apprehended at birth, services should be provided to minimize the impact of this trauma and aid in the reunification process.

PA081-S

Prenatal care providers' perspectives and practices for women with a previous C-section  
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Many pregnant women with a previous cesarean (CS) have the option of an elective repeat CS (ERCS) or a trial of labor (TOL) to attempt a vaginal birth after cesarean (VBAC). National guidelines recommend VBACs for most women, yet the rate is <10%. Research on the mode of birth decision shows the prenatal care provider is a main factor, but little is known about providers' opinions and practices. Understanding this is crucial for designing programs to increase TOL. A web-based cross-sectional survey was conducted from 02-11/2016 to examine provider opinions and practice patterns regarding TOL/VBAC. Of 45 prenatal care providers in the study area invited to participate, 37 completed the survey. The mean age was 49; 62% were male; 87% were Non-Hispanic White. All but 2 offered a TOL. Given 23 clinical situations, providers were split on whether to encourage a TOL, indicating substantial practice variations across providers. Important factors providers considered before recommending a TOL were: current pregnancy risk factors (100%), reason for the previous CS (89%), and strength of patient preference (83%). Convenience of scheduling the delivery was unimportant to 40%; concern for litigation risks was unimportant to 29%. Regarding pre-decision discussions with patients, 39% used a VBAC calculator (a tool to aid patients' mode of birth decision) always or very often; 25% never did. There was more consistency in risks discussed with patients for TOL but fewer risks consistently discussed for ERCS. Only 48% agreed the risks associated with a TOL were lower for the mother compared to an ERCS; only 29% disagreed the risks of TOL were lower for the infant. This study shows variation in practice patterns and discussions with patients regarding the mode of birth decision, and a lack of awareness and agreement about risks and recommendations. Despite more encouragement of VBACs in recent years, this study indicates a need to establish and disseminate best practices guidance.

PA082

Maternal perceptions of the quality of lactation support and its association with breastfeeding experiences and postpartum mental health outcomes  
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Many postpartum women receive lactation consultant (LC) support, but how they perceive that support as positive or negative and how those perceptions influence breastfeeding and psychosocial outcomes is poorly understood. In 2016 we recruited women 2-6 months' postpartum from the NIH CTSA ResearchMatch online portal and several Facebook moms groups to complete an online questionnaire about infant feeding, lactation support, and physical and psychosocial postpartum health. Multiple linear regression was used to examine ever receiving LC support since delivery and perceptions about that support (a binary variable derived from a 22 feeling checklist) in relation to continuous outcomes assessed at time of the survey: breastfeeding self-efficacy (Breastfeeding Self-Efficacy Scale), personal evaluation of breastfeeding success (Maternal Breastfeeding Evaluation Scale), state anxiety (State-Trait Anxiety Inventory), and depressive symptoms (Edinburgh Postnatal Depression Scale). Of 267 eligible women, 138 (52%) had received LC support since delivery (78% before the end of the 1st postpartum month and not again). 98 (71%) of those who received support rated it overall positively, 40 (29%) overall negatively. Receipt of LC support was not associated with any outcomes. Negative overall perceptions of LC support were associated with much lower breastfeeding self-efficacy ( $\beta=-9.0$  [0.6-SD diff.] 95% CI: -14.3, -3.8), a much less successful breastfeeding experience ( $\beta=-18.2$  [0.8-SD diff.] CI: -26.2, -10.3), and greater general anxiety ( $\beta=6.0$ , CI: 1.8, 10.2) but not depressive symptoms ( $\beta=0.7$ , CI: -0.8, 2.3), after controlling for confounders including race, education and others. Women who had a negative LC support experience had poorer breastfeeding and mental health outcomes. Our effects estimates may have been subject to recall bias and confounding by indication. Simply receiving lactation support may be inadequate to ensure positive outcomes, as perceptions of the quality of support are also important.

PA083-S

Iodine deficiency and thyroid dysfunction among Finnish pregnant women

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Iodine deficiency is thought to be eradicated in several countries through long-standing salt iodization programs. However, changes in diet and use of non-iodized salt by food industry may have reintroduced iodine deficiency in countries with long-term iodine sufficiency, such as Finland and the U.S., particularly among vulnerable populations like pregnant women. We used thyroglobulin and thyrotropin to evaluate the prevalence of iodine deficiency and thyroid disease among Finnish pregnant women. We randomly selected a population-based sample of 250 singleton pregnancies (2012-2013) with clinical data from the Finnish Medical Birth Register and early pregnancy serum samples from the Finnish Maternity Cohort. The samples were analyzed for thyroglobulin and thyrotropin (TSH) by an immunoassay. Women were deemed iodine deficient if their thyroglobulin concentration was  $>40$  ng/ml. This cut-off was selected based on literature on standardized measures of thyroglobulin to define iodine deficiency among school-aged children. Women were deemed to have low and high TSH concentration if they had TSH concentration  $<0.1$  mU/l or  $>2.5$  mU/l in the first trimester or  $<0.2$  mU/l or  $>3.0$  mU/l in the second trimester, respectively. Altogether 46 women (18.4%) had thyroglobulin concentration  $>40$  ng/ml. TSH concentrations were similar among women with high and normal thyroglobulin concentrations (median: 1.16 vs. 1.14; min-max: 0.01-3.70 vs. 0.04-5.00 IU/l, p-value 0.529). The rate of high TSH concentrations was similar among women with high and normal thyroglobulin concentration (6.5% vs. 7.4%), but the rate of low TSH was nonsignificantly higher among women with high thyroglobulin concentrations (8.7% vs. 2.9%, p-value 0.166). Our data show that less than 20% of Finnish pregnant women have high thyroglobulin concentrations, which might suggest mild iodine deficiency. The prevalence of thyroid dysfunction was high, but similar among women with high and normal thyroglobulin concentrations.

PA084-S

Stress and anxiety during early, mid, and late pregnancy modulate gestational weight gain in Hispanic women

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Prior studies on the impact of stress and anxiety on gestational weight gain (GWG) are sparse and have been limited by use of psychosocial questionnaires that were not validated for use during pregnancy and were administered at only one pregnancy time point. The majority examined only total GWG and did not include Hispanic women, who are less likely to meet GWG guidelines compared to non-Hispanic white women. Therefore, we investigated the association between stress and anxiety in early, mid, and late pregnancy and rate of GWG and total GWG among 1,308 pregnant Hispanic participants in Proyecto Buena Salud, a prospective cohort study conducted in Massachusetts from 2006 to 2011. We measured stress with the Perceived Stress Scale and anxiety with the State-Trait Anxiety Inventory. We abstracted GWG from medical records. Nearly 20% of women ( $n=232$ ) had inadequate total GWG and 52% of women ( $n=611$ ) had excessive total GWG; mean total GWG was 30.2 pounds (lbs) ( $SD=16.2$  lbs) with a mean rate of GWG in the second and third trimesters of 1.0 lb/week ( $SD=0.5$  lbs). Mean levels of stress ( $M=26.1$ ,  $SD=7.0$ , possible range 3-48) and anxiety ( $M=40.2$ ,  $SD=10.3$ , possible range 20-76) were highest in early pregnancy and declined into late pregnancy. After adjusting for age, pre-pregnancy BMI, gravidity, total physical activity and depression, women in the highest quartile of stress ( $\beta=-4.00$ ,  $SE=1.85$ ,  $p=0.031$ ) and anxiety ( $\beta=-4.22$ ,  $SE=1.92$ ,  $p=0.044$ ) in early pregnancy had lower total GWG compared to women in the lowest quartile, respectively. Women in the highest quartile of stress in late pregnancy ( $\beta=-0.131$ ,  $SE=0.056$ ,  $p=0.037$ ) and anxiety in early pregnancy ( $\beta=-0.138$ ,  $SE=0.060$ ,  $p=0.021$ ) had a lower rate of GWG in the second and third trimesters compared to women in the lowest quartile, respectively. Findings suggest that prenatal intervention programs targeting stress and anxiety reduction among Hispanic pregnant women should additionally focus on maintaining healthy GWG.

PA085-S

Associations between fat-soluble micronutrients before and during pregnancy and pregnancy outcomes

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**Background:** The relationship between preconception micronutrients and pregnancy outcomes remains uncertain. We assessed associations between preconception and 8-weeks gestation fat-soluble micronutrient levels and pregnancy outcomes. **Methods:** In a secondary analysis among women with 1-2 prior pregnancy losses in the EAGeR Trial, we measured serum zeaxanthin, cryptoxanthin, lycopene,  $\alpha$ - and  $\beta$ -carotene,  $\alpha$ -, and  $\gamma$ -tocopherol preconception (n=1207) and at 8-weeks gestation (n=533). Changes in micronutrient levels from preconception to 8-weeks gestation were evaluated as <25th and >75th percentile, compared with the interquartile range. Generalized linear models with inverse probability weights explored associations between micronutrients and pregnancy, loss, live birth, gestational diabetes mellitus (GDM), preeclampsia, and preterm delivery (PTD). Models adjusted for age, race, smoking, body mass index, physical activity, income, parity, marital status, number of previous losses, vitamin use, site, treatment arm, and total cholesterol. **Results:** Increasing preconception zeaxanthin, lycopene, and  $\beta$ -carotene were positively associated with pregnancy and live birth. Women whose  $\alpha$ -carotene levels decreased from preconception to 8-weeks gestation (median>120% decline) had an increased odds of pregnancy loss (OR 2.24, 95% CI 1.09, 4.62) and decreased live birth (OR 0.43, 95% CI 0.21, 0.86). Increasing preconception  $\alpha$ - and  $\beta$ -carotene levels were associated with a decreased odds of PTD (OR 0.51, 95% CI 0.26, 0.99) and GDM (OR 0.36, 95% CI 0.16, 0.83), respectively. Decreased  $\beta$ -carotene from preconception to 8-weeks gestation (median>47% decline) was associated with an increased odds of GDM (OR 4.75, 95% CI 1.20, 18.76). **Conclusions:** Preconception and early gestation carotenoid intake may reduce the risk of pregnancy complications among women with prior pregnancy losses. The potential role of micronutrient as a means to improve reproductive outcomes warrants further investigation.

PA086-S

PERINATAL AND MATERNAL MORBIDITY AND MORTALITY ASSOCIATED WITH ATTEMPTED MIDPELVIC OPERATIVE VAGINAL DELIVERY AND CESAREAN DELIVERY: A POPULATION-BASED RETROSPECTIVE COHORT STUDY

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**INTRODUCTION:** Increased use of operative vaginal delivery has been advocated as a strategy to curb the rising rate of cesarean delivery, however, there is limited comparative information regarding perinatal and maternal outcomes between operative vaginal and cesarean delivery. **OBJECTIVE:** To quantify severe perinatal and maternal morbidity/mortality associated with attempted midpelvic operative vaginal delivery compared with cesarean delivery. **METHODS:** We conducted a retrospective cohort study of operative vaginal and cesarean deliveries carried out in the second stage of labour in British Columbia from 2004 to 2014. The primary outcomes were severe perinatal morbidity/mortality (including neonatal convulsions, assisted ventilation, severe birth trauma, and perinatal death) and severe maternal morbidity (including severe postpartum haemorrhage, shock, sepsis, and cardiac complications). Logistic regression was used to estimate adjusted odds ratios (AOR) and 95% confidence intervals (CI) after stratifying by indication (dystocia/fetal distress). **RESULTS:** The study included 10,901 deliveries. Among deliveries with dystocia, midpelvic operative vaginal delivery was associated with higher rates of severe perinatal morbidity/mortality compared with cesarean delivery (forceps AOR 2.29, 95% CI 1.28–4.11; vacuum AOR 2.92, 95% CI 1.46–5.83). Rates of severe maternal morbidity were similar following midpelvic operative vaginal delivery and cesarean delivery. Among deliveries with fetal distress, there was a significant increase in severe maternal morbidity (AOR 2.32, 95% CI 1.23–4.37) in the midpelvic forceps group. Severe perineal lacerations rates were high among all midpelvic operative vaginal deliveries, ranging from 8.5% to 23%. **CONCLUSION:** Attempted midpelvic operative vaginal delivery is associated with higher rates of severe perinatal and maternal morbidity/mortality, though these associations vary by indication and instrument.



PA087-S

A Prospective and Longitudinal Study of Thyroid Markers in Pregnancy and Risk of Gestational Diabetes

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Subclinical hypothyroidism or isolated hypothyroxinemia in pregnancy has been associated with increased risk of gestational diabetes (GDM). Previous studies suggest that free triiodothyronine (FT3) and FT3:FT4 ratio, a marker indicating conversion rate of free thyroxine (FT4) to FT3, may also be implicated in glucose homeostasis. Yet, studies examining association between GDM and FT3: FT4 ratio are lacking. In a case-control study including 107 GDM cases and 214 matched controls from the NICHD Fetal Growth Studies-Singleton Cohort (2009-2013), we prospectively and longitudinally examined associations of GDM with FT3: FT4 ratio and other markers of thyroid function and autoimmunity. Plasma thyroid-stimulating hormone (TSH), FT3, FT4, thyroid peroxidase antibody (TPO-Ab), thyroglobulin antibody (TG-Ab) were measured, and FT3: FT4 ratio was derived, from blood samples collected twice before GDM diagnosis (i.e. gestational weeks (GW) 10-14 and 15-26), and at GW 23-31 and 33-39. GDM diagnosis was ascertained from medical records. Adjusted odds ratios (aORs) were estimated using conditional logistic regression adjusting for pre-pregnancy body mass index, thyroid autoimmunity status, and other major risk factors. Isolated hypothyroxinemia at GW 15-26, but not 10-14, was significantly related to increased GDM risk; aOR (95% CI) comparing women with hypothyroxinemia to euthyroid was 4.9 (1.5, 16.0). Both FT3 and FT3:FT4 ratio were positively associated with GDM risk; aOR (95% CI) comparing the highest vs. lowest quartile of FT3 was 4.2 (1.7, 10.6) at GW 10-14 (Ptrend=0.001) and 2.8 (1.2, 6.5) at GW 15-26 (Ptrend=0.007). Similarly, the corresponding risk estimates for FT3:FT4 ratio were 7.6 (2.6, 22.1) and 10.3 (3.4, 31.9) at GW10-14 (Ptrend=0.001) and 15-26 (Ptrend<0.0001), respectively. TSH or FT4 levels were not associated with GDM risk. Our findings show that higher FT3 and FT3:FT4 ratios are independently related to GDM risk starting as early as the first trimester.

PA088

Trends and correlates of postpartum visit attendance in the United States

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The American Congress of Obstetricians and Gynecologists (ACOG) recommends that all women receive a postpartum check-up. We used data from Phases 6 (2009-2011) and 7 (2012) of the Center for Disease Control & Prevention's Pregnancy Risk Assessment Monitoring System (PRAMS) data to examine temporal trends in postpartum visit attendance and to identify factors associated with lack of attendance. Analyses accounted for the PRAMS sampling design and survey weights, and were conducted using the survey procedures in Stata 13.0. From 2009-2012, postpartum visit adherence remained relatively stable, with about 91% of women reporting attending a postpartum visit nationally. Among states for which 2012 data were available, postpartum visit adherence ranged from a low of 83.7% in New Mexico to a high of 94.7% in Illinois. After adjustment, groups at increased odds of missing the postpartum visit included: women of a racial/ethnic minority, those with low educational attainment, unmarried women, smokers, those who initiated prenatal care late, those who remained uninsured at delivery, and women with two or more prior live births. For instance, among women with private insurance, only 5% reported missing their postpartum visit; whereas, among women who were uninsured at delivery, 30% reported missing their visit. Similarly, among women with 16 or more years of education, only 4% reported missing their visit in contrast to 21% of women with 8 years or less. Women in Washington State were asked to indicate the reason(s) why they missed their visit, with about 29% who responded indicating that they were too busy and another 29% reporting that they didn't think they needed the visit. While national adherence with the recommended postpartum visit exceeds 90%, adherence is much lower among certain groups, most notably socioeconomically disadvantaged women. These are the very women at increased risk of medical comorbidities for whom postpartum visits would be valuable.

PA089

Evaluation of expression of interferon epsilon across pregnancy in healthy and Herpes Simplex Virus II infected women  
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Mouse models have shown that a previously uncharacterized type I interferon, interferon-epsilon (IFNE), may be required to form innate immune defense against sexually transmitted infections. Unlike other type I interferons, IFNE is regulated by reproductive hormones and is expressed primarily in the reproductive tract. However, no human studies have evaluated IFNE across pregnancy. This pilot study determined if IFNE can be measured in vaginal samples across pregnancy and examined differences in IFNE levels in the first, second and third trimester of pregnancy in healthy women (n=10) and women infected with Herpes Simplex Virus II (HSV) (n=5). All women in this study had singleton pregnancies, delivered at term without complications and did not have pre-existing chronic conditions. IFNE was compared between groups at each trimester using the Mann-Whitney U test. IFNE was log transformed and repeated measures of ANOVA were used to evaluate IFNE across pregnancy. There were no significant differences in IFNE levels by age, BMI, race, gravidity or fetal sex. IFNE significantly increased across pregnancy in healthy women (P=0.047). In HSV infected women, IFNE levels (pg/ml) increased from the first to second trimester and decreased in the third trimester (p=0.08). Compared to healthy women, HSV infected women had lower IFNE levels in vaginal secretions during the first [median 5.6 (IQR 24.0) vs. 24.1 (185.4) p=0.30, second [90.6(37.1) vs. 505.9 (581.4) p=0.08] and third trimesters [119.2(51.1) vs. 583.8 (968.6) p=0.03]. The results of this study revealed that IFNE is present in vaginal secretions during pregnancy and significantly increases across pregnancy in healthy women. IFNE levels were lower in HSV infected women, which is consistent with results from animal models suggesting that those with elevated IFNE are protected against infection. As this is a pilot project, a large prospective evaluation is needed to better understand the role of IFNE in human pregnancy.

PA090

Pregnancy weight gain charts for Chinese women: 2013-2015

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**Objectives:** No study has examined gestational weight gain growth percentiles in countries outside the United States. Our goal was to construct pregnancy weight gain-for-gestational-age Z score charts for Chinese women, stratified by early pregnancy body mass index (BMI). **Methods:** Serial weight gain measurements were obtained from electronic medical charts from 988 underweight (BMI: <18.5), 2414 normal weight (BMI: 18.5-23.9), and 288 overweight (BMI: 24.0-27.9) women living in PingGuo, Guangxi, China. We restricted to women who initiated prenatal care within 13 weeks gestation, delivered uncomplicated termed singleton births, and had  $\geq 5$  weight measurements. The pattern of maternal weight gain throughout pregnancy was estimated by using a non-linear random-effects regression model. The estimates were used to create a chart with smoothed means, percentiles, and SDs of gestational weight gain for each week of pregnancy. Prepregnancy BMI was assessed at the first prenatal care visit. **Results:** There were a median of 8.8 serial weight measurements for underweight, normal, and overweight women [range: 5, 24]. The majority of our sample was Zhuang ethnicity (87.6%), farmers (88.1%), and completed junior middle school (65.2%). On average, weight gain was minimum within 12 weeks, 13 weeks and 15 weeks gestation for underweight, normal weight and overweight women, respectively and showed a linear increase afterwards. Compared to normal weight women, underweight women had similar pattern of weight gain throughout the pregnancy but with a higher intercept; overweight women had lower rate of weight gain over time. **Conclusions:** Our finding that underweight and normal weight women gained more weight throughout the pregnancy than overweight women is consistent with those in the U.S. These weight gain charts offered an innovative tool to assess weight gain in pregnancy for different weight groups while overcoming commonly seen measurement bias in existing studies.

PA091-S

A Prospective Study of Leukocyte Telomere Length and Risk of Gestational Diabetes in a Diverse Cohort

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Short telomere length (TL), an indicator of cellular aging and oxidative stress, was implicated in glucose homeostasis. Additionally, studies have illustrated a significant interaction between TL and age on metabolic syndrome components and body mass index (BMI). Yet, data on the association between TL and gestational diabetes (GDM) risk are sparse and the potential effect modification by age remains unknown. We prospectively investigated TL in relation to subsequent GDM risk in a case-control study within the NICHD Fetal Growth Studies-Singleton cohort. Leukocyte TL was measured as the ratio of telomere repeat length (T) to copy number of a single copy gene (S) at 10-14 weeks of gestation. A total of 93 women with GDM ascertained from medical records and 186 randomly selected controls matched on age, race/ethnicity and gestational age at blood draw were included in the analytical sample. Odds ratios (OR) and 95% confidence intervals (CI) for GDM risk were estimated using conditional logistic regression adjusted for parity, family history of diabetes, and pre-pregnancy BMI. Overall, TL was shorter in GDM women vs. controls (mean TL=1.03 vs. 1.08 T/S ratio;  $P=0.24$ ), although the difference was not statistically significant. Among women aged <30 years, TL of GDM women was significantly shorter than that of controls (mean TL=1.00 vs. 1.16 T/S ratio,  $P=0.004$ ). The TL-GDM association was significantly modified by age ( $P$  interaction=0.02). Shorter TL was significantly associated with an increased GDM risk among women aged <30 years; adjusted OR comparing the shortest vs. longest tertile was 3.08 (95% CI 1.17, 8.14;  $P$  trend =0.03). The association was not significant among women  $\geq 30$  years. In conclusion, shorter TL in early pregnancy was associated with a greater risk of GDM among women <30 years. Our findings suggest that TL may be implicated in GDM development, particularly among younger women.

PA092-S

Ambient temperature and risk of cardiovascular events at labor and delivery

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Background: Extreme ambient temperatures have been linked to cardiac events in the general population, but no studies have investigated this relationship among pregnant women. We aimed to estimate the associations and attributable risk between ambient temperature and cardiovascular event risk at labor/delivery, and investigate whether these associations vary by maternal race/ethnicity. Methods: Using medical records, we identified 680 women with singleton deliveries ( $\geq 23$  weeks) across 12 US sites who experienced cardiovascular events at labor/delivery. Average daily temperature during the week before, delivery day, and each of the seven days before delivery was estimated for each woman. In a case-crossover analysis, exposures during these hazard periods were compared to two control periods before and after delivery using conditional logistic regression adjusted for humidity, ozone, and fine particulate matter. Results: During the cold season (October-April), 1°C decrease during the week prior to delivery was associated with a 4% (95% CI: 1-7%) increased risk of cardiovascular events. During the warm season (May-September), 1°C increase during the week prior was associated with a 7% (95% CI: 3-12%) increased cardiovascular event risk. These risks translated to an excess of 13.4 and 23.9 cardiovascular events per 100,000 singleton deliveries during the cold and warm season, respectively. The risks were more pronounced on days closer to delivery. During the warm season increased risks were observed for Non-Hispanic Black women (22%, 95% CI: 8-39%) compared to Non-Hispanic White women (7%, 95% CI: 2-13%) for each 1°C increase on the delivery day. Conclusions: In the temperate US climate, we found small changes in temperature affected the risk of cardiovascular events during labor and delivery. Black women appeared to have a differentially higher warm season risk. Given the likelihood of global temperature changes, these strong findings merit further investigation.

PA093-S

Stressful Life Events in Pregnancy and Postpartum Depressive Symptoms among Women in Washington State  
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**Objective:** We examined the association between stressful life events (SLEs) in pregnancy and development of postpartum depressive symptoms (PDS) among women in Washington State and evaluated whether social support factors during pregnancy modified this association. **Methods:** We performed a retrospective cohort study of post-partum women who participated in the Washington State Pregnancy Risk Assessment Monitoring System (WA-PRAMS) survey from 2009 to 2013. Women were classified as having > 1 SLEs if they experienced at least one of 12 SLEs (partner-related, traumatic, financial and emotional). Women were classified as having PDS if they responded “always” or “often” to < 2 questions on depressive symptoms after live-birth compared to women who responded “never”, “rarely” or “sometimes” to both questions. Women having any financial, physical or emotional help were classified as having any social support. We performed multivariable Poisson regression to yield relative risk (RR) estimates with 95% confidence intervals (CI), after adjusting for maternal age, race, education and insurance status. We assessed effect modification by social support using the Wald test. **Results:** Among 6,415 women, 68% reported > 1 SLEs (financial = 76%, partner-related = 40%, emotional = 39% and traumatic = 26%). Nineteen percent of mothers experienced PDS out of whom 79% had at least 1 SLE during pregnancy. Most women (93%) had at least one form of social support; 74% had all 4 types. Compared to women with no SLEs, women with any SLE were 1.7 times more likely (95% CI 1.5, 2.0) to report PDS. Social support did not modify the association between any SLEs and PDS. **Conclusion:** Women experiencing SLEs during pregnancy were more likely to have postpartum depressive symptoms and social support did not modify this association. Our study suggests that women should be screened for SLEs during prenatal visits to identify women at increased risk of developing postpartum depressive symptoms.

PA094

Structural racism and severe maternal morbidity risk in New York State

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**Background:** The prevalence of severe maternal morbidity (SMM) - life threatening complications during childbirth - is increasing in the US, especially among women of color. Previous research has focused on individual and hospital-level factors; however, structural racism may increase SMM risk by restricting the access of Black and Latina women to social resources (e.g., higher education), while increasing their exposure to social structures (e.g., jail) detrimental to health. **Methods:** We analyzed 459,334 deliveries to non-Latina Black (NLB) and non-Latina White (NLW) mothers in New York State (NYS) from 2011-2013 merged with hospital information, American Community Survey data, and data from the Vera Institute of Justice. We defined SMM using a standard Centers for Disease Control algorithm. We defined county-level structural racism as the ratio of NLB to NLW for: 1) females' employment rates; 2) females' four-year college education rates; and 3) jail incarceration rates. We used race-stratified multilevel regression models to estimate the association between county-level structural racism indicators and SMM. **Results:** Approximately 4% of NLB mothers and 2% NLW mothers experienced SMM. Among NLB mothers, chronic disease (e.g., heart disease OR=74.1, 95% CI=7.3, 1.5), having a C-section (OR=5.5, 95% CI=5.1, 6.0), delivering in a regional perinatal center (OR=1.6, 95% CI=1.2, 2.2), delivering in a public hospital (OR=1.5, 95% CI=1.1, 2.0) and residing in a county with high NLB-NLW educational inequality were associated with higher odds of SMM (OR=1.2, 95% CI=1.0, 1.5). Among NLW mothers, similar patterns were noted for individual-level risk factors, but no statistically significant association was noted for hospital quality (OR=0.8, 95% CI=0.7, 1.1) or for any structural racism measures (e.g., educational inequality OR=1.0, 0.9, 1.2). **Conclusion:** Contextual educational inequalities may be associated with greater SMM odds among NLB women in NYS.

PA095-S

Dose-response relationships between maternal age at first birth and risk of adverse pregnancy and birth outcomes  
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First births to women older than 35 are at increased risk for adverse maternal and perinatal outcomes compared with pregnancies to younger women. However, dose-response relationships between maternal age and pregnancy risks remain unclear, and risk differences associated with small increments of maternal age are not known. We evaluated such risks using a population-based cohort of nulliparous women in British Columbia (BC) from 2004-2014 (n=203,434) using the BC Perinatal Data Registry, linked to additional health data by Population Data BC. We examined the relationships between maternal age (using restricted cubic splines) and each outcome using logistic regression. Predicted odds were transformed into absolute risks at each year of maternal age from 20-50. Risks were plotted to display dose-response curves estimated at 1) population average values of age-related risk factors from crude models, and 2) low-risk values of age-related risk factors from multivariable models, defined by the absence of preexisting diabetes/hypertension, smoking, prior pregnancy loss, diagnosed infertility, poor prenatal care, low income, and obesity. Risks of hypertensive disorders of pregnancy and gestational diabetes increased gradually until age 35, and then accelerated. Cesarean delivery risks increased linearly across the age spectrum, driven largely by increases in placenta previa and abruption. Spontaneous preterm birth was not associated with maternal age, while indicated preterm birth showed a strong positive association. Stillbirth, birth weight <1500g, neonatal mortality, and infant mortality had u-shaped relationships with maternal age, with nadirs near age 30. The relationship between increasing maternal age and most outcomes was attenuated for women without other risk factors, providing a “best-case scenario”. This study provides dose-response curves to inform family planning decisions and public health messaging regarding the potential implications of delayed childbearing.

PA096

Change in prevalence of gestational diabetes mellitus after adoption of the 1-step approach to screening and diagnosis.  
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In 2010, the International Association of the Diabetes in Pregnancy Study Groups recommended a 1-step approach to identifying gestational diabetes mellitus (GDM). This approach has a lower threshold for diagnosis than the traditional 2-step approach and it has not been widely adopted. Group Health (GH), a healthcare delivery system in Washington state, provides care to enrollees either through its multispecialty group practice (GP) or a network of contracted providers. In March 2011, the GP issued a new GDM clinical guideline which recommended the 1-step approach and insulin as the first-line medication. We compared the prevalence of GDM and use of insulin during pregnancy before (01/2009-03/2011) and after (04/2012-12/2014) the GH guideline change, in the GP and contracted network. Estimates were computed using the Poisson generalized estimating equation method. Singleton live births to enrollees without pregestational diabetes and with linked health plan data and state birth certificates were identified (N = 19,241; 57% GP and 43% network). After the guideline change, use of the 1-step approach was widespread in the GP but remained uncommon in the network (89.7 versus 4.8 per 100 deliveries). GDM prevalence increased by 5.1 per 100 deliveries in the GP after the guideline, from 6.7 to 11.8 per 100 deliveries, whereas in the network there was little change, from 9.2 to 10.3 per 100 deliveries (p<0.001 comparing change in GP and network). Use of insulin increased by 3.4 per 100 deliveries in the GP after the guideline, from 1.1 to 4.5 per 100 deliveries, compared to little change in the network, from 1.4 to 1.5 per 100 deliveries (p<0.001 comparing change in GP and network). In conclusion, the GH GDM clinical guideline change, which recommended the 1-step approach, was associated with an increased prevalence of GDM and use of insulin during pregnancy. Research is ongoing to evaluate the impact on maternal and neonatal outcomes.

PA097-S

Chlamydia Trachomatis Seroprevalence and Ultrasound Diagnosed Uterine Fibroids in a Large Population of Young African-American Women

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**Background.** Studies have suggested an association between genital Chlamydia trachomatis (gCT) and increased risk of fibroids, but only with self-reported gCT data. Our investigation used serology for gCT, an immunological measure of past exposure. **Methods.** We used cross-sectional enrollment data from a prospective fibroid study that conducted ultrasound examinations to systematically screen for fibroids. Participants were African-American women ages 23-34. Age- and multivariable-adjusted logistic regression were used to estimate odds ratios (ORs). **Results.** Of 1,696 participants, 1,587 had unequivocal gCT serology results; 22% had fibroids. Those seropositive for gCT were less likely to have fibroids (age-adjusted OR: 0.68 95% confidence interval (CI): 0.54, 0.87). The association was of borderline significance in the multivariable-adjusted model (OR: 0.80 95% CI: 0.62, 1.03). Inverse associations were similar for fibroid size, number, and volume. Those reporting more sex partners before age 20, with multiple gCT serogroups, and/or self-reporting a diagnosis of gCT had the strongest reduced odds of fibroids. **Conclusions.** Although a protective association of gCT with fibroids was not expected, it is possible that an immune response to gCT infection might increase immune surveillance and eliminate early lesions. Further investigation is needed on the relationship between fibroid development and gCT and other RTIs.

PA098

Postpartum depressive symptoms and cesarean delivery: a case control study

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**Introduction:** Our aim was to determine if there is an association between cesarean delivery (CD) and postpartum depressive symptoms (PPDS). **Methods:** We conducted an unmatched case control study of women with live births at our institution who were diagnosed with postpartum depression or had Edinburgh Postnatal Depression Scale (EPDS) score of  $\geq 13$  or  $< 5$  from 2012 to 2015. Women with a diagnosis of depression within one year of delivery or an EPDS score  $\geq 13$  were labeled as cases. Controls had an EPDS score  $< 5$ . Medical records were abstracted for medical, social, obstetric, and neonatal data. Logistic regression was used for analysis. **Results:** 740 cases and 353 controls were identified. In univariate analysis, CD, marital status, ethnicity, maternal complications, NICU admission, low birthweight, neonatal complications, maternal BMI at delivery, smoking or drug use, and history of depression were independently associated with PPDS ( $p < 0.05$ ). Non-scheduled CD compared to scheduled CD was not associated with PPDS ( $p = 0.37$ ). However, women with repeat CD compared to primary CD were more likely to have PPDS ( $p = 0.05$ ). CD remained associated with PPDS (OR=1.80, 95%CI: 1.14-2.83) when adjusting for ethnicity, marital status, maternal complications, low birthweight, NICU admission, neonatal complications, maternal BMI at delivery, insurance type, history of depression, and parity. Marital status, NICU admission, low birthweight, being non-Hispanic, and history of depression ( $p < 0.05$ ) were also associated with PPDS ( $R^2 = 0.30$ ) in multivariable analysis. Adjusting for the same covariates, non-scheduled versus scheduled CD showed no association (OR=0.42, 95%CI: 0.17-1.04), but having a repeat compared to primary CD increased the odds of PPDS (OR=3.06, 95%CI: 1.26-7.45). **Conclusion:** CD independently increases the risk PPDS. Repeat CD also appears to increase the risk of PPDS compared to primary CD. Other potential risk factors for PPDS included being single or separated, NICU admission, low birthweight, being non-Hispanic, and maternal history of depression.

PA099

Predictors of Oophorectomy in Girls Hospitalized in Texas with Ovarian Torsion  
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**Background:** Inconsistent results have been reported from studies of the management of pediatric ovarian torsion. The objective of this study was to identify predictors of oophorectomy (OO) in girls hospitalized throughout Texas with ovarian torsion. **Materials and Methods:** The Texas Public Use Data File (years 2013-2014) was queried for the records of females under the age of 18 years who had a principal or secondary discharge diagnosis of ovarian torsion (International Classification of Diseases, Ninth Revision code 620.5). Records were excluded if any of the diagnosis fields contained codes for a benign or malignant neoplasm of the ovary. Adjusted odds ratios (OR) were estimated from a logistic regression model using Firth's bias-reducing penalized likelihood. Variables for inclusion in the final model were identified using a directed acyclic graph. **Results:** A sample of 158 girls was identified with an overall risk of OO during the hospital stay of 41.1% (65/158). Black non-Hispanics and Hispanics of any race were overrepresented in the OO group versus the non-OO group: 9.2% vs. 4.3% for Blacks and 60.0% vs. 51.6% for Hispanics. In a univariate analysis, patients who underwent OO more likely to have been seen at a non-teaching hospital than patients who did not undergo OO: 78.5% vs. 62.4% ( $P=0.03$ ). After adjusting for the patient's age, health insurance status, and the presence of an ovarian cyst, girls who were treated at a teaching hospital were 55% less likely to undergo OO than girls who were treated at a non-teaching hospital:  $OR=0.45$ , 95% confidence limits: 0.21, 0.95,  $P=0.04$ . **Conclusions:** Our analysis of a statewide database revealed that girls with OT who presented at non-teaching hospitals were significantly more likely to undergo OO compared to girls who presented at teaching hospitals.

PA100-S

Associations of Maternal Gestational Weight Gain with the Risk of Offspring Obesity and Body Mass Index Z Scores Above the Mean  
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**Background:** Studies are inconclusive about whether the association between maternal gestational weight gain (GWG) and offspring obesity varies by maternal pre-pregnancy weight. Existing studies do not examine the associations across the entire distribution of body mass index Z scores (BMIZ). **Objectives:** To examine the dependency on pre-pregnancy weight of associations of meeting the 2009 Institute of Medicine (IOM) GWG guidelines with offspring's obesity and BMIZ at age six. **Methods:** Data came from the Infant Feeding Practices Survey II Study (2005-2007) and its Year Six Follow-Up Study (2012) ( $n=1,296$ ). Logistic regression and quantile regression models were used to examine the associations. **Results:** Eleven percent of children were obese. Children born to mothers who gained excessive weight during pregnancy had an increased risk of obesity as compared with those born to mothers who gained adequate weight (adjusted odds ratio (AOR): 1.67, 95% confidence intervals (CI): 1.04, 2.63). The association was stronger among normal weight mothers (AOR: 3.50, 95% CI: 1.35, 9.08), while no association was observed among overweight or obese mothers. Inadequate GWG was not associated with offspring obesity in overall and sub-samples by maternal pre-pregnancy BMI. Children born to mothers who gained excessive weight had higher BMIZ. The magnitude of the association with BMIZ was 0.25 (0.05, 0.45) at the 20th percentile and 0.33 (0.18, 0.49) at the 60th percentile. This distributional association was more pronounced among normal weight mothers. Children born to obese mothers who gained inadequate weight had lower BMIZ at certain percentiles of the BMIZ distribution. **Conclusions:** Excessive GWG was associated with an increased risk of offspring obesity and BMIZ above the mean at age 6, particularly among normal weight mothers. Inadequate GWG was negatively associated with BMIZ only among obese mothers.

PA101

Baby walkers: knowledge, current practices and related injuries in Kuwait

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**Background:** Most parents hold the impression that baby walkers (BW) are useful to accelerate gait acquisition and to keep children safely entertained. However, studies suggest that these notions are incorrect; and that BWs increase the risk of injury. **Objectives:** The objectives of this study were to: 1) explore the mothers' knowledge about BWs in Kuwait, 2) estimate the prevalence of BW use, and 3) estimate the prevalence of injuries related to BWs among children. **Methods:** A cross-sectional study was conducted on 785 mothers attending vaccination centers in all governorates of Kuwait. Data were collected through face-to-face interview using a structured questionnaire. Logistic regression was used to investigate the association between baby walker use and related factors. **Results:** Of 839 mothers invited to participate, 785 (93.5%) responded. The prevalence of BW use (ever use) was 700(89.2%; 95% CI: 86.8-91.2%). Of the study group, 290(36.9%) thought BWs have benefits but no harms; while 444(56.6%) thought BWs make children walk earlier. Of the total users, 463(66.1%) reported using BWs to strengthen the legs of their children; and 8(1.1%) reported an injury that required hospital admission while 35(5.0%) reported injuries that required medical treatment without hospital admission. Factors that were significantly associated with BW use included mother's education, having a domestic helper (maid), age of the youngest child, and factors related to knowledge on BWs. **Conclusion:** Several misconceptions about the benefits of BWs prevail among mothers in Kuwait. The use of BWs is extremely common with substantial number of users had BW related injuries. Our findings support the calls for banning BWs which several professional organizations have already issued.

PA102

Kuwait Nutritional Surveillance System (KNSS): Indicators for infant and young child feeding practices.

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**Background:** Kuwait Nutritional Surveillance System (KNSS) collects data from Kuwaiti children on various aspects of nutrition. We summarized the results of the KNSS related to the indicators for assessing infant and young child feeding practices as outlined by WHO. **Methods:** Children  $\leq 2$  years were selected from health centres during vaccination from all governorates of Kuwait. Data were collected by face-to-face interviews on infant feeding practices. Weight of children was measured using digital scale to the nearest 100 gm; while length was measured to the nearest 0.1 cm using length board. Data collectors were trained to conduct the interview and measure the weight and height in a standardized manner. **Results:** Data were collected on 1,723 children of whom 876(50.8%) were males. Overall, 31.54% initiated breastfeeding within the first hour of delivery or cesarean section. This was higher in public hospital compared to private hospitals (36.88% vs. 30.27%,  $p=0.04$ ). Of children  $\leq 2$  years, 89.26% were ever breastfed with no difference by the gender of child or the place of delivery. This was lower in Jahra and Mubarak Al-Kabeer Governorates compared to other governorates ( $p<0.001$ ). Current breastfeeding (any breastfeeding) was 35.6% and 26.2% among children  $\leq 3$  months and children  $\leq 6$  months, respectively. Exclusive breastfeeding was rare; 7.3% among children  $\leq 3$  months and 4.3% among children  $\leq 6$  months. Finally, the minimum dietary diversity indicator was 39.80% with no significant difference between different governorates ( $p=0.003$ ). **Conclusion:** Efforts should be made to improve breastfeeding practices among Kuwaiti mothers. The majority of deliveries by Kuwaiti mothers occur in private hospitals, therefore, private sectors should be involved in the strategies that aim to increase breastfeeding among Kuwaiti mothers.



PA103-S

The Association between Respiratory Pathogens and Exacerbation Severity, Health Care Utilization, Treatment Response and Morbidity in Children with an Asthma Exacerbation: A Systematic Review.

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**Background:** Asthma exacerbations constitute a large burden of illness in asthmatic children, with 60-80% triggered by respiratory pathogens. The role of pathogens in the clinical evolution of exacerbations is unknown. We systematically reviewed the association between the presence of pathogens and short-term clinical outcomes in children presenting with an exacerbation. **Methods:** PubMed, Embase, Biosis and the Cochrane Central Register of Controlled Trials were systematically searched and screened in duplicate for full text studies on children with an exacerbation reporting on respiratory pathogen exposure and a clinical outcome: exacerbation severity, healthcare (HC) utilization, treatment response or morbidity. The Risk of Bias In Non-Randomized Studies of Interventions tool was used for quality assessment. **Results:** We included 28 observational studies (4253 children) reporting on 112 different comparisons between exposure to any pathogen (n=45), rhinovirus (HRV; n=34), atypical bacteria (n=21), specific virus (n=11) or bacteria (n=1) and outcomes of exacerbation severity (n=26), HC utilization (n=38), response to treatment (n=19) and morbidity (n=29). 92/112 comparisons had a non-critical overall risk of bias and were included in the descriptive analysis. The heterogeneity in the published data precluded data aggregation. Using only comparisons with a moderate risk of bias showed an association between HRV and increased exacerbation severity on presentation (non overlapping 95% CI) and between the presence of any pathogen and treatment failure (OR 1.57, 95% CI 1.04-2.37). There was also an association between HRV and morbidity (symptom duration after the index visit) for 2/3 comparisons, but not with HC utilization. **Conclusion:** The lack of good quality data leads to limited strength of evidence on the association between respiratory pathogens and short-term clinical outcomes. Further research on the role of pathogen-treatment interaction and outcomes is needed.

PA104

Sleep Disorders and Allergic Diseases in Chinese Toddlers

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**Objective:** Optimal sleep is important for child growth, development, and immune function. We aimed to explore whether sleep disorders were associated with the risk of allergic diseases in Chinese toddlers. **Methods:** This study included 566 children (aged 23.9± 0.7 months; 51.1% boys) in Shanghai, China. Sleep parameters (total sleep time, sleep onset latency, nocturnal awaking and snoring) were assessed by an expanded version of brief infants sleep questionnaire (BISQ-expanded). Information on four allergic diseases (wheeze, eczema, food allergy and allergic rhinitis) in the past year was collected via standard questionnaire and judged by pediatricians. We used logistic regression to calculate odds ratios (ORs) and their 95% confidence intervals (CIs) for having any/and each of the four allergic diseases, based on sleep parameters, adjusting for children's age and gender, mode of delivery, any breastfeeding duration, children's BMI, children's exposure to passive smoking, maternal education, family income, family allergic history, and children antibiotic use. **Results:** There were 23.3% of children with at least one of the four allergic diseases. Snoring was significantly associated with increased odds of having any allergy (adjusted OR=1.95; 95% CI: 1.17,3.26) and eczema (OR=1.83, 95% CI: 1.03, 3.23) and food allergy (OR=4.31, 95% CI: 1.23, 15.14), after adjustment for potential confounders. Nocturnal awaking > 2 times per night was associated with higher risk of food allergy (OR=3.92, 95% CI: 1.00, 15.35) and wheeze (OR=6.16, 95% CI: 1.28, 29.74). **Conclusions:** In this study, presence of certain sleep disorders was associated with higher risk of having allergic diseases in Chinese toddlers.

PA105

Medical Home Profile for Toddlers Born Preterm: Gaps and Associations with Socio-demographic Factors and Birth Outcomes  
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The family-centered medical home benefits children with special healthcare needs (CSHCN), but some children do not have access. Although CSHCN are a major focus of medical home research, access in children born preterm has not been uniquely explored. To characterize medical home access and perceptions for preterm children during toddlerhood, a critical period for early intervention. A parent/guardian of 205 children 10-16 months' corrected age, born at <35 weeks gestation, enrolled in a dietary supplement trial (Columbus OH) completed the National Survey of Children's Health medical home module and socio-demographic questions at baseline. Medical home was defined as having 1) a personal doctor/nurse; 2) a usual place for care; and 3) receiving effective care coordination, family-centered care (FCC), and no problems getting referrals. Access to a medical home was examined in relation to socio-demographics, gestational age, developmental status and follow-up program attendance, using log-binomial regression. 107 (52%) children had a medical home. Children with poor language development (RR=.64, CI: .43, .97) and of parents with low education (RR=.43, CI: .28, .66) were less likely to have a medical home; while gestational age and follow-up clinic attendance were not associated with medical home access. Areas of concern include: 15% of families had referral problems, 23% lacked family-centered care, 34% lacked effective care coordination. Families of lower SES were less likely to report that doctors spent enough time with their child (RRPublicAssist=.87, CI: .79, .96) and were sensitive to family values/customs (RRLowEd=.84, CI: .74, .97) Children with motor (RR=1.2, CI: 1.0, 1.6) or language (RR=1.2, CI: 1.0, 1.4) delay and those attending follow-up clinic (RR=1.3, CI: 1.0, 1.4) were more likely to be satisfied with communication between their doctor and child care/early intervention providers. Access to a medical home was lacking for many preterm toddlers. It was associated with lower SES and developmental status but not degree of prematurity. Children who attended neonatal follow-up were not more likely to have a medical home, but were more likely to express satisfaction with doctor communication with child care/early intervention providers.

PA106-S

Gluten free diets in children with autism spectrum disorder: prevalence and associated factors of ever use of a gluten free diet in the Study to Explore Early Development  
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Gluten free diets (GFD) are among many strategies parents of children with autism spectrum disorder (ASD) try to reduce gastrointestinal (GI), behavioral, and developmental problems associated with the disorder, despite a lack of clear evidence for efficacy based on limited randomized control trials. We estimated the prevalence of ever use of a GFD among children with ASD and controls. We also evaluated phenotypic factors associated with GFD use in children with ASD. We used data from 2011 families (707 with ASD) who participated in the Study to Explore Early Development, a multi-site, case-control study of ASD. Children with ASD and controls were enrolled at 30-68 months of age. Ever use of GFD was defined as any indication on maternal interviews or surveys that the child used a GFD for any period of time. Data on child GI problems (including vomiting, diarrhea, and constipation) and developmental conditions were collected via maternal interview and direct child assessments. We ran Log-Poisson models to estimate prevalence and to examine traits associated with the GFD in ASD and control children. All models were weighted to control for study site, maternal age, race, and ethnicity, and child's year of birth. Prevalence of ever use of GFD was 19.4% (95% confidence interval (CI): 16.5, 22.8) in the ASD group and 3.7% (95% CI: 2.6, 5.2) in the control group. Among children with ASD, prevalence of ever use of GFD was higher among those who had developmental regression (prevalence ratio 1.78, 95% CI: 1.29, 2.48) or child GI problems (prevalence ratio 2.89, 95% CI: 1.92, 4.35) but did not differ by the presence of intellectual disability. Nine of eleven control children who had ever use of GFD also had GI problems. GFD was prevalent in our sample of children with ASD, particularly those with GI problems or developmental regression. In addition to understanding the prevalence of ASD, further study of the impact of GFD on autism

PA107-S

Maternal Preconception Vitamin D and Neonatal Outcomes

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**Background:** Maternal hypovitaminosis D has been linked with low birth weight, growth restriction, skeletal deformities, and other long-term health complications. Currently evidence is limited regarding the potential link between maternal preconception 25(OH)D concentrations and neonatal anthropometric parameters and outcomes. **Methods:** This study was a secondary analysis of the EAGeR trial. Preconception 25(OH)D concentrations were measured from serum samples collected at baseline visits. Generalized linear models estimated associations between preconception 25(OH)D concentrations and neonatal outcomes, including birth weight (grams), length (inches), head circumference (inches), Apgar scores, and neonatal intensive care unit (NICU) admissions. Models were adjusted for race, BMI, maternal height, smoking, parity, season, income, treatment arm, physical activity, and infant sex. **Results:** Among 571 women who had preconception 25(OH)D and neonatal outcome data, 69 women (12.1%) had deficient 25(OH)D levels (<20ng/mL), 208 (36.4%) had inadequate levels (20-29.9 ng/mL), and 294 (51.5%) had sufficient levels ( $\geq 30$ ng/mL). We did not observe an association between maternal 25(OH)D status and head circumference ( $\beta$  0.03, 95% confidence interval [CI] -0.01 to 0.07, per 1 ng/mL increase in 25(OH)D), birth weight ( $\beta$  1.19, 95% CI -2.24 to 4.62), length ( $\beta$  -0.004, 95% CI -0.02 to 0.01), or Apgar scores. There was a trend towards more NICU admissions among mothers that were 25(OH)D deficient compared to insufficient and adequate (16% vs. 9% vs. 10%, respectively), though differences were not statistically significant. **Conclusion:** Maternal preconception vitamin D status was not associated with neonatal anthropometric parameters, or NICU admissions. Effects of preconception 25(OH)D status on neonatal body size and relatively rare neonatal health outcomes may warrant further investigation among larger birth cohorts.

PA108-S

Association between metal exposure and anxiety problems in children residing near coal ash storage facilities

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**Background:** The coal combustion process creates a by-product made up of small particles that can contain metals. This waste, termed coal ash, is largely discarded in open-air landfills and ash ponds. Fly ash, the largest constituent of coal ash, can become suspended in the air, potentially contributing to air pollution and metal exposure in the surrounding community. Metal exposure is known to cause oxidative stress, which could lead to neurological changes and possibly result in adverse mental health outcomes. The purpose of this study was to investigate the association of metal exposure and anxiety problems in children living near coal ash storage facilities. **Methods:** The Child Behavior Checklist (CBCL) was completed for children residing in neighborhoods surrounding two large coal ash storage facilities. In-home air samples were collected and analyzed with Proton-Induced X-ray Emission (PIXE) to assess metal exposure. Wilcoxon-Rank Sum tests were used to assess the relationship between environmental metal concentrations and t-scores in the Anxious/Depressed and Anxiety Problems subscales of the CBCL. **Results:** Higher concentrations of copper were significantly associated with borderline or clinically significant t-scores in the Anxious/Depressed subscale of the CBCL (p-value=0.034). The association between higher concentrations of aluminum and copper and borderline or clinically significant Anxiety Problems t-scores approached statistical significance (p-value=0.055 and p-value=0.064, respectively). Additional modeling will be utilized to investigate these associations further. **Conclusions:** The results of this on-going study represent findings based on the current recruited population. To date, few studies have explored the role of metal exposure in adverse mental health outcomes, particularly in regards to metal exposure that may be from coal ash. Future research is needed to investigate this relationship further.

PA109-S

Air pollution exposure during pregnancy, maternal asthma and neonatal respiratory outcomes  
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**Background:** Maternal asthma increases neonatal respiratory outcomes risk and air pollution may further increase risk. No prior studies have examined air quality and neonatal respiratory health. **Methods:** Criteria air pollutant exposures were calculated in modified Community Multiscale Air Quality models and outcomes were based on medical records from the Consortium on Safe Labor (2002-08). Transient tachypnea of the newborn (TTN), asphyxia, and respiratory distress syndrome (RDS) were assessed among 223,375 singletons. Multi-pollutant Poisson regression models estimated the relative risk (RR) and 95% confidence interval (CI) for an interquartile range increase in average pollutant exposure during preconception, trimesters, and whole pregnancy. Maternal asthma and term delivery were evaluated as potential effect modifiers. Models adjusted for region, marital status, parity, age, smoking/alcohol, comorbidities, cesarean delivery, insurance, body mass index, race, and season of conception. **Results:** TTN risk increased 9-10% with particulate matter <10 microns (PM10) exposures in preconception and trimester 1, and PM<2.5 microns (PM2.5) (RR=1.17, CI=1.05-1.30) and carbon monoxide (CO) (RR: 1.10, CI:1.04-1.16) exposures over the whole pregnancy. Asphyxia risk increased 34-73% with ozone exposure consistently, PM2.5 exposure in trimester 1 (RR=1.48, CI:1.09-2.03) and whole pregnancy (RR=1.84, CI:1.17-2.90), and CO exposure in trimester 2 (RR=1.32, CI: 1.04-1.67) and whole pregnancy (RR=1.28, CI:1.02-1.61). RDS risk consistently increased with nitrogen oxide (33-42%) and ozone (9-21%) exposures. Inverse associations were consistently observed for sulfur dioxide and intermittently for other pollutants. No interaction with maternal asthma was observed and term birth results were similar. **Conclusions:** Several air pollutants appear to increase neonatal respiratory outcomes risk but inverse associations were also observed. These novel associations merit further investigation.

PA110

IDENTIFYING PATIENT AND FAMILY CENTERED OUTCOMES RELEVANT TO INPATIENT VERSUS AT-HOME  
MANAGEMENT OF NEUTROPENIA IN CHILDREN WITH ACUTE MYELOID LEUKEMIA

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**Background:** Little data exist on the comparative effectiveness of inpatient versus at-home monitoring of children with AML and neutropenia. While it is important to assess the comparative effectiveness of these two approaches relative to clinician derived outcomes, it is also necessary to identify and compare outcomes meaningful to patients and their families. **Objectives:** To identify outcomes related to inpatient versus at-home management of post-chemotherapy neutropenia that are important to children with AML and their families that may be examined in future comparative effectiveness studies. **Design/Method:** An in-depth qualitative study was conducted to better understand the experience of patients and their families during periods of neutropenia after AML chemotherapy. Semi-structured interviews were conducted with parent-patient dyads for patients  $\geq 8$  years of age. Parent only interviews were conducted for patients < 8 years of age. Interviews were performed either within 6-12 months of completion of the second course of chemotherapy or up to 3 years after completion of all frontline AML chemotherapy. Participants were purposefully sampled to include a combination of patients whose neutropenia was managed in the hospital and others managed at home. Interviews were audio recorded, transcribed and analyzed for repeated themes using a modified grounded theory approach. **Results:** Interviews were conducted from November 2015 to December 2016 with 72 respondents (46 parents and 26 children) recruited from 7 children's hospitals across the United States (3 early discharge sites). We identified 3 main themes repeated across respondents: (1) children and parents described substantial distress about the impact of prolonged hospitalizations on siblings, (2) parents felt safer and less anxious in the hospital as they trusted hospital staff to be well equipped to identify and manage neutropenia complications and (3) patients experienced sleep disturbances during therapy that were worse in the hospital. Parents were universally concerned about their child acquiring an infection during neutropenia, while child concern about infection varied by age with teenagers expressing greater concern. Neither parents nor children were concerned about chemotherapy course delays. **Conclusion:** A systematic qualitative investigation of the experiences of children with AML and their families consistently identified stress on siblings, parent anxiety over neutropenia complications, patient sleep disturbance and concerns of infection as important patient-centered outcomes. These themes are being used to develop a structured questionnaire to enable a quantitative comparison between children with AML and neutropenia managed in the hospital versus at home in a prospective multi-institutional trial.

PA111  
Neonatal Abstinence Syndrome and Child Protective Services Involvement  
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**Background:** Neonatal Abstinence Syndrome (NAS), primarily associated with prenatal exposure to opiates, is increasing nationally. Analyses of NAS often focus on case identification and clinical symptoms. However, understanding outcomes beyond delivery is a key component of NAS surveillance. In Alaska, healthcare providers are required to report NAS infants to child protective services (CPS), which assesses the need for intervention. **Methods:** We used three data sources: Medicaid claims, birth records, and CPS case files. Infants with NAS were identified in 2004-2015 Medicaid claims data by extracting all ICD-9-CM and ICD-10CM codes for “Drug Withdrawal Syndrome in Newborn” (779.5 and P96.1) occurring within 28 days of birth. Multiple claims for the same infant were de-duplicated based on name, date of birth, and Medicaid ID. NAS infants were linked with birth records and CPS reports on name and date of birth. Additional linkages were completed based on mother’s last name and aliases identified through CPS. **Results:** We identified 541 infants with NAS, 538 of whom linked to an Alaska birth certificate. From 2004-2015, the rate of NAS among Medicaid eligible live births increased from 2.7 to 18.4 per 1,000 ( $p < 0.01$ ). 347 NAS infants (64%) were reported to OCS for prenatal exposure to illicit substances or prescription drugs. Of those, 296 (85%) were investigated. Within one month of being investigated by OCS, 139 (40%) were temporarily or permanently removed from their homes; 72 (52%) of removed infants were placed with other family members for care. There was no change in the % of NAS infants reported, screened in, or removed during the 12-year time period ( $p = 0.3, 0.5, \text{ and } 0.3$ , respectively). **Conclusions:** The majority of infants diagnosed with NAS were reported to CPS for prenatal exposure to illicit substances. As NAS rates increased, so did the number of infants requiring CPS intervention and temporary and permanent foster care placements.

PA112-S  
Wheeze and Food Allergies in Children Born via Cesarean Section - The Upstate KIDS Study  
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Lack of microbiome seeding at birth has been suggested as a bio-mechanism by which cesarean delivery (CD) influences the development of allergic disorders. We examined whether CD increased the risk of wheeze or food allergy in early childhood compared to vaginal delivery (VD). We also assessed if breastfeeding mediated the observed associations. Upstate KIDS (2008–2010) is a birth cohort ( $n=6,171$  infants) designed to explore the effects of infertility treatment on child-development. Using New York State birth certificates (excluding New York City) and frequency-matched on region of birth, singletons conceived with infertility treatment were sampled at a ratio of 1:3 with those not conceived with infertility treatment. All twins were invited to participate. Child wheeze was reported at ages 4,8,12,18,24,30 & 36 months while food allergy was reported at ages 8,12,18,24,30 & 36 months. Modified Poisson regression was used to compare risks for wheeze and food allergy by mode of delivery. The controlled direct effects of CD on wheeze and food allergy, independent of breastfeeding in the first year of life were estimated. Potential confounders were identified a priori using directed acyclic graphs. Emergency CD ( $n=1,356$ ) was associated with elevated risk of wheeze when adjusting for pregnancy complications, maternal atopy, gestational age, birth weight and pregnancy smoking (Risk Ratio [RR] 2.62, 95% confidence interval [CI]:1.41–4.85). Emergency CD was also associated with food allergy, when adjusting for maternal atopy, parity, pre-pregnancy body mass index and pregnancy smoking (RR 2.97, 95% CI:1.24–7.14) compared to VD infants ( $n=2,832$ ). Neither outcome was associated with planned CD ( $n=1,565$  infants). Further, breastfeeding didn’t significantly mediate the association between mode of delivery and the outcomes. Emergency CD but not planned CD was associated with increased risk of childhood wheeze and food allergy.

PA113-S

Predictors of Having First Child Apprehended at Birth: A Population-Based Longitudinal Study  
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**Objectives:** This study links events and diagnoses in the two years before childbirth to identify women who may be at higher risk for having their first child apprehended at birth. **Approach:** A cohort of women whose first child was born in Manitoba between April 1, 1998 and February 28th, 2015 and who lived in Manitoba at least two years before the birth of her first child (n = 53,565) was used. A logistic regression model determined the adjusted odds ratios (AORs) of having a child apprehended at birth. Several time-varying covariates (diagnoses of substance abuse, and mood and anxiety disorders, involvement with the criminal justice system, receiving Employment and Income Assistance, and residential mobility) are examined in two time periods in the two years before the birth – during pregnancy and pre-pregnancy. **Results:** Characteristics producing the greatest odd of apprehension at birth are substance abuse in both time periods (AOR = 10.25), disability (AOR = 6.56), schizophrenia (AOR = 6.29), not having had any prenatal care (AOR = 5.28), being a teenage mother (AOR = 4.29), and involvement with the criminal justice system in both time periods (AOR = 4.21). When examining criminal justice involvement during pregnancy, those involved as the accused (AOR = 2.93) and as victims (AOR = 2.37) had the greatest odds of apprehension. For all variables examined in the two time-periods, sustained exposure produced the greatest odds of apprehension. Covariates included in the adjusted model produced great discrimination (C-Statistic = 0.912). **Conclusion:** Most characteristics of women deemed to be at high risk for having their child apprehended at birth are modifiable or could be mitigated with appropriate services. Allowing the attachment of mother and child in the critical first year of life increases the likelihood of a better long-term mother-child relationship.

PA114-S

Emotional and informational support during pregnancy associated with reduced risk of postpartum depression  
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**Intro:** Postpartum depression (PPD) affects between 6 and 13% of women in the 1st year after giving birth. Low social support is consistently associated with PPD, however previous studies are mostly cross-sectional and cannot account for the possibility that depressive symptoms affect perception of social support. Support can be emotional, informational or tangible and understanding the type needed can inform interventions. **Objective:** To assess what type of social support during pregnancy is associated with a risk of PPD at 4 months postpartum. **Methods:** Mental health information was collected from 3000 mothers in the All Our Babies Study twice during pregnancy and at 4 months postpartum. PPD was assessed with the Edinburgh Postpartum Depression Scale. Social support was assessed with the Medical Outcomes Survey Scale (4 subscales for type). Binomial regression modeling was used to evaluate the association between social support type and PPD, controlling for previous mental health (history of depression, Adverse Childhood Experiences, depressive or anxiety symptoms during pregnancy). Effect modification by income, ethnicity, parity and previous mental health were explored. **Results:** At 4 months postpartum, 12% of mothers scored at risk of PPD. During pregnancy, 19-20% of mothers had low levels of social support on any one of the 4 subscales. Controlling for covariates, overall high social support in pregnancy was associated with a 0.54 RR of PPD (95% CI: 0.44, 0.64). When assessing the relative importance of support type (all subtype simultaneously), high emotional/information support in pregnancy was significantly associated with a 26% reduced risk of PPD at 4 months (ARR: 0.74, 95% CI: 0.56, 0.98 p=0.037). **Conclusion:** Providing emotional and informational support to mothers during pregnancy may reduce the risk of PPD. These types of support are amenable to the use of technology, can be provided at low cost and in and remote locations to improve outcomes for mothers.

PA115-S

Tipped-wage work is associated with depression in U.S. women

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**Background:** Ten percent of women suffer from depression, a condition exacerbated by income volatility. Income volatility occurs in tipped service occupations, which pay subminimum wage and are dependent on unpredictable gratuities. Women comprise 67 percent of tipped-wage workers. We tested the hypothesis that reproductive-aged women in tipped-wage occupations were more likely to report depression than women in non-tipped service occupations and non-service occupations. **Methods:** In multivariable logistic regression, depression (self-report of diagnosis or symptoms) was modeled as a function of self-reported occupation type (US Bureau of Labor Statistics categories: tipped-wage service, non-tipped service, and non-service) using National Longitudinal Study of Adolescent to Adult Health (Wave IV, 2007-2008; age 24-33 years) data. All analyses used multiply-imputed data. To address bias due to non-random selection into occupation, propensity-scores were computed as a function of childhood and adolescent characteristics, used to trim off-support observations (N=2452 retained), then used to adjust regression models. For sensitivity analyses, we restricted to women with incident depression (N=1019). **Results:** Women in tipped-wage occupations were more likely to report depression than women in non-service occupations [Odds Ratio (OR): 1.68; 95% Confidence Interval (CI): 1.15,2.46]; restriction to incident depression strengthened this association [OR: 2.09; 95% CI: 1.09,4.03]. Odds of depression in women in non-tipped service occupations were 40% greater than women in non-service occupations [OR: 1.40; 95% CI: 1.05,1.86] yet were attenuated when restricted to incident depression. **Conclusions:** In a nationally representative sample of women, working in a tipped-wage service occupation was associated with greater prevalent and incident depression relative to non-service occupations. Reducing the income volatility in tipped-wage work may be a promising mental health intervention.

PA116-S

Past-month cannabis use in populations of reproductive age from 2002-2014: An age-period-cohort analysis

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**Introduction:** Cannabis is the most commonly used illicit drug among populations of reproductive age in the US. Despite recent evidence suggesting cannabis may have adverse effects on both male and female reproductive health, little is known about how patterns of cannabis use are changing in this population. The objective of this study is to estimate how underlying population factors – such as age, cohort, and period effects due to legislation changes – drive trends in cannabis use among populations of reproductive age from 2002-2014. **Methods:** We conducted a fixed-effects age-period-cohort (APC) analysis to estimate how these inter-related parameters influenced trends in past-month cannabis use among individuals aged 15-64 from 2002-2014. Data were derived from the National Survey of Drug Use and Health, a nationally-representative annual survey of drug use patterns in the United States (n=54,081). We assessed whether period effects differed by gender. **Results:** Past-month cannabis use increased slightly from 10.4% (SD=3.0%) in 2002 to 10.8% (SD=3.1%) in 2014. Age was the strongest predictor of past-month use ( $p<0.01$ ), followed by period and cohort. Past-month use was highest among 18-21 year olds (mean=20.0%, SD=4.0%) and 22-25 year olds (mean=15.4%, SD=3.6%). However, the greatest increase in past-month use between 2002 and 2014 was observed for 26-29 year olds (+53%) and 30-34 year olds (+59%). The period effect significantly differed by gender ( $p=0.04$ ), with a stronger effect among women than men. Subsequent analyses will assess interactions between the A, P, and C parameters. **Conclusions:** Age, period, and cohort are important predictors of past-month cannabis use among populations of reproductive age. Period effects differ substantially by age and gender. Identifying underlying demographic patterns associated with trends in cannabis use sheds light on socio-cultural changes in cannabis use, providing useful information for policy-makers and health care providers.

# Poster Session B



PB001

Attention-Deficit Hyperactivity Disorder Medication Use During Pregnancy and Risk for Birth Defects - United States, 1997-2011

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**Background:** Attention-deficit hyperactivity disorder (ADHD) is a neurodevelopmental disorder affecting individuals across the lifespan, including an estimated 10 million adults. Given increasing diagnosis and treatment of ADHD, rates may be increasing among pregnant women. Little is known about ADHD medication safety during pregnancy. **Analysis objectives** were to assess prevalence of overall ADHD medication use (i.e., psychostimulant and non-stimulant medications) at any time during pregnancy and estimate associations between early pregnancy use (one month before through third month of pregnancy) and specific birth defects. **Methods:** We analyzed data from the National Birth Defects Prevention Study (1997–2011), a U.S. population-based multicenter case-control study. Birth defects surveillance systems were used to identify cases (n=32,000); controls were randomly-sampled live-born infants without major defects representing the same geographic regions (n=11,892). Mothers of cases and controls completed a computer-assisted telephone interview. We calculated prevalence of ADHD medication use anytime during pregnancy and used logistic regression to estimate the association between early pregnancy ADHD medication use and 14 birth defects. For gastroschisis, we adjusted for maternal age. **Results:** Overall, 0.2% of women reported any ADHD medication use during pregnancy, and 20 control mothers and 65 case mothers reported early pregnancy use. Early pregnancy ADHD medication use was associated with gastroschisis (odds ratio [OR]: 3.24; 95% confidence interval [CI]: 1.32–7.92), omphalocele (OR: 3.99; 95% CI: 1.18–13.47), and transverse limb deficiency (OR: 3.23; 95% CI: 1.10–9.49) in infants. **Conclusions:** ADHD medication use during pregnancy was rare, but early use was associated with 3 of 14 birth defects investigated. Additional research is needed to confirm observations and help clinicians provide appropriate counseling to women of reproductive age who use ADHD medications.

PB002

Benzene and Congenital Anomalies in Oklahoma Children, 1997-2009

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**Introduction:** In Oklahoma, the infant mortality rate due to congenital anomalies was the second highest in the US with 178 deaths per 100,000 live births from 2007-2013. As the natural gas industry has proliferated in this region, concerns about the potential health effects of benzene have increased. While benzene is known to affect the central nervous system, the effects on the developing fetus are unclear. **Methods:** We conducted a retrospective cohort study to evaluate the association between ambient benzene concentrations and the prevalence of congenital anomalies among 646,024 children born in Oklahoma from 1997–2009. We defined benzene exposure using estimates from the Environmental Protection Agency’s 2005 National-Scale Air Toxics Assessment for the census tract of the birth residence. We used modified Poisson regression with robust standard errors to calculate prevalence proportion ratios (PPR) between quartiles of benzene exposure and any anomaly, neural tube defects, cardiovascular defects, and cleft lip/palate adjusted for maternal education and tobacco use. **Results:** We observed a modest increased prevalence of any anomaly among those exposed to the 2nd (0.33-<0.57 µg/m<sup>3</sup> PPR: 1.04, 95% CI: 1.00, 1.08), 3rd (0.57-<0.87 µg/m<sup>3</sup> PPR: 1.07, 95% CI: 1.03, 1.11), and 4th (≥0.87 µg/m<sup>3</sup> PPR: 1.08, 95% CI: 1.04, 1.12) quartiles of benzene concentrations compared to the 1st (<0.33 µg/m<sup>3</sup>). When examining specific anomalies, we observed an increased prevalence of cardiovascular anomalies among those with benzene exposures in the 3rd (PPR: 1.09, 95% CI: 1.02, 1.17) and 4th quartiles (PPR: 1.16, 95% CI: 1.09, 1.23) compared to the 1st quartile. We observed no association for neural tube defects or cleft lip/palate. **Discussion:** Our findings of increased cardiovascular anomalies among those residing in areas with higher ambient concentrations of benzene suggests that further investigation into specific sources of benzene exposure, including natural gas wells, is warranted.

PB003

Association between Income Inequality, Structural Racism, and Preterm Birth Rates in Large US Counties

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Previous research suggests that structural racism—namely, the systemic exclusion of people of color from opportunities such as employment and education—may contribute to differences in health outcomes between Black and White Americans. Notably, one recent paper found significant associations between state-level indicators of structural racism and income inequality on the odds of small-for-gestational-age birth. Our analysis investigates whether these associations hold for preterm birth rates at the county level. Our sample consisted of 2010-2014 data for US counties with a population of 250,000 or more (n=1192). Using US Census Bureau data, we employed county-level Gini coefficients to measure income inequality and assessed structural racism using the ratios of Blacks to Whites who were (a) employed and (b) had a bachelor's degree or higher. Each indicator was dichotomized at the median, whereby counties that fell below the median (or above for Gini coefficients) were assigned to the high inequality group for that year. County-level preterm birth rates were obtained from the Centers for Disease Control. Generalized estimating equations models were used to quantify the associations between education, employment, and income inequality and preterm birth rates, while controlling for maternal health, demographic, and socio-economic differences. Consistent with prior research, our results indicate modest joint effects of structural racism and income inequality on preterm rates in areas where levels of both are high. However, these effects were present only for births to Black women. Our models predict that counties with high levels of both education and income inequality will have more preterm births (beta=0.44, 95% confidence interval=0.15-0.72) to Black non-Latina women each year than counties with low levels of both or just one type of inequality. Results were similar for counties with both high employment and income inequality (beta=0.38, 95% CI=0.13-0.63).

PB004-S

Maternal and Child Polymorphisms in the Aryl Hydrocarbon Receptor Pathway and Birthweight in the Seveso Second Generation Health Study

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Introduction: 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) and other environmental chemicals are proposed to interfere with fetal growth via altered activity of the Aryl Hydrocarbon Receptor (AhR) pathway which regulates myriad biological and developmental processes including metabolism of xenobiotics. Genetic variation in the AhR pathway is an important driver of susceptibility to low birthweight in Japanese children exposed in utero to smoking. Little is known about genetic susceptibility in the AHR-pathway in relation to birth outcomes in populations of European ancestry and in interaction with other chemical exposures. Methods: The Seveso Women's Health Study (SWHS), initiated in 1996, is a cohort of 981 Italian women exposed to TCDD from an industrial explosion in the summer of 1976. In 2014-2016, we enrolled post-explosion offspring of the SWHS in the Seveso Second Generation Health Study. We genotyped mothers (n=407) and their children (n=478) in 58 single nucleotide polymorphisms (SNPs) from 7 candidate genes in the AHR-pathway. We measured TCDD concentrations in maternal serum. Birthweight was obtained from maternal report and confirmed with birth records in a subsample. We used multivariate generalized estimating equations (GEE) to model the associations between individual SNPs and child birthweight. Results: In preliminary analyses, we found 12 SNPs across four genes to be significantly associated with birthweight. One SNP (AHR, rs2066853), a known functional missense mutation, was associated with the largest reduction in birthweight, in models separately examining the mother and the child's genotypes [(adj-β=-205.1, 95% CI -324.3, -85.9) and (adj-β=-114.0, 95% CI -244.0, 15.9), respectively]. We will present analyses of gene-dioxin and polygenic associations with birthweight. Conclusions: We found that certain variants in xenobiotic metabolizing genes are associated with birthweight in Europeans. Next we will determine if there are gene-environmental interactions.

PB005

Preoperative infections may reduce the risk of postoperative infections after surgical repair of hypospadias

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Hypospadias is a frequently occurring birth defect in boys, which needs surgical repair in the majority of cases. However, complication rates after hypospadias repair are substantial (up to 50%). Several factors have been studied for possible effects on the occurrence of postoperative complications, but the effects of preoperative illnesses in the weeks just before surgery are unknown. The aim of this retrospective cohort study was to determine the associations between preoperative medical conditions that are not severe enough to postpone surgery and short-term postoperative complications after hypospadias repair in children. Data were collected from the medical files of 681 boys with anterior or middle type hypospadias, who had initial one-stage repair between 1983 and 2012 in the Radboud university medical center, The Netherlands. The associations between medical conditions, such as common cold, fever, and ear infection within two weeks prior to surgery and postoperative complications, such as urethrocutaneous fistula, wound dehiscence or infection, and urinary tract infection within two months and one year after surgery were analysed using multivariable logistic regression analyses. Of the 681 boys, 22.0% had a preoperative illness and 14.5% had a short-term postoperative complication. Contrary to expectation, children with a preoperative medical conditions developed fewer complications within two months or one year after surgery than children without preoperative medical conditions (OR 0.5, 95%CI 0.3-0.9 and OR 0.7, 95%CI 0.4-1.1). These reduced risks could for the most part be attributed to associations between preoperative and postoperative infections both within two months and one year (OR 0.4, 95%CI 0.1-1.0 and OR 0.3, 95%CI 0.1-0.9). Several hypotheses have been put forward to explain the observed protective effect on the occurrence of postoperative infections. However, independent replication of the results is needed before firm conclusions can be drawn.

PB006

Folate related birth defects and future maternal cardiovascular mortality

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Low levels of plasma folate are associated with increased homocysteine levels and may be linked to cardiovascular disease (CVD). Maternal periconceptional folic acid supplementation prevents offspring Neural tube defects (NTD), and possibly other birth defects. We evaluated premature (40-69 years) CVD mortality in women whose first infant had folate-related birth defects, accounting for the number of life-time births (1 vs >1). We used pooled data from the Medical Birth and Cause of Death Registries from Sweden (1973-2010) and Norway (1967-2014), and linked successive births to their mothers. Major birth defects were defined according to the European network of congenital anomaly registries, folate-related defects were defined as NTDs, oral clefts, cardiac defects, or limb reduction defects, chromosomal excluded. Women were followed from their 40th birthday or, if later, their last delivery, to death or 2010/2014, and Cox regression analyses were used to compare CVD mortality rates between mothers of firstborns with and without a folate-related defect, adjusting for confounders. Among 2,237,648 women (Norway: 42.4%, Sweden: 57.6%) there were 48,903 premature deaths and 5,961 premature CVD deaths. A folate-related defect in first birth was modestly associated with increased premature CVD mortality (adjusted hazard ratio (aHR) 1.3; 95% CI 1.0-1.8), seemingly driven by cardiac defects (aHR 2.1; 1.3 to 3.2). The relation was, however, limited to mothers with one birth only: Folate-related (3.3; 2.1 to 5.1) and cardiac defects (5.0; 2.7 to 9.0); vs mothers with >1 birth (1.0; 0.6 to 1.5 and 1.4; 0.8 to 2.6 for overall and cardiac defects, respectively). Excluding women with diabetes in first pregnancy and foreign born women slightly attenuated results. In conclusion, we found that having a first born with cardiac defects predicts a higher risk of premature CVD in the mother. The role of diabetes and factors associated with fertility deserves further exploration.

PB007

Maternal asthma or asthma medication as risk factor for the development of anorectal malformations?

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Several studies investigated the effects of maternal asthma and its pharmacological treatment on the occurrence of birth defects and reported conflicting results. Studies on anorectal malformations (ARM) in particular are scarce and could not disentangle the roles of the disease and the drug treatment. Therefore, we studied the associations between maternal asthma and/or its pharmacological treatment and the risk of delivering a child with ARM in a case-control study among 413 ARM patients and 2,138 population-based non-affected controls, obtained from the AGORA data- and biobank at the Radboud university medical center. Parental questionnaires were used to obtain information on asthma, its drug treatment, and potential confounders before conception and in the first months of pregnancy. Asthma was observed among 3.1% of mothers and use of asthma medication among 2.5%. Logistic regression analyses showed that asthmatic women had an increased risk of having a child with ARM (OR 2.0; 95%CI: 1.2-3.3). When they did not use medication, the risk was higher (OR: 3.0; 95%CI: 1.3-6.8) compared to women who used medication (OR: 1.6; 95%CI: 0.9-3.1). For women using asthma medication without having chronic asthma, we did not see an increased risk of ARM based on small numbers (OR:0.6; 95%CI:0.1-4.7). The risk of ARM was higher when rescue medication was combined with long-term controllers (OR 2.8; 95%CI: 1.2-6.6), compared to using rescue medication only (OR 1.3; 95%CI: 0.4-4.7). None of the case mothers used long-term controllers only. These results point towards an increased risk of having a child with ARM for asthmatic women, especially when no asthma medication is used. A combination of rescue medication and long-term controllers seems to be more harmful compared to rescue medication only, but may point towards more severe maternal asthma. Most likely, maternal asthma is associated with an increased risk of having a child with ARM, but not the pharmacological treatment.

PB008-S

Maternal Tobacco Exposure and Risk of Orofacial Clefts in the Child

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**Introduction** While a relationship between maternal tobacco exposure and development of orofacial clefts in the child has been established for some time, the actual degree of risk conferred is not well quantified. A better understanding of this risk would benefit prenatal specialists in the counseling of prospective parents. **Methods** A case-control study was conducted at the Cleft Hospital and the Bashir Hospital in Gujrat, Pakistan from December 2015 to December 2016. All new cases of cleft lip and/or cleft palate (CLP) at the Cleft Hospital were included. Sociodemographically similar patients without congenital malformations at the Bashir Hospital were selected as controls. Bivariate analyses were performed to identify risk factors associated with CLP. These variables were then included alongside maternal tobacco exposure (at least one parent smokes) in a multiple logistic regression to calculate adjusted odds ratios of developing CLP associated with each factor. **Results** A total of 329 patients with CLP and 131 controls were included in the study. Upon bivariate analysis, the following factors were associated with CLP: maternal tobacco exposure ( $p<0.001$ ), complications during pregnancy ( $p<0.001$ ), maternal hypertension ( $p=0.01$ ), mother not on any medications ( $p<0.001$ ), mother not receiving vaccinations ( $p<0.001$ ), and lower socioeconomic status ( $p<0.001$ ). After adjustment for these variables, having a smoking parent was associated with a 2.09 times increased odds of the child developing CLP (95% CI 1.22-3.58). Complications during pregnancy (OR=2.38, 95% CI 1.45-3.90), mother receiving vaccinations (OR = 0.32, 95% CI 0.16-0.64), and higher socioeconomic status (OR = 0.15, 95% CI 0.04-0.63) were also associated with CLP within this model. **Conclusion** This study provides an adjusted estimate of the risk of development of orofacial clefts in the child associated with maternal tobacco exposure. This finding will be of value to providers in the context of perinatal counseling.

PB009-S

Lithium use during pregnancy and birth defects: Findings from the National Birth Defects Prevention Study  
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Lithium is a primary pharmacotherapy for bipolar disorder and is also prescribed off-label for depression. The FDA classifies lithium as Category D—use during pregnancy may be warranted despite evidence of fetal risk because discontinuation is associated with relapse and higher risk of suicide. Lithium has been inconsistently associated with congenital heart defects (CHDs), yet its association with other birth defects remains unstudied. We investigated the risk of birth defects among women using lithium during early pregnancy in the National Birth Defects Prevention Study, a case-control study of over 30 types of major structural birth defects. Cases (n=32,200) were livebirths, stillbirths, or terminations identified by birth defects surveillance registries in 10 states; controls were livebirths without birth defects (n=11,829). We examined demographic and pregnancy characteristics of mothers who reported lithium use and calculated exact odds ratios (ORs) and 95% confidence intervals (CI). Mothers of 28 cases (0.09%) and 8 controls (0.07%) reported lithium use during the first trimester or month before pregnancy. Among controls, mothers who reported lithium use were more likely to be non-Hispanic white, be under- or overweight, have used tobacco or marijuana during pregnancy, and have experienced seizures; they were less likely to have intended the pregnancy. Unadjusted ORs were 1.4 for CHDs (95% CI=0.5, 4.0; n=12), 3.6 for craniosynostosis (95% CI=0.8, 13.6; n=4), and 3.5 for limb deficiencies (95% CI=0.6, 14.6; n=3). This is the first population-based case-control study of lithium and specific birth defects in the US. Because lithium use is infrequent, our results are imprecise and unadjusted for potential confounding. However, the magnitudes of the observed ORs warrant further investigation and replication in other data sets. Next steps include an aggregate analysis with an independent study population in Slone Epidemiology Center's Birth Defects Study.

PB010

HPV Vaccine in Pregnancy and Adverse Infant Outcomes  
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Background: Among United States (US) active duty service members HPV vaccine is recommended, though not compulsory, through 26 years of age, if not previously received. Administration is not recommended in pregnancy, but may occur inadvertently as over 25% of pregnancies are late-recognized. This study evaluated how inadvertent HPV vaccination in pregnancy affects subsequent infant health outcomes among infants born to female military personnel, including preterm births, birth defects, growth problems in utero and in infancy, and infant sex ratio. Methods: This study included infants born to active duty women, ages 18-28 years, captured in the DoD Birth and Infant Health Registry (2006-2010). Adverse outcomes were identified using diagnostic and procedure codes in administrative medical records, and exposure to HPV vaccine in pregnancy was ascertained from personnel immunization records. A multivariable survival analysis model was used to estimate the hazard ratios and 95% confidence intervals (CIs) for preterm birth; and multivariable logistic models were used to calculate odds ratios and 95% CIs for birth defects, growth problems in utero and in infancy, and infant sex ratio with exposure to HPV vaccination in pregnancy. Results: Approximately 40,000 infants were included in the analytic sample and 3- 9% were born with an adverse outcome of interest. Of those, 1-3% had mothers who were exposed to the HPV vaccination in pregnancy. Preliminary findings do not indicate a significant relationship of preterm birth, birth defects, growth problems in utero, growth problems in infancy, or infant sex ratio with exposure to HPV vaccination in pregnancy. Conclusions: These results are reassuring for circumstances of inadvertent exposure to HPV vaccine in pregnancy, though future studies that can adjust for other behavioral and lifestyle risk factors are needed. Further analyses that can account for pregnancy recognition will reduce potential confounding.

PB011-S

Exposure to maternal depression during pregnancy and DNA methylation changes in cord blood: A cohort study in the Avon Longitudinal Study of Parents and Children.  
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**Background.** Many women are affected by depression, especially during vulnerable periods of their lives such as pregnancy. Up to 13% of women may experience symptoms of depression during pregnancy and in the postpartum period. Maternal depression during pregnancy has been associated with an increased risk of adverse neurodevelopmental outcomes in the children. Epigenetic mechanisms could be one of the biological pathways that explain this association. The aim of this study was to investigate the association between prenatal maternal depression and DNA methylation changes in the cord blood of the new-born under the hypothesis that maternal depression during pregnancy may cause a change in the transcription of genes in the developing infant brain that could in turn lead to alterations in the structure of the brain and thereby to an altered susceptibility to later neurodevelopmental problems or psychiatric illness. **Methods.** 877 mother-child pairs were included in our study. We ran an epigenome wide association study (EWAS) between maternal depression during pregnancy and DNA methylation in cord blood samples. Maternal depression was defined as an EPDS score  $\geq 12$  at any time during pregnancy. **Results.** We discovered 2 CpG-sites in our single-site analysis associated with maternal depression in the early part of pregnancy. cg08667740 ( $\beta = -0.025$ ;  $p = 3.9 \times 10^{-8}$ ) and cg22868225 ( $\beta = -0.005$ ;  $p = 5.89 \times 10^{-8}$ ). 39 differentially methylated regions (DMRs) survived correction for multiple testing (Sidak  $p$ -value  $< 0.05$ ). We found 184 different significantly ( $p < 0.01$ ) enriched biological process GO terms and 44 KEGG pathways among the DMRs. Replication was attempted in the GenR Study. **Conclusion** This study is to our knowledge the first of its kind. The CpG sites and DMR's discovered, related to several genes associated with psychiatric disease and brain development. Larger sample sizes are needed and causality also remains to be established in future studies.

PB012-S

Timing of Maternal Depression and Sex-specific Child Growth, the Upstate KIDS Study  
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**Objective** Maternal depression was associated with diminished child growth in some but not all studies. The mixed evidence may be due to disproportionate impact by child sex. Accordingly, this study investigated sex differences in the association between maternal depression and child growth. **Methods** 3,440 singletons participating in the population-based Upstate KIDS Study cohort had longitudinal growth trajectory data from birth through 3 years of age. Antepartum depression requiring in/outpatient hospital care before the birth was derived from ICD-9 codes from the claim data. Severe maternal depressive symptom at 4, 12, 24, and 36 months was defined by a score of  $\geq 8$  score on the abridged Edinburgh Postnatal Depression Scale. Mothers reported children's weight and height from birth through 3 years of age, which were then used to estimate standardized weight, height, body mass index and weight-for-height using the World Health Organization child growth standards. Linear mixed effects models with random effects for age and robust standard errors were used to estimate the 4 growth outcomes after stratifying by sex and applying sampling weights. Covariates included maternal socio-demographics and behavioral characteristics. **Results** We found sex-specific associations between maternal depression and child growth during early childhood. Boys of mothers with antepartum depression were lighter ( $b = -0.16\text{kg}$ , 95%CI: -0.33, -0.00) and shorter ( $b = -0.82\text{cm}$ , 95%CI: -1.38, -0.26) as compared to boys of mothers without depression. Girls of mothers with severe postpartum depressive symptoms were more likely to weigh more for their height (0.27 z-score units, 95%CI: 0.01, 0.54) as compared to girls of mothers without depressive symptoms. No differences were found for other growth measures. **Conclusion** Potential sex-specific growth responses to maternal depression may provide a way to understand the observed impacts on child growth during early childhood.

PB013-S

Maternal polycystic ovarian syndrome and growth in offspring: The Upstate KIDS Study

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Research suggests that exposure to elevated androgens in utero is associated with increased risk of growth abnormalities. Polycystic ovary syndrome (PCOS) is associated with elevated levels of androgens in women, however few studies have examined whether growth in offspring born to mothers with PCOS differs from those born to mothers without PCOS. We examined whether maternal PCOS was associated with differences in offspring growth in the Upstate KIDS Study, a prospective cohort study of infants born in New York State (excluding New York City) sampled to account for fertility treatments and multiple births. Measurements of offspring length/height and weight were recorded by parents at doctor visits through three years of age. Diagnosis of pre-pregnancy PCOS was reported by mothers on baseline questionnaires. We used linear mixed models with random effects for child and mother to estimate differences in growth by PCOS exposure adjusting for maternal age, race, BMI, education, marital status, smoking, drinking, sex, any diabetes, private insurance, and plurality. We also used logistic regression to examine whether infants experienced rapid weight gain at 4, 9, and 12 months. 4438 mothers reported at least one measurement of child size for their 5420 children (1980 twins). 457 mothers (10.3%) had a diagnosis of PCOS. PCOS was not associated with early childhood growth. Compared to children born to mothers without PCOS, children of mothers with PCOS averaged similar weights (4.81g; 95% CI -95.1, 104.7), lengths/heights (0.18cm; -0.16, 0.52), and BMIs (-0.14; 0.-30, 0.01) through 3 years of age. There was some evidence of rapid infant weight gain from birth to 4 months among twins (aOR 1.72; 1.03, 2.89). Otherwise, associations did not differ by plurality. This study is among the first to prospectively examine the relationship between maternal PCOS and early growth in offspring. We found little evidence to suggest that maternal PCOS influences early childhood growth.

PB014-S

Paternal antidepressant use as a negative control for maternal use

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Maternal antidepressant use is associated with shorter duration of pregnancy and child anxiety, even after adjusting for measured confounders and using a sibling design for unmeasured confounders. We employed the fathers' antidepressant use around pregnancy as a negative control to indirectly assess whether confounding by genetic or environmental factors associated with depression in the family may induce these relationships. We used data from the Norwegian Mother and Child Cohort Study (MoBa), a population-based cohort that recruited pregnant women from 1999-2008. We included families where the father completed a questionnaire on medication use within 6 months of pregnancy. Gestational age at birth (GA) was obtained from the Medical Birth Registry of Norway. In subjects who completed a 3-year follow-up, we computed z-scores for the anxiety domain of the Child Behavior Checklist. We used linear regression to assess the association between paternal antidepressant use and both GA and anxiety. To validate exposure, we compared data from the Norwegian Prescription Registry from 2004-2008 to fathers' self-reported medication use in MoBa. We included 71,207 singleton pregnancies without congenital malformations; 42,824 had 3-year follow-up. Father's antidepressant use was not associated with GA (-0.5 days, 95% CI -1.5 to 0.4) whereas it was associated with anxiety (.15 SD, 95% CI .05 to .25). There was substantial agreement between father's self-report and prescription records (kappa 0.74); like what was reported for mothers. Fathers' antidepressant use was not associated with GA which may enhance our confidence in the suggested effect of maternal use of antidepressants in pregnancy on shorter gestation. The null association for paternal exposure was not explained by poorer quality of medication reporting from fathers. However, our results suggest familial confounding for the effect of prenatal exposure to antidepressants on offspring internalizing mental health outcomes.

PB015-S

Iron deficiency and anemia in middle childhood are associated with externalizing behavior problems in adolescence  
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**Background.** Iron deficiency (ID) in infancy is related to behavioral problems later in life. The effects of ID in middle childhood are uncertain. **Objective.** To examine the associations of ID and anemia in middle childhood with externalizing behavior problems in adolescence. **Methods.** Using information from 1042 participants in the Bogota School Children Cohort, a longitudinal study of schoolchildren aged 5-12 y at recruitment, we assessed whether baseline ID (plasma ferritin <15 µg/L) or anemia (hemoglobin <12.7 g/L) were associated with externalizing problems in adolescence. We administered the Youth Self Report, a survey used to evaluate behavior problems, after a median 6.2 y of follow-up, when children were 11-18 y of age. From the children's responses, we calculated age- and sex-standardized scores for externalizing problems and the rule breaking behavior, aggressive behavior, and attention problems subscales. Mean score differences were compared between categories of baseline exposures with use of multivariable linear regression. **Results.** Prevalence of ID and anemia was 3.2% and 3.0%, respectively. None of the anemic children had ID. Mean ± SD externalizing problems score was 52.6±9.6. Among boys, ID and anemia at recruitment were associated with 6.4 (95% CI: 1.9, 10.8; P=0.005) and 6.2 (95% CI: 1.6, 10.7; P=0.008) higher mean externalizing problems scores in adolescence, respectively; after adjustment for baseline age, time spent watching television or playing videogames, mother's height, and socioeconomic status. Also in boys, anemia was significantly positively associated with aggressive behavior subscale scores; whereas in girls, anemia was related to less rule breaking behavior. Biomarkers of other micronutrients that are relevant for neurodevelopment including zinc, vitamin B12, and folate were not associated with externalizing problems. **Conclusions.** ID and anemia in middle childhood are related to externalizing problems in adolescent boys.

PB016-S

Characterizing public health relevance of in utero pesticide exposure on persistent childhood fevers in a rural South African population: Effect modification, mediation, and estimation of potential policy effects by parametric g-computation.  
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In certain regions of South Africa, indoor insecticide application for malaria vector control exposes mothers and children to high concentrations of dichlorodiphenyltrichloroethylene & dichlorodiphenyldichloroethylene (DDT/E) and pyrethroids. In utero exposure to these endocrine-disrupting chemicals may have lasting effects on child immune function, however they are largely unstudied in this setting. In a prospective birth cohort of 752 mother-child pairs in Limpopo, South Africa, where gastrointestinal and respiratory infections are the leading causes of child mortality, we examined associations between maternal late pregnancy serum DDT/E and urinary pyrethroid metabolite concentrations and the frequency of persistent fevers (lasting 4+ days) in the second year of life, and whether relationships differed by maternal poverty, energy malnutrition, or HIV status. Using multivariable Poisson regression, a 10-fold higher maternal p,p-DDE concentration was associated with an 18% higher rate of fever (Incidence Rate Ratio = 1.18 [95% confidence interval: 1.01, 1.39]). This association was stronger among children of malnourished (IRR = 1.24 vs. 1.08), poor (1.30 vs. 0.96), and HIV infected (1.26 vs. 1.18) mothers. Other DDT/E isomers and pyrethroid metabolites were positively, but more weakly, associated with fevers. Exploratory four-way decomposition analyses suggest associations may be partially mediated through severe diarrhea in the first year. In modeling of hypothetical interventions, limiting p,p-DDE exposure of the entire population to 878 ng/g lipids (25th percentile) would reduce the total number of persistent fevers by about 12% (38 fevers eliminated of 307 total). Eliminating severe diarrhea in addition to limiting p,p-DDE exposure may reduce fevers by about 20% (61 eliminated). Results suggest intervening on p,p-DDE in this population may be effective in reducing infection burden, however further work testing modeling assumptions is warranted.



PB017-S

Prenatal exposure to acetaminophen and risks of overweight and obesity in the offspring: study based on the Danish National Birth Cohort

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**Background:** Early life exposure to xenobiotic that alter metabolic processes could predispose individuals to weight gain. Acetaminophen is the most common over-the-counter medication to treat pain and fever in pregnancy, and it was suggested to have endocrine effects in animals. We evaluated the associations between maternal acetaminophen use during pregnancy and overweight and obesity in the offspring at age 7 and 11. **Methods:** We studied 39,314 mothers and children enrolled in the Danish National Birth Cohort (DNBC; 1996-2002). Prenatal acetaminophen use was prospectively recorded in three telephone interviews. Parents reported children's body-mass-index (BMI) and waist circumference at their 7 or 11 years of age. Children with BMI greater than 85th or 95th percentiles were considered being overweight or obese. Comparing prenatal acetaminophen use with no use, we estimated differences in childhood BMI and risk ratio (RR) for being overweight or obese, adjusting for indications for use and other potential confounders. We used inverse-probability-weight to account for non-participation in follow up. **Results:** We found no association between prenatal acetaminophen exposure and BMI or waist circumference at age 7. At age 11, girls who were prenatally exposed to acetaminophen had higher BMI ( $\beta=0.09$  95%CI 0.01, 0.17), and were more likely to be overweight (RR=1.12 95%CI 1.04, 1.20) or obese (RR=1.15 95%CI 1.00, 1.33). A dose-response like association was found for increasing duration of exposure in pregnancy (p-trend <0.001 and 0.036 for overweight or obese). These associations were less consistent in boys, but long-term acetaminophen use in pregnancy was associated with being obese in boys at age 11 (i.e. RR 1.24 95% 1.00, 1.55 if acetaminophen was used in all 3 pregnancy trimesters). **Conclusions:** Adiposity promoting effects of acetaminophen seem to emerge during the pre-pubertal ages, and apparently stronger in girls. The associations need replication and further inquiry of the causality.

PB018-S

Leukocyte telomere length in middle childhood and age at menarche

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**Background:** Telomere length is a biomarker of cumulative stress and inflammation, and a predictor of aging-related health outcomes in adults. It is unknown whether telomere length in childhood is related to developmental milestones, such as age at onset of puberty, that in turn predict morbidity and mortality in the long term. **Objective:** To examine the association between leukocyte telomere length (LTL) in middle childhood and age at menarche. **Methods:** We measured LTL on a group of 385 Colombian premenarcheal schoolgirls (ages 5-12 y), in stored leukocyte DNA samples collected at the time of enrollment into a cohort study. Girls were followed periodically for a median 5.7 y for the occurrence of menarche. We estimated median ages at menarche by quartiles of LTL using Kaplan Meier survival probabilities. Adjusted differences in median age at menarche and 95% confidence intervals (CI) between LTL categories were estimated with the use of accelerated failure time models with a normal distribution. **Results:** Median age at menarche was 12.3 y. Among all girls, there was a positive, weak, non-statistically significant association between LTL and age at menarche (median ages at menarche in LTL quartiles 1-4, respectively: 12.21, 12.23, 12.33, and 12.34 y; P, trend=0.45). Nevertheless, among girls whose LTL was assessed at 9-12 y of age, there was a non-linear, positive association between LTL and age at menarche. Compared with girls whose LTL was in the lowest quartile, girls with longer LTL had a median age at menarche 0.43 y older (95% CI: 0.05, 0.82; P=0.03) after adjustment for baseline height- and BMI-for-age z-scores, maternal age at menarche and parity, and socioeconomic status. LTL was not associated with age at menarche in girls who were 5-8 y-old at recruitment (P, test for age-LTL interaction=0.16). **Conclusion:** Short LTL between ages 9-12 y predicts earlier menarche.

PB019-S

Pregnancy-related weight and offspring BMI at 3-6 years in the ARCH cohort, Lansing MI  
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To provide a broader perspective on the relationship of maternal and child obesity, we examined the relationship between several components of pregnancy-related weight and offspring body mass index (BMI). The Archive for Child Health (ARCH) enrolled and interviewed women at first prenatal visit in three clinics in Lansing, MI. A subset of mothers with singleton children participated in an age 3-6 y follow-up visit (mean=4.8 y) where anthropometric data was collected on both mother and child. The study sample (n = 117) was 54% White; 13% Black; 18% Hispanic; 15% other; mean maternal age was 26.4 y at delivery and 82% had household incomes < \$50,000/year. Pre-pregnancy BMI was obtained by self-report at enrollment, gestational weight gain (GWG) was obtained from birth certificates, and at follow-up, height, weight, waist circumference and body fat percent (bioelectrical impedance) were obtained from mothers and children. Age and gender-standardized BMI was calculated for children, and post-partum weight loss for mothers. Linear regression was used to examine the association between maternal weight and body composition measures and childhood BMI. In unadjusted models, only pre-pregnancy BMI ( $\beta=0.84$ , 95% CI 0.13, 1.55) and maternal waist circumference at follow-up ( $\beta=0.27$ , 95% CI 0.02, 0.52) were significantly associated with child BMI. Adjustment for maternal age and race did not alter the findings. GWG ( $\beta=0.35$ , 95% CI -0.43, 1.12), postpartum weight loss ( $\beta=-0.08$ , 95% CI -0.42, 0.26), and maternal body fat percentage ( $\beta=0.50$ , 95% CI -0.15, 1.14) were not statistically significantly associated with child BMI. Our findings go beyond recent literature in showing associations between a maternal postpartum body composition and childhood BMI. Maternal postpartum body composition may reflect parental factors including stress, depression, and breastfeeding, as well as diet, exercise, or other factors.

PB020-S

Children's Problem Behavior Across Gender And Race/Ethnicity at 9 Years of Age  
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Child problem behavior negatively impacts children's adult life. Examinations of differences regarding specific types of behavior problems are limited. Our purpose is to examine differences in internalizing and externalizing problem behavior by gender and race/ethnicity in children 9 years of age. We used data from the Fragile Families and Child Well-Being Study (N=3,630). The Child Behavior Checklist was used by primary caregivers to assess behavior. Unadjusted ordinal logistic regression was used to model problem behavior on gender and race/ethnicity. In weighted, unadjusted ordinal logistic regression analyses, females were significantly less likely to have higher externalizing behavior scores compared to males (odds ratio [OR]=0.78, 95% confidence interval [CI]: 0.61,0.99) and Hispanic children were significantly more likely to have higher internalizing behavior scores (OR=1.75, 95% CI: 1.08,2.83) compared to Black, non-Hispanic children. These differences did not remain after adjustment for maternal, family, and household variables. Weighted, adjusted analyses of behavior assessments by teachers and self assessments by children indicated similar results to those of primary caregivers with regard to gender. However, these analyses indicated that Hispanic and non-Hispanic, White children were significantly less likely to have higher externalizing and overall behavior scores compared to Black, non-Hispanic children, which may suggest potential race/ethnicity bias on the part of teachers and children themselves. Our results highlight the need for targeted approaches to address internalizing and externalizing behavior problems among children who may receive greater benefit from behavior-specific interventions and the importance of evaluating behavior assessments provided by multiple informants. Additional research is needed to understand manifestations and implications of behavioral differences in youth and adulthood.

PB021

Impact of exposure to general anaesthesia during paediatric procedures on early child development

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**Background:** Animal studies demonstrate that exposure to anaesthetic drugs in early life can lead to neurodegeneration. Recent population-based studies have found a small, yet increased risk of early developmental vulnerability following exposure to GA. However, studies were based on older data, included children with neurodevelopmental disability and did not differentiate major from minor surgery or other diagnostic procedures requiring GA. **Aim:** Investigate developmental and educational outcomes of children exposed to GA before the age of four years by type of procedure. **Methods:** Population-based record linkage study of all term, liveborn children in New South Wales, Australia, 2001-2009 with a developmental assessment at school-entry (aged 4-6 years). Children with major congenital anomalies, neurodevelopmental disability or who had major neurological, cardiovascular, eye or plastic surgery were excluded. Study outcome was defined as children developmentally high risk (DHR)- vulnerable in  $\geq 2$  of 5 developmental domains. Multivariable binary generalised estimating equations were used to estimate the association between GA (overall, type of procedure) and DHR adjusting for socio-demographic, assessment characteristics and clustering within schools. **Results:** Of 86,367 children, 17% were exposed to GA at  $<4$  years. Of those exposed, 72% had major, 23% minor surgery and 5% a diagnostic procedure and majority exposed once (86%). There was an increased odds of children being DHR following any exposure to GA (adjusted odds ratio (aOR) 1.18; 95%CI 1.11, 1.26); and with GA for major surgery (aOR 1.11; 1.03,1.20), minor surgery (aOR 1.32;1.17,1.49) and diagnostic procedures (aOR 1.55;1.19,2.01). No difference in results when restricting analyses to children with only one exposure to GA and no other admission to hospital. **Conclusion:** Exposure to GA in the first four years of life is associated with poor child development, with our study the first to demonstrate that children undergoing minor surgery or diagnostic procedures have greatest risk. Further detailed data on unreported neurological conditions, duration of GA exposure and type of sedation is required to provide reliable evidence to inform clinical decision-making.

PB022-S

Health Care Provider Attitudes and Practices Related to Quick Start Initiation of Contraception for Adolescents

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**PURPOSE:** Adolescents may encounter many barriers to initiating contraception. Quick Start is a safe protocol in which hormonal contraception can be initiated on the same day as a provider visit. We examined factors associated with health care provider attitudes and practices related to Quick Start of combined hormonal contraception (CHC) and depot medroxyprogesterone acetate (DMPA) for adolescents. **METHODS:** We analyzed weighted survey data from office-based physicians and from providers in publicly-funded health centers (Title X, non-Title X) (n=1,951). Using multivariable logistic regression, we estimated adjusted odds ratios (aORs) and 95% confidence intervals (CIs) of the associations between provider characteristics and misconceptions (unsafe or unsure) about the safety of Quick Start and infrequent Quick Start practices (not often or never) for adolescents. **RESULTS:** Among providers, the prevalence of having a misconception about the safety of using the Quick Start approach with adolescents was 17.4% for CHCs and 19.1% for DMPA. Compared with Title X providers, non-Title X providers (CHC aOR=5.29, CI=3.24, 8.63; DMPA aOR=3.61, CI=2.41, 5.42) and office-based physicians specializing in obstetrics/gynecology (CHC aOR=5.65, CI=2.91, 11.00; DMPA aOR=2.22, CI=1.23, 4.01) and family medicine (CHC aOR=3.81, CI=1.45, 10.07; DMPA aOR=2.40, CI=1.09, 5.31) had increased odds of misconceptions. About half of providers reported infrequent Quick Start provision of CHC (50.4%) and DMPA (48.7%) to adolescents. Reporting misconceptions about Quick Start safety was associated with infrequent Quick Start provision (CHC aOR=17.00, CI=6.02, 47.99; DMPA aOR=6.76, CI=2.11, 21.67). **CONCLUSIONS:** Approximately half of providers reported infrequent provision of contraception to adolescents using Quick Start. Health care provider education on the safety and implementation benefits of Quick Start of hormonal contraception for adolescents may reduce barriers to contraception in this population.

PB023-S  
The Effects of Stress on Couples Trying to Conceive  
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Is stress the new contraceptive? There is evidence to suggest that chronic stress affects the development and treatment of physical diseases and psychological disorders. However, the current literature is inconclusive about the association between stress and infertility. There needs to be further investigation in how stress impacts reproductive health which includes relationships and the ability to conceive. This study aims to examine self-reported individual stress levels and sexual frequency around the time of ovulation in both members of heterosexual couples intending to conceive a pregnancy using the Home Observation of Periconceptional Exposures (HOPE) study. The HOPE study includes 170 participant couples from the greater Salt Lake City, Utah area between 2012 and 2015. Stress classification was defined as Low, Medium, and High based on self-reported individual stress (1-10 high) distributions. There is a statistically significant difference in frequency of intercourse among stress categories. Women were less likely to report intercourse on days that they reported stress which was in the high category of individual daily stress levels (72.23%) compared to medium (69.93%) or low (66.33%) stress days (chi-square p-value <0.0001). Men were less likely to report intercourse on days that they reported stress which was in the high category of individual daily stress levels (61.21%) compared to medium (57.65%) or low (54.80%) stress days (chi-square p-value=0.0010). Furthermore averaging the daily stress levels within couples show a statistically significant difference between the frequency of intercourse among couple stress categories. Couples recording a high stress average were less likely to report intercourse (64.36%) compared to medium (54.58%) and low (56.46%) stress averages. Elucidating how stress affects couples trying to conceive can lead to a better understanding of how environmental pressures affect the reproductive system and behavior.

PB024-S  
A prospective study of physical activity and fecundability  
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Background: Physical activity (PA) may influence fecundability through alterations in endocrine function. Prior studies of the association are inconclusive and are limited by lack of gold-standard measurement of PA and use of retrospective report of time-to-pregnancy (TTP). Methods: We evaluated the association between PA and TTP in the Effects of Aspirin in Gestation and Reproduction trial, which included 1228 women attempting pregnancy ages 18–40 with one to two prior pregnancy losses. PA was measured at baseline using the self-administered, short form of the International Physical Activity Questionnaire (IPAQ) to determine hours/day of activity (vigorous, moderate, and walking) and sedentary (sitting) behavior. Study participants were followed for up to 6 menstrual cycles while trying to become pregnant; 797 women achieved pregnancy. Pregnancy was assessed using urine hCG assays. Discrete time Cox models were used to estimate fecundability odds ratios (FORs) adjusted for parity, marital status, education, and time since last pregnancy loss, accounting for left truncation and right censoring. Results: Fecundability was not associated with vigorous activity (FOR= 0.99, 95% CI: 0.96, 1.02), moderate activity (FOR=1.00, 95% CI: 0.97, 1.02), walking (FOR= 0.99, 95% CI: 0.97, 1.01), or sitting (FOR=1.01, 95% CI: 0.99, 1.04). Use of categorized PA variables to allow non-linearity did not affect results. In comparisons by IPAQ categories, no differences were observed between high (FOR=0.94, 95% CI: 0.76, 1.17), or moderate baseline exercise levels (FOR=0.97, 95% CI: 0.79, 1.19) compared to low baseline exercise levels in adjusted models. Further adjustment for age did not change this finding and results were similar in models stratified for BMI. Conclusion: These results suggest that neither PA nor time spent in sedentary (sitting) behavior influences fecundability in women with a history of one to two pregnancy losses.

PB025

Accounting for bias due to selective participation, attrition, and confounding in an internet-based pilot study of fecundity  
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While it is well recognized that observational studies will require adjustment for confounding to estimate a causal effect of exposure on an outcome, selective participation and attrition are also possible threats to study validity. We explore adjustment for selection bias due to participation and attrition, along with confounding, in an internet-based pilot study of the feasibility of daily reporting and fecundity. Of the 2,303 persons screened, 245 women were determined to be eligible to participate; 28% of them initiated study participation. Of those who initiated the study, 26% were followed to the study endpoint. Through the framework of inverse probability weighting, we investigate the impact of adjustment for selective participation, attrition, and confounding, on the causal estimates of the impact of being overweight or obese on time to pregnancy (TTP). We estimate separate models for the probability of selective participation, for the time varying probability of censoring due to attrition, and for the probability of being exposed (overweight or obese). To estimate the effect of overweight or obesity on fecundity (fecundity odds ratio (FO)), pooled logistic regression models and discrete time survival models, weighted by the combined stabilized inverse probability weight, were used. When accounting for selective participation, attrition, and confounding, longer TTP was found for those who were overweight or obese (FO: 0.23, 95% CI (0.04, 1.26)). Only accounting for selective participation and confounding yielded similar, but attenuated toward 1, estimates of the FO (0.30, 95% CI (0.07, 1.25)). Adjustment for confounding alone estimated the FO to be further biased, and more variable (0.59, 95% CI: 0.17, 2.05). Although not commonly employed, adjustment for selection into a cohort and attrition, should be considered when designing and evaluating exposures in an observational study.

PB026

Estimation of the daily probabilities of conception; modification of Royston's algorithm for the small sample study  
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Purpose Among various factors that may affect conception, the timing and frequency of intercourse has a major impact on the probability of conception. Royston 1999 proposed an algorithm to estimate the daily probability of conception, however, it did not perform well among small samples. We modified the model to estimate the conception probability in a Japanese prospective study. Method Konishi et al. (ISEE-ISES AC 2016) conducted the prospective study with 80 women aged 20 to 34 years old. The study collected information about menstruation and intercourse for up to 24 weeks, and the pregnancy outcomes. Royston's original algorithm proceeds as follows: (i) specify a fixed potentially fertile window of  $F=\{a,\dots,b\}$  in each period including the ovulation day as 0; (ii) specify the most fertile intercourse day (MFID)  $d$  as  $\operatorname{argmax}\{x_i \cdot p_i\}_i$  for all cycles, where  $x_i$  and  $p_i$  are the intercourse indicator and conception probability of day  $i$ , respectively; (iii) calculate the total number of pregnancies and cycles in which the MFID occurred on day  $i$ ; (iv) fit the fractional polynomial model (FPM) for  $p_i$  as a function  $d$ , and update the probability  $p_i$ ; and (v) repeat (ii) through (iv) until the estimate of  $p_i$  remains unchanged. We changed the FPM to a generalized additive model (GAM) in step iv, because of difficulty with convergence. Furthermore, a numerical simulation study was performed to compare the accuracy of the statistical models. Results We analyzed the data of 355 cycles and 28 pregnancies of 73 participants. The estimated daily probabilities of conception and MFID varied depending on the model and width of potentially fertile windows. A numerical evaluation showed that the method with GAM was more accurate than the original method with FPM. Conclusion The estimates of the daily probabilities of conception were sensitive to the analysis method, especially in the small sample. The Royston algorithm using GAM appeared to be more accurate than FPM for a small sample study.

PB027-S

Is couples' time-to-pregnancy associated with neonatal anthropometry?

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The number of cycles or months of unprotected intercourse required to achieve pregnancy, time-to-pregnancy (TTP), is a useful clinical tool for the assessment of fertility. As such, studies have demonstrated a relationship between a longer TTP ( $\geq 12$  months) and increased risk of adverse birth outcomes. Still, no study has investigated prospectively measured TTP and neonatal anthropometry. We used data from the LIFE Study cohort, 501 female and male partners recruited prior to conception from 16 counties in Michigan and Texas and followed through delivery to explore this potential relationship. In multiple linear regression models of birth outcomes (weight, length, head circumference, Ponderal Index and post-conception gestational age estimated by peak fertility) we modeled TTP as a continuous, binary ( $TTP \geq 3$  cycles/ $TTP < 3$  cycles) and categorical ( $TTP < 3$  cycles,  $TTP 3-6$  cycles and  $TTP \geq 7$  cycles) variable. Models were adjusted for various combinations of a priori confounders including maternal and paternal body mass index, preconception smoking and alcohol, parity, household income, multivitamin use, maternal age, and the difference between maternal and paternal age. Regression models were weighted by the inverse probability of pregnancy given that 344 couples (69%) achieved a singleton pregnancy and there were 236 live singleton births (47%). In all linear models, a 1 cycle increase in TTP was not associated with any birth outcome. The  $\beta$  (95% CIs) from fully adjusted linear models included [birthweight: -0.94 g (-27.3, 25.5); length: -0.03 cm (-0.17, 0.12); -0.08 cm (-0.21, 0.05); Ponderal Index: 0.004 g/cm<sup>3</sup> (-0.01, 0.02); and gestational age: -0.53 days (-1.4, 0.37)]. Findings were predominantly similar for models of binary and categorical TTP. In a prospective cohort study of couples planning for birth outcomes, we found no relationship between the length of time it took couples to achieve pregnancy and neonatal anthropometry.

PB028

Use of prescribed antibiotics and female fecundability

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Background: Antibiotic use has been associated with adverse reproductive effects in animals; however, there are few studies in humans. Objective: To examine the effect of preconception intake of antibiotics on female fecundability. Methods: We examined this relation in a prospective cohort study of 5,279 Danish pregnancy planners who had been trying to conceive for  $\leq 6$  cycles at study entry. Participants completed a baseline questionnaire and bi-monthly follow-up questionnaires for up to 12 months or until reported pregnancy. From the Danish National Prescription Registry, we retrieved data on prescribed antibiotics using Anatomical Therapeutic Chemical Classification System codes. Exposure was defined as redemption of  $\geq 1$  prescription for antibiotics (J01), penicillins (J01C), macrolides (J01F), and sulphonamides (J01E) within 30 and 90 days before study entry. We used proportional probabilities models to compute adjusted fecundability ratios (FRs) and 95% confidence intervals (CI). We adjusted for demographics, lifestyle factors, parity and intercourse frequency. Results: Within 30 and 90 days before study entry, 252 (4.8%) and 675 (12.8%) participants redeemed a prescription for antibiotics, respectively. Compared with women not prescribed antibiotics, the adjusted FR (95% CI) for women redeeming  $\geq 1$  prescription for antibiotics within 30 days was 0.90 (0.78-1.04), and the adjusted FRs (95% CI) for 1 and  $\geq 2$  prescriptions redeemed within 90 days were 0.99 (0.90-1.09) and 0.90 (0.74-1.09), respectively. For use of penicillins, macrolides, and sulphonamides within 30 days, the FRs were 0.84 (0.70-1.01), 1.27 (0.88-1.83) and 1.02 (0.72-1.45), respectively. Based on the 90-day window the FR (95% CI) for penicillin was 1.00 (0.90-1.11). Conclusion: Preconception penicillin use within 30 days was associated with reduced fecundability. The extent to which this finding reflects the effect of penicillin itself or factors related to penicillin use warrants further research.

PB029

The association between written clinical protocols for providing high quality contraceptive counseling and provider practices in publicly-funded family planning clinics  
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**Background:** The 2014 Recommendations for Providing Quality Family Planning Services described key components for providing high quality contraceptive counseling, which included: assessing the client's reproductive life plan, presenting contraceptive method effectiveness with the most effective methods mentioned first, helping the client think about potential barriers to using their selected method correctly, and informing adolescents that long-acting reversible contraceptives are safe and effective. The association between including these components in written clinical protocols and resulting provider practices has not yet been evaluated. **Methods:** Using a nationally representative survey of publicly-funded family planning clinics (n=1312), we examined the association between having written protocols in place for all four key components of high quality contraceptive counseling, as reported by the clinic administrator, and whether a medical provider at that clinic reported incorporating all four components "very often" into their contraceptive counseling. Unadjusted and adjusted prevalence ratios and 95% confidence intervals (CI) were estimated using predicted margins logistic regression models, accounting for survey design. **Results:** Approximately 45% of clinics had written protocols in place for all four contraceptive counseling components. Among clinics without protocols, 32% of providers reported performing all four practices very often; among clinics with all four written protocols, 54% of providers reported performing all four practices very often (prevalence risk ratio 1.70, 95% CI: 1.45, 1.99). After adjusting for clinic and provider characteristics, the adjusted prevalence risk ratio was 1.48 (95% CI: 1.25, 1.75). **Conclusion:** Having written clinical protocols in place for contraceptive counseling was associated with more frequent reports of providers performing these practices.

PB030

Higher 25-hydroxyvitamin D (25(OH)D) is associated with increased fecundability  
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In rodents, vitamin D deficiency has been associated with reduced fertility. No studies have prospectively examined vitamin D status and natural conception. We examined the association of vitamin D with fecundability in a prospective community-based cohort study of time to pregnancy, Time to Conceive. Women aged 30-44, with no known fertility problems, were enrolled in Time to Conceive early in their attempt to become pregnant. Women provided a whole blood sample that was spotted, dried, and stored frozen. Women used daily diaries to record menstrual bleeding and daily vitamin and supplement use for up to four months. We measured the number of menstrual cycles required to achieve a positive pregnancy test. 25(OH)D<sub>2</sub> and 25(OH)D<sub>3</sub> were measured in duplicate in the baseline blood spots using liquid chromatography tandem mass spectrometry. The median measured total 25(OH)D was 35ng/ml (IQR: 28, 41). We developed a predictive model to adjust the measured total 25(OH)D for changes in season and supplement use across each woman's menstrual cycles. We analyzed the association between time to pregnancy and cycle-specific 25(OH)D using a discrete time proportional odds model that adjusted for age, race, recent estrogen use, education, obesity, alcohol use, and caffeine intake. The 463 women in our sample contributed 1671 menstrual cycles (of which 288 were conception cycles). A 10 ng/ml increase in 25(OH)D was associated with an approximately 12% higher odds of conception in any given cycle (Fecundability odds ratio(FOR)(95% Confidence Interval (CI)): 1.12 (0.99, 1.26). Women with high 25(OH)D ( $\geq 40$ ng/ml) had the highest fecundability; by comparison the FOR for  $<25$ ng/ml was 0.64 (0.39, 1.07), and for 25- $<40$ ng/ml it was 0.99 (0.73, 1.33). In this population of late reproductive-aged women, increasing 25(OH)D was associated with an increased odds of conceiving a pregnancy. Women who are attempting to conceive a pregnancy may benefit from maintaining high 25(OH)D levels.

PB031-S

Patterns of estradiol across the menstrual cycle are associated with concentrations of vitamin D metabolites

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Vitamin D is acquired through sunlight or dietary intake, and US women are often vitamin D deficient. Vitamin D is Important for bone health, and has also been associated with menstrual cycle characteristics, though patterns and associations with hormones across the cycle are unknown. We sought to characterize the pattern of vitamin D metabolites across ovulatory menstrual cycles and to compare the pattern of reproductive hormones between categories of vitamin D metabolites. Eighty-nine young white women in the BioCycle Study had 25 hydroxy-vitamin D (25OHD) measured 3 times across 2 cycles, and 1,25-dihydroxy-vitamin D (1,25D) and intact parathyroid hormone (iPTH) measured on average 5 times per cycle. 1,25D and iPTH concentrations across cycles were modeled using a linear regression model with a cosinor function. The pattern of reproductive hormones across ovulatory cycles was modeled using non-linear mixed models for categories of vitamin D metabolites adjusted for age, parity, body mass index and physical activity. Median concentrations of 1,25D and iPTH were 107.1 pmol/L and 35.3 pg/mL respectively. Both showed small-amplitude cyclic changes across the cycle. 1,25D was lowest in the follicular phase and highest in the luteal phase (difference 7.3 pmol/L, 95% Confidence Interval (CI) 1.6, 12.9). iPTH showed a similar, but inverted pattern. The median concentration of 25OHD was 29.5 ng/ml. Women above the median had elevated estradiol (17.8%, 95% CI 6.9, 29.7). Women in the lower half of iPTH concentrations, which corresponds biologically to sufficient 25OHD, also had elevated estradiol. No associations were observed for progesterone or the gonadotropins. Results in ovulatory cycles suggest that sufficient concentrations of 25(OH)D are associated with elevations in estradiol across the menstrual cycle. These results support research highlighting the importance of vitamin D for reproductive health, possibly through hormonal pathways.

PB032-S

Urinary concentrations of phthalate metabolites and associations with rise of human chorionic gonadotropin and rescue of the corpus luteum

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Phthalates are found in flexible plastics and many personal care products, and exposure to these endocrine disrupting chemicals may affect reproduction. The initial rise in human chorionic gonadotropin (hCG) after implantation and rescue of the corpus luteum are critical for early pregnancy maintenance. To examine the relationship between phthalate exposure and these two early pregnancy events, we used data from the North Carolina Early Pregnancy Study (EPS) (1982-86). The EPS was a cohort study of women with no known fertility problems or chronic health conditions, recruited at the time they discontinued birth control, and followed with daily urine collection. We examined women who had a pregnancy that lasted beyond 6 weeks (n=151). Phthalate levels were measured in a pooled urine sample from 3 preimplantation days of the conception cycle. The outcome of corpus luteum rescue was assessed by a post-implantation rise in urinary progesterone metabolite. The rate of rise of hCG was examined over 7 days: implantation and the next 6 days. We assessed the relationship between individual phthalate levels and the pattern of hCG rise using linear mixed models. The initial rate of hCG rise was slower in conceptions where the mother was exposed to higher levels of the molar sum of the di-2-ethylhexyl phthalate metabolites ( $\Sigma$ DEHP;  $p=0.04$ ) and monobenzyl phthalate (MBzP;  $p=0.01$ ). This reduction was later compensated by an increased rate of hCG rise, a pattern similar to that previously described for women exposed to diethylstilbestrol. The association remained statistically significant after adjustment for women's age at the start of the study. Women with higher levels of monoethyl phthalate (MEP) were more likely to have no rise in progesterone with corpus luteum rescue. Our results suggest MBzP and  $\Sigma$ DEHP metabolites may influence the initial rate of hCG rise and MEP may affect the type of corpus luteum rescue.



PB033-S

Adiposity, fecundability, and anovulation among women with prior pregnancy loss

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Central adiposity may be particularly detrimental to ovulation and fecundability due to associated insulin resistance and altered hormonal milieu. The few studies of central adiposity and fertility yielded mixed results, and often used self-reported data. We prospectively examined overall and central adiposity in relation to fecundability and sporadic anovulation in the EAGeR preconception cohort. Participants were attempting pregnancy while using fertility monitors and had a history of 1-2 pregnancy losses,  $\leq 2$  live births, regular menses, and no infertility diagnosis. Weight, height, waist and hip circumference, and skinfolds (suprailiac, subscapular, and triceps) were measured at baseline prior to trying to conceive. Follow-up lasted up to six menstrual cycles, with pregnancy detected by clinical pregnancy test. Daily urine samples were collected during cycles one and two; an absence of a rise in luteal progesterone determined anovulation. A repeated-measures log-binomial regression model estimated the RR and 95% CI of anovulation per cycle, adjusted for age, income, smoking, time since loss, and body mass index (BMI), where appropriate. A Cox proportional hazards model estimated fecundability odds ratios (FOR). Among 1,098 eligible women, relative to BMI of 18.5-24.9 kg/m<sup>2</sup>, the FORs for <18.5, 25.0-29.9, 30.0-34.9, and  $\geq 35.0$  kg/m<sup>2</sup> were: 2.21 (0.94-5.66); 0.89 (0.72-1.11); 0.74 (0.56-0.97); and 0.59 (0.43-0.80). Assessing anovulation, the respective RRs were 0.72 (0.30-1.93); 1.17 (0.85-1.62); 1.72 (1.23-2.40); and 2.22 (1.64-3.02). Waist circumference  $\geq 88$ cm vs. <88cm and sum-of-skinfolds tertiles were associated with lower fecundability, but not after adjusting for BMI. Waist-hip ratio was not associated with fecundability, before or after adjusting for BMI. In conclusion, in a cohort of fertile women, obesity was associated with lower fecundability and increased sporadic anovulation, while central adiposity was not independently associated with either outcome.

PB034

Initial results from an international study of natural procreative technology and other treatment for infertility

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We conducted a multi-site, prospective cohort study of infertile couples who sought care for natural procreative technology (NPT) at participating clinics in the United States, Canada, United Kingdom, or Poland. Follow-up information was obtained by direct contact with the participating couples through online questionnaires for up to 3 years after initial clinical contact. Follow-up included whether the couples continued with NPT, or received in vitro fertilization (IVF), or other treatment. Prior to and during 2014, completion of online questionnaires was compensated, with completion rate of 61% and 42% for women and men, respectively. During 2015, compensation was not given due to lack of funding, and the completion rate of online questionnaires was 50% and 24% for women and men, respectively. The study completed recruitment in December 2015, and enrolled 798 couples. The mean woman's age was 34.2 years, 37% had a prior pregnancy, and 8% had previously attempted in vitro fertilization. The overall cumulative adjusted live birth rate at 30 months' follow-up was 57% for those who continued with NPT treatment, and 38% for those who had other treatments. Live birth rates were higher for women who had been trying for shorter time to conceive, or who had a prior live birth. In a subgroup analysis of 333 pregnancies for which more complete data were available, the mean gestational age for live births attributable NPT was 39.0 weeks, while for live births attributable to IVF it was 37.6 weeks. Similarly, mean birth weight was 3360 grams and 2995 grams for NPT and IVF, respectively.

PB035

Prepregnancy Serum Lipids and Early Pregnancy Changes in Association With Length of Gestation

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Maternal lipids are important for steroidogenesis for the mother, placenta, and fetus, and for fetal growth. However, the impact of the known lipid rise and rate of change for pregnancy health is unclear as prepregnancy data are almost nonexistent. Thus, in a secondary analysis, 337 pregnant women receiving placebo as part of the Effects of Aspirin in Gestation and Reproduction trial (2007-2012) were included. Participants had 1-2 prior pregnancy losses and no prior diagnosis of infertility. Total cholesterol, low and high density lipoprotein cholesterol (LDL-C and HDL-C, respectively) and triglycerides were measured up to 6 months prepregnancy (time 0) and during pregnancy at 4, 8 and 12 weeks' gestation. Adjusted logistic regression estimated the association of odds of early loss (n=54) vs no loss (n=283) and preterm (n=34) vs not preterm (n=249) with prepregnancy lipid levels and the rates of change from both prepregnancy to 4 weeks and from 4 to 8 weeks. Losses were defined as < 12 weeks and preterm as 14 to < 37 weeks. On average, lipids decreased from preconception to 4 weeks, then increased until 12 weeks. Neither prepregnancy lipids nor the rate of change from prepregnancy to 4 weeks' gestation were associated with pregnancy loss or preterm delivery. Between 4 and 8 weeks, for every 1 unit increase in HDL-C, there was a 22% decreased odds of pregnancy loss (OR=0.78; 95% CI 0.60-0.99) or preterm delivery (OR=0.78; 95% CI 0.62-0.97); there was no association for other lipid components. In summary, after an initial decrease very early in pregnancy, we found lipids started to rise earlier than previously reported. Also, given that HDL-C has been hypothesized to protect maternal vascular endothelium from damage from lipid peroxidation and reactive oxygen species, an impaired rise of HDL-C concentrations early in pregnancy may be a signal for maladaptation to pregnancy that is associated with higher rates of pregnancy loss or preterm delivery.

PB036

Comparison of predictive ability for small-for-gestational-age using fetal biometry at 21-25 weeks of gestation

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Background: Early detection and management of small-for-gestational-age (SGA) babies help reduce adverse perinatal outcomes. There are limited studies evaluating prediction ability of fetal ultrasound biometry at early pregnancy for SGA, especially in developing countries. We used data from the Born in Guangzhou Cohort Study (BIGCS), China to evaluate the predictive ability of fetal biometry at 21-25 weeks for SGA. Method: A total of 8968 pregnant women from BIGCS were included. Information on fetal biometry [bi-parietal diameter, head circumference, abdomen circumference (AC) and femur length] at 21-25 weeks was extracted from medical record. Z scores of fetal biometry were calculated and SGA was defined as birth weight less than 10th percentile for gestational age, based on INTERGROWTH-21st standards. Logistic regression model was used to construct the prediction model. Area under receiver operator characteristic curves (AUC) and calibration plot were used to evaluate predictive performance for maternal characteristics alone (maternal age, education, income, pre-pregnancy body mass index, pre-pregnancy hypertension and diabetes, and passive smoking during pregnancy), fetal biometry alone and combination of maternal characteristics and fetal biometry. Delong test was used to compare AUCs from different models. Results: AUC (95% CI) of maternal characteristics alone was 0.61 (0.58, 0.64), while that of fetal biometry [Z scores of 4 measurements were simultaneously included] was 0.75 (0.73, 0.77). Using AC Z score as the single predictor [0.75 (0.73, 0.77)] had similar performance, compared to all four fetal biometry (P=0.99). Combination of maternal characteristics with fetal ultrasound biometry [0.76 (0.74, 0.78)] did not significantly improve the performance (P=0.27). All models had good calibration. Conclusions: Fetal biometry at 21-25 weeks alone has a moderate predictive ability for SGA. Our findings have implication to develop early screening strategy for SGA.

PB037

Association of Antepartum Depressive and Anxiety Disorders with Infant Birth Weight and Gestational Age at Delivery  
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**Objective:** To evaluate the extent to which antepartum depression and generalized anxiety disorders are associated with infant birth weight (BW) and gestational age at delivery (GA). **Methods:** A cohort of 4,401 Peruvian women were interviewed in early pregnancy (mean gestational age=10.3 weeks). Antepartum depression and anxiety were assessed using the Patient Health Questionnaire 9 (PHQ-9) and Generalized Anxiety Disorder-7 (GAD-7). GA and BW were obtained from medical records. Multivariable linear and logistic regression procedures were used to estimate adjusted measures of association ( $\beta$  coefficients and odds ratios) and 95% confidence intervals (CI). **Results:** The prevalence of antepartum depression and anxiety were 26.1% and 32.4%, respectively. After adjusting for confounders, a diagnosis of antepartum depression or generalized anxiety was statistically significantly and inversely associated with infant BW ( $\beta=-50.5g$ ,  $P=0.002$ ) and GA ( $\beta=-0.13$  weeks,  $P=0.02$ ). Women who were diagnosed with antepartum generalized anxiety alone had increased odds of low birth weight (OR=1.73; 95%CI: 1.23-2.51), preterm birth (OR=1.43; 95%CI: 1.02-1.96) and small-for-gestational age [SGA] (OR=1.69; 95%CI: 1.14-2.50) as compared to those who had not been diagnosed with neither psychiatric disorder. The ORs of low birth weight, preterm birth and SGA associated with antepartum depression alone were (OR=1.08; 95% CI: 0.62-1.78), (OR=1.09; 95%CI: 0.68-1.67) and (OR=0.86; 95%CI: 0.46-1.59), respectively. **Conclusion:** Antepartum depression and generalized anxiety are associated with reductions in infant BW and GA at delivery, as well as with increased risks of low birth weight, preterm birth and SGA risk. Antenatal care should be tailored to screen and provide additional mental health services and care to at risk mothers.

PB038-S

Maternal serum CRP measured between 16 and 27 weeks' gestation and birthweight for gestational age  
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Inflammation pathways may contribute to fetal growth restriction. Studies of associations between the acute inflammatory protein, C-reactive protein (CRP), and fetal growth have produced mixed results, therefore further investigations of this relation are warranted. We analyzed data from 1,308 sub-cohort women in the Pregnancy Outcomes and Community Health (POUCH) Study. Women were enrolled in the 16th -27th week of pregnancy from 52 clinics in 5 Michigan communities. Newborn birth weight for gestational age (BW/GA) was evaluated using a national reference. Serum CRP levels, measured in maternal blood collected at enrollment, were compared across 3 groups of mothers, i.e. those who delivered a small for gestational age (SGA) infant (< 10th percentile BW/GA), large for gestational age (LGA) infant (>90th percentile BW/GA), or the remainder, average for gestational age (AGA) infant. Analyses used linear regression and adjusted models included maternal race/ethnicity, pre-pregnancy body mass index, gestational age at blood sampling, and maternal age. In unadjusted models, maternal geometric mean CRP values ( $\mu g/L$ ) were 3.76 (SGA), 5.43 (AGA) and 6.36 (LGA) ( $p=0.002$  for SGA vs AGA). After including covariates, the largest change from unadjusted to adjusted estimates was among mothers of LGA infants; the significantly lower CRP levels in mothers of SGA infants persisted ( $p=0.008$ ). Adjusted geometric mean CRP values ( $\mu g/L$ ) were 3.89 (SGA), 5.1 (AGA), and 5.41 (LGA). In sensitivity analyses, results were robust after removing women with hypertensive disorders of pregnancy, extreme CRP values, and adjusting for antibiotic use prior to maternal blood draw. While we anticipated evidence of maternal inflammation with poor fetal growth, our unexpected findings motivate queries into why levels of this particular acute phase reactant, CRP, might be lower at mid-gestation among mothers of SGA infants.

PB039-S

Association between maternal weight gain during pregnancy and offspring's birth weight in a minority-inhabited region in Southwestern China

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**Objectives:** Little is known about maternal gestational weight gain (GWG) during pregnancy among ethnic population in China. Our goal was to examine maternal GWG in a predominantly Zhuang ethnic population and its association with offspring's birth weight. **Methods:** Data came from 5,912 pregnant women who started prenatal care within 12 weeks gestation and delivered singleton live births in Pingguo county, Guangxi during 2013-2015. GWG was categorized as inadequate, adequate, and excessive according to the 2009 Institute of Medicine's (IOM) recommended weekly rate of weight gain in the 2nd and 3rd trimesters. Multinomial logistic regression models were used to examine correlates of meeting IOM's guideline and the association between GWG and offspring's birth weight (<2500, 2500-3999, ≥4000 grams). **Results:** The majority of our sample (87.8%) was Zhuang ethnic women. Over half of them (53.8%) gained weight above the guideline and 30.1% and 16.19% were within and below the guideline, respectively. Advanced maternal age (≥30 years), at or less than elementary education, and being underweight (body mass index (BMI)<18.5) were associated with increased risk of inadequate GWG, while having college or more education and being overweight (BMI ≥25) were associated with increased risk of excessive GWG. Inadequate GWG was associated with 1.6 times higher odds of low birth weight (adjusted OR: 1.6, 95%CI: 1.1-2.3), while excessive GWG was associated with 1.9 times higher odds of high birth weight (adjusted OR: 1.9, 95%CI: 1.2-3.2), when compared with those gaining within the guideline. **Conclusions:** Nearly two-thirds of women living in this Zhuang-inhabited region were gaining weight outside IOM recommended range and inadequate or excessive rates of GWG were associated with low or high birth weight, respectively. These findings indicate the emerging need for targeted prenatal care programs for this minority population in China.

PB040

Pre-pregnancy kidney function and subsequent pregnancy outcomes: The CARDIA Study

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**Background:** Appropriate response of the renin-angiotensin system may be required for the plasma volume expansion and vascular remodeling needed for healthy pregnancy. Renal insufficiency is associated with pregnancy complications including fetal growth restriction, preterm birth (PTB), and pre-eclampsia. The effect of preconception kidney function, particularly if not clinical impairment, on pregnancy outcome is unknown. **Methods:** 1041 women who participated in the CARDIA study who had kidney function and biochemical analyses measured before at least one pregnancy delivered during 20 years post-baseline were included in analysis. Kidney function (as estimated by modified CKD-EPI equations), serum creatinine, and urinary albumin/creatinine ratio were evaluated as predictors of birthweight, gestational age, birthweight-for-gestational-age, and hypertensive disorders of pregnancy, using multiple regression with adjustment for confounders (age, race, smoking, BMI, center, parity, systolic blood pressure). Serum uric acid was also examined at both baseline and year 10. **Results:** In unadjusted analysis, higher eGFR at study baseline was associated with lower average birthweight and birthweight-for-gestational-age. When stratified by race, results were in the direction of increased birthweight with higher eGFR for blacks (adjusted beta 46 g,  $p=0.06$ ) and reduced birthweight with higher eGFR for whites (adjusted beta -36 g,  $p=0.13$ ;  $p$  for interaction<0.05). No associations were found with uric acid at baseline or year 10, or with urinary A/C ratio at year 10 for pregnancies after that time. After adjustment for confounders, no association was found with gestational age or hypertensive disorders. **Conclusions:** No strong evidence for an association between preconception kidney function and birthweight or gestational age was found. Possible racial differences in these relationship warrant further examination.

PB041

Predictors of the vaginal microbiome: Do they correspond to risk factors for preterm birth?

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Background: Infections such as bacterial vaginosis have been associated with preterm birth. Racial and socioeconomic disparities in birth outcomes are long-standing, and new microbiota profiling techniques may provide more insight into the biology of these disparities. Methods: A pilot study of 61 first-trimester pregnant women was conducted to look at social and biological risk factors for adverse birth outcomes and how they correlate with vaginal microbiota. Women self-collected vaginal swabs during gestational weeks 10-14, and were interviewed about their demographic, social, and behavioral characteristics. Vaginal flora samples were sequenced on the Illumina MiSeq using a 2x250bp V2-kit and targeting the V4 region. High resolution sequence variants were inferred using DADA2. Sequence variants were assigned taxonomy using PECAN. Samples were then clustered into 3 distinct Community State Types (CSTs) using Bray-Curtis distances. Risk factors were correlated with CSTs using chi-square tests and ANOVA. Results: Results indicate three CSTs: 24 (39%) dominated by *Lactobacillus iners* (CST1), 28 (46%) dominated by *Lactobacillus crispatus* (CST2), and 9 (15%) with a more diverse microbiota structure (CST3). Age, race, Medicaid, and drinking status were associated with CST profiles, with CST1 being associated with black race and being on Medicaid, CST2 being associated with younger age and drinking, and CST3 being associated with white race, older age, non-drinker, and not being on Medicaid (all  $p < 0.05$ ). Conclusions: Microbiome profiles can be identified that are associated with risk factors for preterm birth.

PB042-S

Associations between repeated ultrasound measures of fetal growth and maternal oxidative stress & inflammation

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Biomarkers of oxidative stress (OS) and inflammation have been inversely associated with birth weight and intrauterine growth restriction, with indications that elevated levels early in pregnancy may be particularly problematic. We evaluated associations between repeated ultrasound and delivery indices of fetal growth and biomarkers of maternal OS and inflammation measured at multiple time points in pregnancy. Of interest was whether biomarkers from specific windows of vulnerability were related to variation in fetal growth later in pregnancy. Pregnant women from the prospective LIFECODES birth cohort were recruited early in gestation and followed until delivery. Fetal growth outcomes (abdominal and head circumferences, femur length, and fetal weight) were estimated from ultrasounds up to three times during pregnancy and standardized to gestational age specific z-scores. Birth weight was also measured and standardized. Women provided urine and plasma at up to four visits in pregnancy. In a subset of the population ( $N=482$ ), we analyzed biomarkers of OS (8-hydroxydeoxyguanosine [8-OHdG] and 8-isoprostane [8-iso]) in urine, and biomarkers of inflammation (C-reactive protein [CRP], cytokines IL-1 $\beta$ , IL-6, IL-10, and TNF- $\alpha$ ) in plasma. We used linear mixed models to assess associations between an interquartile range increase in biomarker concentrations and repeated fetal growth measures. Inflammation markers were generally negatively associated with fetal growth; for example CRP and fetal weight (FW) ( $\beta$  -0.12, 95% CI -0.21, -0.02). 8-OHdG and 8-iso were negatively associated with head circumference ( $\beta$  -0.13, 95% CI -0.24, -0.02;  $\beta$  -0.20, 95% CI -0.37, -0.02), and 8-iso concentrations later in pregnancy were negatively associated with FW ( $\beta$  -0.15, 95% CI -0.26, -0.03). Our results suggest OS and inflammation during pregnancy may play a role in fetal growth and development. These mechanisms may have an important but previously under recognized role late in gestation.

PB043

Neighborhood Deprivation and Prenatal Smoking: Assessing Effect Modification by Residential Stability  
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Prenatal smoking is the leading preventable cause of perinatal morbidity and mortality in the U.S. Although individual-level risk factors of prenatal smoking are well-established, exposures within the maternal social environment are understudied. Increased odds of prenatal smoking have been observed among mothers living in highly deprived communities, but no study has explored potential effect modification by residential stability. Geocoded New Jersey birth certificate records were linked with U.S. census tract-level data for 2000 and 2010, the two years in which residential stability was measured. We analyzed a subset of live, singleton infants born to mothers residing in an urban census tract at birth (N2000=86,697; N2010=94,349). Results from year-specific multilevel generalized linear models (adjusted for maternal race, nativity, age, education, employment, insurance, and marital status) showed that neighborhood deprivation (2000: adjusted odds ratio (AOR), 1.15; 95% confidence interval (CI), 1.10-1.21; 2010: AOR, 1.34; 95% CI, 1.25-1.43) and residential stability (2000: AOR, 1.03; 95% CI, 1.01-1.04; 2010: AOR, 3.41; 95% CI, 2.70-4.31) were associated with increased odds of prenatal smoking. Effect modification of residential stability was subsequently observed: women in highly deprived, highly stable neighborhoods exhibited the greatest odds of prenatal smoking (2000: AOR, 1.07; 95% CI, 1.04-1.10; 2010: AOR, 1.45; 95% CI, 1.20-1.76). Supplementary race-stratified models revealed these associations operated primarily among non-Hispanic White (but not Black, Hispanic, or Asian) mothers. We conclude these communities signal environments in which residents are exposed to severe economic deprivation and are also geographically immobile, thereby posing the highest risk of adopting unhealthy behaviors. Practitioners could use this information to allocate sparse prevention dollars, implementing prenatal smoking cessation programs in neighborhoods with this risk profile.

PB044

Preterm Delivery in First Systemic Lupus Pregnancies – Iatrogenic vs Spontaneous  
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Background: Women with systemic lupus erythematosus (SLE) have higher risk of preterm deliveries. Most studies have not distinguished spontaneous from iatrogenic preterm birth. However, this distinction is pertinent for risk communication to the patient. Methods: SLE and general population pregnancies were identified using national Swedish registers (2001-2013). SLE was defined as  $\geq 2$  SLE ICD-coded visits (inpatient and outpatient non-primary care) with  $\geq 1$  coded by a specialist. Preterm delivery, i.e., before 37 weeks' gestation, was defined as either spontaneous (premature rupture of the membranes or labor with no induction and no C-section indicated) or iatrogenic (no PPRM and either planned C-section or induced labor). Mediation analysis estimated the proportion of iatrogenic deliveries mediated through preeclampsia. Medication dispensing data were available in 2006. Analyses considered first singleton births only. Results: Of 358 SLE deliveries 22% were preterm, compared to 6% of 4760 non-SLE deliveries. SLE preterm deliveries were more likely iatrogenic: particularly among extremely and very preterm ( $<32$  weeks) 90% SLE vs 47% non-SLE, but also among moderate to late preterm (54% SLE, 29% non-SLE). Preeclampsia was noted in 68% of SLE iatrogenic deliveries  $<32$  weeks compared to 30% in the non-SLE group. Mediation analysis suggested that less than one-third of iatrogenic preterm deliveries are mediated through preeclampsia. Conclusions: Women with SLE are more likely to deliver early, however these data show that these are not spontaneous. Effective communication between clinician and patient about these risks is critical. Future work needs to explicate the additional indications for preterm delivery as these may be productive therapeutic or clinical targets.

PB045-S

Previaible Preterm Birth and Probability of Subsequent Preterm Birth Among the Migrant Ethnicities of Western Australia (WA)

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**Background:** Previaible preterm birth, 20-23 weeks gestation, in most occasions result in devastating outcomes and death. The influence of race on such event as well as probability of recurrent preterm birth is uncertain. We investigated ethnic disparities in previable preterm birth in WA and estimated probability of a subsequent preterm birth. **Methods:** The study was a population-based retrospective cohort of all non-Indigenous births in WA from 2005 to 2013 comprising of 261,430 births. 71,340 women with more than one confinement registered were included. Multivariable logistic regression was used to calculate the odds ratios (OR) and 95% confidence intervals (95%CI) for previable birth in index pregnancy. Cumulative incidence and P-value (P) for subsequent preterm birth was estimated. Non-Indigenous Australians comprised the comparison group. **Results:** Migrants had statistically significant higher odds of previable preterm birth compared with Australians (OR: 1.35 95% CI: 1.10-1.65). When stratified by ethnicity, the odds of previable preterm birth in migrant Indians , Africans , Maoris and women from other non-Caucasian ethnicities were more than twice the odds of their Australian counterparts and significant statistically (OR 2.45, 2.15, 2.32, 2.20 respectively). Asians had 45% increased odds (P=0.05). The probability of a subsequent preterm birth, while higher in migrants particularly in Africans, was not statistically significant (P>0.05). **Conclusion:** Migrant populations of certain ethnicities are at higher risk of previable preterm birth than Australians. Further research on factors influencing such disparity and preventive measures is warranted. Probability of a recurrent preterm birth among ethnic groups may not differ from Australians.

PB046-S

Residential Green Space and Birth Outcomes in a Coastal Setting

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**BACKGROUND:** Residential green space may improve birth outcomes. Studies show a higher birthweight among infants of women living in greener areas; however, results from studies evaluating associations with preterm birth are mixed. Further, no studies have evaluated the influence of proximity to water, or 'blue space', either in conjunction with or independent of green space. **OBJECTIVES:** We aimed to quantify associations between green and blue space and birth outcomes in a coastal area of the northeastern United States. **METHODS:** Using residential surrounding greenness (measured by satellite-based average Normalized Difference Vegetation Index (NDVI) values within 150, 250, and 500 meter circular buffers around the maternal address) and proximity to recreational facilities, coastline, and freshwater as measures of green and blue space, we examined associations with preterm birth and term birthweight among 63,846 births in Rhode Island. We tested incremental adjustment for socioeconomic status and built environment metrics. **RESULTS:** An interquartile range (IQR) increase in NDVI was associated with a 12% increase (95% confidence interval: 4, 20%) in odds of preterm birth when fully adjusted. In unadjusted models, higher NDVI and coastal proximity were associated with 58.3 gram (95% CI: 52.2, 64.4) and 25.2 gram (95% CI: 15.2, 35.1) increases in birthweight, respectively; associations were attenuated after adjustment. **CONCLUSIONS:** This study provides evidence of a small association between residential green space and increased risk of preterm birth, and a possible small increase in birthweight associated with green and blue space. Mechanisms through which green space may impact length of gestation should be investigated to explain the potentially small (paradoxical) increased risk of preterm birth associated with NDVI.

PB047

Hormonal contraceptive use prior to conception and adverse perinatal outcomes: a prospective cohort study  
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Hormonal contraceptives are widely used by women of reproductive age, but conclusive evidence on adverse effects of use just before or even during pregnancy is lacking. To determine whether periconceptional use of hormonal contraceptives is associated with adverse perinatal outcomes, we used data from the prospective PRenancy and Infant DEvelopment (PRIDE) Study in the Netherlands. A total of 2,699 pregnancies were included from 2,601 women enrolled before gestational week 17 in 2012-2016. Data on outcomes and covariates were collected using web-based questionnaires, while exposure was assessed from questionnaires and pharmacy records. We calculated kappa statistics ( $\kappa$ ) as measures of agreement and adjusted ORs as effect estimates using logistic regression analyses. The use of any hormonal contraceptive 4-12 months or 0-3 months before pregnancy was not associated with preterm birth, low birth weight, or macrosomia. For specific types of hormonal contraceptives, we identified associations between use of combination oral contraceptives containing gestodene and low birth weight (OR 4.9, 95%CI 1.6-15.2) and between vaginal ring use and macrosomia (OR 3.0, 95%CI 1.3-6.9). Using pharmacy records, additional associations were observed between combination oral contraceptives and macrosomia (exposure 0-3 months before pregnancy: OR 4.0, 95%CI 1.8-9.1) or low birth weight (exposure during pregnancy: OR 2.2, 95%CI 1.0-5.0). However, agreement between self-reported and pharmacy data was poor 3 months before and during pregnancy ( $\kappa$  0.49, 95%CI 0.43-0.55 and  $\kappa$  0.11, 95%CI -0.02-0.24). In conclusion, most hormonal contraceptives used in the periconceptional period were not associated with adverse perinatal outcomes, but some may affect birth weight. Due to misclassification of exposure status, analyses based on prescription data may lead to spurious associations. Therefore, exposure assessment of hormonal contraceptive use with detailed self-reported data is preferable.

PB048-S

Are thermal and mechanical energy from serial prenatal ultrasound exams associated with neonatal anthropometry in the NICHD Fetal Growth Studies-Singletons?

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Ultrasound imaging involves the transfer of energy and pressure into the body and indicators of energy output, thermal (TI) and mechanical indices (MI), are recommended to be below 1.0, with higher values acceptable for limited durations. We used multiple linear regression models to examine associations between number of ultrasounds with TI/MI exceeding 1.0 and mean change in neonatal anthropometry for 1,731 neonates from low-risk pregnancies with up to 6 ultrasounds during pregnancy. Models included maternal race/ethnicity, body mass index, weight gain and delivery gestational age. Ultrasounds with TI or MI >1.0 were not associated with birthweight, neonatal length, nor head, chest and abdominal circumferences. For TI models, positive associations,  $\beta$  (95% CI), primarily included neonatal skinfolds (mm) [abdominal flank: 1 scan= 0.5 (0.3,0.7), 2+ scans= 0.7 (0.3,1.0); anterior thigh: 1 scan= 0.4 (0.0,0.7), 2+ scans= 0.5 (0.0,1.0); subscapular: 1 scan= 0.2 (0.0,0.5), 2+ scans= 0.5 (0.2,0.9)]. Negative associations included neonatal circumferences (cm) [mid-upper arm: 1 scan=- 0.3 (-0.4,-0.1), 2+ scans= -0.6 (-0.9,-0.3); and Mid-upper thigh: 1 scan=- 0.4 (-0.7,-0.1), 2+ scans= -0.8 (-1.3,-0.3)]. For MI models, associations were generally negative, specifically neonatal skinfolds (mm) [Anterior thigh: 2+ scans= -0.4 (-0.8,-0.1) and triceps: 2+ scans= -0.3 (-0.61,-0.1)] and neonatal circumferences (cm) [Mid-upper thigh: 1 scan=-0.3 (-0.5,-0.02), 2+ scans= -0.9 (-1.2,-0.6) and umbilical: 2+ scans= -0.7 (-1.1,-0.2)]. In sum, prenatal ultrasounds with sporadic TI/MI >1.0 did not identify a pattern of diminished birth size. Associations with measures of adiposity were inconsistent with TI >1.0 but negatively associated with MI >1.0. Our findings support current guidelines aimed at keeping energy outputs as low as possible while achieving necessary imaging.



PB049

Environmental phenol associations with repeated fetal growth measures exhibit marked sex differences  
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Phenols are used ubiquitously in consumer products including pesticides, plastics, and personal care products, and exposure in pregnant women is common. Bisphenol-A has been associated with reduced fetal growth but other phenols have been explored minimally. We examined repeated measures of urinary phenols during pregnancy to test associations with ultrasound and delivery parameters of fetal growth. Pregnant women were recruited early in gestation as part of the LIFECODES birth cohort and provided urine samples at up to 4 study visits (median 10, 18, 26, and 35 weeks gestation). Abdominal and head circumference, femur length, and estimated fetal weight were recorded at up to 3 time points per subject, as was birth weight. All measures were standardized to gestational age specific z-scores. Using linear mixed effects models we examined associations between repeated growth measures and a subject-specific average of each phenol, including: 2,4-dichlorophenol (2,4-DCP); 2,5-dichlorophenol (2,5-DCP); benzophenone-3 (BP3); butyl, ethyl, methyl, and propyl parabens; triclosan; triclocarban; and bisphenol-S (BPS). Most phenols were highly detectable in urine samples from the study population (>70%). In males, 2,4-DCP and 2,5-DCP were inversely associated repeated measures of estimated or actual fetal weight z-scores ( $\beta = -0.15$ , 95% CI = -0.31, 0.02;  $\beta = -0.20$ , 95% CI = -0.39, -0.01, respectively). BP3 and each of the parabens were not associated with weight z-scores but were associated with decreased abdominal circumference. No clear associations were observed in males for triclosan, triclocarban, or BPS. In females, associations were generally null. However, detection of BPS was associated with lower estimated or actual fetal weight z-scores in repeated measures models ( $\beta = -0.25$ , 95% CI = -0.49, -0.02). These results suggest an important sexually dimorphic role of environmental phenol exposure in fetal development.

PB050-S

Sex-specific differences in gross placental morphology and fetal growth in singletons  
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Background: The placenta is an important regulator of fetal growth. Several studies have examined this relationship. Additionally, studies have reported sex-specific differences in placental development. The current study examines gross placental morphology in relation to fetal growth and examines whether this relationship varies by sex. Methods: We used data from the Stillbirth Collaborative Research Network's population-based case-control study conducted in 2006-2008. Study recruitment occurred in five states: Rhode Island and counties in Massachusetts, Georgia, Texas, and Utah. This analysis focuses on data from population controls. We further restricted the analysis to term, singleton live births with a complete placental examination (n=954). Data were weighted to account for oversampling, consent, and availability of the placental examination. We evaluated four placental characteristics: thickness, shape, surface area, and umbilical cord insertion. We modeled small for gestational age (SGA; birth weight <10th percentile for gestational age) as a function of placental characteristics and covariates using weighted logistic regression. Results: Infants with placentae with small surface areas (<10th percentile) were more likely to be SGA than those with average-sized placentae (10th-90th percentile). However, the association was stronger in males than females (male odds ratio (OR): 8.53, 95% confidence interval (CI): 3.31, 21.99; female OR: 5.16, 95% CI: 2.13, 12.48). Conversely, female infants with thin placentae (<10th percentile) were more likely than those with thicker placentae (10th-90th percentile) to be SGA (OR: 4.62, 95% CI: 1.79, 11.92). A similar association was not observed in males (male OR: 1.69, 95% CI: 0.55, 5.17). Placental shape and umbilical cord insertion were not associated with fetal growth. Conclusions: Our results support a relationship between placental morphology and fetal growth. The relationship appears to differ by sex.

PB051

Multiple Airborne Metals and Volatile Organic Compounds in Relation to Preterm Birth in Milwaukee, Wisconsin  
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Some air pollutants, such as fine particulate matter, polycyclic aromatic hydrocarbons (PAHs), and perhaps benzene, have demonstrated risk for preterm birth. Yet hundreds of other airborne metals and volatile organic compounds with known toxicities have not been studied. We examined their associations with preterm birth (birth < 37 weeks of gestation, 10.9% of sample) in a population-based cohort study using 94,730 vital records of live birth in Milwaukee, Wisconsin, born 1998–2006. We used maternal address at birth (95% geocoded) and closest birth year to link to census-tract air toxics concentrations from the emissions-based model, the National-scale Air Toxics Assessment annual averages from 1999, 2002, and 2005, including 136 air toxics detected in > 10% and with sufficient geographic variability. Risk ratios and 95% confidence intervals are from GEE models with a log link, clustering by census tract (307 in Milwaukee), for each log-transformed air toxic (contrasting the 75% vs. 25% concentration), adjusted for categorical variables: birth year, maternal education, race/ethnicity, maternal age, and smoking in pregnancy. Associations with benzene (1.01 [0.98, 1.04]) and PAH (1.02 [1.00, 1.03]) were not substantially elevated. Controlling the false discovery rate at 5% using the Benjamin Hochberg approach, we found positive associations with 14 volatile organic compounds and airborne cadmium: 1.07 (1.03, 1.11) and no inverse associations. Associations of highest magnitude were for dibutylphthalate: 1.60 (1.15, 2.23), dibenzofurans: 1.50 (1.17, 1.92), and methyl ethyl ketone (MEK): 1.44 (1.12, 1.87). Our design cannot establish a true lack of risk for any air toxic because of likely exposure measurement error expected to attenuate associations. But these findings suggest that several previously-unstudied air toxics may have a role in preterm birth, although alternate explanations include residual confounding by socio-economic position or correlated air toxics.

PB052-S

Chlamydia trachomatis and preterm birth subtypes  
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Chlamydia trachomatis (CT) is a prevalent and predominantly asymptomatic bacterial sexually transmitted infection (STI). It is generally accepted that prenatal CT screening may prevent adverse birth outcomes. However, studies examining CT and pregnancy outcomes such as preterm birth have been inconsistent. Furthermore, some populations with high chlamydia prevalence, such as Hispanic women, remain under-represented in studies of prenatal chlamydia. The goal of this study was to determine if CT is associated with preterm birth subtypes in a large population of primarily low-income Hispanic women. Methods: We analyzed medical record data from 4729 women who gave birth at four hospitals in Houston, TX from 2011–2016. This analysis included primiparous singleton pregnancies with no history of chronic conditions. Logistic regression was used to examine associations between CT infection and preterm birth [(PTB) delivery <37 weeks of gestation], defined by clinical subtype (spontaneous and medically indicated) and preterm premature rupture of membranes (pPROM). All models were adjusted for demographic factors: race/ethnicity, age, education, marital status, alcohol, smoking, and drug use. Results: Overall, chlamydia prevalence was 6.5% in this sample. CT was lower in maternal alcohol users (OR=0.7, CI 95% 0.5, 1.0) and foreign-born women (OR=0.8, CI 95% 0.6, 1.0), but higher in drug users (OR=1.9, 95% CI 1.2, 3.3). There was no significant association between CT and medically indicated PTB (OR=1.4, CI 95% 0.7, 2.7), spontaneous PTB (OR=0.9, CI 95% 0.4, 1.7), or pPROM (OR=0.4, CI 95% 0.1, 1.2). Conclusion: We found no association between CT and preterm birth subtypes. Future work should examine associations between CT and other pregnancy outcomes along with behavioral, psychological, and sociological risk factors.

PB053

Prevalence of small for gestational age and preterm birth among infants born to women with laboratory evidence of possible Zika virus infection during pregnancy, US Zika Pregnancy Registry, December 2015-December 2016  
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The full spectrum of infant outcomes associated with Zika virus (ZIKV) infection during pregnancy, including small for gestational age (SGA) and preterm birth (PTB), is unknown. Overall, 10% of US singleton livebirths are born SGA and 8% are born preterm. The US Zika Pregnancy Registry (USZPR) conducts surveillance of pregnancy and infant outcomes among women with laboratory evidence of possible ZIKV infection during pregnancy. Using USZPR data from 50 states and the District of Columbia, we examined the prevalence of SGA and PTB among singleton livebirths reported from December 2015 through December 2016. SGA was defined as birthweight <10th percentile for sex and gestational age (GA) using the INTERGROWTH-21st standard; PTB was defined as GA <37 completed weeks at delivery. Birth defects potentially related to ZIKV infection included microcephaly, brain abnormalities, neural tube defects, eye abnormalities, and/or consequences of central nervous system dysfunction. Laboratory-confirmed cases were: 1) ZIKV RT-PCR positive; or 2) ZIKV IgM positive/equivocal, ZIKV plaque-reduction neutralization test (PRNT) positive, and dengue PRNT negative. Possible ZIKV infection also included cases that were: 1) ZIKV IgM positive/equivocal, ZIKV PRNT positive, and dengue PRNT positive or not done for maternal tests; or 2) ZIKV IgM positive/equivocal for infant tests. Of the 787 singleton livebirths in the USZPR, 753 had GA at birth available; 10% were born preterm. Of those with complete data to calculate birth weight percentiles (270/787); 16% were SGA. Among laboratory-confirmed cases, 28% were SGA and 12% were born preterm. Among infants with potentially ZIKV-related birth defects (n=37), 56% were SGA and 17% were preterm. Preliminary evidence from USZPR suggests the prevalence of SGA and PTB may be higher than expected among singleton births with possible and confirmed ZIKV infection exposure in utero.

PB054-S

A randomized controlled trial on reducing disparities in preterm birth through group prenatal care: implementation and interim results from Centering and Racial Disparities (CRADLE) Study  
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CRADLE study is a NIH funded, randomized controlled trial to test the effect of CenteringPregnancy group prenatal care (GPNC) compared to traditional individual prenatal care (IPNC) on preterm birth and racial disparities in preterm birth. Pregnant women are eligible to participate if they are 14-45 years old and enter prenatal care before 20 6/7 weeks of gestational age (GA). Women who agree to participate are randomized 1:1 into GPNC or IPNC, stratified by race. Women allocated to IPNC will attend standard, individual prenatal care according to American College of Obstetrics and Gynecologists (ACOG)-recommendations. Women allocated to GPNC are grouped with 8-10 other women, and attend ten two-hour group prenatal care sessions per the Centering Healthcare Institute curriculum, which meets the ACOG recommendations for prenatal care. Participants complete Survey 1 at the baseline (8-23) weeks GA, Survey 2 at 32-36 weeks GA, and followed until 12 weeks postpartum. The surveys are self-administered and include demographic information, psychosocial, and lifestyle/behavioral measures. As of January 30th 2017, 611 participants (307 in CPNC; 304 in IPNC) were enrolled. Among them, 41.5% self-identified as Black, 37.4% White, 15.4% Hispanic, and 5.7% as mixed or "Other" race. The race distributions are balanced between CPNC and IPNC groups. Women enrolled in the current study represent a low-income and medically underserved population, with 60.1% reporting an annual household income of less than \$20,000, and 55.4% reporting no insurance coverage within the past year. Among the participants who completed the study, 99.3% and 79.6% have answered Survey 1 and Survey 2, respectively. Of the women who were due before January 30th 2017, 202 delivered live births. Results from CRADLE study will support public health efforts and future research designed to improve the effectiveness of prenatal care services in promoting positive birth outcomes and reducing racial disparities.

PB055

Maternal HIV-infection and adverse birth outcomes in Suriname: results from Perisur

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**Background** Literature on the association between maternal HIV-infection and birth outcomes have been conflicting. In Suriname, no research has been performed yet. Assessment of the impact of maternal HIV-infection on adverse birth outcomes in Suriname is essential for tailoring public health measures to reduce mother-to-child transmission of HIV and reduce the risk of adverse birth outcomes. **Aims** This study aims to estimate the prevalence of maternal HIV-infection in Suriname, characterize HIV-infected pregnant women and determine their association with adverse birth outcomes. **Methods** Data from Perinatal Interventions Suriname (Perisur) were used. Perisur implements preventive perinatal interventions in Suriname in order to improve care for pregnant women and their babies. Data on pregnant women and their babies are registered. Data on 11,110 newborns from three participating hospitals were available (65% of all births in Suriname in 2013-2014). Adverse birth outcomes were defined based on four outcomes of the newborns, namely stillbirths, preterm birth, low birth weight and low Apgar score. Bivariate and multivariate analyses were conducted to study the association between maternal HIV-infection and adverse birth outcomes, adjusted for maternal age, gravidity and parity, and expressed as crude and adjusted odds ratios with 95% confidence intervals. **Results** The prevalence of HIV-infection among pregnant women was 0.4% (n=50). Creole and Maroon women were significantly more often HIV-infected than women from other ethnic groups (0.7% vs. 0.4%;  $p<0.001$ ). Overall prevalence of adverse birth outcomes within the study population was 18.9% (n=2,096). Adverse birth outcomes were more prevalent among HIV-infected women (46.9% vs. 18.8%;  $p<0.001$ ) and these women had a four times increased risk of adverse birth outcomes (OR=3.8; 95% CI 2.2-6.7). After adjustment for age, gravidity and ethnicity, maternal HIV-infection remained significantly associated with adverse birth outcomes (OR=3.6; 95% CI 2.1-6.4). **Conclusions** HIV-infected pregnant women are at increased risk of adverse birth outcomes, independent of their age, gravidity and ethnicity. HIV-infected pregnant women should have access to adequate medical and antenatal care in order to reduce the risk of mother-to-child transmission and adverse birth outcomes.

PB056-S

Sex-specific Associations of Maternal Birthweight with Offspring Birthweight in the Omega Study

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**Background:** Maternal birthweight (BW) is one of the strongest predictors of offspring BW; however, there is limited consensus concerning potential non-linear and offspring sex-specific relationships of maternal-offspring BW. Additionally, the role of maternal pre-pregnancy body mass index (ppBMI) as moderator has not been examined. **Methods:** The study was conducted among N=3736 participants of the Omega study, a pregnancy cohort. Maternal BW was modeled as a continuous variable, linear spline with knots at 2500grams and 4000grams (macrosomia), and binary variable indicating low birthweight (LBW) (<2500 vs. ≥2500grams). Offspring BW was modeled as a continuous and binary variable. We fit linear regression models, estimating beta coefficients ( $\beta$ ) and 95% confidence intervals (CIs), and logistic regression models, estimating odds ratios (ORs) and 95% CIs, as appropriate. Non-linearity was assessed using likelihood ratio tests (LRT) in marginal linear spline models. **Results:** For every 100gram increase of maternal BW, offspring BW increased 22.3 (95%CI: 17.6, 27.0) or 23.4 (95%CI: 6.9, 40.0) grams among mothers with normal BW or macrosomia, respectively, but not among LBW mothers ( $\beta$ =−8.6 grams; 95%CI: −22.9, 5.7) (LRT  $p$ -value<0.001). For every 100gram increase in maternal BW, BW of male offspring increased 23.5 (95%CI: 16.8, 30.2) or 25.2 (95%CI: 4.4, 46.1) grams among mothers with normal BW or macrosomia, respectively, while it decreased 31.4 grams (95%CI: −51.6, −11.2) among LBW mothers (LRT  $p$ -value<0.001). Corresponding increases in BW of female offspring (16-22 grams) did not differ among mothers with LBW, normal BW or macrosomia (LRT  $p$ -value>0.05). The associations observed among male ( $p>0.05$ ) or female ( $p>0.05$ ) offspring were not statistically significantly different between normal and overweight/obese ppBMI categories. **Conclusions:** Maternal-offspring BW associations are evident among normal BW and macrosomic mothers. These associations differ by offspring sex.

PB057-S

Reported hurricane experience in pregnant women and low birthweight and preterm birth in infants  
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Background Studies commonly use vital records or ecological data to assess the effects of hurricane exposure on pregnancies. Data from a cohort study of reproductive age women was used to study whether hurricane experience during pregnancy is more likely to result in an infant born preterm or low birth weight compared to pregnancies unexposed to hurricanes. Methods Women were asked their past experiences with hurricanes Katrina, Rita, Gustav, Ike and Isaac. Singleton gestations born to women between the ages of 18 and 45 during all 5 hurricanes were included. Hurricane exposure was measured by 12 questions about different aspects of disaster, such as house damage, exposure to danger, and injury. Women were considered exposed if they answered yes to any hurricane exposure questions and were <32 weeks gestation at time of exposure. Only women who experienced at least one exposed and one unexposed pregnancy were included in the study. Log-binomial regression using generalized estimating equations clustered by individual were used to estimate relative risk, with adjustment for age, gravidity, income, and education. Results 114 women with 273 pregnancies were included in the study. Of the pregnancies included in the study, 9.2% (n=25) resulted in a preterm baby while 9.5% (n=25) resulted in a low birthweight infant. Hurricane exposure was not associated with preterm birth in unadjusted models (Risk Ratio [RR] =1.16, 95% Confidence Intervals [CI] 0.58-2.34) nor in adjusted models (RR=1.04, 95% CI 0.54-2.01). There was no association between hurricane exposure and low birthweight in the unadjusted (RR: 1.26, 95% CI 0.63-2.54) and adjusted models (RR: 1.37, 95% CI 0.70-2.66). Results were not different when more severe disaster exposure was considered. Conclusion When characteristics of the mother were held constant, pregnancies occurring during hurricanes were not associated with low birthweight or preterm birth compared to pregnancies that were not exposed to a hurricane.

PB058

Social disadvantage and the black-white disparity in spontaneous preterm delivery among California births  
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There is a two-fold higher prevalence of preterm birth among black women relative to white women. We examined the contribution of markers of social disadvantage to this disparity. Analyses included 127,358 black and 615,721 white singleton California births from 2007-11 and data from their linked vital and hospital discharge records. To estimate risks, we ran 4 logistic regression models, for early (<32 gestational wks) and moderate (33-36 wks) spontaneous (preceded by spontaneous onset of labor or membrane rupture) preterm birth (ePTB, mPTB), among blacks and whites. We then conducted a heuristic potential impact analysis to consider how the disparity might change if social factors were more equal between blacks and whites, using a substitution estimator approach. The odds ratio (OR) for less than high school education (vs. college degree) was 1.8 for ePTB among whites but smaller for the other 3 groups (ORs 1.3-1.4). For all 4 groups, higher neighborhood poverty was associated with increased risk (ORs 1.03-1.05 per 9% change in poverty). ORs were close to 1.0, and many 95% confidence intervals included 1.0, for the other variables (payer for delivery, and neighborhood percent black and the Gini index of income inequality). Setting 3 factors (education, poverty, payer) to 'favorable' values was associated with lower predicted probability of ePTB (25% lower among blacks, 31% among whites) but a 9% higher disparity as compared to predicted probabilities based on observed values; for mPTB, the respective percentages were 28% and 13% lower probability of PTB among blacks and whites and a 17% lower disparity. In summary, the black-white disparity was much more pronounced for ePTB than mPTB, and the studied markers of social disadvantage had modest potential impact on the disparity, indicating that future studies should focus on ePTB and more specific factors related to social circumstances.

PB059

The contribution of interpregnancy intervals to disparities in preterm birth between non-Hispanic black and non-Hispanic white women, 48 states and the District of Columbia  
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**Background:** Short and long interpregnancy intervals (IPI) are associated with increased risk of preterm birth, a health outcome with marked racial disparities in the United States. We examined how differences in the IPI distribution between non-Hispanic black (NHB) and non-Hispanic white (NHW) women could contribute to the NHB-NHW preterm birth disparity, comparing data over time. **Methods:** Data are based on second-born or higher, singleton births to residents of 48 states and D.C. that implemented the 2003 revised standard birth certificate by January 1, 2015. The same 48 states and D.C. were examined in 1993, the year IPI was last included on the national birth files. The differences in NHB-NHW preterm birth rates were partitioned into differences due to IPI-specific preterm birth rates and distributional differences in IPI for 1993 and 2015, separately, using the Kitagawa decomposition method. **Results:** Between 1993 and 2015, preterm birth decreased among NHB women (12.7 to 11.5%) and increased among NHW women (5.4 to 6.5%); corresponding NHB-NHW preterm birth risk ratios were 2.37 and 1.77. Between 1993 and 2015, among NHB and NHW women, respectively, the percentage of IPI <12 months had a relative decrease of 27% (25.8 to 18.9) and 8% (16.8 to 15.5), the percentage of IPI between 12-17 months increased by 11% (14.4 and 16.0) and decreased by 12% (12.5 and 11.1), and the percentage of IPI ≥60 months increased by 33% (20.3 and 27.0) and 5% (16.8 and 17.5). Overall, differences in IPI distributions between NHB and NHW women contributed 6% in 1993 and 9% in 2015 to the NHB-NHW preterm birth disparity. **Conclusion:** NHB women had substantial declines in short IPI over time compared with NHW women. This trend was offset by an increase in long IPI corresponding to an increased contribution of IPI distribution to the preterm birth disparity. Research examining determinants of preterm birth disparities should account for the changing patterns of IPI over time.

PB060-S

Antenatal Midwifery Care: Reducing Prevalence of Small-for-Gestational-Age Birth and Preterm Birth For Women with Low Socioeconomic Position  
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**Background:** To date, of the few studies comparing perinatal outcomes of antenatal midwifery to physician-led care for women with low socioeconomic position, a number of them are limited by methodological weaknesses including lack of control for current or prior health complications, and failure to utilize intent-to-treat analysis. **Purpose:** To determine among women with low socioeconomic position if antenatal care provided by midwives vs. obstetricians or general practitioners was associated with small-for-gestational-age stature (SGA) and/or preterm birth. **Methods:** We undertook a population level, retrospective cohort study restricted to women with low to moderate risk pregnancy, residing in British Columbia (B.C.), Canada, who had singleton births between January 1, 2005 to December 31, 2012, no more than two provider-types involved in care, and received medical insurance premium assistance (n=57,872). Logistic regression models were used to control for confounding. **Results:** Odds of SGA were significantly reduced among midwives' vs. obstetricians' patients (adjusted odds ratios (AOR) 0.60, 95% confidence interval (CI): 0.51-0.70), and vs. general practitioners' patients (AOR 0.73, 95% CI: 0.63-0.84). Odds of preterm birth was reduced for midwives' vs. obstetricians' patients (AOR 0.53, 95% CI: 0.45-0.62), and vs. general practitioners' patients (AOR 0.74, 95% CI: 0.63-0.86). Substance using midwifery patients were significantly less likely to have preterm birth (AOR 0.25, 95% CI: 0.12-0.52), vs. obstetricians patients, as were substance using midwifery patients with mental health conditions (AOR 0.21, 95% CI: 0.07-0.65). **Conclusion:** Among women with low socioeconomic position, antenatal care provided by midwives was associated with a reduced likelihood of SGA and preterm birth compared to antenatal care provided by obstetricians or general practitioners. This association was stronger among women living with concomitant addiction and mental health conditions.

PB061-S

First Day but not Later Neonatal Deaths Share Etiology with Stillbirth: A Study of 2013 United States Births with Implications for the Definition of Perinatal Death

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**Background** Current definitions of perinatal death combine stillbirths with neonatal deaths (<28 days) or early neonatal deaths ( $\leq 7$  days). This may distort research findings and surveillance efforts if the etiology of neonatal deaths is distinct from stillbirths. Deaths within a day of birth may be more similar to stillbirths than later neonatal deaths, but little is known about first day deaths. **Methods** National Center for Health Statistics (NCHS) public fetal death and linked birth-infant death certificate files were used to create a cohort of all US resident births in 2013. Perinatal deaths were categorized as stillbirth, first day (0 - 23 hours), first week (days 1-7) and first month (days 8 - 27). Cause of fetal death has not been released in public files; we used published NCHS cause-specific mortality data for stillbirths (National Vital Statistics Reports Vol. 65 Num. 7, 2016). **Results** The 38,677 perinatal deaths consisted of: 60% stillbirths (n=22,994), 25% first day deaths (n=9,695), 8% first week deaths (n=3,011) and 8% first month deaths (n=2,977). Ninety-four percent of stillbirth and 82% of first day deaths were among four cause groups: complications of pregnancy (maternal, placenta and cord), prematurity, unspecified fetal death (stillbirth only), and birth defects versus 43% of first week and 33% of first month deaths. Birth defects and perinatal infectious and hematologic conditions were the top two causes of first week and month deaths, followed by perinatal respiratory complications (first week) and non-perinatal-specific conditions (first month). **Conclusions** The majority of neonatal deaths occurred within the first day. Primary etiologies of stillbirth and first day death overlap substantially and are largely distinct from later neonatal deaths. First day deaths should be reported separately from later neonatal deaths. Use of a combined category of perinatal death including all first week or first month deaths is not advised for etiologic research.

PB062

Preventing Stillbirths: An evaluation of Inter-pregnancy Interval as a Risk Factor for Stillbirth  
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Risk factors of stillbirth (SB) remain understudied, however short and long inter-pregnancy intervals (IPI) are risk factors for other adverse perinatal outcomes. We examined the association between SB (defined as fetal death  $\geq 20$  weeks) and IPI (the number of months between the date the pregnancy prior to the index ended and the estimated date of last menstrual period of the index pregnancy) using data from the Stillbirth Collaborative Research Network's (SCRN) population-based case-control study. The SCRN was conducted in 2006-2008 among hospitals in Rhode Island and selected counties in Massachusetts, Georgia, Texas, and Utah. We restricted our analysis to singleton pregnancies among multiparous or multigravid women and accounted for complex survey design and non-participation with weighted multivariable logistic regression. Short and long intervals were evaluated separately as it was assumed that the etiology of their effect on stillbirth risk might differ. Inter-pregnancy interval was categorized into six categories. The reference category for IPI was 18-23 months. Short IPI included: < 6, 6-11, and 12-17 months. Long IPI included: 24-59 and 60-100 months. A total of 1,276 pregnancies were included in this analysis, with 985 controls and 291 cases. Adjustment for confounding by older maternal age, poor prior pregnancy outcome, and lack of insurance reduced the crude OR for short IPI (<6 months) from 3.3 (95%CI: 1.8, 6.2) to an adjusted OR (aOR) of 1.8 (95%CI: 0.8, 3.5), but adjustment for these and other potential confounders did not change the aOR for long (60-100 months) IPI (aOR: 2.4; 95%CI: 1.3, 4.4). Long IPI (60-100 months) contributed to a statistically significant increase in the risk of SB. Our findings are consistent with the American Congress of Obstetricians and Gynecologists recommendation regarding birth spacing. These results contribute to the gap in knowledge regarding risk factors for stillbirth and may be used to inform the guidance on appropriate timing of pregnancies.

PB063

Pregravid physical activity and risk of stillbirth

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**Objectives** To evaluate pregravid physical activity for its association with subsequent stillbirth delivery. **Methods:** Cohort Norway regional health surveys (1994 – 2003) were linked to Medical Birth Registry of Norway for deliveries through 2012. Past-year physical activity and risk of subsequent stillbirth was evaluated in 13,497 births to 8,478 women. Poisson regression entering mothers' pseudo-ID as a cluster variable evaluated incidence rate ratios (IRR) and 95% confidence intervals associated with physical activity in unadjusted and multivariable adjusted analyses. **Results** Mean (SD) length of follow-up was 5.5 (3.5) years. Baseline past-year light physical activity of three or more hours per week was reported by 48% and vigorous activity of three or more hours per week was reported by 16% of birth's mothers. A baseline past-year vigorous physical activity of three hours or more per week (resulting in shortness of breath/sweating) was associated with increased risk of stillbirth (Incidence Rate Ratio (IRR) 2.5; 1.2-4.9) compared to no vigorous activity. In contrast, baseline past-year light physical activity of three or more hours per week associated with 50% reduced risk of stillbirth (IRR 0.53; 95% CI 0.30 – 0.93) compared to less than 3 hours of light physical activity. Analyses adjusted for baseline age and length of follow-up. Data were further evaluated in analyses adjusting for body mass index and, in a sensitivity analyses, of women with a normal BMI. **Conclusion** Physical activity could be a modifiable risk factor for stillbirth delivery, but further research looking also at physical activity during pregnancy is needed.

PB064-S

Racial differences in the association between WIC and stillbirth

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**Background:** Black non-Hispanic women are at an increased risk of stillbirth compared to White non-Hispanic women. Participation in the Special Supplemental Nutrition Program for Women, Infants and Children (WIC) reduces the risk of adverse birth outcomes, especially for Black women. However, whether WIC participation is associated with lower risk of stillbirth risk is uncertain. **Methods:** We used data from a population-based case-control study conducted by the Stillbirth Collaborative Research Network (SCRN), restricted to Black and White women with singleton pregnancies, maternal interview and abstracted medical records. Unweighted samples included 454 Black women (123 stillbirths, 331 livebirths) and 846 White women (205 stillbirths, 641 livebirths). We examined WIC participation using multivariable logistic regression. Analyses were weighted for study design and differential consent. Models adjusted for gestational age and maternal age, race, education, receipt of wages, insurance status, hypertension, diabetes, pre-pregnancy BMI, prior pregnancy outcomes and drug use. An interaction term for Black race and WIC participation was also included in the model. **Results:** Among women with live born infants, a greater proportion of Black than White women participated in WIC (52.6% vs 19.5%). In the adjusted model, the interaction between Black race and WIC participation was significant ( $p < 0.002$ ). Among Black women, those on WIC had lower odds of stillbirth (adjusted odds ratio [aOR]: 0.28, 95% confidence interval [CI]: 0.13, 0.62). In contrast, among White women, there was no association between WIC participation and stillbirth (1.31, 95% CI: 0.69, 2.49). **Conclusions:** Our findings are consistent with studies of WIC participation and outcomes other than stillbirth. More research is needed to examine reasons for this difference.



PB065

The relationship between state-level income inequality and infant mortality risk among infants born in the United States in 2010  
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Background: Empirical evidence suggests income inequality is associated with infant mortality. For example, high US state-level income inequality has been shown to be associated with infant mortality rates. However, most researchers investigating the relationship between income inequality and infant mortality have utilized the ecological study design. Methods: We used data from the 2010 United States Statistics Linked Infant Birth and Death Records to assess the relationship between state-level income inequality in 2010, and the change in income inequality from 1990 to 2010 and an infant's mortality risk. Data were available for 3,672,841 infants and their mothers. Multi-level logistic regression was used to determine whether US State-level income inequality, as measured by the Gini coefficient (Z-transformed) and change in Gini coefficient between 1990 and 2010 (Z-transformed) were significant risk factors for infant mortality, while adjusting for individual and state-level covariates. Results: The average 2010 State-level Gini coefficient was 0.45(SD=0.02) and the average change in Gini coefficient between 1990 and 2010 was 0.063 (SD=0.015). In 2010 there were 22,142 deaths or 0.6% of all births. There was no significant relationship between the 2010 Gini Z-score and infant mortality risk. However, unadjusted analysis indicated the change in Gini Z-score was associated with a decreased odds of infant mortality (OR=0.96, 95% CI=0.95, 0.98). When we adjusted for individual and state-level characteristics, the observed increase in the Gini coefficient was associated with a significant increase likelihood of infant mortality (AOR=1.04, 95% CI=1.00, 1.08). Similar findings were observed when the neonatal infant mortality was the outcome (AOR=1.12, 95% CI=1.06, 1.18). Conclusions: Infants born in 2010 in states with greater changes in income inequality between 1990 and 2010 experienced a greater likelihood of infant mortality.

PB066-S

Do son-biased sex ratios at birth persist among second generation South Asian women in Ontario?  
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Introduction: Previous research in Ontario has found that first generation Indian women with two previous daughters gave birth to half the expected number of daughters compared to sons at the third birth. Biased sex ratios were likely facilitated by sex-selective abortion. Our objective was to examine whether son-bias persists among second generation South Asian (SA) women in Ontario. Methods: We analyzed births to immigrant and Canadian-born SA women as well as the general population who gave birth in Ontario between 1991 and 2014. SA women were identified using a comprehensive list of exclusively SA surnames [positive predictive value = 89.3%; sensitivity=50.4%]. SA immigrants were identified using a combination of this list and an official immigration database (1985-2012). Second generation SA women excluded immigrants and was further restricted to those who were born in Ontario. Male to female (M:F) ratios and 95% confidence intervals (95% CI) were calculated according to the sex of previous live births for each group and further stratified by those who did and did not have an abortion since the previous live birth. Results: For births to SA immigrants (n = 36,816, of whom 65% were born in India), the M:F ratio at the third birth among women with two previous daughters was 1.42 (95%CI 1.25-1.62) for women with no previous abortion and 2.46 (95%CI 1.93-3.12) for women with at least one previous abortion since the second birth (n=325). Biased sex ratios among births to second generation SA women (n=10,427) were evident only among those with two previous daughters and at least one previous abortion (n=46) [2.80 (95%CI 1.36-5.76)]. Conclusion: Son-biased M:F ratios generally do not persist among second generation SA women with the exception of a minority of women with two previous daughters with at least one abortion since their second birth.

PB067

Fetal sex differences in soluble fms-like tyrosine kinase 1 (sFLT) among preeclamptic women  
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Female fetal sex has been shown to increase the risk of some preeclampsia subtypes, although the mechanisms by which sexual dimorphism impacts pregnancy outcomes has not been elucidated. Some studies have suggested that fetal sex alters the maternal angiogenic profile possibly explaining these differences. We examined differences in circulating soluble fms-like tyrosine kinase-1 (sFLT), endoglin and leptin, which have been previously found to increase preeclampsia risk, by fetal sex in normotensive and preeclamptic women. Data were obtained from a previous nested case-control study of 367 preeclamptic women and 269 normotensive controls with primiparous singleton pregnancies enrolled in the Danish National Birth Cohort at a median gestation of 17 weeks. Preeclampsia was defined by blood pressure  $\geq 140/90$  mmHg and proteinuria ( $\geq 0.3$  gms or 300mg/24 hrs). Associations between fetal sex and sFLT, endoglin and leptin (log transformed) were examined using linear models adjusting for gestational age of blood draw, body mass index, maternal age and smoking. These analyses were stratified by normotensive and preeclamptic women. As a secondary analysis, we explored if fetal sex interacted with sFLT1 to alter the odds of preeclampsia. We found no differences by fetal sex in normotensive women. In preeclamptic women, male fetal sex was associated with reduced sFLT ( $b=-0.25$ ;  $p=0.04$ ) and displayed a trend towards reduced endoglin ( $b=-0.09$ ;  $p=0.08$ ) but not leptin ( $b=-0.05$ ;  $p=0.27$ ). Male fetal sex appeared to interact with sFLT1 to reduce the odds of preeclampsia ( $b=-0.35$ ;  $p=0.08$ ), but this was not statistically significant. We found that women carrying male fetuses had reduced sFLT compared to women carrying female fetuses. Increased circulating sFLT in female fetuses may increase the risk of preeclampsia.

PB068-S

Depression, Anxiety, Anti-depressant, Anxiolytic Medication use And their Associations with Maternal Hypertension  
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Studies of depression/anxiety and anti-depressant/anxiolytic medication use in relation to maternal hypertension have produced inconsistent results. We used Blue Cross Blue Shield of Michigan (BCBSM) medical and pharmacy claims data to identify pregnancies ending in live singleton births (2010 - 2014) among women ages 15-44 years enrolled in BCBSM from 2 years prior to last menstrual period (LMP) of the index pregnancy to ninety days after delivery. These data were linked to Michigan birth certificate data resulting in a de-identified sample of 12,647 women. Depression and anxiety diagnoses (ICD-9CM codes) and anti-depressant and anxiolytic prescription fillings (National Drug Codes) were ascertained from BCBSM claims and noted for timing, i.e. before and/or after LMP. Outcomes were: 1) chronic hypertension (CH) prior to and during first 20 weeks of pregnancy; and 2) pregnancy related hypertension (PH), i.e. preeclampsia, gestational hypertension first detected after 20 weeks. Weighted logistic regression models were used for analyses. Among 10.6% of women with depression or anxiety diagnosis (defined as  $\geq 1$  inpatient or  $\geq 2$  outpatient visits) only 0.9% had no diagnoses in the 2 years prior to pregnancy. Depression (without anxiety overlap) prior to LMP was associated with CH (aOR= 1.6 95% CI 1.1, 2.3) but not with PH diagnoses. Antidepressants, both prior to and during pregnancy, were associated with PH diagnosis (aOR= 1.2 95% CI 1.0, 1.5). Anxiolytics, both prior to and during pregnancy, were associated with CH (aOR= 2.9 95% CI 2.0, 4.3). Initiation of anxiolytic medication during pregnancy was associated with PH (aOR= 2.3 95% CI 1.3, 3.9). To better understand the relationships among depression/anxiety, related medications, and maternal hypertension, it is important to consider timing, i.e. before and/or during pregnancy. Medical insurance claims data may help in this goal.

PB069

Hypertensive Disorders of Pregnancy: Timing of Onset and Interval to Delivery  
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Most studies of hypertensive disorders of pregnancy are limited by the lack of information on timing and progression. Through detailed medical record abstraction, we studied gestational hypertension (HTN), preeclampsia (PE), and severe PE among 2447 women with HTN disorders delivering between 2001 and 2009 at a United States tertiary care hospital. We calculated crude associations between four baseline covariates (gravidity, pre-pregnancy body mass index, maternal age, and race), and the onset, progression, and interval to delivery of HTN disorders. The median (interquartile range) gestational age at onset was 36 (34-38) completed weeks for 629 cases of gestational HTN, 36 (34-38) weeks for 273 cases of PE, and 35 (32-37) weeks for 73 cases of severe PE. Twenty-four percent of gestational HTN cases had early onset < 34 weeks. Women with a prior pregnancy were 1.4 (95% CI: 1.1-1.9) times more likely to have early onset gestational HTN compared to women with no prior pregnancies. Other covariates were not significantly associated with early onset gestational HTN. The risk of gestational HTN progressing to PE (114/629, 18%), was not significantly related to the baseline covariates, but was negatively associated with gestational age at onset (risk ratio for one week increase in onset=0.94, 95% CI:0.92-0.96). The median (interquartile range) time between disorder onset and delivery was 9 (2-24) days for gestational HTN, 2 (1-8) days for PE, and 1 (0-1) day for severe PE. Among 528 women who did not progress past gestational HTN, interval from HTN onset to delivery was not significantly related to baseline covariates. However, for every one week increase in gestational age at onset of HTN, time between onset and delivery decreased by 5.8 (95% CI: 5.7-6.1) days. Because of the preponderance of gestational HTN among women with HTN disorders, and its long and variable interval from onset to delivery, optimization of gestational HTN management should be a research priority.

PB070

Reported use of contraindicated antihypertensive medications in the National Birth Defects Prevention Study relative to publication of clinical treatment guidelines

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Hypertension is increasing among pregnant women in the US. Given that research is constantly being published, physicians are challenged to stay up to date on current recommendations when treating hypertensive pregnant women. Over the course of the National Birth Defects Prevention Study (NBDPS), 1997-2011, the evidence contraindicating angiotensin-converting enzyme inhibitor (ACE) and angiotensin II receptor blocker (ARB) use during pregnancy has grown. ACE/ARBs are consistently associated with fetopathic effects when taken late in pregnancy (second and third trimesters) and recent studies have raised concern about use of these during early pregnancy. This research has serious clinical implications, but the impact on clinical practice is unclear. We sought to explore the use of ACE/ARBs in the NBDPS, relative to when clinical guidelines were published. We used chi-square tests to compare women who reported late pregnancy ACE/ARB use to those who reported late use of other antihypertensives and the Cochran-Armitage test to evaluate time trends in reported late pregnancy use of ACE/ARBs. After excluding mothers using antihypertensive medications for other indications or unknown hypertension information (959 cases/307 controls), we analyzed self-reported data on 42,763 mothers of infants with birth defects and non-malformed controls. Overall, 906 (2.1%) mothers reported using antihypertensives late in pregnancy, and 61 (6.7%) of these reported using ACE/ARB. ACE/ARB users were more likely to report non-Hispanic Black or Hispanic race/ethnicity, less education, lower household income, and pre-existing diabetes than mothers using other late pregnancy antihypertensives. We found six guidelines published during NBDPS, contraindicating ACE/ARB use after the first trimester. While the percent of late antihypertensive users taking ACE/ARB ranged from 1.8–12.1% during NBDPS, there was not a statistically significant time trend in late pregnancy ACE/ARB use.

PB071

The great obstetric syndrome – a sibling design, focusing long term maternal death  
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The Great Obstetric Syndromes (GOS) describes the link between 6 or 7 central factors of pregnancy and birth, and the risk for adverse outcomes of the child. Romero (1) suggested the following GOS components in the clinical syndrome: Premature labour/delivery, premature rupture of membranes, small for gestational age, congenital malformations and pregnancy-induced hypertension. Later, placental abruption and gestational diabetes (GDM) was added to GOS. We study GOS in terms of long term maternal death, specifically the occurrence of GDM, preeclampsia, preterm birth, small-for-gestational age, large-for-gestational age, perinatal death, and placental abruption. We analyse sibship-organized births from Norway, covering all births in 1967-2014 for 1.09 million mothers with 2.39 million singleton births. We find that with an average of two factors per pregnancy, the maternal CVD death correspond to hazard ratios (HR) of 5.7 (95% C.I. 4.5-7.2), 5.7 (3.6-8.9) and 7.6 (4.5-12.9) for women with one, two or three pregnancies, i.e. around six fold increased risk relative to women without complications in three pregnancies. Forty-four % of women experience one or more pregnancy complications during their lifetime (within the selected list of 7 factors). For women with 3 pregnancies, more than 20% experience 2 complications or more. For women with 4+ pregnancies, these percentages are even higher. When examining all 7 factors across up to 4 pregnancies per women and maternal CVD death, the results show strong dose-response patterns that illustrate the importance of examining the presence of GOS factors in the complete reproductive history and not solely in the first pregnancy. The results also show that it is important to examine different pregnancy complications when evaluating women's long-term health. (1) Romero R. Prenatal medicine: the child is the father of the man. J Matern Fetal Neonatal Med. 2009;22(8):636-9.

PB072-S

Effect of exposure and referent group definitions on observed associations between maternal age and risk of adverse pregnancy outcomes

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Increased risks of adverse pregnancy and birth outcomes among women of advanced maternal age (AMA) compared with younger women are well established. However, definitions of AMA and younger referent groups vary substantially across studies. Here, we aim to determine how sensitive associations between AMA and adverse pregnancy and birth outcomes are to AMA and referent group definitions. We examined 9 outcomes (hypertensive disorders of pregnancy, gestational diabetes, cesarean delivery, preterm delivery, severe postpartum hemorrhage (PPH), stillbirth, low birth weight, neonatal and infant death) using a population-based birth cohort from British Columbia, 2004-2014. We used log binomial regression to estimate risk ratios (RRs) with 95% CIs for each outcome using multiple AMA and referent group definitions:  $\geq 35$ ,  $\geq 40$ , or  $\geq 45$  vs. 20-24, 20-29, or 20-34,  $< 35$ ,  $< 40$ , or  $< 45$ . We compared the resulting RRs by outcome. Of 436,566 pregnancies, 23.0% were to women  $\geq 35$  years old, 4.3% to women  $\geq 40$ , and 0.3% to women  $\geq 45$ . RRs increased with higher AMA cutoffs for virtually all outcomes, but were most pronounced among nulliparous women for severe PPH and neonatal and infant death. RRs for neonatal death among nulliparous women were 1.3 (95% CI: 1.0, 1.7) defining AMA as  $\geq 35$ , 1.6 (CI: 1.0, 2.5) defining AMA as  $\geq 40$ , and 6.6 (CI: 2.9, 15.0) defining AMA as  $\geq 45$ , as compared with women age 20-24. RRs for infant death among nulliparous women were 1.0 (95% CI: 0.8, 1.3) defining AMA as  $\geq 35$ , 1.3 (CI: 0.9, 2.0) defining AMA as  $\geq 40$ , and 4.8 (CI 2.3, 10.3) defining AMA as  $\geq 45$ , as compared with women age 20-24. Gestational diabetes was the only outcome for which RRs varied meaningfully by referent group definition. We found that associations between AMA and some pregnancy outcomes are sensitive to the threshold used to define AMA, but robust to referent group definitions. Identifying dose-response relationships between maternal age and pregnancy outcomes with more granularity is recommended.

PB073

Validity of the Posttraumatic Stress Disorders (PTSD) Checklist in Pregnant Women

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**Background:** The PTSD Checklist-civilian (PCL-C) is one of the most commonly used self-report measures of PTSD, however, little is known about its validity when used in pregnancy. This study aims to evaluate the reliability and validity of the PCL-C as a screen for detecting PTSD symptoms among pregnant women. **Methods:** A total of 3,372 pregnant women who attended their first prenatal care visit in Lima, Peru participated in the study. We assessed the reliability of the PCL-C items using Cronbach's alpha. Criterion validity and performance characteristics of PCL-C were assessed against an independent, blinded Clinician-Administered PTSD Scale (CAPS) interview using measures of sensitivity, specificity and receiver operating characteristics (ROC) curves. We tested construct validity using exploratory and confirmatory factor analytic approaches. **Results:** The reliability of the PCL-C was excellent (Cronbach's alpha = 0.90). ROC analysis showed that a cut-off score of 26 offered optimal discriminatory power, with a sensitivity of 0.86 (95% CI: 0.78 – 0.92) and a specificity of 0.63 (95% CI: 0.62 – 0.65). The area under the ROC curve was 0.75 (95% CI: 0.71 – 0.78). A three-factor solution was extracted using exploratory factor analysis and was further compared with three other models using confirmatory factor analysis. A three-factor model based on DSM-IV symptom structure had reasonable fit statistics with comparative fit index of 0.86 and RMSEA of 0.09. **Conclusion:** The Spanish-language version of the PCL-C may be used as a screening tool for pregnant women. The PCL-C has good reliability, criterion validity and factorial validity. The optimal cut-off score obtained by maximizing the sensitivity and specificity should be considered cautiously; women who screened positive may require further investigation to confirm PTSD diagnosis.

PB074-S

Assessment of Pre-Existing Conditions in Pregnancy: Misclassification and Timing of Ascertainment

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**BACKGROUND:** Misclassification of pre-existing conditions in pregnancy studies using healthcare databases exists, however the extent has not been adequately quantified. We aimed to show how length of the ascertainment interval affects identified cases for two neurologic conditions; and assess the impact of misclassification when only delivery hospitalizations are available. **METHODS:** Multiple sclerosis (MS) and epilepsy cases were reverse ascertained in increasingly longer intervals from delivery date until up to three years before delivery in the 2011-14 Truven Health MarketScan Database. Using a reference interval that maximized number of cases and sample size, we compared cases identified in this interval to those identified during the delivery admission. Finally, we analyzed the adjusted odds ratios for three delivery complications (cesarean section, preterm delivery, preeclampsia) associated with neurologic conditions ascertained during pregnancy and during the delivery admission. **RESULTS:** We used a 270-day interval before delivery as the reference since most cases were identified and 60% of the sample were continuously enrolled in this interval. Of women identified here, 73% of those with epilepsy and 60% of those with MS had a condition code at delivery. Of those coded at delivery, 63% of those with epilepsy and 78% of MS cases had been identified in the reference interval. Different intervals did not alter the odds ratios of complications for most contrasts, however, the odds ratio for preeclampsia was biased upwards when epilepsy was ascertained at delivery only. **CONCLUSIONS:** Ascertainment of MS at the delivery admission in claims data may underestimate the prevalence, but odds ratios for delivery complications appear valid. Epilepsy, however, should be ascertained in longer windows that exclude the delivery admission in order to avoid misclassification with eclampsia.

PB075-S

The impact of differential exposure misclassification on performance of propensity score methods for binary outcome models: a simulation study

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**Abstract.** Differential exposure misclassification (DEM) can arise in studies where data are collected retrospectively, resulting in different exposure information quality for individuals with and without the outcome of interest. DEM may result in unpredictable bias, and is a serious threat to validity. Propensity score (PS) methods are frequently used to reduce confounding bias, but our previous work suggests that some implementations are more susceptible to nondifferential exposure misclassification; however, no previous work has examined the impact of DEM on the ability of PS methods to reduce confounding bias. We conducted a simulation study on opioid exposure during pregnancy and low birth weight in infants. We simulated 10 confounders, and a dichotomous exposure variable conditional on these confounders. We generated a binary outcome  $Y$  conditional on both exposure and covariates, setting the true exposure effect to  $OR=2.0$ . We examined two scenarios interchanging exposure misclassification between cases and non-cases, for varying levels of sensitivity and specificity. We fit models based on the misclassified exposure, and compared five common PS methods (matching[M], regression adjustment[RA], inverse probability of treatment weighting[IPTW], standardized mortality weighting[SMRW], and stratification[S]) in terms of bias and coverage of 95% confidence intervals. PS estimates were similar in most scenarios, with some notable exceptions. For fixed specificity and misclassified non-cases, losses in sensitivity resulted in greater bias and lower coverage for weighting estimators (bias [-30%, -20%] for SMRW and IPTW, vs [-15%, -7%] for M, S, and RA). On the contrary, weighting estimates performed better with losses of specificity only when cases were misclassified (bias <10% for IPTW and SMRW, vs >20% for S, M, and RA). These preliminary results suggest researchers should consider exposure misclassification when choosing a PS method for confounding control.

PB076-S

Statistical process control to monitor perinatal mortality

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Rates of stillbirth and neonatal death are known to vary across the UK by maternity care provider. Accurate and timely information is vital to allow organisations that provide perinatal care services to continuously monitor the risk of perinatal death. The introduction of statistical process control (SPC) methodology would allow for early identification of a potential abnormal rate of perinatal mortality. Investigations and remedial actions can then be taken immediately. SPC is a graphical tool used to monitor a process over time with an upper and a lower threshold that outline the expected range of variation. In this work, SPC charts based on the log likelihood ratio test are investigated: sequential probability ratio test (SPRT), cumulative sum (CUSUM) and resetting SPRT (RSPRT). The lower and upper thresholds of these charts are defined as the process performing as expected and the process performing worse than expected respectively. The SPRT, CUSUM and RSPRT charts are evaluated in their ability to monitor perinatal mortality with the view of implementation in individual maternity care providers. The SPC charts were applied to the data obtained from MBRRACE-UK, the perinatal mortality surveillance audit programme for the UK. Births from 1st January 2014 to 31st December 2014 were included. Higher rates of mortality can be identified using all three SPC charts. However, CUSUM and RSPRT charts have the advantage over the SPRT chart in continuously monitoring for higher than expected rates of perinatal mortality, through the use of a resetting lower threshold. Thus, these charts are more sensitive to negative changes within a process than the SPRT chart. However, the resetting property means that the thresholds cannot be set using the type one and two error probabilities, as the probability of eventually crossing the upper threshold becomes 1, increasing the risk of false alarms. Further work is required in choosing the appropriate parameters for the SPC charts.

PB077-S  
Performance of statistical process control charts  
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The choice of statistical process control (SPC) chart for real-time monitoring of perinatal mortality within individual maternity care providers in the UK is not straightforward. The choice depends on the ability to monitor an organisation with a low mortality rate caring for a diverse and large number of babies and to signal a true alarm quickly when there is a rise in the odds of mortality but to have a low false alarm rate. The performance of the resetting sequential probability ratio test (RSPRT) and the cumulative sum (CUSUM) charts are investigated using the median run length (MRL). This is the median number of observations until a process is deemed to be performing worse than expected. There are two types of MRL: MRLin and MRLout. MRLin is the median number of observations required to signal a false alarm when the process is performing as expected. MRLout is the median number of observations required to signal a true alarm when the process is performing worse than expected. A chart that has a long MRLin and a short MRLout is considered efficient. This is dependent on the study population studied, the thresholds set on the SPC chart, the true underlying odds ratio and the odds ratio to be detected,  $r$ . A simulation study was conducted to compare the two SPC charts for monitoring perinatal mortality. The MRLin and MRLout values are computed at different thresholds and values of  $r$ . Data was simulated approximating a cohort of births from 24+0 weeks gestation in the UK in 2014 from the MBRRACE-UK dataset. Given any value of the MRLin, the RSPRT chart had a shorter MRLout than the CUSUM chart. The CUSUM chart was the most sensitive to negative changes within a process, yet more likely to give a false alarm than the RSPRT chart. Furthermore, as the value of  $r$  increased, the values of MRLin and MRLout decreased for a given upper and a lower threshold. Fewer observations are required to detect changes in the rate of an outcome if the value of  $r$  is assumed to be high.

PB078  
How Many Are There? Estimating National Rare Disease Prevalence from Surveillance in Selected Sites.  
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Monitoring disease prevalence is critical for accurate planning of services. Public health surveillance, often the best approach, may be limited to a few sites, especially for rare diseases, and the data applied beyond those regions. Formal uncertainty analysis allows estimation of the magnitude of uncertainty associated with such extrapolation and more credible generalizations. In preparation for an uncertainty analysis of national prevalence estimates of muscular dystrophies derived from the sites that form the Muscular Dystrophy Surveillance, Tracking, and Research Network (MD STARnet), we identified potential sources from a systematic review of relevant literature, independently conducted by two analysts, and survey of MD STARnet investigators. We grouped the sources of uncertainty into four classes: sources (1) inherent in all surveillance systems, (2) particular to rare disease surveillance, (3) particular to medical records based surveillance, and (4) due to extrapolation from local to national estimates. The first class includes case ascertainment, misclassification of disease status, and migration. The second class includes small case numbers, resulting in unstable estimates in small or rapidly changing populations; regional differences in incidence; unreliable coding; and biases in care-seeking behaviors and diagnostic practices. The third class includes lack of standardization in assessments, treatments and records, and incomplete data on residence history, demographics, diagnostic indicators or disease progression. The fourth class includes differences between the local and national populations. Hence, estimating uncertainty in the extrapolation of the prevalence of a rare disease from a local to a national scale requires attention to surveillance methodology, the characteristics of the condition under surveillance, and differences and similarities between of the local and national populations.

PB079-S

Large-scale placental tissue collection procedures for epidemiologic studies.

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Analyzing placental tissue samples can provide valuable information regarding pregnancy complications but is currently infeasible in large scale studies - standard procedures are often cost prohibitive and require sample acquisition within 40 minutes of delivery. We compared the precision of a simpler approach involving the collection of tissue samples following 24 hours of refrigeration of whole placentae at 4°C to the “gold standard” of snap freezing excised tissue within 40 minutes of delivery. Due to increasing interest in cytokines in placental study, tissue samples were analyzed for concentrations of the inflammatory cytokines IL-6, IL-8, IL-10, and TNF- $\alpha$ . Placentae were collected from 12 women after delivering live-born singleton babies via uncomplicated vaginal delivery. Precision of the simpler approach was identified by comparing average concentrations and standard deviations of 3 sections of each placenta: sections 1 (full thickness) and 2 (excised) were obtained within 40 minutes of delivery and snap frozen in liquid nitrogen and section 3 (full thickness) was obtained after refrigerating the placenta at 4°C for 24 hours. Average  $\pm$  standard deviations of concentrations (pg/mg) in sections 1, 2, and 3 were 4.1 $\pm$ 1.9, 4.4 $\pm$ 2.2, 6.3 $\pm$ 7.6 for IL-6; 6.0 $\pm$ 3.5, 5.4 $\pm$ 2.6, 8.1 $\pm$ 3.5 for IL-8; 0.9 $\pm$ 0.6, 0.8 $\pm$ 0.4, 1.2 $\pm$ 0.5 for IL-10; and levels of TNF- $\alpha$  were too low among samples to reliably measure using immunoassay. Notably, an outlier approximately 3.8 times the mean concentration increased the standard deviation of IL-6 in section 3. In conclusion, IL-6, IL-10, and IL-8 had comparable variability overall in placental tissue stored up to 24 hours at 4°C, suggesting that a simpler approach appropriate for large scale sample procurement does not compromise precise detection of these cytokines. This methodology lays the groundwork for the study of placental inflammatory cytokines that may be useful for future epidemiologic studies.

PB080

Management and outcomes of gallstone disease during pregnancy: a population based data linkage study  
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Background Gallstone disease is a leading indication for non-obstetric surgery during pregnancy. Studies examining maternal and neonatal outcomes following gallstone disease have been limited by small sample sizes and inability to follow disease progression. Aim To describe the prevalence, management and outcomes of gallstone disease during pregnancy. Methods Linked hospital, birth and mortality data for all women with a singleton pregnancy in New South Wales, Australia between 2001-2012 were analysed. Exposure of interest was gallstone disease (acute biliary pancreatitis, gallstones with/without cholecystitis). Outcomes (mode of delivery, preterm birth, morbidity and mortality [maternal and neonatal]) were compared between pregnancies with and without gallstone disease and within subgroups of gallstone disease. Adjusted risk ratios (aRR) and 95% confidence intervals were estimated using modified Poisson regression and adjusted for maternal and pregnancy factors. Results Among 1064089 pregnancies, 1882 (0.18%) had gallstone disease. Of these, 239 (12.7%) had an antepartum cholecystectomy and 1643 (87.3%) were managed conservatively. Of those managed conservatively, 319 (19.0%) had a postpartum cholecystectomy. Gallstone disease was associated with increased risk of preterm birth (aRR 1.29, 1.11-1.50), maternal morbidity (aRR 1.57, 1.21-2.03) and maternal readmission (aRR 4.55, 4.16-4.98). There was increased risk of preterm birth (aRR 1.79, 1.00-3.22) [iatrogenic aRR 2.32, 1.12-4.81, spontaneous aRR 1.27, 0.40-4.02] among pregnancies with acute biliary pancreatitis compared to other forms of gallstone disease. Cholecystectomy was associated with decreased risk of maternal readmission (aRR 0.35, 0.22-0.56). Conclusion Most women with gallstone disease are managed non-surgically. Acute biliary pancreatitis is associated with iatrogenic preterm birth while cholecystectomy is associated with lower rates of maternal hospital readmissions.



PB081

Appendicectomy during pregnancy and preterm birth risk  
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Background: Suspected appendicitis is the most common non-obstetric indication for abdominal surgery during pregnancy. There are few large contemporary population-based studies describing pregnancy outcomes following appendicectomy during pregnancy. Of particular interest is whether the risk of preterm birth is increased. Aim: To determine the association between appendicectomy during pregnancy and preterm birth. Method: Population-based study of all singleton pregnancies in New South Wales, Australia between 2001 and 2010. Linked birth, hospital discharge and mortality data were utilised. The exposure was appendicectomy during pregnancy and the comparison group was pregnancies without appendicitis or abdominal surgery during pregnancy. Outcomes included preterm birth (<37 weeks), maternal morbidity (composite measure of serious adverse conditions occurring at birth), time from surgery to delivery and perinatal mortality. Crude and adjusted risk ratios (aRRs) were estimated using modified Poisson regression and adjusted for maternal and pregnancy factors. Results: Of 877075 pregnancies, 883 (0.1%) had appendicitis. Among these, 709 (80.3%) had an appendicectomy [laparoscopic (50.3%) and open (30.0%)], 170 (19.3%) had conservative management and 4 (0.5) had other abdominal surgery. Women with appendicitis were more likely to be younger ( $p<0.001$ ), born in Australia ( $p<0.001$ ), smokers ( $p<0.001$ ) and from a lower socioeconomic background. Mean gestational age at time of appendicectomy was 15.1 weeks (interquartile range 10.0-22.4 weeks). After adjustment, appendicectomy was associated with increased risk of preterm birth (aRR 1.43, 99% CI 1.04-1.97) [iatrogenic (aRR 1.43, 99% CI 0.85-2.40) and spontaneous (aRR 1.46, 99% CI 0.96-2.23)] and caesarean delivery without labour (aRR 1.08, 99% CI 1.00-1.14). Conclusions: Most appendicectomies are performed prior to the third trimester. Appendicectomy during pregnancy is associated with preterm birth.

PB082

Physical activity and sleep in pregnant Hispanic women  
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Poor sleep is common during pregnancy and has been associated with adverse maternal outcomes such as gestational diabetes mellitus (GDM). However, few studies have sought to identify modifiable risk factors for poor sleep during pregnancy and none were conducted in a Hispanic population, which faces disproportionately risk of GDM. We assessed demographic, behavioral and medical history factors related to sleep quality and duration using baseline data from Estudio PARTO, an ongoing randomized controlled trial aimed at reducing type 2 diabetes among 253 Hispanic women at elevated risk. Sleep quality and duration were assessed at baseline (26.5±6.9 wks gestation) with the Pittsburgh Sleep Quality Index (PSQI). Physical activity (PA) was assessed with the Pregnancy PA Questionnaire. Probable major depression was defined as having a score >15 on the Edinburgh Depression Scale (EDS). A total of 72 (28%) women reported short sleep duration (<5 hrs/day) and 39 (15%) reported long sleep duration (>8 hrs/day). The top quartile of PSQI scores ( $n=72$ ), used to categorize poor sleep quality, had a mean score of  $12 \pm 2.2$ , range 10 to 18. In multivariable logistic models, higher age (OR=0.62, 95% CI: 0.43-0.91), education (OR=0.55, 95% CI: 0.35-0.85), total PA (OR = 0.66, 95% CI: 0.46-0.96), light intensity PA (OR=0.63, 95% CI: 0.43-0.91), and PA for transportation (OR=0.65, 95% CI: 0.45-0.92) were inversely associated with odds of long sleep duration. Women reporting probable major depression (OR= 0.26, 95% CI: 0.13-0.55) had a lower odds of short sleep duration and a lower odds of reporting poor sleep quality (OR=0.22, 95% CI: 0.11-0.47). Other demographic or behavioral factors such as pre-pregnancy body mass index and smoking were not associated with sleep quality nor duration. Findings help to better characterize high-risk groups and inform interventions targeting health-risk behaviors.

PB083

Gestational weight gain and low risk first birth cesarean delivery in an integrated health care delivery system.  
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The Healthy People 2020 Objectives recommend decreasing the proportion of low-risk, first-birth (LRFB) cesarean deliveries (defined as nulliparous, term, singleton and vertex) which are considered to be preventable. The Joint Commission requires maternity hospitals to report LRFB cesarean delivery rates as a quality measure. However, a better understanding of modifiable risk factors for LRFB cesarean delivery is needed. Gestational weight gain is one such potentially modifiable risk factor for LRFB cesarean, however its relationship to LRFB cesarean delivery is unclear. We aimed to assess the association between gestational weight gain in relation to the 2009 Institute of Medicine (IOM) guidelines and LRFB cesarean delivery in an integrated health care delivery system from 2008 to 2012. We identified cohort of 57,093 nulliparous women who delivered a singleton livebirth in the vertex position at term (>37 weeks' gestation) in Kaiser Permanente Northern California between 2008 and 2012. Overall, the proportion of LRFB cesarean deliveries was 23.5%. In a multivariable model adjusting for maternal age, education, delivery year, medical facility, body mass index, glucose tolerance status and hypertension disorders, women who exceeded the 2009 Institute of Medicine guidelines for gestational weight gain had a 40% increased likelihood of having a LRFB cesarean delivery (OR 1.40; 95%CI: 1.32-1.48); whereas women who gained below the 2009 IOM guidelines had 25% reduced likelihood of having a LRFB cesarean delivery. We found no evidence of effect modification by pre-pregnancy body mass index or race-ethnicity. Obstetric clinicians should be aware that excess gestational weight gain increases the likelihood of needing a cesarean delivery even among low risk women. Interventions to improve gestational weight gain in pregnancy have potential to also decrease the cost of health care delivery in pregnancy by reducing the number of preventable LRFB cesarean sections.

PB084

A PREDICTION MODEL OF GESTATIONAL DIABETES MELLITUS IN EARLY STAGE OF PREGNANCY:  
DEVELOPMENT AND VALIDATION

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Background: Increasing prevalence of gestational diabetes mellitus (GDM) was observed in China, with limited evidence for prediction of GDM using easily accessible predictors. We aimed to develop a model for predicting GDM during early pregnancy in Born in Guangzhou Cohort study (BIGCS), China. Method: The study population included a derivation cohort (n=9518) and a validation cohort (n=1292) of nulliparous women. GDM was diagnosed at 22-28 weeks by a 75-g, 2-hour oral glucose tolerance test using International Association of Diabetes and Pregnancy Study Groups 2010 criteria. The prediction model was first constructed in derivation cohort using Logistic regression. Data on potential predictors was collected around 16 weeks of gestation, including maternal age, education and family history of diabetes, paternal income, pre-pregnancy body mass index (BMI), and extent of early gestational weight gain. The model was then fitted in the validation cohort. Area under receiver operating characteristic curve (AUC) was used to evaluate performance of the model. Bootstrap test was used to compare AUCs from derivation and validation cohort. Results: GDM occurred in 13.8% of women in derivation cohort. Multivariable analysis showed maternal age (odds ratio [95% confidence interval]: 1.11 [1.09-1.13] for per year increase), pre-pregnancy BMI (1.10 [1.08-1.13] for per kg/m<sup>2</sup> increase), family history of diabetes (1.53 [1.28-1.82]) and excess weight gain (1.30 [1.15-1.48]) increased the risk of GDM, while inadequate weight gain was negatively associated with GDM (0.79 [0.64-0.98]). The prediction model based on these factors yielded an AUC of 0.64 (95%CI: 0.63-0.66), which did not differ significantly from the AUC of prediction model (0.64(95%CI: 0.58-0.69)) in validation cohort (P=0.84). Conclusions: Despite a moderate AUC value, the prediction model seemed stable and easily operable, which may be widely applied to identify at-risk women of GDM after further improvement.

PB085-S  
Gestational diabetes mellitus and inter-pregnancy weight change  
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Background: Overweight is an important risk factor for Gestational Diabetes Mellitus (GDM). Weight change between pregnancies may have a causal effect on GDM, however knowledge is not conclusive. We assessed the risk for GDM in second pregnancy by change in Body Mass Index (BMI) between first and second pregnancy, and if BMI and gestational weight gain (GWG) modified the risk of GDM. Methods: Prospective population-based cohort study (2006-2014) with 26,364 mother-sibling units. Weight change was defined as pre-pregnant BMI in second pregnancy minus pre-pregnant BMI in first pregnancy, and categorized by units:  $<-2$ ,  $-2$  to  $<-1$ ,  $-1$  to  $<1$ ,  $1$  to  $<2$ ,  $2$  to  $<4$  and  $\geq 4$  kilo/ meters squared. Relative risk (RR) estimates were obtained by general linear models for the binary family and adjusted for potential confounders. Analyses were stratified by BMI (first pregnancy) and GWG (second pregnancy). Results: Compared to women with stable BMI, women who gained weight between pregnancies had higher risk of GDM by units gained:  $1$  to  $<2$ : Adjusted RR 2.0 (95% CI 1.5-2.6);  $2$  to  $<4$ : RR 2.8 (2.2-3.7) and  $\geq 4$ : RR 5.4 (4.0-7.3). Risk increased both for women with BMI below and above 25 at first pregnancy, although significantly more among normal-weight women. GWG in second pregnancy did not modify the relation. Conclusions: The risk of GDM increased by increasing weight gain from first to second pregnancy, and most among women with BMI $<25$  in first pregnancy. Our results suggest a metabolic mechanism behind the increased risk of GDM, represented by the weight change itself.

PB086  
Short interpregnancy interval and pregnancy intention by maternal age, National Survey of Family Growth  
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Increased access to family planning services can lead to better birth outcomes by improving pregnancy spacing and reducing unintended pregnancy, yet the relationship between these two health outcomes across maternal age is not clear. Using data from the 2006-2010 and 2011-2015 National Survey of Family Growth, we examined women who reported at least one pregnancy following a live birth in the previous 5 years (6,382 pregnancies among 5,079 women). We estimated the percentage of these pregnancies that were reported as unintended (unwanted or mistimed) at the time of conception by short interpregnancy interval (IPI;  $<18$  months) vs. longer IPI (18+ months), and compared percentages using Rao-Scott Chi-square tests. Results were then stratified by maternal age at the time of the previous live birth: 15-19, 20-24, 25-29, and 30+ years. Linear trend p-values for maternal age were estimated using unadjusted logistic regression models. All analyses accounted for survey design and used sample weights. Approximately 36% (standard error [SE]=1.0) of all pregnancies analyzed were conceived  $<18$  months following a live birth, which increased across age categories from 32% (SE=2.0) in women aged 15-19 to 42% (SE=2.3) in women aged 30+ (linear trend  $p<0.01$ ). Overall, 40% (SE=1.0) of pregnancies were reported as unintended at the time of conception, a percentage which decreased across age categories from 54% (SE=2.2) in women aged 15-19 to 40% (SE=4.7) in women aged 30+ (linear trend  $p<0.01$ ). The percentages of pregnancies that were unintended following a short IPI vs. longer IPI were 54% vs. 33% ( $p<0.01$ ) overall, and for women aged 15-19, 20-24, 25-29, and 30+ years, 73% vs. 45% ( $p<0.01$ ), 62% vs. 35% ( $p<0.01$ ), 45% vs. 27% ( $p<$ ), and 42% vs. 26% ( $p<0.01$ ), respectively. Our findings of higher prevalence of unintended pregnancy among short interpregnancy intervals suggest there is an unmet need for family planning services for women during the first 18 months following a live birth.

PB087

Folic Acid and Smoking Behaviour Changes in Early Pregnancy

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In the context of a case-control study of congenital heart disease (CHD), we analysed the health behaviours of a representative sample of pregnant women in Northern Ireland (controls) in relation to changes in folic acid and smoking. Mothers of babies with no CHD diagnosis were recruited at 20 week anomaly scan appointments; 7% refused. Of 969 mothers recruited, 873 (90%) completed an iPad questionnaire and 96 posted a paper questionnaire (10%). Logistic regression controlled for age, education, parity and whether pregnancy planned. 89% of mothers suspected pregnancy by 6 weeks gestational age (GA). 46% took folic acid before pregnancy, 75% by 6 weeks, and 89% after seeing a health professional. Corresponding figures for smoking were 24%, 14% and 5%. Women with university education (ORadj 1.62 95%CI 1.04-2.53) and planned pregnancies (ORadj 15.73 95%CI 9.61-25.77) were more likely to start taking folic acid before pregnancy compared to those with lower levels of education and unplanned pregnancies. University education (ORadj 1.55, 95%CI 1.01-2.41) and planned pregnancies (ORadj 3.69 95%CI 2.65-5.14) also predicted starting folic acid by 6 weeks GA. For smoking, those with higher secondary (ORadj 0.44 95%CI 0.30-0.65), university education (OR 0.27adj 95%CI 0.17-0.41) and planned pregnancies (ORadj 0.52 95%CI 0.37-0.73) were more likely to be non-smokers/stopped before pregnancy compared to those who continued to smoke and did not plan pregnancy. Higher secondary (ORadj 0.35 95%CI 0.21-0.56), university education (ORadj 0.19 95%CI 0.12-0.37) and planned pregnancies (ORadj 0.37 95%CI 0.24-0.58) predicted smoking behaviour at 6 weeks GA. Parity was associated with folic acid before pregnancy (ORadj 0.67, 95%CI 0.48-0.94). The pattern of behaviour change suggests that information with pregnancy test kits, and targeted early healthcare appointments, may help women to make early behaviour changes. Maintaining changes after the first pregnancy is an area needing attention.

PB088

The relationship between serum folate during pregnancy and perinatal depression

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Given the high prevalence of perinatal depression (12%-20%), and limitations with current treatment options, research to understand determinants of perinatal depression is imperative for developing safe and effective interventions. Nutrition, specifically folate has been found to influence depression risk in the general population, but little is known about the perinatal period. To examine the relationship between serum folate levels during pregnancy and perinatal depression, we conducted a longitudinal study of 209 pregnant Kaiser Permanente Northern California (KPNC) members who provided a serum sample during their first or second trimester of pregnancy. Through KPNC's universal perinatal depression screening program all women are screened for depression with the Patient Health Questionnaire (PHQ-9) twice during pregnancy (first prenatal visit and glucola visit) and once postpartum (4-6 weeks). Participants were included if they did not have a depression diagnosis or antidepressant medication dispensing in the 6 months prior to pregnancy through the time of blood draw. Perinatal depression was defined as a depression diagnosis or PHQ9  $\geq 10$ . Cox Proportional Hazards models with left truncation were conducted. Thirty-three (16%) of the women received a depression diagnosis. Women with folate levels below the mean (Mean=82.9 nmol/L, SD=63.5) were more likely to have perinatal depression (17%) compared to women with higher folate levels (12%), yet these results were not significant ( $p=0.44$ ). Preliminary results suggest a 60% increase in the risk of perinatal depression associated with low folate concentrations (HR: 1.64, 95% CI: 0.6, 4.3) after adjusting for dietary folate intake, cortisol levels, homocysteine and race, yet these findings could be due to chance. Our findings highlight the need for adequately powered studies to assess the relationship between low folate levels and perinatal depression. We are expanding our study to include an additional 700 women.

PB089

Distinct prospective associations between individual plasma saturated fatty acids and gestational diabetes

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Saturated fatty acids (SFAs) may play a role in glucose homeostasis. Despite the varied origins (exogenous and endogenous) and potential distinct roles, data on individual plasma SFAs, rather than total SFAs via dietary assessment, and subsequent gestational diabetes (GDM) risk are lacking. We prospectively investigated individual and subclasses of SFAs in relation to GDM risk. Within the NICHD Fetal Growth Studies-Singleton cohort (2009-2013), we identified 107 GDM cases by medical record review and randomly selected 214 non-GDM controls matched on age, race/ethnicity, and gestational week (GW) at blood draw. Individual plasma phospholipid SFAs were measured at GW 10-14, 15-26, 23-31, and 33-39. The individual SFAs were also grouped into subclasses of even- or odd-chain SFAs. Conditional logistic regression adjusted for pre-pregnancy body mass index and other major risk factors. Before GDM diagnosis, even-chain SFA 16:0 concentrations were significantly higher, whereas odd-chain SFAs 15:0 and 17:0 were significantly lower among cases than controls. At GW 10-14, SFA 16:0 was positively associated with GDM risk comparing the highest vs. lowest quartile [adjusted odds ratio (aOR<sub>Q4-Q1</sub>)=4.76 (95% confidence interval 1.72-13.1); *P*<sub>trend</sub>=0.001]. In contrast, odd-chain SFAs were inversely related to GDM risk [aOR<sub>Q4-Q1</sub>=0.32 (0.11-0.92) for SFA 15:0, *P*<sub>trend</sub>=0.025; 0.20 (0.07-0.58) for SFA 17:0, *P*<sub>trend</sub>=0.003]. In combination, high ( $\geq$  median) even-chain SFAs levels and low ( $<$  median) odd-chain SFAs were associated with a 9-fold (3.26-27.3) increased risk compared to women with low even-chain and high odd-chain SFAs. Results were similar at GW 15-26. In conclusion, plasma SFAs, as early as GW 10-14, demonstrated distinct associations with GDM varying by chain length. Our novel findings highlight the potentially important, and more notably, different roles of individual SFAs for GDM development, which may underlie distinct nutritional, metabolic, or physiological processes.

PB090

Pre-diagnostic liver enzymes, abdominal adiposity, and risk of gestational diabetes

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Liver enzymes are markers of liver fat deposits and may play a role in glucose homeostasis, but their individual roles during pregnancy and interaction with abdominal adiposity in relation to subsequent GDM risk remain unclear. We prospectively investigated alanine aminotransferase (ALT),  $\gamma$ -glutamyl transferase (GGT) and waist-to-hip-ratio (WHR) in relation to GDM risk in a nested case-control study within the Pregnancy Environment and Lifestyle pregnancy cohort. Among 815 women who had delivered by June 2015, 78 GDM cases were diagnosed at gestational weeks 24-28 and each was matched to two controls on age, race/ethnicity and gestational weeks at blood draw. Serum ALT and GGT were measured at visit 1 (V1, 10-13 weeks) and visit 2 (V2, 16-19 weeks). Waist and hip circumferences were measured at V1. Compared to controls, GDM cases had higher levels of ALT and GGT at both V1 and V2 and higher WHR (all  $P < 0.05$ ). After adjustment for parity, family history of diabetes and alcohol consumption, GGT but not ALT in the highest vs. lowest quartile at V1 and V2 was associated with a 3.01-fold (95% CI 1.23-7.38) and 3.06-fold (1.18-7.94) increased risk of GDM, respectively; however, the associations were attenuated and became non-significant after additional adjustment for body mass index (BMI) and WHR. After adjustment for covariates including BMI, WHR in the highest vs. lowest quartile was associated with a 7.05-fold (1.8-27.5) increased risk of GDM. Further, having an ALT or GGT and a WHR above the respective median was associated with 4-fold (1.55-12.7) or 8-fold (2.29-27.8) increased risk of GDM compared to women with both values below the median at V1; similar results were observed at V2. In contrast, no joint effects between liver enzymes and BMI were observed. Our findings suggest an adverse synergistic effect of elevated liver enzymes and abdominal adiposity as early as the first trimester on subsequent risk of GDM, which may help to early identify high-risk women.

PB091-S  
Factors Associated with Mode of Delivery in a Peri-urban Indian Population  
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**Background:** The rate of Cesarean section (CS) delivery is increasing worldwide, likely influenced by a range of medical practice and maternal factors. The objective of this study is to determine whether women in a peri-urban Indian population who deliver by CS differ from women who deliver vaginally in demographic, prenatal health, reproductive history, and labor and delivery factors. **Methods:** We analyzed data from 931 singleton pregnancies delivered between 2009 and 2015 among multiparous women participating in the Longitudinal Indian Family hEalth (LIFE) Study, a prospective cohort study of reproductive aged women recruited pre-conception (72%) or within 14 weeks of gestation and followed through delivery in Telangana State, India. Multivariable modified Poisson regression with robust error variance was applied to identify factors associated with CS compared to vaginal delivery. Adjusted relative risks (aRR) and 95% confidence intervals are presented. **Results:** CS was the mode of delivery in 46% of births. In multivariable analysis, reproductive history factors associated with an increased likelihood of CS delivery include prior CS (aRR 2.3, 2.0-2.8), prior twin delivery (aRR 1.6, 1.4-1.8), or diagnosis of gestational diabetes (aRR 1.5, 1.0-2.3), hypertension (aRR 1.3, 1.1-1.6), or preeclampsia (aRR 1.7, 1.2-2.4) in a prior pregnancy. In addition, composite variables representing any prenatal complication (aRR 1.3 (95% CI 1.1-1.6) or labor complication (aRR 1.5, 95% CI 1.1-2.0) increased the likelihood of CS, as did intra-uterine growth restriction (aRR 1.4, 1.1-1.9) and cephalo-pelvic disproportion (aRR 1.3, 1.0-1.8). **Conclusion:** In this peri-urban Indian population, CS delivery was higher in multiparous women with a history of prior CS, multiple gestation or pregnancy morbidity, and among women who experienced prenatal or labor and delivery complications. The medical indications in our findings correspond with those associated with CS in multiparous women in the US.

PB092  
Urinary Iodine Nutrition in Pregnancy in a US Population  
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Severe iodine deficiency in pregnancy can damage the fetal brain. In populations with borderline iodine deficiency, pregnancy urinary iodine concentrations (UIC) decrease with advancing gestational age, likely due to increasing glomerular filtration rate (GFR) during pregnancy. This change over gestation makes it difficult to apply reference population standards for assessing iodine sufficiency in pregnancy, and no recent longitudinal pregnancy data have been reported in the US. The US Midwest was historically an iodine deficient region thought to be iodine sufficient now because of iodization of salt and other dietary changes, but urinary iodine levels in pregnant women in a 2001-2006 national study were half those of levels found in 1971-2. We therefore assessed the level of urinary iodine excretion at several points in pregnancy in a large Midwestern sample to assess both overall iodine nutrition and the influence of gestational age. The Archive for Research in Child Health (ARCH) enrolled and interviewed women at first prenatal visit in three clinics in Lansing, MI. Urinary specimens were obtained, aliquoted, and stored at -80°C at enrollment and twice additionally during routine prenatal care. We assessed UIC in 1,013 urine samples from 494 ARCH participants, 65% of whom were White, 28% Black and 7% reported other race. Some higher education was reported by 53%; completion of high school by 32%; while 16% had <12 years of education. Median UIC was 172 µg/L (n=180) in the first trimester, 175 µg/L (n=484) in the second trimester, and 180 µg/L (n=349) in the third trimester. The fraction of women with iodine levels < 50 µg/L ranged from 2-6% in five-week gestational intervals with no trend across gestational age. The World Health Organization considers iodine nutrition adequate in a population if median UIC is at least 100, and no more than 20% have levels <50. In our study population, iodine nutrition was adequate and showed no variation with gestational age.

PB093  
Disparities in Access to Prenatal Care among Women in the United States  
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About 1 in 5 births in the United States is born to a foreign-born woman. Foreign-born mothers are, on average, older and have lower socioeconomic status than their US-born counterparts. Studies have shown that immigrants are less likely to have health insurance and use healthcare services, including prenatal care. Ideally, prenatal care should start early and continue regularly throughout the pregnancy to monitor the health of mothers and infants and to detect and manage complications in a timely way. The objective of the study is to identify disparities in access to prenatal care among women in the United States. We use birth certificate data for the years of 2009-2013. Information on the timing of prenatal care is only available for states using the 2003 revision, which represent 80% of the births in the period, but number of prenatal care visits is available for all births. Multivariate logistic regression models with state fixed effects were used to look at the association between maternal characteristics and access to prenatal care while controlling for state-level variation. Results show that 71% of mothers in the United States have access to early prenatal care; this figure is 5% lower among foreign-born mothers. Women who are native born, non-Hispanic White, older than 20 years old, are married, or have private insurance, are more likely to initiate prenatal care during their first trimester. These same characteristics are positively associated to the number of prenatal care visits. The average number of prenatal care visits in the United States is 11.2 (Std. Dev. = 4.01); ranging from 10.2 to 13 across the different states. On the other hand, minority and foreign-born mothers, as well as those who are single, younger than 20 years old, have less than high school education, or have non-private insurance, are more likely to start prenatal care late or to receive no prenatal care at all. In the United States, about 5% of all mothers start prenatal care until their third trimester, and less than 2% receive no prenatal care at all. Access to prenatal care was associated with reduced odds of Low Birth weight (OR = 0.86; 95% CI = 0.85; 0.88) and Preterm Birth (OR = 0.912; 95% CI = 0.911; 0.913), and with higher initiation rates of breastfeeding (OR = 1.2; 95% CI = 1.19; 1.21).

PB094-S  
Impact of neighborhood context on stress-reduction intervention to improve weight-related pregnancy outcomes among high-risk pregnant women in the Maternal Adiposity Metabolism and Stress (MAMAS) study  
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Optimal metabolic health during and after pregnancy may have lasting benefits for mothers and infants. Neighborhood contexts may interact with individual-level interventions to modify their potential benefit. We tested neighborhood environment as an effect modifier of a mindfulness-based stress-reduction intervention to improve glucose tolerance (GT), gestational weight gain (GWG), and postpartum weight retention (PPWR). We used data from low income, overweight/obese pregnant women (n=208) participating in a mindfulness-based stress reduction intervention. Latent-class analysis was used to jointly classify four neighborhood domains—socioeconomic context, food, resource, and safety—into four neighborhood types: 1—wealthy, well-resourced; 2—middle income, poorly-resourced; 3—high poverty, well-resourced; 4—high poverty, unhealthy food resources only. Self-reported prepregnancy and measured pre-delivery and postpartum weights were used to calculate GWG and 6mo PPWR. Institute of Medicine guidelines were used to classify excessive GWG. GT was measured using a one-hour, oral glucose tolerance test at 24-28 weeks gestation. Multivariable regression using generalized estimating equations assessed interaction between neighborhood type and intervention effect; wald tests with p-value < 0.10 identified significant interaction. Models were adjusted for maternal- and neighborhood-level sociodemographic factors. Significant neighborhood interactions were detected for GT (p-value = 0.002) and 6mo PPWR (p-value = 0.02). The intervention significantly lowered blood glucose levels in wealthy ( $\beta = -20.95$  mg/dL; 95% Confidence Interval (CI): -36.76, -5.14) and middle-income ( $\beta = -36.36$  mg/dL; 95% CI: -55.35, -17.30) neighborhoods. The intervention significantly decreased PPWR in poor, well-resourced neighborhoods ( $\beta = -8.46$  kg, 95% CI: -16.26, -0.67), but increased PPWR in wealthy, well-resourced neighborhoods ( $\beta = 5.88$  kg, 95% CI: 0.55, 11.20). Our findings highlight the importance of considering neighborhood context when evaluating individual-level intervention effectiveness and developing multilevel interventions going forward.

PB095-S

Factors associated with elective repeat caesarean delivery in women eligible for trial of labour after caesarean  
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**Objective:** To identify maternal characteristics associated with elective repeat caesarean delivery (ERCD) in women eligible for trial of labour after caesarean (TOLAC) in Brazil. **Methods** This was a national population-based study in 266 hospitals totalling 23,894 puerperal women. We selected women from the 208 public/mixed funding hospitals who belonged to group 5 of Robson classification. We further excluded women with  $\geq 2$  previous caesareans, previous other uterine scar, placenta praevia and other conditions that might be an indication for ERCD or require specific management. We examined the associations by non-conditional multivariate hierarchical regressions, adjusting for confounders. **Results** Among the 3,590 women from group 5 of Robson classification, 1,555 (43.3%) were eligible for TOLAC according to our exclusions; 743 (52.2%) had ERCD. Risk of ERCD increased in mixed hospitals (OR 2.4, 95% CI 1.8-3.7), with increasing maternal education (OR 1.9, 95% CI 1.3-2.5), in women with no previous vaginal delivery (OR 3.5, 95% CI 2.3-4.5), in women with preference for CS at the beginning of pregnancy (OR 3.2, 95% CI 2.1-4.2) and in women who delivered macrosomic babies (OR 1.8, 95% CI 1.3-2.2). **Conclusion:** ERCD is associated with socioeconomic, obstetric and hospital characteristics. The knowledge of ERCD determinants can help in the elaboration of strategies to improve vaginal birth after cesarean (VBAC) rates and reduce unnecessary cesareans.

PB096-S

Predictors of Three-Years Postpartum Categorical Body Mass Index Change among Young Women  
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**Introduction:** Childbearing is associated with weight retention in women across the full spectrum of reproductive ages; its association with categorical body mass index (BMI) change among young women is unknown. We sought to characterize predictors of BMI change postpartum in a national sample of women ages 15-24 years old. **Methods:** We analyzed data from baseline and year three along with from medical records from the Fragile Families and Child Wellbeing Study, a cohort of mother and father dyads and their children born in U.S. cities from 1998-2000 ( $n=1,032$ ,  $N=146,488$ ). Multivariable logistic regression was used to characterize individuals whose BMI category increased at three years postpartum (compared to either staying in same category or decreasing) from their pre-pregnancy BMI. **Results:** Among our weighted sample, mean maternal age was 21 years (standard deviation=3); 32% were black; 40% were Hispanic; 40% had income under the Federal Poverty Level; 27% were overweight (i.e. BMI 25.0-29.9) and 20% were obese (i.e. BMI 30.0-39.9) before pregnancy. During pregnancy, 59% of women gained more weight than recommended. By three years postpartum, women who were overweight at baseline and who had lower household income were more likely to be in a higher BMI category (i.e., obese) postpartum than were normal weight women (odds ratio=4.35 [95%CI= 1.34, 14.17],  $p=0.016$ ) after adjustment for other factors. **Conclusions:** Young women who are overweight at conception may be at highest risk of becoming obese compared to women with healthy BMI at conception and may benefit from targeted efforts to prevent long-term obesity.



PB097-S

EXCLUSIVE BREASTFEEDING AND DIAGNOSIS OF ALLERGIC CONDITIONS AND ASTHMA AMONG 6-YEAR-OLD US CHILDREN

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Previous studies examining the relationship between breastfeeding patterns and allergic conditions are inconclusive. The objective of the study was to examine the association between exclusive breastfeeding and physician-diagnosed allergic conditions and asthma among 6-year-old children. Data came from the Infant Feeding Practices Study (IFPS) II conducted in 2005-2007 and its Year 6 Follow-up (n=1261). Exclusive breastfeeding was grouped into four categories: no breastfeeding; non-exclusive breastfeeding; exclusive breastfeeding < 4 months; exclusive breastfeeding  $\geq$  4 months. Multivariable logistic regression models were used to examine the associations between breastfeeding and study outcomes (eczema/skin allergy, hay fever/respiratory allergy, and asthma) while adjusting for confounders. The prevalence of current physician diagnosis of hay fever/respiratory allergy, eczema/skin allergy, and asthma at 6 years were 18.9%, 12.7%, and 6.7%, respectively. Compared to children who were exclusively breastfed  $\geq$  4 months, children who were not exclusively breastfed had 2.4 times higher odds of eczema/skin allergy (adjusted odds ratio (AOR): 2.4, 95% CI: 1.4, 4.3) while the odds of eczema/skin allergy among those who were exclusively breastfed for < 4 months and who were never breastfed were not significantly different from the reference group. Also, no significant associations were seen with breastfeeding patterns and hay fever/respiratory allergy and asthma ( $p>0.05$ ). The most significant predictor of allergic conditions at age six was reported history of infantile eczema. In conclusion, we found that offspring, who were not exclusively breastfed, had a higher odd of eczema/skin allergy than those who were exclusively breastfed for  $\geq$  4 months. However, the potential benefits of breastfeeding on allergic conditions cannot be ascertained from the study. Given, other well-established benefits of breastfeeding, mothers should still be encouraged to breastfeed.

PB098-S

Are adverse childhood experiences associated with weight trajectory in reproductive age women?

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Adverse childhood experiences (ACEs), such as physical and/or sexual abuse, are associated with poor health outcomes later in life. Cross-sectional studies have reported associations between ACEs and obesity in women, and longitudinal studies of children have noted differences in weight trajectories during late childhood and early adolescence. The POUCH (Pregnancy Outcomes and Community Health) study offers an opportunity to examine the effect of physical and/or sexual abuse on weight trajectories in adult women. Data were obtained from the POUCH study (T1), a prospective cohort study of women at mid-pregnancy from 52 clinics in Michigan. Two follow-up studies were conducted 5-15 years after pregnancy (T2 and T3). History of physical and/or sexual abuse was assessed through self-reported questionnaire at enrollment. Body Mass Index (BMI) was measured by self-report at T1 and T2, and physical measurement at T3. Longitudinal trajectories of BMI (continuous) were analyzed in relation to abuse history using linear random effects models, adjusting for age, education, race, parity, smoking and Medicaid coverage. Of the 1365 women in our sample, 405 (29.7%) women reported experiencing physical and/or sexual abuse. Approximately 21.5% of these had physical abuse, 51.8% had sexual abuse, and 26.7% had both physical and sexual abuse. Mean pre-pregnancy BMI was 27.6 for women who reported abuse compared to 26.8 for those who did not ( $p<.05$ ). Longitudinal analysis showed that BMI trajectories over the course of the study did not differ between the two groups ( $p=.61$ ). In this cohort of reproductive age women we find no evidence that women who experience physical or sexual abuse in childhood have a different trajectory of weight in adulthood. The differences observed at baseline may reflect different trajectories of weight gain in adolescence or childhood.

PB099

Periconceptional folic acid supplementation and childhood asthma, a Right From the Start pediatric follow-up study  
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Asthma is common in childhood. Prenatal folic acid (FA) has been studied as a risk factor for child asthma but study results are inconsistent. FA supplementation is recommended before conception to prevent neural tube defects. Here, we investigate if FA supplementation is associated with child asthma when initiated near/before conception versus later in pregnancy. We contacted mother-child dyads previously enrolled in Right From the Start, a prospective pregnancy cohort (2000-2012). We included children age 4 to <9 years at follow-up (2013-14) in this analysis. Using first trimester interviews, we estimated whether initial folic acid-containing supplement (FACS) use occurred near/before estimated conception ("periconceptional") or after ("first trimester"). Maternal questionnaires were used to define if a child ever had a provider diagnosis of asthma ("ever asthma") or had an asthma diagnosis with recent symptoms or medication use ("current asthma"). We examined associations between asthma outcomes and maternal FACS initiation using logistic regression, excluding preterm births and adjusting for child age and sex; maternal race, education, age, and parity; parental asthma and breast feeding. Of 3708 dyads, 1151 responded to surveys, 612 of whom were age 4 to <9. Excluding preterm births, we classified 543 dyads into periconceptional (45%) or first trimester (55%) FACS initiation status. Overall, 9% of children had an "ever asthma" diagnosis; 6% had current asthma. Periconceptional FACS initiation was associated with elevated odds of ever asthma (adjusted Odds Ratio(aOR): 1.83(95% Confidence Interval (CI):0.96, 3.5)) and current asthma (aOR: 2.01 (95%CI:0.93, 4.34)), relative to the first trimester. Conclusion: We observed positive, although not statistically significant, associations between periconceptional FACS use and child asthma outcomes. FA is key for prevention of neural tube defects, but larger studies of child asthma and FA dose and timing are needed.

PB100

Vitamin A deficiency in middle childhood is associated with asthma incidence through adolescence  
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Background. Asthma is the most common chronic disease in children. Its prevalence is on the rise in many countries worldwide. Diet has been involved in the etiology of asthma, but the role of specific nutrients remains uncertain. Objective. To determine if micronutrient status in middle childhood is associated with asthma incidence through adolescence. Methods. Using data from 1028 healthy Colombian school children enrolled in a cohort study at ages 5-12 y, we examined the association of baseline blood hemoglobin, ferritin, zinc, vitamins A and B12, and erythrocyte folate with physician-diagnosed incident asthma, per the children self-report, over a median 6.1 y of follow-up. We compared rates of asthma by categories of micronutrient status indicators and estimated adjusted hazard ratios (HR) with 95% confidence intervals (CI) using Cox regression. Results. There were 53 new cases of asthma during 6258 child-y of follow-up (rate = 8.47 per 1,000 child-y). The asthma rate of children with baseline vitamin A deficiency (VAD, serum retinol <0.7  $\mu\text{mol/L}$ ) more than doubled that of children without VAD (16.9 vs 7.7 per 1000 child-y;  $p = 0.02$ ). After adjustment for baseline age, height-for-age, and number of household assets the HR for children with vs. without VAD was 2.05 (95% CI: 1.08, 3.90;  $p = 0.03$ ). Further adjustment for C-reactive protein did not change the results. None of the other micronutrient status biomarkers was related to rates of asthma. Asthma incidence was also positively associated with height-for-age at recruitment and inversely related to the number of household assets. Conclusion. Vitamin A deficiency in middle childhood was associated with an increased incidence of asthma through adolescence in Colombian children.

PB101-S

Childhood lead exposure in relation to average sleep duration during adolescence: a longitudinal investigation conducted in Mexico City, Mexico

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**Background:** There is a potential link between early childhood exposure to lead (Pb) and sleep outcomes during later childhood. However, this evidence was based on self-reported rather than objective sleep measures. Furthermore, it is unknown whether the association persists into adolescence, a period marked by substantial changes in sleep patterns. **Methods:** The study population included 395 participants from the Early Life Exposure in Mexico to Environmental Toxicants project, a group of sequentially enrolled birth cohorts from Mexico City. Blood Pb levels were measured up to 9 times from ages 3 months to 5 years (y); values were averaged to estimate childhood exposure. Average sleep duration was assessed once between the ages of 9 and 18 y with wrist accelerometers worn for a continuous 7-day interval. Linear regression analyses were used, with average sleep duration as the outcome and log-transformed average childhood blood Pb level as exposure. Adjusted models included age, sex, and maternal education. **Results:** Mean (SD) age at follow-up was 14.7 (2.1) y, and 48% were boys. Median (Q1, Q3) average childhood Pb was 4.5 (3.6, 5.9)  $\mu\text{g/dL}$  and mean (SD) individual-averaged sleep duration was 7.9 (0.9) hours. There was not a statistically significant association between log-transformed childhood Pb and sleep duration at follow-up (adjusted  $\beta = -7$  minutes with 95% CI -23 to 8 minutes;  $P = 0.34$ ). However, in subgroup analyses, there was an inverse relation between Pb exposure and sleep duration among children  $< 13$  y of age ( $n = 106$ ). Every unit log-Pb was related to 24 minutes shorter average sleep duration after adjusting for age, sex, and maternal education (95% CI -46 to -1;  $P = 0.04$ ). **Conclusion:** Early childhood exposure to Pb may be related to shorter sleep duration in pre-teenage adolescents but not among those  $\geq 13$  y of age. Whether this difference is related to changes in sleep architecture that occur during adolescence should be further examined.

PB102

Otitis Media, Hearing Loss, and Sequela in Early Primary School Grades: The U.S. Early Childhood Longitudinal Study–Kindergarten Class of 2010–11 (ECLS–K:2011)

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**Objective:** To describe associations between parents' reported ear infections/otitis media since birth and hearing loss in second grade. **Methods:** ECLS–K:2011 children ( $n = 18,170$ ) were drawn from a national sample of public and private schools in 2010–11. Information on children's health, including medically-diagnosed ear infections (EIs) and hearing trouble (HT), was reported by parents; additional information was provided by teachers, schools, and daycare providers. Trained examiners administered age-appropriate assessments of intellectual development and hearing exams ( $n = 3,500$ ) in school settings. Logistic regression models were statistically-adjusted for covariates using national sampling weights. **Results:** EIs were reported during time periods: birth to age 2 (40% of children), birth to kindergarten entry (70%), kindergarten year (29%), 1st grade (19%), and 2nd grade (17%); 98% of reported EIs were medically-diagnosed. By spring 2nd grade, 27% of children had at least one time period with 3+ EIs; approximately 9% of children had been treated with pressure-equalization ear tubes (ETs). Three percent of children had HT by parental report (80% "a little"; 20% moderate/worse HT). After controlling for child's age, sex, race/ethnicity, and parents' education, the strongest associations with HT (2nd grade) were ETs, odds ratio [OR] = 16.5 (95%CI: 5.8–46.9) and 3+ EIs/without ETs, OR = 9.9 (95%CI: 5.4–18.4), followed by "diagnosed speech problems", OR = 10.4 (95%CI: 2.8–38.8) and "oppositional defiance" behavior, OR = 4.4 (95%CI: 1.3–15.0). HT was associated also with parents' report their child was "slightly less well able to pronounce words and communicate than other children their age", OR = 3.0 (95%CI: 2.0–4.4) and "much less than other children", OR = 5.3 (95%CI: 2.3–12.1). **Conclusion:** HT in 2nd grade was associated with EIs and risk was greatest for children treated with ETs. In addition to communication/speech problems, HT was associated with some behavioral problems.

PB103

Zika virus disease in children in Colombia

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**Background:** Children are considered a potentially vulnerable population for Zika virus infection. However, data on pediatric Zika virus infection are sparse. **Methods:** We analyzed data from Colombia's national surveillance system during the 2015--2016 Zika virus outbreak on patients meeting the clinical case definition of Zika virus disease (ZVD) among children aged 1 month--18 years to evaluate incidence by demographic characteristics and characterize the occurrence of selected complications, including hospitalizations and neurologic diagnoses. **Results:** Between August 14, 2015 and May 28, 2016, there were 18,576 reported cases of postnatal ZVD among children aged 1 month--18 years; 6.5% were laboratory confirmed (laboratory testing was prioritized for high risk patients --- infants, pregnant women, adults over 65 years, and persons with serious co-morbidities). The greatest number of cases had symptom onset the first week of February 2016 (N=1,391). Cumulative incidence of reported ZVD in this pediatric population was 114.4 per 100,000, with the highest reported incidence among children aged <1 year (257.3 per 100,000). Incidence differed by sex, depending on the age group; the largest difference was observed for 15--18 year olds, with females having a higher incidence than males (cumulative incidence ratio: 2.5, 95% confidence interval: 2.3, 2.7). At the time of report to the surveillance system, there were 631 pediatric patients (3.4%) hospitalized and 96 patients (0.5%) had accompanying neurological diagnoses, including Guillain-Barré syndrome (GBS; an autoimmune neurologic condition) in 40 patients; however most reports of neurological diagnoses including GBS have not been verified. **Conclusions:** Only a small proportion of reported pediatric ZVD cases in Colombia were hospitalized or had reported neurological conditions following ZVD. However, the potential for some serious outcomes demonstrates the importance of preventing Zika virus infection in children.

PB104

A Preliminary Examination of Racial Disparities in Children with Cerebral Palsy (CP): an intergene correlational analysis.

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The prevalence of CP in US children is higher in Black (B) than White (W) children. Using newborn mRNA transcripts (from archived newborn blood spots) we examined changes in the pattern of correlations among genes within a gene set since such changes reflect the possibility that the regulation of these genes differs between B and W children with CP. Data stem from a larger Michigan case-control study. Eligible participants (n=89) included children with a CP diagnosis, aged 2-15 years (yr), and mother self-identified as B (n=14) or W (n=75). Since B and W children with CP differed in gestational age (GA), we performed an unmatched analysis, controlling for birth yr, GA and sex; and a matched analysis matching the 14 B with up to 4 W children on birth yr and GA. In both analyses, Gene Set Net Correlational Analysis was used to assess differences between B and W in the pattern of correlations among expression values for genes within each gene set of interest. In the unmatched analysis (GA difference=2.8 wks), both the empirical inflammatory gene set (FIRS, p=0.040) and canonical hypoxic gene set (ASPHYXIAL, p=0.042) showed significant differences between B and W in the pattern of correlations among genes. For the hypoxic gene set, the gene TH (tyrosine hydroxylase, the first and limiting enzyme in catecholamine production), contributed greatly to this difference, with 7 genes having a strong relationship ( $r > 0.45$ ) with TH uniquely in W. For the FIRS gene set, S100A12 and S100A9 both had larger correlations with other genes in W. In the GA-matched analysis, (GA difference=0.2 wks) no significant difference in the pattern of correlations among genes was found for the hypoxic gene set. Differences between B and W for the FIRS gene set remained statistically significant (p=0.039), with S100A9 having a strong relationship with 5 other genes uniquely in W. Our analyses suggest the TH gene may play an important role in CP; GA may be related to differences in TH gene regulation.

PB105-S

Psychological and behavioral assets in childhood and the maintenance of optimal cardiometabolic health to age 17  
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Research suggests that the development of cardiometabolic disease begins early in life with behavioral and biological risk factors accumulating over time. However, less is known about protective resources that may promote health. This research uses data from the Avon Longitudinal Study of Parents and Children (n=2,827) to test whether positive psychological and behavioral factors in childhood are associated with a greater likelihood of maintaining optimal cardiometabolic health to age 17. Cardiometabolic health was defined using 7 biomarkers: high-density lipoprotein (HDL) cholesterol, non-HDL cholesterol, systolic blood pressure, diastolic blood pressure, C-reactive protein, insulin resistance, and body mass index. Biomarker levels were dichotomized using standard high risk cut-points, and youth were classified as unhealthy at ages 7 and 17 if they were high risk on 2+ biomarkers and healthy if they were high risk on  $\leq 1$ . A binary outcome was then created to indicate if a healthy risk profile was maintained or acquired from age 7 to 17. Scores on 7 measures of positive psychological skills (e.g. executive functioning) and behaviors (e.g. prosocial) were used to construct an index of childhood assets. Associations between assets and health were examined using Poisson regression models with robust variance estimates, and patterning of assets by social factors was assessed using Chi-squared tests. Youth with 4+ assets were 9% more likely to stay or become healthy by age 17 compared to those with  $\leq 1$  asset (p=0.05). Assets were socially patterned by gender (p<0.001), poverty (p=0.02), class (p=0.05), and maternal education (p=0.06) such that socially advantaged youth possessed more assets. These findings demonstrate that positive psychological and behavioral factors are health promoting over the lifecourse but negatively associated with low social status. Developing assets in children may be a promising primordial prevention strategy, particularly for disadvantaged youth.

PB106-S

Pilot Study of Reading Ability and Eye Movement in Children Treated for Congenital Cataract and Amblyopia  
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Existing literature suggests binocular vision is preferable to monocular vision, even for two-dimensional tasks, such as reading speed and quality. However, few studies have examined the role of monocular vision and its treatment on reading ability and quality of life in this population. The Studying the Effect of Eyesight in Kids (SEEK) Study investigated the impact of unilateral vision on quality of life in school-aged children. The study enrolled children ages 10-11 with unilateral congenital cataract (UCC) (n = 27) from the existing Infant Aphakia Treatment Study (IATS). Children diagnosed with amblyopia (n = 20) and normal vision controls (n = 54) were recruited from the waiting room of a pediatric eye clinic. All children underwent a ReadAlyzer assessment to measure reading ability. Using infrared eye tracking, the ReadAlyzer measured reading speed and recorded fine eye movements, such as fixations, forward saccades and backward saccades. During the assessment, participants silently read three passages of varied grade level text, including a third-grade level passage. At the third-grade reading level, children with UCC read faster compared with amblyopic children and normal vision controls. Forward saccades were fewer in the UCC group compared to normal controls and amblyopic children. More backward saccades were seen in amblyopic children and children with UCC compared to normal controls. Average fixation duration was similar in all three groups. Overall, children with unilateral vision did not differ significantly from the control group for any of the reading measures analyzed. Our preliminary results do not support the hypothesis that reading ability and eye movement at the third-grade level differs among children treated for unilateral vision compared to normal vision controls. Additional analyses will address potential confounding of these associations and incorporate the repeated reading measures collected on each child.

PB107

A Preliminary Examination of Racial Disparities in Children with Cerebral Palsy: Using gene expression and clinical data  
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We examined Black (B) and White (W) differences in clinical and biomedical factors previously associated with CP. Data stem from a larger Michigan case-control study. Eligible participants (n=89) included singleton-born B (n=14) and W (n=75) children with CP diagnosis, age 2-15 years (yr). We matched 14 B with up to 4 W children (52 in total), on birth yr and gestational age (GA). Conditional logistic regression was used to compare the 2 groups on clinical factors. To examine group differences in mean gene expression for and in intergene correlation within each focal gene set, we used Generally Applicable Gene Set Enrichment approach and Gene Sets Net Correlations Analysis, respectively. B mothers were younger and had less education. GA-matched groups did not differ in mean birthweight; but B were more likely to be small-for-GA. Trends also suggested B had a greater frequency of clinical signs of neonatal encephalopathy (NE) and severe functional limitations. For mean mRNA expression, in B (relative to W) mean expression levels were up-regulated in the empirical hypoxic gene set ( $p=0.036$ ). For intergene correlation, we found a significant difference between groups in the correlations between gene expression levels in those genes within the empirical inflammatory gene set (FIRS,  $p=0.038$ ). S100A9 (S100 calcium binding protein A9), a gene that regulates inflammatory processes and immune response, contributed greatly to this difference, showing stronger correlations among B. The observed dysregulation of the empirical hypoxic gene set paralleled the clinical findings of signs of NE in B with CP. Results also implicate dysregulated fetal-inflammation related pathways since there was stronger intergene correlation in B than W children with CP; driven largely by co-expression difference involving S100A9. S100A9 plays an important role in parturition; and is detectable in the maternal serum and amniotic fluid of women with intra-amniotic inflammation, a risk factor for CP.

PB108-S

Neonatal and health services outcomes following a planned caesarean section versus planned vaginal delivery in pregnancies with no clear maternal indication of cesarean section: A meta-analysis

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Objective: to conduct a meta-analysis of intervention and observational studies evaluating effects of planned mode of delivery in low risk women. Data Sources: We conducted a systematic search of PubMed (MEDLINE), Embase, Cochrane Library and Cochrane Pregnancy and Childbirth Group's Trials Register, CINAHL, SciELO, LILACS, and PsycInfo. Reference lists of eligible studies, relevant systematic reviews/meta-analyses/conference programs were manually reviewed to identify human studies in any language published January 1950-July 2015, using MeSH terms: "caesarean section," "delivery," "elective," "low risk," and "pregnancy" and synonyms. Study Selection: Of 2249 studies identified in the literature search, 12 met inclusion criteria. Data Extraction: Study characteristics were extracted independently by two investigators using a standardized abstraction form. Exposure was planned mode of delivery (vaginal delivery [VD] or cesarean section [CS]) and outcomes of interest were APGAR score, neonatal intensive care unit (NICU) admission, respiratory morbidity, cost, and maternal length of hospital stay. Data synthesis: Outcomes were pooled using the fixed or random effects model. Planned CS was associated with a higher risk of neonatal respiratory morbidity (odds ratio [OR]=2.07, 95% confidence interval [CI] 1.15-3.73; 3 studies with 158088 participants), lower 5 minute APGAR (OR=1.42, 95% CI 1.33-1.52; 2 studies with 125508 participants), higher cost (mean difference=\$1843; 95% CI 1792-1894; 2 studies with 245115 participants), and length of maternal hospital stay (mean difference=1.58 days, 95% CI 1.13-2.03; 5 studies with 249146 participants). No difference was found for NICU admission. Conclusions: This meta-analysis indicates that planned CS delivery increased risk of neonatal respiratory morbidity and low APGAR and increased cost and maternal length of hospital stay. Additional high quality studies are needed to better understand the effect of planned CS.

PB109

Risk factors for neonatal vitamin D deficiency

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**Risk factors for neonatal vitamin D deficiency** Weiguang Bi, Anne Monique Nuyt, Yuquan Wu, William Fraser, Shu Qin Wei. Obstetrics and Gynecology, Sainte-Justine Hospital, University of Montreal, Montreal, QC. **Introduction:** Vitamin D play an important role in infant's development. Vitamin D deficiency, defined as circulating 25-hydroxyvitamin D (25(OH)D) <50 nmol/L, is common in pregnant women and neonates worldwide. Vitamin D deficiency can lead to abnormal bone growth, fractures, or rickets in newborns. However, the risk factors are unknown. **Objective:** To evaluate the risk factors for neonatal vitamin D deficiency. **Method:** This was a prospective cohort study from 3D Cohort. We explored the associations between maternal characteristics and social economic status and infant's vitamin D status in cord blood. Cord plasma 25(OH)D levels were measured by liquid chromatography–mass spectrometry. **Results:** Deficient cord blood vitamin D status in infants were associated with maternal obesity (pre-pregnancy high body mass index (BMI)  $\geq 30.0$ ), non-white ethnicity, unemployed, and low household income (< 30,000\$) ( $p < 0.05$ ). Maternal asthma had increased risk of cord vitamin D deficiency (68.6% vs. 43.2%,  $p = 0.004$ ). Placenta abruption was associated with higher rate of 25(OH)D less than 50nmol/l ( $p = 0.01$ ). **Conclusion:** Our findings suggest that the likelihood for an infant to be born with vitamin D deficiency was related mainly to maternal obesity, non-white race/ethnicity, low family socioeconomic status, maternal asthma and placenta abruption.

PB110-S

Prenatal exposure to acetaminophen and childhood asthmatic symptoms in LA birth cohort

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**Background:** Prenatal exposure to acetaminophen has been linked to asthma in children, but a majority of studies were conducted in Caucasian population. Here we investigated the association between maternal use of acetaminophen in pregnancy and childhood asthmatic symptoms in a Los Angeles cohort with predominately Latina mothers and their children. **Methods:** We analyzed data from 1,201 mother and child pairs enrolled in the UCLA Environment and Child Health Outcomes Study (ECHOS). Information of prenatal acetaminophen use was collected in questionnaire from the mothers at 3–6 months postpartum. The mothers also indicated the trimester and frequency of use. Asthmatic symptoms of the children at age of 3.5 years were reported by the mothers using the International Study of Asthma and Allergies in Childhood (ISAAC) questionnaire. We used logistic regression to estimate the Odds Ratio (OR) and 95% confidence interval (CI) for asthmatic symptoms (including wheezing, dry cough, or asthma diagnosis) comparing acetaminophen users to non-users, adjusting for maternal socio-economic factors, maternal infection and fever during pregnancy and other potential confounders. Inverse-probability-weight was used to adjust for non-participations in the follow-up. **Results:** We found modest positive associations between prenatal acetaminophen exposure and asthmatic outcomes in children (i.e. OR=1.33; 95%CI: 0.99, 1.79 for wheezing, OR=1.43; 95%CI: 1.03, 1.97 for dry cough, and OR=1.42; 95%CI: 0.93, 2.16 for asthma diagnosis). The effect estimates appeared to strengthen when acetaminophen was used in the second and the third pregnancy trimester. Higher frequency of exposure (i.e. more than once a month) was associated with asthma diagnosis together with the presence of wheezing and/or dry cough (OR=1.78; 95%CI: 1.00, 3.17). **Conclusions:** Our findings lend additional support to the previously suggested link between in-utero exposure to acetaminophen and risk of asthma in childhood.

PB111-S

Intracranial Pressure Monitoring for Pediatric Traumatic Brain Injury

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**Background:** Traumatic brain injury (TBI) is a common injury experienced by youth in the United States accounting for an estimated 2 million ER visits among children <18 years old annually. Current guidelines for pediatric patients with severe TBI recommend intracranial pressure (ICP) monitoring to improve outcomes. We aimed to calculate the effect of ICP use on adverse outcomes (in-hospital mortality, discharge to a skilled nursing facility, long-term care or hospice) in patients with TBI. **Methods:** We defined our cohort as pediatric (age<18 years) patients with TBI who were admitted to a hospital participating in the National Trauma Databank from 2007-2014; this included 291,794 patients. We calculated the relative risk (RR) of an adverse event comparing patients undergoing ICP placement and those not within strata of TBI severity (Glasgow-Coma Scale [GCS] 3-8=severe, 9-13=moderate, 14-15=mild TBI), adjusting for GCS, injury severity score, polytrauma, age, race, blood pressure, region, hospital teaching status, trauma level and size. An ensemble learning approach, coupled with the use of targeted maximum likelihood, was used to obtain efficient estimates with maximal mitigation of confounding. **Results:** Patients with severe TBI were most likely to receive ICP monitoring (severe TBI 15.2%, moderate 3.0%, mild 0.2%). Overall, patients with ICP monitoring were more likely to have an adverse outcome (RR=4.28, 95% CI: 4.19-4.37), with higher risk among patients with lower TBI severity (severe: RR=1.56, 95%CI: 1.51-1.60; moderate: RR=3.86, 95%CI: 3.43-4.33; mild: RR=17.01, 95%CI: 16.42-17.75). **Discussion:** While the observed increase in adverse outcomes in monitored patients may be due to unmeasured confounding, the use of flexible techniques for confounding adjustment and the large cohort size provide a better estimate of the treatment effect than previously obtained. These findings suggest that the potential benefits of ICP monitoring should be scrutinized further.

PB112-S

Planned Out of Hospital Birth and Medicaid Policy Changes in Oregon

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Oregon has a high rate of out-of-hospital births among low risk women; publicly insured women account for more than 20% of these births. While Oregon is one of the few states to allow Medicaid reimbursement to direct entry midwives, changes in Medicaid policies, including transition to a system where networks of local providers constitute Coordinated Care Organizations (CCOs), may have influenced financing of out-of-hospital births among low-income women. We used linked 2008-2014 Oregon birth certificate, Medicaid enrollment, and Medicaid claims data to study planned and completed out-of-hospital birth among all women, Medicaid enrollment among out-of-hospital births, and payment for out-of-hospital births among enrollees. We assessed outcomes over three times: pre-CCOs (2008-2011); post-CCOs (2012-2013); and post-Medicaid expansion (2014) using logistic regression with robust standard errors for clustering of multiple births per woman. Analyses included singleton, cephalic, non-anomalous births at term (39-41 weeks) and excluded prior cesareans or unplanned out-of-hospital birth. Overall 4.5% (7,737/171,626) of births were planned and completed out of hospital. These births increased from 4.2% pre-CCOs to 4.9% post-CCOs (Odds Ratio [OR]:1.16 95%CI:1.11-1.22) and leveled off to 5.0% post-expansion. Medicaid enrollees accounted for 34% (2,636/7,737) of out-of-hospital births, increasing from 32% pre-CCOs to 35% post-CCOs (OR:1.14 CI:1.03-1.26) and to 39% post-expansion (OR:1.32 CI:1.15-1.52). Only 31% (812/2,636) of Medicaid-enrolled out-of-hospital births had paid claims. This figure dropped from 33% pre-CCOs to 27% post-CCOs (OR:0.76 CI:0.63-0.91) and rebounded to 31% post-expansion. Few women overall choose out-of-hospital birth, yet Medicaid-enrolled women comprise an increasing share of these births. CCOs may make reimbursement more difficult for healthcare providers who operate outside of clinical settings despite state policies that allow these reimbursements.



PB113

The effects of patient education on desire for multiples and use of single embryo transfer during assisted reproductive technology treatments: A systematic review  
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Although single embryo transfer (SET) can reduce the risk of multiple pregnancies due to assisted reproductive technology (ART) treatments, eligible patients may choose to transfer more than one embryo. We conducted a systematic review to evaluate the effectiveness of patient education among ART users on knowledge of multiple pregnancy risks, desire for multiples, SET preference or use, and multiple pregnancy rates. We searched PUBMED and EMBASE databases from January 1978 to June 2016 using Medical Subject Headings. Study selection and data extraction were performed by two authors. Studies were ranked for quality and assessed for risk of bias. Of 187 references retrieved, six were selected. The studies were conducted in four countries. Most focused on patients undergoing first ART cycle with mean age <35 years. Patient education was delivered via written materials, DVDs, or discussion. Four out of five studies reporting on knowledge of risks or desire for twins showed significant effects of oral and written descriptions of risk scenarios of multiple pregnancy complications, risks of twins versus singletons, and DVDs with factual information. All studies reported on SET use or preference with five showing improvements following education. SET use increased with education on multiple pregnancy risks combined with a single blastocyst transfer policy while preference also increased with education and hypothetical offers of insurance. None found any significant effect of education on twin rates. Patient education may increase awareness about success rates of livebirths of SET versus double embryo transfers, single blastocyst transfers, and maternal and infant health risks of twin pregnancies. Clinic policies and the availability of insurance coverage may further support these effects. These methods may be relevant in the U.S., where patient treatment preferences may be motivated by high out-of-pocket costs of ART.

PB114

The Spatial Concentration of Neighborhood Affluence and Its Protective Effect against the Risk of Prenatal Smoking  
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Poor maternal social environments pose significant risk to prenatal smoking behavior. Higher odds of prenatal smoking have been observed among women exposed to neighborhoods with low levels of affluence. With rising economic inequality in the U.S., affluence has become increasingly spatially clustered. No studies have yet accounted for this spatial clustering while investigating the effects of neighborhood affluence on prenatal smoking. Using geocoded New Jersey birth certificate records linked with U.S. census-tract level data (1999-2014; N=1,160,525), we analyze a spatially uninformed model (a multilevel logistic regression model) and a spatially informed model (a spatial multiple membership model) predicting prenatal smoking. Both models adjust for key covariates (maternal education, age, participation in Medicaid/Healthy Start, race-ethnicity) and were estimated within a Bayesian paradigm using Markov Chain Monte Carlo. Substantial global (Moran's  $I = 0.747$ ) and local (331 high-high clusters, 270 low-low clusters, 1 high-low cluster, 1 low-high cluster) spatial clustering of affluence was confirmed. Results showed a stronger effect of neighborhood affluence on prenatal smoking within a spatially informed model [adjusted odds ratio (AOR), 0.68; 95% confidence interval (CI), 0.67-0.69], than within a spatially uninformed model (AOR, 0.73; 95% CI, 0.70-0.75). Affluence is thought to improve individual-level health behaviors because affluent residents (highly educated, wealthy persons employed in prestigious occupations) can collectively leverage resources to attract health-promoting services to their community; these resources can benefit all residents regardless of individual-level socioeconomic status. Findings suggest women living in spatial clusters of low-low affluence may lack access to key health-promoting services. Policymakers could direct institutional and programmatic resources to these communities in an effort to stimulate higher smoking cessation rates.

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Although maternal smoking during pregnancy increases the risk for birth defects, it is not known whether policies targeting smoking would reduce these defects. Using data from the birth certificate on 23,105,560 mothers aged 16-49 years who delivered singletons in 47 states from 2005-2014, we used a conditional mixed-process model to assess the impact of tobacco control policies on birth defects. In the first stage, we estimated a probit difference-in-differences regression model to estimate the effects of state cigarette taxes and smoke-free legislation on maternal smoking during the first trimester. In the second stage, we estimated an additional probit model to examine the effect of a change in the predicted probability of smoking on each birth defect for a \$1.00 cigarette tax increase and the enactment of smoke-free legislation. Models were adjusted for maternal socio-demographic characteristics, infant sex, and state- and year-fixed effects. Overall, 9.1% of mothers smoked and 0.17% of their infants had a birth defect, with the highest rates among low-educated white mothers (37.2% and 0.28%, respectively). We found that among mothers with less than a high school degree, every \$1.00 increase in cigarette taxes reduced the level of smoking by 3.7 percentage points (-0.0366 95% CI -0.0638, -0.0093) and reduced the risk of their infant having any birth defect by 0.003 percentage points (-0.00003; -0.00006, -0.00001). This translates to a 1.8% reduction in the probability of having any birth defect. Tax increases also reduced the risk of limb reduction, cleft lip, and cleft palate, but not heart defects or gastroschisis. We did not find evidence for an association with smoke-free legislation nor associations among other racial/ethnic and educational groups. Our results suggest that there are important downstream effects of cigarette taxes on infant health and tax increases may be a potential population-level intervention to reduce smoking-related birth defects.