

TIDES UMN Publications

1. Lyden GR, Barrett ES, Sathyanarayana S, Bush NR, Swan SH, Nguyen RHN. Pregnancy intention and phthalate metabolites among pregnant women in The Infant Development and Environment Study cohort. *Paediatr Perinat Epidemiol.* 2020;34(6):736-743. doi: 10.1111/ppe.12674. PMID: [PMC7541656](#)

People who plan their pregnancies are more likely to engage in healthful behaviors of pregnancy, such as not drinking alcohol and taking folic acid. Our study examined whether pregnancy planners also try to limit their exposure to phthalates or other chemicals in the environment. In TIDES, most pregnancies (71%) were planned, and first- and third-trimester phthalate levels were similar between planned and unplanned pregnancies. This might mean that even pregnancy planners did not attempt to limit phthalate exposure or were not successful. We expected that people with unplanned pregnancies might decrease their exposure from the first to third trimester, after having more time to learn and make behavioral changes, but we did not observe this pattern in TIDES. Finally, we found no differences between planned and unplanned pregnancies in a survey of environmental health attitudes and behaviors. Our study confirms the need for universal educational campaigns about the risks of phthalate exposure to pregnant people and the developing fetus.

2. Lyden GR, Vock DM, Barrett ES, Sathyanarayana S, Swan SH, Nguyen RHN. A permutation-based approach to inference for weighted sum regression with correlated chemical mixtures. *Stat Methods in Med Res.* 2022 Apr;31(4):579-593. doi: 10.1177/09622802211013578. PMID: 35128995. PMID: In Process.

Many statistical methods can estimate the effect of a single treatment or exposure on health, but few methods exist to estimate the simultaneous effect of many exposures. This is an important topic in environmental health, where two key questions are: 1) What is the effect of combined exposure to a mixture of chemicals? and 2) If the effect is harmful, which chemicals are the “bad actors” (that is, most harmful)? A new statistical method called Weighted Quantile Sum (WQS) regression advocates a two-step approach, where each chemical is first assigned a weight and then an effect is estimated for the weighted combination of all chemicals. Unfortunately, correct application of WQS requires analysts to split their data in half, meaning there is less information available and scientific findings are less precise. In this paper, we develop the first statistical approach that can use the entire dataset to estimate chemical weights and overall mixture effects. Our method applies a penalized regression model from machine learning that can set weights to exactly zero for chemicals that do not appear to be bad actors (that is, penalize them), so that more weight is placed on true bad actors. In TIDES data, our method identified two phthalates that negatively affect male infant reproductive development, confirming the results of previous studies, which WQS was unable to do.

3. Bedell SM, Lyden GR, Sathyanarayana S, Barrett ES, Ferguson KK, Santilli A, Bush NR, Swan SH, McElrath TF, Nguyen RHN. First- and Third-Trimester Urinary Phthalate Metabolites in the Development of Hypertensive Diseases of Pregnancy. *Int J Environ Res Public Health.* 2021;18(20):10627. doi:10.3390/ijerph182010627. PMID: [PMC8536149](#)

Our study examined blood pressure and hypertensive diseases of pregnancy (such as pregnancy-induced hypertension and preeclampsia) in relation to first and third trimester phthalate levels from the urine samples provided by moms. We observed that higher levels of three types of phthalates found in the first trimester urine samples were associated with greater increases in blood pressure from early to late pregnancy (third trimester). One of these phthalates - monoethyl phthalate (MEP), which is found in a wide variety of consumer products including cosmetics and soaps - and two other phthalates were also significantly associated with diagnosis of a hypertensive disease not previously diagnosed during pregnancy. Future research will look at possible biological explanations for these findings and how the timing of phthalate exposure during pregnancy plays a role.

TIDES UMN Publications

4. Ricke IJ, Oglesby A, Lyden GR, Barrett ES, Moe S, Nguyen RHN. Knowledge, Attitudes, and Behaviors Regarding Chemical Exposure among a Population Sample of Reproductive-Aged Women. *Int J Environ Res Public Health* 2022;19:3015. doi:10.3390/ijerph19053015 PMID: [PMC8910600](https://pubmed.ncbi.nlm.nih.gov/3910600/)

We examined the knowledge and attitudes of reproductive-age women toward environmental chemicals and determined how these affect consumer behaviors. At the 2018 Minnesota State Fair, a large community sample of reproductive-age women was recruited to complete a survey on environmental health attitudes and behaviors. Descriptive statistics, chi-square tests, and logistic regression models were used to characterize current attitudes about chemicals. Multivariable logistic regression models examined how sociodemographic characteristics predict knowledge, attitudes, and consumer behaviors. A total of 871 women completed the survey; 74% strongly agreed that chemicals in the environment are dangerous, and 44% of women reported having heard of phthalates, while only 29% reported always practicing at least one environmentally healthy behavior (such as consuming food and beverages from safe plastics). Being older and working in a healthcare profession were associated with strong agreement that chemicals in the environment are dangerous. Women who strongly agreed that chemicals are dangerous were more likely to practice consumer behaviors to reduce their exposure. Interventions targeting knowledge and attitudes towards environmental chemicals could be an effective strategy for reducing harmful exposures.

5. Nguyen RHN, Knapp EA, Li X, Camargo CA, Conradt E, Cowell W, Derefinko KJ, Elliott AJ, Friedman AM, Khurana Hershey GK, Hofheimer JA, Lester BM, McEvoy CT, Neiderhiser JM, Oken E, Ondersma SJ, Sathyanarayana S, Stabler ME, Stroustrup A, Tung I, McGrath M. Characteristics of Individuals in the United States Who Used Opioids During Pregnancy. *J Womens Health (Larchmt)*. 2022 Nov 9. doi: 10.1089/jwh.2022.0118. Epub ahead of print. PMID: 36350685. PMID: In Process

Opioids are a class of drugs used as prescription pain relievers that can cause dependence or addiction. The opioid crisis has disproportionately affected women, and use of these drugs can have detrimental effects on women of reproductive ages and on developing fetuses. Previous studies of opioid use during pregnancy have been limited to individuals in specific geographic locations or those with specific types of insurance. The stigmatization of this population has also complicated the collection of data on maternal opioid use during pregnancy. Using a large sample size, this study examined opioid use in a diverse population of pregnant people across the United States to investigate rare exposures – such as polysubstance use - and characteristics associated with opioid use during pregnancy. The researchers gathered data from 20,000 pregnant people from 32 ECHO cohorts across the US who were already participants in ECHO cohorts between 1991 and 2021. Medical records, laboratory tests, and self-reports were used to assess opioid use and potentially related factors, such as demographics, use of other substances, and history of anxiety or depression. Most of the participants who used opioids were non-Hispanic White and had at least some college education. Opioid use was more common among people who used tobacco or illegal drugs, and those with a history of depression or anxiety. Additionally, opioid use during pregnancy in this study was rare—only 2.8% of participants used opioids during pregnancy, and the majority of opioid use originated from a prescription. Results from this study strengthened evidence about the co-occurrence of opioid use in pregnancy with depression and use of multiple substances (such as tobacco and illegal drugs). These findings will help to inform further research on screening tools for opioid use during pregnancy. Additionally, the finding that most opioid use originated from prescriptions reinforces the need to reduce the amount of circulating prescription drugs and to better monitor over-prescription of opioids to pregnant people and provide them with alternative treatment solutions for pain management and opioid dependency. This study shows that further research is needed on the factors that may lead to use of multiple substances during pregnancy and the association between substance use and depression. This research can help inform the development of screening tools and procedures for identifying individuals who are potentially at risk for opioid use during pregnancy.