LAY ABSTRACT

TITLE: Statistical Methods for Chemical Mixtures: A Roadmap for Practitioners Using Simulation Studies and a Sample Data Analysis in the PROTECT Cohort

JOURNAL: Environmental Health Perspectives. 2025 Jun; 133(6):67019.

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This is attributed to the CEECR grant: UG3CA267907

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Our environment, such as the air, water, food, and consumer products we use, can expose us to combinations of chemicals. Research on these environmental exposures often looks at more than one chemical at a time, and how these chemicals affect our health. Researchers use statistical tools to study these mixtures. Choosing the best tool can be hard and depends on the research questions. In this study, the research team compared eleven different tools to see how well they can identify (1) the most harmful chemical in a mixture, (2) how chemicals interact in a mixture to impact health, and (3) how much the chemical affects our health.

The research team used real-world data from a birth study in Puerto Rico called the PROTECT cohort to test the different statistical tools. They also created simulated (practice) data to further test the tools. They used these datasets to look at the relationship between chemical mixtures and a health outcome. The chemicals they looked at included certain metals, polycyclic aromatic hydrocarbons (PAHs), phthalates, and phenols, which have all been shown in past studies to negatively affect our health.

The researchers found that there is no best statistical tool that works for every chemical mixture and research question. Some tools are better at helping us understand how harmful each chemical in a mixture is for our health. Some methods are better at identifying the most harmful chemical in a mixture.

The study team has shared a software tool to help other researchers select the best method for their specific research question. Researchers can use these tools to study how environmental exposures affect cancer risk.