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Beyond the Light under the Lamppost: New Chemical Candidates for Biomonitoring in Young Children

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The National Institutes of Health research program known as Environmental Influences on Child Health Outcomes (ECHO) seeks to better understand how chemical exposures and other environmental factors affect children's health.[1] Of the vast number of potentially toxic chemicals used in the United States,[2] very few are routinely monitored in the U.S. population.[3] In a paper recently published in *Environmental Health Perspectives*,[4] researchers prioritized several dozen more chemicals for further study through ECHO.

First author Edo Pellizzari, lead fellow emeritus with the nonprofit RTI International, has spent nearly 40 years studying environmental pollutants, including their burden in the human body and effects on various health outcomes.

"I've noticed over the years that there's been a continued focus on a relatively small set of chemicals in our environment," Pellizzari says. "We felt that there were many more important chemicals that should be examined. Perhaps we should start looking beyond the light under the lamppost."

When Pellizzari joined the newly established ECHO program in 2016, he says, "It was an opportunity to pull all of these facets together into a national-scale study." Eventually ECHO will include 84 cohorts comprising more than 50,000 children followed from before conception to 5 years of age.[5] Investigators will assess the effect of pre-, peri-, and postnatal chemical exposures on health.

Pellizzari et al. also saw the 7-year study as an opportunity to break new ground. The new paper represents their effort at expanding the scope of ECHO—and that of research to come—beyond the 212 chemicals currently measured in the Centers for Disease Control and Prevention's longstanding National Health and

Investigators nominated 36 chemicals commonly encountered by mothers and children, including 12 pesticides, for biomonitoring in ECHO cohorts. Image: © emin kuliyev/Shutterstock.

Nutrition Examination Survey (NHANES).[6] Specifically, they sought to identify chemicals that mothers and children are likely to be exposed to in the course of their daily routines.

The authors began their search by scanning the U.S. Environmental Protection Agency Chemical and Products Database (CPDat)[7] as well as government reports and other scientific literature for potentially toxic chemicals that have not been measured in NHANES. From a list of 720 compounds found in air, water, food, or consumer products, they selected 155. The chosen chemicals fall into eight categories: alternative flame retardants, alternative plasticizers, aromatic amines, environmental phenols, organophosphorus-based flame retardants, perfluoroalkyl substances, pesticides, and quaternary ammonium compounds.

The authors' review of the available toxicological and human exposure data for these 155 chemicals showed varied evidence of potential endocrine, developmental, reproductive, and neurotoxic health effects. If a probable toxicant was known to be present in the environment or human populations—and also had an existing biomarker, or way of being measured in the body—the authors recommended it for biomonitoring as part of ECHO. Thirty-six chemicals met these criteria, including the alternative flame retardant hexabromocyclododecane,[8] the environmental phenol bisphenol A diglycidyl ether,[9] the perfluoroalkyl substance perfluorobutanoic acid,[10] and the pesticides azoxystrobin,[11] captan,[12] cyprodinil,[13] and glyphosate.[14]

For another 108 chemicals, the authors recommended that biomonitoring be deferred until investigators can fill in missing information on toxicity, exposure, and biomarkers. When more evidence becomes available, it may indicate these chemicals should be monitored through ECHO as well, Pellizzari says. The authors also classified 11 compounds as low priority for biomonitoring, based on the chemicals' limited occurrence, low reported toxicity, or both.

"We really need to move the field of epidemiology forward by broadening the list of compounds that we're evaluating," says senior author Deborah Bennett, a professor at the University of California, Davis. "We need to get at some of these less-studied compounds."

Dana Boyd Barr, a research professor in environmental health at Emory University and former NHANES investigator who was not involved in the new study,[15] says the paper is "very much needed in our community in order to prioritize work that should be done. It helps to define the priorities in this area and what I should be working on from a laboratory perspective."

University of Michigan professor John Meeker, who serves as co-chair of the ECHO Chemical Exposures Working Group but did not participate in the study, says the exhaustive effort also illuminated gaps and weaknesses inherent in existing databases. "Government, academic, and industrial scientists can look at this and help prioritize what to study next," Meeker says. "I think it's going to have broad application to people who want to be on the cutting edge of what chemicals we should be concerned about next and what chemicals might have fallen through the cracks."

Pellizzari says a forthcoming ECHO study will examine 28 of the chemicals identified by the team, along with 73 other related chemicals. "They will be measured by a single method in urine collected by ECHO cohorts for about five thousand children," Pellizzari says. "Other chemicals recommended in our paper would require a different method for analysis and may be done in the future."

Nate Seltenrich covers science and the environment from the San Francisco Bay Area. His work on subjects including energy, ecology, and environmental health has appeared in a wide variety of regional, national, and international publications.

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