"Association of Birth Outcomes with Fetal Exposure to Parabens, Triclosan and Triclocarban in an Immigrant Population in Brooklyn, New York" (2017), by Laura Geer, Benny Pycke, Joshua Waxenbaum, David Sherer, Ovadia Abulafia, and Rolf U. Halden [1]

By: Bains, Ajeet Keywords: The Florence Statement [2] paraben exposure [3] fetal health [4]

In 2017, Laura Geer and colleagues published the results of a study investigating the effects of parabens and antimicrobial compounds on birth outcome in the article "Association of Birth Outcomes with Fetal Exposure to Parabens, Triclosan and Triclocarban in an Immigrant Population in Brooklyn, New York" in the *Journal of Hazardous Materials*. Parabens are a class of preservatives found in cosmetic and pharmaceutical products and antimicrobial compounds are compounds that kill microorganisms such as bacteria. In the University Hospital of Brooklyn's Prenatal Clinic in New York City, New York, the authors tested the concentration of parabens and certain antimicrobial substances in pregnant women's urine and umbilical cord [5] blood plasma, finding that the concentration of one of the substances, triclocarban, may affect many health outcomes for the developing fetus [6]. The authors' results demonstrate how some common consumer products, in large quantities, may have harmful reproductive effects and birth outcomes.

As of 2019, Geer an associate professor and the Chair of the Department of Environmental and Occupational Health Sciences at the State University of New York Downstate School of Public Health in New York City, New York. Her research focuses on clinic-based environmental exposure and how certain environmental chemicals can impact maternal and infant health. Geer and her co-authors Benny Pycke and Rolf Halden of Arizona State University in Tempe, Arizona, along with Joshua Waxenbaum, David Sherer, and Ovadia Abulafia of the State University of New York Medical Center also in Brooklyn, New York, previously published research examining how maternal air pollutant exposures are linked to negative birth outcomes.

Parabens and antimicrobial chemicals such as triclosan and triclocarban are all endocrine-disrupting chemicals. Endocrine-disrupting chemicals, or EDCs, are compounds from the environment which may interfere with the body's endocrine system, which is a series of hormone [7] producing glands. EDCs can contribute to adverse health outcomes, such as immunological deficiencies and developmental effects in humans [8]. Exposure to parabens, triclosan, and triclocarban occurs primarily through use of cosmetics and antimicrobial consumer products in adults and, in newborns, ingestion of breast milk containing residues of chemicals.

Parabens are a class of chemicals used in cosmetics and foods as preservatives. Manufacturers add parabens to deodorants, shampoos, body lotions, and makeups to stop the growth of fungus, bacteria, and other harmful microbes. Parabens mimic estrogen [9], a hormone [7] in the human body that plays a role in sexual development, especially in females. Parebens bind to estrogen [9] receptors on cells when they enter the human body, which makes the body think the parabens areestrogen [9]. Research has shown that the perceived influx of estrogen [9] can trigger increased breast cell division and the development of tumors. Researchers have linked paraben exposure to the disruption of uterine blastocyst [10] implantation [11] in mice. That means that the mice's fertilized eggs do not implant into their uterus [12], which is a necessary step for pregnancy [13] to occur. Some scientists say that that evidence demonstrates a link between paraben exposure and poor reproductive health outcomes in rats, and potentially, other animals like humans [8].

Other scientists also assert that the antibacterial agents triclosan and triclocarban, commonly used in numerous products from personal care to industrial cleaning, exhibit endocrine-disrupting potential. Triclosan is a chemical added to several consumer products that reduces or prevents bacterial contamination. Scientists add triclosan to some antibacterial soaps, body washes, and cosmetics. According to Geer, various studies revealed an association between triclosan exposure and increased sensitivity of body tissue toward allergens in humans [8] and the inhibition of muscle function in mice. In a study looking at exposure and birth outcomes, triclosan was inversely associated with body length and birth weight, meaning that neonates that were exposed to triclosan tended to be smaller. Meanwhile, triclocarban is an antimicrobial active ingredient used worldwide in a wide range of cleansing products including deodorants, detergents, and cleansing lotions. Triclocarban is also a strong inhibitor of epoxide hydrolase, which is an enzyme involved in the process of cholesterol synthesis. In their paper, Geer and her team explored the extent of human fetal exposure to said endocrine-disrupting chemicals and antimicrobials with a particular focus on the presence of adverse birth outcomes identified previously in both human and animal models.

“Association of Birth Outcomes” consists of five main sections, including an introduction, materials and methods, results, discussion, and conclusions, along with a brief section at the beginning that explains what parabens, triclosan, and triclocarban are. In the methods section, the authors describe how they used previously collected data from an earlier study to obtain the certain concentrations of chemicals in maternal urine and umbilical cord [5] blood. In the results section, the authors describe the specific correlations between the parabens measured and certain negative birth outcomes. In the discussion section, the authors compare the results with other chemicals that have shown similar correlations. Finally, the authors reiterate their main findings within the conclusion.

In the methods section, the authors explain that they performed a chemical analysis on maternal urine samples that had originally been collected in two previous studies. The samples originated from an urban immigrant population previously investigated for prenatal exposure to mercury and certain antimicrobial compounds. The researchers in the original study recruited pregnant women, who ranged from eighteen to forty-five years old, at the University Hospital of Brooklyn’s Prenatal Clinic between October 2007 and December 2009. In order to compare the concentrations of the chemicals in the mothers’ urine samples to exposure within the fetus [6], the authors of the original study obtained anumbilical cord [5] blood specimen from the neonate for plasma isolation shortly after birth. Geer and colleagues also used a questionnaire that authors of the previous study had developed to establish the subjects’ demographic data, including maternal age, education level, and medical history. Geer and colleagues also used that questionnaire to determine the subjects’ sources of environmental exposure to the parabens. The authors of “Association of Birth Outcomes” shipped the blood and urine samples to Arizona State University to perform a new chemical analysis that determined the levels of triclosan and triclocarban in the samples.

Geer and colleagues then proceed to describe their results in the next section. They measured the quantity of different chemicals in maternal urine samples and umbilical cord [5] blood samples, and compared those values with information about birth weight, gestational age at birth, body length, and head circumference. The authors note that there were some inconsistencies in their data, such as some groups of people missing certain datasets. After applying a more stringent analysis of their data, the authors concluded that the results were not considered scientifically significant, which means that the relationship between the two variables was likely due to chance.

In the discussion section, the authors assert that their study was one of the first to measure the effects of maternal exposure to triclosan and triclocarban on fetuses, particularly in the time following birth. They talk about how high maternal levels of triclocarban were associated with decreased gestational age, body length, and weight at birth. However, the authors found no similar associations for other types of parabens such as methylparaben or ethylparaben, or for triclosan. Geer notes how decreases in gestational age, birth weight, and body length could be an indicator for additional adverse outcomes in early childhood, such as increased body weight or increased risk of diabetes. The extensive presence of chemicals like triclocarban in cosmetic and personal care products means that newborns may be at high risk for exposure when the pregnant woman is exposed while pregnant. The authors note that many studies have focused on the *in utero* effects of endocrine-disrupting compounds, many of which discuss bisphenol A [14], or BPA, which is an industrial chemical that has been used to make certain plastics. Research on such compounds often produced results similar to those found in Geer and colleagues' study. However, the authors also note that their results contradict some other studies. For example, in a 2008 study, Mary S. Wolff and colleagues found that exposure to triclosan was associated with low neonatal birth weight and shorter body length for male neonates. That differed from Geer and colleagues’ findings that triclosan had no effect on those variables. The authors note that study limitations may have resulted in those differences.

As of 2021, researchers have cited “Association of Birth Outcomes” over one hundred times. One such source was a joint document titled “The Florence Statement on Triclosan and Triclocarban,” signed by physicians and researchers calling for more transparency on antimicrobial products. In December of 2017, the US Food and Drug Administration [15], or FDA, issued a final rule on healthcare antiseptics containing twenty-three active ingredients, including triclosan-containing antimicrobial products. A final rule is an additional regulatory step that makes the regulatory process more transparent to the public and enables citizens to submit comments to the federal register. However, the FDA stated that the six most common antimicrobial chemicals were not included on the list of ingredients.

The authors’ study in an urban immigrant sub-population identified potential adverse birth outcomes inhumans [8], such as reductions in birth weight, gestational age at birth, and body length due to exposure to certain chemicals. Previous to the time at which Geer and colleagues released their study, many scientists relied on animal models to make comparisons between certain chemical exposures with birth outcomes. The International Federation of Gynecology and Obstetrics emphasizes the need for a better understanding of the reproductive health impacts from exposure to potentially toxic chemicals, particularly endocrine-disrupting chemicals. The authors call for additional research to study the potential reproductive effects of common consumer products that contain chemicals like triclocarban.

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- Contact Us

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