

Prenatal Exposure to Glycol Ethers and Neurocognitive Abilities in 6-Year-Old Children: The PELAGIE Cohort Study

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ABSTRACT

Background:

Glycol ethers are organic solvents used industrially in paints, dyes, inks and perfumes. They are also found in cosmetics and cleaning products. There are thousands of chemicals compounds that are considered glycol ethers as reported by the Environmental Protection Agency[1]. Humans can be exposed to various glycol ether compounds via inhalation and skin contact. Glycol ethers have been associated with acute health effects such as liver and kidney damage, and several families of organic solvents have proven neurotoxic properties. However, limited information is available on the human reproductive or developmental effects of glycol ethers[2].

The use of, or exposure to, glycol ether-containing products in pregnant women may negatively impact the neurodevelopment of the developing child. This is the only known study that has examined glycol ether exposure and specific impacts to children's health. There is a need for comprehensive research studying the potential role of liquid solvents in affecting children's development due to their particular vulnerability compared to adults.

Objective:

Researchers explored the relationship between glycol ethers (GE) found in pregnant women and the neurocognitive performance of their children at 6 years of age.

Methods:

The final study population consisted of 287 mother-child pairs from the PELAGIE Cohort in France between 2002 and 2006. Five types of GE were measured in 204 maternal urine samples (71% of the women) during the first trimester of pregnancy. GE concentrations were categorized into 3 levels, called tertiles. Each woman was asked to complete a questionnaire at recruitment and also when her child turned 2 and 6 years old. The questionnaire collected information on each child's health and potential exposure to solvents.

Psychologists performed 2 neuropsychological assessments on the children at 6 years of age: **1)** the Wechsler Intelligence Scale for Children (WISC) to generate scores for verbal comprehension (VCI) and working memory (WMI) and **2)** Developmental Neuropsychological Assessment (NEPSY) to measure children's ability to process and interpret visual information. Additionally, the Wechsler Adult Intelligence Scale (WAIS) was used to estimate the mothers' cognition skills, and a home assessment

was conducted. The home assessment measured to what extent the home environment fostered positive stimulation and support for the child.

The relationship between GE concentrations and WISC and NEPSY scores was assessed, adjusting for potential confounding variables such as maternal age and tobacco consumption.

Results:

The frequency of detection of the five GEs measured in maternal urine ranged from 91% for ethoxyacetic acid (EAA) to 100% for 2-Butoxyacetic acid (BAA) and phenoxyacetic acid (PhAA). There was a significant association observed between higher concentrations of PhAA during pregnancy and low WISC-VCI scores in children. There was also an association between high concentrations of EAA and poor visual performance on a particular subtest score (NEPSY). Because GEs typically clear out of the body quickly, the high prevalence observed in this study may reflect “common and repeated” exposures.

Conclusion:

This study found associations between maternal levels of two glycol ethers measured during pregnancy and indicators of specific neurodevelopmental deficits in their 6 year old children.

POLICY IMPLICATIONS

This study indicates that there are potential harmful effects to children’s neurodevelopment from prenatal exposure to glycol ethers. More research is needed to support these findings, but taking a precautionary approach to exposure risks would best protect children’s development.

Exposure to glycol ethers can occur via the workplace. The Occupational Safety and Health Administration (OSHA) establishes standards for glycol ether concentrations in workplace air. To best protect children who may be exposed prenatally, OSHA should revisit their standards as new research (such as this study) is published and consider tightening their standards accordingly. Effective since 2015, industries that want to use any of seven specific ethylene glycol ethers in a significant, new way, must notify the U.S. Environmental Protection Agency (EPA) at least 90 days before manufacturing or processing begins to determine the level of risk, if any, from the significant new use^[3]. A precautionary approach such as this is prudent, and EPA should be provided with full safety testing data from industry and additional time if the information provided is not sufficient. Another route of prenatal exposure to glycol ethers is via common consumer products. The U.S. Food and Drug Administration (FDA) should revisit the issue of limiting glycol ethers in products such as cosmetics, used by many women of childbearing age.

Investments are needed in further research and green chemistry, and the transparency and safety of consumer products, furnishings, and housing are essential. In addition, providing the public health field with the capacity and resources to bring awareness and to share preventive measures of exposure reduction is needed.

REFERENCE

[1] Toxics Release Inventory: List of Toxic Chemicals within the Glycol Ethers Category (2000). *Environmental Protection Agency*. Retrieved 21 April 2017 from <https://www3.epa.gov/ttn/atw/glycol2000.pdf>

[2] Glycol Ethers (2000). *Environmental Protection Agency*. Retrieved 21 April 2017 from <https://www.epa.gov/sites/production/files/2016-09/documents/glycol-ethers.pdf>

[3] Ethylene Glycol Ethers; Significant New Use Rule. (2014). *Office of Federal Register*. Retrieved 20 April 2017, from <https://www.federalregister.gov/documents/2014/12/16/2014-29429/ethylene-glycol-ethers-significant-new-use-rule>

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