

# Children exposed to the common pollutant naphthalene show signs of chromosomal damage

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According to a new study, children exposed to high levels of the common air pollutant naphthalene are at increased risk for chromosomal aberrations (CAs), which have been previously associated with cancer. These include chromosomal translocations, a potentially more harmful and long-lasting subtype of CAs.

Researchers from the Columbia Center for Children's Environmental Health (CCCEH) at the Mailman School of Public Health, Columbia University Medical Center, and the [Centers for Disease Control and Prevention \(CDC\)](#) report the new findings in *Cancer, Epidemiology, Biomarkers & Prevention*, a journal of the American Association for Cancer Research.

[Naphthalene](#) is found in both outdoor and indoor urban air. It is present in automotive exhaust, tobacco smoke, and is the primary component of household mothball fumes. Classified as a possible carcinogen by the International Agency for Cancer Research, naphthalene belongs to a class of air pollutants called polycyclic aromatic hydrocarbons (PAH). Prior research at the CCCEH has established a link between prenatal exposure to PAH and increased risk for childhood obesity, IQ deficits, and CAs. The new study is the first to present evidence in humans of CAs, including translocations, associated with exposure to one specific PAH—naphthalene—during childhood.

The researchers followed 113 children, age 5, who are part of a larger cohort study in New York City. They assessed the children's exposure to naphthalene; a CDC laboratory measured levels of its metabolites—1- and 2-naphthol—in urine samples. (Metabolites are products of the body's metabolism, and can serve as marker for the presence of a chemical.) Researchers also measured CAs in the children's white blood cells using a technique called fluorescent in situ hybridization.

Chromosomal aberrations were present in 30 children; of these, 11 had translocations. With every doubling of levels of 1- and 2-naphthol, translocations were 1.55 and 1.92 times more likely, respectively, to occur.

CAs have been associated with increased cancer risk in adults.

Translocations are of special concern as they result in a portion of one chromosome being juxtaposed to a portion of another chromosome, potentially scrambling the genetic script. "Translocations can persist for years after exposure. Some accumulated damage will be repaired, but not everyone's repair capacity is the same. Previous studies have suggested that chromosomal breaks can double an adult's lifetime risk for cancer, though implications for children are unknown," says first author Manuela A. Orjuela, MD, ScM, assistant professor of clinical environmental health sciences and pediatrics (oncology) at Columbia University Medical Center and a pediatric oncologist at New York-Presbyterian Morgan Stanley Children's Hospital.

To obtain a better sense of the long-term consequences of naphthalene exposure, Dr. Orjuela and other CCCEH investigators are following some of the children in the study as they reach fourth grade. While they expect to see further translocations, they do not expect to see any signs of cancer in the white blood cells. "So far, the translocations seem to be random, and there has been no evidence of the specific translocations that are known to be associated with leukemia. This is entirely expected; leukemia is very rare." Frederica Perera, DrPH, senior author on the

paper, adds that "the findings provide yet more evidence of the vulnerability of the young child to carcinogenic air pollutants."

The researchers hypothesized that naphthalene exposure was primarily from mothballs, which can release high levels of the chemical. Furthermore, according to previous research, some Caribbean immigrant families use mothballs as an air freshener. Other important sources of naphthalene in indoor air are tobacco smoke, paint fumes, cooking, and heating. The new findings have implications beyond the urban environment as elevated levels of naphthalene metabolites have been documented in rural communities using biomass-burning stoves (coal, wood)—another source of PAH exposure.

Provided by Columbia University's Mailman School of Public Health

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