Adverse Birth Outcomes

Study Results

Evaluation of contaminated drinking water and preterm birth, small for gestational age, and birth weight at Marine Corps Base Camp Lejeune, North Carolina: A cross-sectional study

Study Purpose

The purpose of this study was to determine if maternal exposures to contaminants in drinking water at Camp Lejeune were associated with preterm birth and fetal growth retardation. This study is a reanalysis of a previous study, which incorrectly categorized as "unexposed" some maternal exposures before June 1972 based on information available at the time.

Besides considering the re-categorized births to exposed women, the Agency for Toxic Substances and Disease Registry (ATSDR) recreated monthly estimates of past levels of drinking water contamination using computer models. These estimates were not available when the first study was conducted.

Drinking water at Camp Lejeune was contaminated with volatile organic compounds (VOCs) including trichloroethylene (TCE), tetrachloroethylene (PCE), benzene, 1,2-dichloroethylene (DCE) and vinyl chloride from the 1950s through 1985.

What Was Studied

The study included live singleton births 28-47 weeks gestation weighing 500 grams or more. The births occurred between 1968 and 1985 to women who resided on base for at least one week before giving birth. These years were chosen because computerized birth certificates in North Carolina became available in 1968 and the contaminated wells on base were shut down in 1985. The authors cross referenced birth certificate data for Onslow County, NC, where Camp Lejeune is located, with Camp Lejeune housing records and identified 11,896 births that met the study criteria.

Outcomes of interest in this study were preterm birth and fetal growth retardation. Fetal growth retardation was measured by reduced mean birth weight (MBW), term low birth weight (TLBW), and small for gestational age (SGA). Information about these outcomes was obtained from birth certificates. Preterm births were defined as births occurring at less than 37 weeks of gestation. Gestational age was calculated using date of mother's last menstrual period from the birth certificate. TLBW was defined as full-term babies (37 weeks or more gestation) weighing less than 2,500 grams at birth. SGA births were defined as births weighing less than the 10^{th} percentiles using sex- and race-specific weight by gestational week norms. For the MBW analysis, only full-term infants were included.

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Features of this Study

Because of the lack of exposure information, ATSDR used extensive water modeling to reconstruct exposures before 1987. The water modeling allowed the investigators to examine associations between monthly estimates of exposures to VOCs in drinking water at the residences and the risk of adverse birth outcomes.

Conclusion and Key Results

The following effects were seen in births from 1968-1985 to women exposed to contaminated drinking water at Camp Lejeune. These findings also apply to women who gave birth before 1968 if they were exposed to similar levels of VOCs-contaminated drinking water.

- Exposure to PCE in the womb was associated with preterm birth (before 37 weeks of pregnancy).
  - For PCE and preterm birth, the strongest association was seen for exposures during the 2nd trimester (4th to 6th months).
- Exposure to TCE in the womb was associated with SGA, TLBW and reduced MBW.
  - The risk of TLBW increased with increasing levels of exposure to TCE during the 2nd trimester.
  - The finding for SGA is consistent with findings from a previous study conducted in Woburn, MA.
- Exposure to benzene in the womb was associated with TLBW.
  - The risk of TLBW increased with increasing levels of exposure to benzene throughout the pregnancy.