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Hazardous Air Pollutants (HAPS)

The increased awareness in recent years of the dangers of toxic air pollutants has caused Congress to design regulatory efforts to control toxic substances in the air. These hazardous air pollutants (HAPS) are air pollutants for which National Ambient Air Quality Standards (NAAQS) do not exist. These pollutants may be expected to cause cancer, developmental effects, reproductive dysfunctions, neurological disorders, heritable gene mutations, or other serious or reversible chronic or acute health effects in humans.

More

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The Clean Air Act of 1970 required the EPA to set National Emission Standards for Hazardous Air Pollutants (NESHAPS). These standards would be required to provide an "ample margin of safety" to human health. However, unlike criteria pollutants, HAPs have no exposure threshold. In other words, there is no minimum amount or duration of exposure to a HAP that can be considered "safe". Because of this, twenty years later only eight pollutants were being regulated as HAPs. NESHAPS were established for asbestos, vinyl chloride, benzene, arsenic, beryllium, mercury, radon, radionuclides other than radon.

The Clean Air Act Amendments (CAA) of 1990 established a new approach for regulating HAPs on the federal level. The amendments revised the Clean Air Act to include 189 compounds as hazardous air pollutants. Recently one pollutant was removed from the list. Standards for these 188 HAPs would be set solely on the basis of available control technology. The current terminology associated with the new standards is "maximum available control technology" or MACT. Sources of HAP emissions subject to MACT standards are categorized as either major or area sources.

Major sources are defined as those sources having the potential to emit ten or more tons per year of any individual HAP or 25 tons per year of any combination of HAPs. The maximum available control technology is determined differently for new and existing sources. MACT for all new sources must be equivalent to the best controlled similar source in a given industry. MACT for existing sources represents the average emission limit achieved by the best-performing 12 percent of the existing sources for which the EPA has information. Existing sources have three years to comply with the applicable MACT standard. MACT standards can be technology based, health based, work practice based, or combinations thereof. Control methods for HAPs are similar to those for the criteria pollutants. The method utilized depends on whether the HAP is a particulate, volatile organic compound (VOC), or a gas.

Area sources are any stationary sources of HAPs that are not major sources; however development of an emissions standard is not required unless an area source category presents a threat to public health or the environment. To date only eight area source categories have been identified and are subject to MACT standards. These include:

- Asbestos Processing
- Chromic acid Anodizing
- Commercial Dry Cleaning Transfer Machines
- Commercial Dry Cleaning Dry-to-dry Machines
- Commercial Sterilization Facilities
- Decorative Chromium Electroplating
- Hard Chromium electroplating
- Halogenated Solvent Cleaners

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Hazardous Air Pollutants and Adverse Birth Outcomes in Portland, OR

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Background: The impact of multiple hazardous air pollutant (HAP) exposures during pregnancy on adverse birth outcomes is unknown. We examined associations between cumulative and individual HAP exposures and adverse birth outcomes in Portland, OR, a region that has exceeded HAP air quality guidelines for decades.

Methods: We used vital statistics records in the Portland Metropolitan Region from 2000 to 2014 (n = 279,051 births). Prenatal exposure to 19 HAPs was assessed using a dispersion model applied to maternal residential address at delivery. We used linear and logistic multivariate regression models to assess associations between individual and cumulative HAP exposures and preterm term (PTB), term birth weight (TBW), and small for gestational age (SGA), adjusting for several potential individual and neighborhood confounding factors.

Results: We observed no associations for composite HAP exposure metrics and adverse birth outcomes. Associations were observed in fully adjusted models comparing the highest to lowest quintiles of exposure for certain HAPs including chromium VI and TBW (−12.70; 95% confidence interval [CI]: −23.10, −2.31); 1,3-butadiene and TBW (−16.86; 95% CI: −29.66, −4.06) and SGA (1.18; 95% CI: 1.07, 1.30); and cadmium and TBW (−31.37; 95% CI: −56.20, −.54). For some HAP metrics, we observed higher HAP exposures for minority groups and large unadjusted associations between other HAPs and adverse birth outcomes, but most associations were attenuated in adjusted models.

Conclusions: Adverse birth outcomes were not consistently associated with most HAP exposures in Portland, OR, although some specific air toxic exposures warrant further attention.

Keywords: Adverse birth outcomes; Hazardous air pollutants; air toxics; preterm birth; small for gestational age; birth weight; chromium; cadmium; 1,3-butadiene

Background

Currently, the United States Environmental Protection Agency (EPA) regulates emission of 187 specific hazardous air pollutants (HAPs) via the Clean Air Act.[1] Unlike criteria air pollutants, HAPs are defined as air toxics with known or suspected serious health effects, usually focusing on cancer outcomes.[1] However, 105 of these 187 HAPs are known to be associated with health effects other than cancer, including adverse birth outcomes.[2] Many areas, such as Portland, OR, attain criteria air pollutant standards but fail to maintain HAP levels that are compliant.[3,4] There is no exposure threshold for HAPs that is considered safe for human health per the EPA,[1] but there is a dearth of epidemiological research linking HAP exposure to birth outcomes.

Most of the evidence for an association between HAP and adverse pregnancy outcomes come from studies of traffic-related air pollutants. For example, a meta-analysis of 62 studies observed a decrease in term birth weight of 28.1 g (95% confidence interval [CI]: −44.8, −11.5) per 20 ppb increase in nitrogen dioxide (NO_2).[5] NO_2 is a surrogate for the traffic-related air pollution mixture that contains numerous HAPs, such as diesel particulate matter (DPM), polycyclic aromatic hydrocarbons (PAHs), and benzene, toluene, ethylbenzene, and xylene (BTEX).[6,7] While there are fewer studies specifically examining nonvehicle air toxic exposures, some studies have observed associations between adverse birth outcomes and nonspecific ambient HAP exposures to PAHs, chromium, and nickel[8–10] as well as proximity to industrial sources such as oil and gas development,[11–14] coal power plants,[15–17] mining activity,[18,19] and metal smelters.[20] Overall, there are limited studies examining exposure to specific HAPs during pregnancy, especially HAP mixtures from multiple sources.[5,21,22]

What this study adds

Using a vital statistics cohort (n = 279,051 births), our study examined associations between adverse birth outcomes and hazardous air pollution (HAP) exposures in Portland, OR. Few studies have addressed the effects of HAP exposures during pregnancy, a major shortcoming to the literature that we address in a city with high HAP concentrations and extensive community concern. We documented exposure gradients by sociodemographic characteristics, highlighting a potential environmental inequity. However, we did not observe consistent associations between adverse birth outcomes and cumulative HAP exposures after accounting for sociodemographic characteristics. Some HAP-specific models (e.g., butadiene, cadmium, chromium) demonstrated elevated risks that should be investigated in more depth.

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The data used in this research are not publicly available but can be requested from the Oregon Vital Statistics program.

SDC Supplemental digital content is available through direct URL citations in the HTML and PDF versions of this article (www.environepidem.com).

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