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Dioxin Emissions From a Municipal Solid Waste Incinerator and Risk of Invasive Breast Cancer: A Population-based Case-control Study With GIS-derived Exposure

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[Authors and Disclosures](#)

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Abstract and Background

Abstract

Background: To date, few epidemiologic studies have examined the relationship between environmental PCDD/F exposure and breast cancer in human populations. Dioxin emissions from municipal solid waste incinerators (MSWIs) are one of the major sources of environmental dioxins and are therefore an exposure source of public concern. The purpose of this study was to examine the association between dioxins emitted from a polluting MSWI and invasive breast cancer risk among women residing in the area under direct influence of the facility.

Methods: We compared 434 incident cases of invasive breast cancer diagnosed between 1996 and 2002, and 2170 controls randomly selected from the 1999 population census. A validated dispersion model was used as a proxy for dioxin exposure, yielding four exposure categories. The latter were linked to individual places of residence, using Geographic Information System technology.

Results: The age distribution at diagnosis for all cases combined showed a bimodal pattern with incidence peaks near 50 and 70 years old. This prompted us to run models separately for women aged 20-59 years, and women aged 60 years or older. Among women younger than 60 years old, no increased or decreased risk was found for any dioxin exposure category. Conversely, women over 60 years old living in the highest exposed zone were 0.31 time less likely (95% confidence interval, 0.08-0.89) to develop invasive breast cancer.

Conclusion: Before speculating that this decreased risk reflects a dioxin anti-estrogenic activity with greater effect on late-onset acquired breast cancer, some residual confounding must be envisaged.

Background

Established risk factors for breast cancer are hormonally mediated: age, family history of breast cancer, early menarche, late menopause, late first full-term pregnancy or nulliparity, breast density, and benign breast disease.^[1,2] But taken together, these well-established risk factors account for only about half of all breast cancer cases.^[3] Considerable interest has therefore recently focused on environmental contaminants having the potential to affect breast cancer risk, although explicit environmental links to this disease are still limited.

Dioxin is the name given to two classes of organochlorine compounds; 75 polychlorinated dibenzo-*p*-dioxins (PCDD) and 135 polychlorinated dibenzofurans (PCDF). Seventeen tetrachloro-substituted congeners are toxic, with 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD) being the most potent. The U.S. Environmental Protection Agency and the International Agency for Research on Cancer have classified TCDD as a human carcinogen.^[4,5]

This compound is also known to disrupt multiendocrine pathways in animals at body burdens which are

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close to those present in the background human population.^[10]

However, accumulating evidence suggests that TCDD also possesses estrogen-like activity. TCDD induces an estrogen-like gene expression profile in the uteri of immature ovariectomized mice in the absence of histopathological or morphological manifestations,^[11] and mediates the induction of estrogen dependent tumors in rat.^[12,13]

The opposing actions of TCDD, anti-estrogenic in the presence of estrogen and estrogenic in its absence, suggest that the effects of TCDD may vary depending on developmental stage at exposure.^[13]

To date, few epidemiologic studies have examined the relationship between PCDD/Fs and breast cancer in human populations. Most of these have consisted of occupational cohorts yielding conflicting results.^[14] Warner et al. have recently conducted a retrospective cohort study to examine the association between serum TCDD levels and breast cancer risk in women residing around Seveso, Italy, in 1976, at the time of an industrial explosion that resulted in the highest known population exposure to TCDD.^[15] Twenty years later, the relative risk for breast cancer associated with a 10-fold increase in serum log₁₀ TCDD levels was significantly increased by 2.1-fold (95% confidence interval [CI], 1.0-4.6), while adjusting for established breast cancer risk factors.

Dioxin emissions from municipal solid waste incinerators (MSWIs) are one of the major sources of environmental dioxins and are therefore an exposure source of public concern. Our team recently detected a cluster of non-Hodgkin lymphoma (NHL) in an area that contains a MSWI with high dioxin emission levels (Besançon, France).^[17]

Both the suggestive results by Warner et al.,^[15] and the availability of a validated dispersion model as a proxy for dioxin exposure, prompted us to carry out a population-based case-control study focusing on breast cancer in the vicinity of this MSWI.

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