

Breast cancer risk in relation to occupations with exposure to carcinogens and endocrine disruptors: A Canadian case-control study¹

Summary of the Research Findings

INTRODUCTION

Breast cancer is the most commonly diagnosed cancer in Canadian women. Less than half of the cases can be explained by such traditionally recognized risk factors as family or reproductive history. Breast cancer is likely caused by a combination of environmental, genetic, hormonal, and lifestyle influences. In industrialized countries, breast cancer incidence increased dramatically in the second half of the twentieth century as thousands of new chemicals with unknown health effects were being introduced and women were entering the workforce in record numbers. From advances in research we are learning about the relationship between chemical exposures and disease. It is believed that there is a complex interaction in the human body between cancer-causing and hormone disrupting agents in which the endocrine system plays an important role. The exposure history of workers can generally be reconstructed with much greater accuracy than for the general population. Workers who are exposed occupationally can encounter much higher concentrations of toxic chemicals and therefore be at a greater risk for developing cancer. The purpose of this study was to contribute to a better understanding of cancer causation, particularly for work-related breast cancer.

BACKGROUND AND METHODS

This research was conducted in Essex and Kent counties in southern Ontario, Canada, where there is extensive manufacturing and agriculture. Two previous smaller studies in this area found elevated breast cancer risk related to farming and subsequent work in the automotive industry. This study involved 1006 women with breast cancer and 1147 women without the disease who provided detailed occupational histories in order for the researchers to identify potential exposures to carcinogens and endocrine disruptors. Participants also provided information on reproductive risk factors including number of pregnancies,

history of breastfeeding, age at menstruation and menopause, as well as risk factors such as level of physical activity, alcohol use and smoking history.

Some workers face a toxic burden made up of multiple exposures to chemicals from their paid employment, everyday environment, consumer products, and dietary sources. Airborne exposures are of particular concern as women in some of the industries examined in this study described the air in their workplace as a "toxic soup" of chemicals. Women's occupational health has not been a priority for researchers and regulators despite the fact that many workers are regularly exposed to cancer-causing agents and endocrine disrupting chemicals at work.

CARCINOGENS, ENDOCRINE DISRUPTORS & WINDOWS OF VULNERABILITY

Carcinogens: There are several stages involved in the development of cancer including initiation, promotion and progression. The complex mixture of chemical exposures in the industrial workplace may have an impact on each of these stages.

Endocrine Disrupting Chemicals: Synthetic chemicals can disrupt a variety of essential endocrine functions in the body. Disruption of the delicate hormone balance can result in reproductive disorders, immune system dysfunction, some cancers, birth defects, and neurological effects. In traditional toxicology a higher dose of a substance is expected to produce a greater effect. This is not necessarily the case with endocrine disrupting chemicals which can have health impacts even at very low levels.

Windows of Vulnerability: The timing of chemical exposure and stage of biological development can have an impact on a woman's risk of developing breast cancer. Women are more susceptible to the effects of endocrine disrupting

¹ Brophy, J., Keith, M., Watterson, A., Park, R., Gilbertson, M., Maticka-Tyndale, E., Beck, M., Abu-Zahra, H., Schneider, K., Reinhartz, A., DeMatteo, R., & Luginaah, I. (2012). "Breast cancer risk in relation to occupations with exposure to carcinogens and endocrine disruptors: A Canadian case-control study." *Environmental Health*. <http://www.ehjournal.net>.

chemicals before breast tissue is fully matured. This study considered cumulative exposures during four critical windows: a) before menstruation, b) menstruation to the first full term pregnancy, c) first full term pregnancy to menopause, and d) after menopause.

FINDINGS

Across all subjects in this study there was a statistically significant association of breast cancer risk with work in jobs classified as highly-exposed; 10 years of work in such jobs was estimated to increase breast cancer risk by 42 percent. For many specific sectors, with small numbers of women workers, there were too few people to show significant results, but for work in agriculture, metal-related manufacturing, automotive plastics, food canning operations, bars and casino work, statistically significant excesses were observed. Women who worked for ten years in jobs classified as highly exposed to cancer-causing substances and endocrine disrupting chemicals in the following occupational groups were found to have a higher risk for developing breast cancer:

Farming: A 36 percent increased breast cancer risk (OR=1.36) was found in the farming sector. Research has shown several pesticides act as mammary carcinogens and many are endocrine disrupting chemicals. Employment in farming, and thus the related chemical exposures, often begins earlier in women's lives than for other occupations. This may be a significant factor in cancer development.

Plastics: A statistically significant more than 2-fold increased breast cancer risk was found in the automotive plastics industry sector (OR=2.68). The increase rose to an almost 5-fold excess among those who were pre-menopausal. Many plastics and additives have been found to release estrogenic and carcinogenic chemicals and cumulative exposures to mixtures of these chemicals are a significant concern.

Food Canning: A statistically significant 2-fold breast cancer risk was found in the food canning sector (OR=2.35). The increase rose to more than 5-fold among those who were pre-menopausal. Exposures to chemicals in the food canning industry may include pesticide residues and emissions from the polymer linings of cans. There has been little research conducted on women's health in this industry.

Metalworking: A statistically significant 73 percent increased breast cancer risk was found in the metalworking sector (OR=1.73). Women working in tooling, foundries, and metal parts manufacturing are exposed to a variety of potentially hazardous metals and chemicals. There has been little research conducted on breast cancer risk in this area, but this could have relevance for a broad range of blue-collar industrial operations.

Bar/Casino/Racetrack: A 2-fold increased breast cancer risk approaching statistical significance was found in the bar/casino/racetrack sector (OR=2.28). The elevated risk of developing breast cancer may be linked to second-hand smoke exposure and night work which has been found to disrupt the endocrine system.

IMPLICATIONS

Study of occupational risks for breast cancer has been a neglected area of research. This study demonstrates the value of including detailed work histories in the environmental and occupational epidemiology of breast cancer. Although exposures to the myriad of specific agents in the work environment could not be individually discerned for this study's population, the strong, significant associations based on a generic classification system imply the likelihood that carcinogens and endocrine disrupting chemicals in these work environments increased breast cancer risk. Resources should be aggressively allocated to preventing occupational exposures to cancer-causing and endocrine disrupting chemicals linked to breast cancer. Furthermore, women who have developed breast cancer from workplace exposures should be compensated. To date no women in Canada from any of the sectors identified in this study which pose an increased risk of breast cancer have received workers' compensation. These findings also have important implications for the general public where exposures to similar agents may occur, albeit at much lower levels. Because lower exposure levels may not be protective in the case of carcinogens or endocrine disrupting chemicals, the findings point to the need to re-evaluate the occupational and environmental exposure limits established by government, keeping in mind that there may be no determinable safe levels.

The full study, tables and references can be found on the websites of the National Network on Environments and Women's Health (www.nnnewh.org), the University of Windsor (www.uwindsor.ca/socanth), the Canadian Women's Health Network (www.cwhn.ca), the Canadian Breast Cancer Foundation (www.cbcbf.org), the University of Stirling (www.stir.ac.uk), and Environmental Health (www.ehjournal.net).

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