



Breast cancer and the environment: what is left to learn?

*A Countercurrents Series^a with
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Public interest in the link between the environment and breast cancer has waxed in recent months. In the two decades that I have been involved in breast cancer research, a level of interest in occupation and the environment has always been simmering—with a wealth of lukewarm research results—but the topic resurfaced with renewed vigor in 2012.

In 2011, the Institute of Medicine in the United States published a thick monograph (443 pages) titled *Breast Cancer and the Environment: A Life Course Approach*, which is available free of charge for anyone with Internet access and a ream of paper¹. They concluded (not surprisingly) that more research is needed and that environmental factors are indeed important causes of breast cancer, provided that “environment” is redefined in a more convenient way. The new “environment” includes hormone replacement therapy, alcohol intake, body weight, obesity, and exercise. Every opportunity is taken to admonish the sedentary. On the other hand, the committee also considered 6 heavy metals and 19 chemicals (pesticides, industrial chemicals, consumer products); however, the related evidence was scanty, and the committee displayed less zeal about them—not the message the environmental activists wanted to hear. For every chemical listed, anyone scouring PubMed could find an incriminating report or two, but for no particular chemical was the evidence sufficient to classify it as breast carcinogen. Most of the relevant data came from injecting mice and not from affixing monitors to the lapels of women and enrolling them in robust epidemiology studies.

Given the contemporary state of the art, should we invest more money in this line of research or should we all go on a retreat and head back to the flipchart?

Of course it might always be argued that more studies are needed—larger studies, better indices

of exposure, and better definitions of breast cancers—to really make a go of it. In that respect, it is noteworthy that the Susan G. Komen for the Cure Foundation, a grassroots Texas-based organization devoted to breast cancer research, was one of the promoters of the Institute of Medicine initiative. As the basis for a targeted funding announcement, the Komen Foundation picked 3 of the 13 Institute of Medicine recommendations:

- Studies of Occupational Cohorts and Other Highly Exposed Populations
- New Exposure Assessment Tools
- Minimizing Exposure to Ionizing Radiation

I would have predicted the first two, but the third comes as a surprise. There is no doubt that ionizing radiation is a cause of breast cancer, as has been amply demonstrated in young women exposed to high doses (for example, from therapeutic radiation, fluoroscopy, atomic bombs), but I cannot imagine that even 1% of breast cancer in Canada could be a result of occupational sources of radiation. Ionizing radiation exposures can be monitored and limited using the film badges already in use (as, for example, in my lab until about 5 years ago). Do the people at the Komen Foundation suggest that the use of film badges be extended to women with lower levels of exposure and that this will help reduce the burden of breast cancer?

Elizabeth Cardis at the International Agency for Research on Cancer and her colleagues from 15 countries studied cancer risk among 407,391 workers exposed to radiation². They found that the risk of breast cancer was not higher in women having 5–100 mSv of cumulative exposure compared with women having less than 5 mSv. Only 18% of the occupationally exposed women had achieved a dose level exceeding the baseline category. If this study of 400,000-plus workers who amassed a total of 5 million years of exposure failed to show an effect, is starting monitoring anew really necessary? The

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acceptable dose levels were designed to protect against the most radiosensitive types of cancer (thyroid, leukemia, lung) and should be adequate to protect against breast cancer as well.

The other two goals are worthwhile, but it is not clear if the background is really established to select groups for monitoring or exposures for measuring. There are literally hundreds of occupational groups and thousands of chemicals that could be studied, and only a few can be pursued. And what do they mean by “highly exposed populations”? Exposed to what?

James Brophy and colleagues suggest that women in the automotive plastics and casino industries and agricultural workers would be a good start³. They base their choices on the results of a recent case–control study of women in the Windsor, Ontario, area. They studied 1006 breast cancer cases referred by a regional cancer centre and 1146 community-based controls. Occupational histories were taken by telephone (a 1- to 2-hour personal interview). About 90% of the cases and 50% of the controls picked up the telephone and agreed to participate. An enormous difference between cases and controls emerged in terms of both education and social class. In a departure from almost all other studies, these authors found that lower social class was a risk factor for breast cancer. What worries me about the study (besides the small number of exposed cases, the multiple comparisons made, and the *post hoc* subgroup analyses) is that I suspect that women in people-oriented professions (such as retail sales and entertainment) might be more inclined to consent to a long telephone interview than, say, a woman who lives on a farm. One of the strongest effects reported was protection against breast cancer for women in retail sales. Were women with retail sales experience perhaps overrepresented among the control subjects? Should this study be considered an interesting pilot that justifies a larger and more expensive study (as the authors suggest), or should we move on? And if not now, when should the decision that it is time to move on be taken?

And of course, as if breast cancer were not challenging enough, there are always gene–environment

interactions to contemplate: that is, exposures that may be toxic only in a subgroup of women rendered susceptible as defined by a particular genotype. That line of inquiry is potentially very productive, given that a single genome-wide association study will yield hundreds of interesting subgroups (gene × environment). And for each study, a compelling argument can be made for the great rationality of funding further studies.

Is there a realistic chance that we can lessen the burden of breast cancer in Canada by controlling women’s exposures to chemicals in the workplace or in the home? Is there a good reason to invest more money here? Or should we look elsewhere to study the causes of breast cancer? Everyone is entitled to an opinion.

CONFLICT OF INTEREST DISCLOSURES

The author has no financial conflicts of interest to declare.

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