

Breast Cancer Risk: Timing and Environmental Exposures



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A discussion on the timing of exposure
and consumer products



Breast cancer risk is associated with exposure to environmental endocrine disruptors. The term “endocrine disruptors” may sound unfamiliar to us, but we encounter them everywhere, from cosmetics to processed foods. Consumers need to know what dangers lurk beneath the label. Learn more about endocrine disrupters to protect your health.

What Are Endocrine Disrupters?

Latest scientific findings have helped to understand how chemical exposures can impact health and increase the risk of breast cancer. From the earliest points of development, in utero through puberty, from adolescence through pregnancy, the elderly, and women with compromised immune systems; these stages are referred to as the windows of susceptibility (WOS). For the past ten years, the Breast Cancer Environmental Research Program (BCERP) has been exploring the influence of early and extended environmental exposures on breast cancer risk, looking at these dynamic stages through the life course.

Endocrine disruptors (EDs) are of particular interest to BCERP. EDs are compounds that can mimic hormones, antagonize normal endogenous hormones, alter synthesis and metabolism of natural hormones, modify hormone receptor levels or modi-



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fy natural hormone production (1). Human exposure to a wide range of endocrine disruptors is common, and concern continues to increase about their effect on human health. A recent CDC report indicates that all Americans harbor significant levels of many EDs in their bodies (2). This has prompted several governmental agencies, including NIH, EPA and CDC to make the investigation of these compounds a high research priority (2, 3, 4).

"Breast Cancer Genomics in Windows of Susceptibility to Endocrine Disruptors," a project headed by Principal Investigators Dr. Susan Teitelbaum and Dr. Jia Chen of the Icahn School of Medicine at Mount Sinai, is funded by the National Institute of Environmental Health Science (NIEHS) and National Cancer Institute (NCI). This study uses an innovative approach of combining an animal and a human population study. First, animals will be exposed to three commonly-used EDs; triclosan, methylparaben and diethyl phthalate (individually and in combination) in physiological relevant doses at different windows of development. Laboratory findings will be validated using the extensive database and biorepository from the Long Island Breast Cancer Study Project.

Where Do We Find Endocrine Disrupters?

Since triclosan, paraben and phthalates are found in a myriad of consumer products including cosmetics and pharmaceuticals, public exposure is widespread. These three chemicals are of concern because women in WOS (e.g., pregnancy, adolescence and teens) are frequent buyers of cosmetic products. According to a 2010 New York Times article, girls as young as nine years old are shopping for all kinds of cosmetics. "Regular



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use of certain cosmetics is rising sharply among tween girls," according to a new report from the NPD Group, a consumer research company (5). Seventeen Magazine surveyed teenage girls in 2009 and found that nearly three quarters of them are spending their money on personal care products; cosmetics in general (70%), hair products (71%) and skin care (74%)

Considering that we are not exposed to risk factors one at a time, and most non-infectious diseases are not the result of an individual exposure, we must find ways to expand our ability to examine the effect of multiple exposures that may be occurring on many levels. This is particularly true of environmental epidemiology, due to the complex web of exposures that we encounter in the environment throughout our lives. Recent investigations into the low dose mixture effects of endocrine disruptors demonstrate that there is support not only for additive effects of low level environmental exposures, but also for synergistic effects (6, 7).

Phthalate exposures are high because parent diesters are so widely used and because there are at least 10 different parent compounds in commerce. They are also largely unregulated in the US and are not required to be on product labels, including medications. Human absorption of phthalates can occur through inhalation, ingestion, and dermal contact. Lower molecular weight diesters (e.g. diethyl phthalate (DEP)) occur more often in personal care products (fragrances, shampoo, cosmetics and nail polish). Phthalate exposure, specifically MEP, has been associated with increased breast cancer risk in the one published study that has investigated this association (8).



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Parabens are commonly used as antimicrobial preservatives in personal care products, cosmetics, pharmaceuticals and in the processing of foods and beverages (9). Parabens have been hypothesized to play a role in breast cancer due to their potential estrogen activity. However, this family of chemicals' estrogenic potential is many orders of magnitude lower than naturally occurring estrogen (10) based on evidence derived from various *in vitro* studies (8). It has been postulated that parabens contained in deodorants and other cosmetics may increase the risk of breast cancer yet the few studies that have investigated this hypothesis do not provide support for an association (12).

Triclosan, another commonly used antimicrobial, is found in personal care and household products ranging from toothpaste, deodorant and hand soap, to cutting boards and inner soles of shoes. Public interest has been steadily increasing about the ubiquitous exposure sources to this chemical. The hormonal ac-

tivity of triclosan has not been clearly established and results of many investigations are conflicting. Dermal and oral exposure is the main route of contact (13, 14) and triclosan been measured in breast milk (12, 15) indicating that this chemical could act directly on breast tissue.

What Can We Do About Endocrine Disruptors?

When we talk about protecting our health, the translation, dissemination and communication of research findings is at the heart of the matter. Providing the community with a clear understanding of the latest research to support their personal choice in products they purchase is paramount. Guiding the public with the Precautionary Principle- a "better safe than sorry" approach- further empowers the consumer. Translating current findings that guide the advancement of regulatory policies to reduce risk of disease is crucial if we want to improve health.



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As Community Partners supported by the Breast Cancer and the Environment Research Center Programs, we have witnessed the challenges and discoveries facing the Principal Investigators from the Icahn School of Medicine, Drs. Teitelbaum and Chen, as they explore the complex associations between products we use daily and breast cancer risk. Our organizations play an important role providing the most current science based information, empowering individuals to make better health choices, connecting diverse stakeholders throughout the Long Island region and demonstrating that the environment and our health are intimately connected.

Susan Teitelbaum, Ph.D., is an Associate Professor in the Department of Preventive Medicine at the Icahn School of Medicine at Mount Sinai in New York City. Dr. Teitelbaum received her M.P.H. and Ph.D. in Epidemiology from Columbia University. She is a trained cancer and environmental epidemiologist with an interest in environmental risk factors for disease, in

particular, the combined effect of multiple exposures. She is involved in two studies funded under the BCERP: the "Breast Cancer Genomics in Windows of Susceptibility to Endocrine Disruptors" and one of the BCERP puberty studies, the Growing Up Healthy Study.

Karen Joy Miller is Founder & President of the Huntington Breast Cancer Action Coalition (HBCAC), established in 1992. Karen is a cancer survivor and for over 25 years has been a dedicated public health advocate focused on environmental triggers to breast cancer and has received numerous awards, proclamations and special recognitions. In 2000, HBCAC initiated the "Prevention Is The Cure" campaign. Focusing

on primary prevention and environmental links to disease, her organization secured legislation to ban the use of BPA in baby bottles and Sippy cups in New York State. Most recently, they secured the first ban in the nation on thermal cash receipts containing BPA in Suffolk County. Karen was asked to contribute to the recent Interagency Breast Cancer & Environmental



Research Report and is currently partnering with Hempstead, and the New York State Breast Cancer Mount Sinai on the Breast Cancer and Environmental Research Program-Windows of Susceptibility, a National Institute of Environmental Health Sciences and National Cancer Institute Project.

For more information visit:

www.hbcac.org

www.preventionisthecure.org

www.ribbet.org

Laura Weinberg is a Community Partner with the Breast Cancer and Environment Research Project. Weinberg has been working on various Long Island and New York State projects pertaining to breast cancer and the environment for the past 20 years. As president of the Great Neck Breast Cancer Coalition (GNBCC) since 2001, Weinberg has advocated for reduction of toxins in our environment through hundreds of educational presentations and work with local and state public officials on legislation. In 2005, Weinberg and GNBCC created and developed the Students and Scientists Breast Cancer/Environmental Research Scholarship Program, which has sponsored 29 students at seven research centers in the Northeast. Currently, Weinberg is embarking on a one-year educational project with the Icahn School of Medicine at Mount Sinai-New York, the Witness Project of Harlem and BCERP Community Partner Karen Miller of HBCAC. Weinberg has served on the following boards and networks: The Long Island Breast Cancer Network, Ecological Commission for the Town of North

Hempstead, and the New York State Breast Cancer Network. Weinberg is a LEED Green Associate which is recognized by the U.S. Green Building Council.

For more information visit: www.greatneckbcc.org

Jia Chen, Sc.D., is a Professor in the Departments of Preventive Medicine, Pediatrics, and Oncological Science at the Icahn School of Medicine at Mount Sinai in New York City. She received her Sc.D. from Massachusetts Institute of Technology and did postdoctoral training at Harvard Medical School and Harvard School of Public Health. Her research group has been working extensively to elucidate effects of environment and lifestyle on breast cancer using genetic and epigenetic tools. She has conducted multiple NIH and DOD funded studies on this topic using the resources of the Long Island Breast Cancer Study Projects. She has just received NIH funding to study how microRNA influences breast cancer survival in the same population. She is a co-Principal Investigator, with Dr. Susan Teitelbaum, of the study funded under the BCERP: "Breast Cancer Genomics in Windows of Susceptibility to Endocrine Disruptors."

References

1. Sonnenschein C, Soto AM. An updated review of environmental estrogen and androgen mimics and antagonists. J Steroid Biochem Mol Biol 1998 Apr;65 (1-6):143-50.
2. Centers for Disease Control and Prevention. Fourth Report on Human Exposure to Environmental



- Chemicals, 2009. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention. <http://www.cdc.gov/exposurereport/>
3. Environmental Protection Agency. Priority Setting in the Endocrine Disruptor Screening Program. 2003.
 4. National Toxicology Program USDoHaHS. National Toxicology Program's Report of the Endocrine Disruptors Low-Dose Peer Review. National Institute of Environmental Health Sciences, National Institutes of Health 2001 August Available from: URL: <http://ntp-server.niehs.nih.gov/htdocs/liason/LowDoseWebPage.html>
 5. Quenqua, Douglas. "Graduating From Lip Smackers." New York Times. N.p., 28 Apr. 2010. Web.
 6. Kortenkamp A. Ten years of mixing cocktails: a review of combination effects of endocrine-disrupting chemicals. *Environ Health Perspect* 2007 Dec;115 Suppl 1:98-105.
 7. Christiansen S, Scholze M, Dalgaard M et al. Synergistic disruption of external male sex organ development by a mixture of four anti-androgens. *Environ Health Perspect* 2009;117(12):1839-46
 8. Svensson K, Hernández-Ramírez RU, Burguete-García A, Cebrián ME, Calafat AM, Needham LL, Claudio L, López-Carrillo L. Phthalate exposure associated with self-reported diabetes among Mexican women. *Environ Res*. 2011 Aug;111(6):792-6.
 9. Ye X, Bishop AM, Reidy JA, Needham LL, Calafat AM. Parabens as urinary biomarkers of exposure in humans. *Environ Health Perspect* 2006 Dec;114 (12):1843-6
 10. Darbre PD, Harvey PW. Paraben esters: review of recent studies of endocrine toxicity, absorption, esterase and human exposure, and discussion of potential human health risks. *J Appl Toxicol* 2008 Jul;28(5):561-78.
 11. Golden R, Gandy J, Vollmer G. A review of the endocrine activity of parabens and implications for potential risks to human health. *Crit Rev Toxicol* 2005 Jun;35(5):435-58.
 12. Hardefeldt PJ, Edirimanne S, Eslick GD. Deodorant use and breast cancer risk. *Epidemiology*. 2013 Jan;24(1):172.
 13. Ye X, Bishop AM, Needham LL, Calafat AM. Automated on-line column-switching HPLC-MS/MS method with peak focusing for measuring parabens, triclosan, and other environmental phenols in human milk. *Anal Chim Acta* 2008 Aug 1;622(1-2):150-6.
 14. Hargava HN, Leonard PA. Triclosan: applications and safety. *Am J Infect Control* 1996 Jun;24(3):209-18.
 15. Allmyr M, dolfsson-Erici M, McLachlan MS, Sandborgh-Englund G. Triclosan in plasma and milk from Swedish nursing mothers and their exposure via personal care products. *Sci Total Environ* 2006 Dec 15;372(1):87-93.