Xenoestrogens Cause Cancer: Nurse Advocacy and Education

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What is a Xenoestrogen?

- Xenoestrogens are man-made chemicals that mimic estrogen that is naturally produced by the body.
- More than 90% of all people in America are found to have a considerable amount of these chemicals in their urine (Calafat, Reidy, & Needham, 2008).
- The most commonly found xenoestrogens are phenols, parabens, and phthalates.
- Widespread human exposure has been caused by Hydrolysis of the ester bonds in plastics from heat and contact with either acidic or basic compounds (food, etc.). Heating cans lined with plastic to sterilize food, and/or repeated washing of plastic products increase the rate of leaching of bisphenol A (BPA), a common xenoestrogen (vom Saal & Hughes, 2005).

How do they Affect the Body?

- More than 90% of all people in America are found to have a considerable amount of these chemicals in their urine (Calafat, Reidy, & Needham, 2008).
- They have the ability to induce DNA damage, alter DNA methylation, and alter sex hormone metabolism (Sprague, et al., 2013).
- These chemicals are shown to have significantly lower affinities than natural estrogens, meaning they are more readily available to target organs (Nagel, Thayer, Dhar, Boechler, & Welshons, 1997).
- There are numerous studies that have linked xenoestrogens to breast cancer by mimicking the ability of estrogen to drive growth of breast tumors *in vivo* in clinical studies and animal models and also *in vitro* (Darbre & Charles, 2010).
- Studies have shown that many phthalates, parabens, and phenols can bind to and activate the estrogen receptor, promote the proliferation of human breast cancer cells, or increase uterine weight in immature mice (Laws, Carey, Ferrell, Bodman, & Cooper, 2000).
- Bioaccumulation is seen in the fetus and levels are much higher than in the blood of the mother. Breast milk of the mother also has much higher levels of BPA compared to the level seen in the mother's blood. (Welshons, Nagel, & vom Saal, 2006).

Where are Xenoestrogens Found?

- chemical industry pollutants
- byproducts of waste disposal
- cigarette smoke
- pesticides
- flame retardants (including the kind on children's sleepwear)
- household products, including plastics (toys, plastic bottles, metal food cans)
- detergents
- medical devices
- pharmaceuticals
- soft furnishing materials
- chlorines- including feminine hygiene products
- food supply (from chemicals being leeched into the environment)
- water supply (from runoff of landfills and the surrounding ecosystem)
- (Committee on the Health Risks of Phthalates, National Research Council, 2008; Darbre, 2006; Duderstadt, 2012; Fucic, et al., 2012; Kawagoshi et al. 2003; vom Saal & Hughes, 2005

Review of Literature

Three themes in the primary studies were seen. 1. Xenoestrogens initiate progression of tumor growth (Pupo, et al., 2012; Tilghman, et al., 2012; Fernandez & Russo, 2010; López-Carrillo, et al., 2010; Bonefeld-Jorgensen, et al., 2011; Huo, et al., 2013). 2. Xenoestrogens cause an increase in breast tissue density (which is a risk factor for breast cancer) (Sprague, et al., 2013; Trentham-Dietz, et al., 2012). 3. Xenoestrogen exposure in utero increases breast cancer risk (Soto, Brisken, Schaeberle, & Sonnenschein, 2013; Cohn, et al., 2015).

Initiates Progression of Tumor Growth

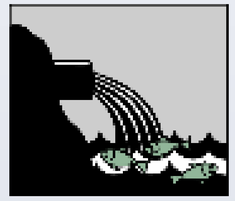
- BPA influenced proliferation and migration of breast cancer cells through a signaling pathway of target genes (Pupo, et al., 2012).
- BPA altered the gene expression in breast cancer cells (Tilghman, et al., 2012).
- Induced the neoplastic transformation in human breast epithelial cells in an *in vitro-in vivo* model (Fernandez & Russo, 2010).
- Women who were recently diagnosed with breast cancer had higher incidence of phthalates in their urine before cancer treatment (López-Carrillo, et al., 2010).
- In an isolated Inuit population, there was a strong link between exposure to xenoestrogens and the increase in breast cancer, which is becoming more prevalent in these populations (Bonefeld-Jorgensen, et al., 2011).
- Exposure to xenoestrogens in air pollution correlated strongly with an increase in family history of breast cancer, younger age at menarche, and more invasive breast cancer by grade (Huo, et al., 2013).

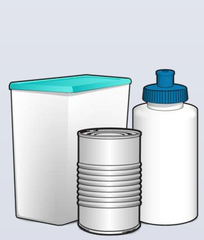
Causes an Increase in Breast Tissue Density

- Breast tissue density is considered a risk factor for breast cancer in postmenopausal women (Boyd, et al., 2010). Women with dense breasts are six times more likely to be diagnosed with breast cancer (Breastcancer.org, 2015).
- Postmenopausal women with high levels of serum BPA and phthalates had elevated breast density (Sprague, et al., 2013).
- There is significantly higher density of breast tissue in women who had higher levels of BPA in their blood than the median level (Trentham-Dietz, et al., 2012).

Exposure In Utero Increases Breast Cancer Risk later in life

- The offspring of rats exposed to BPA in utero exhibit altered mammary gland architecture during puberty and adulthood, including increased breast density (Sonnenschein, & Soto, 2007; Muñoz-de-Toro, Markey, Wadia, Luque, Rubin, Sonnenschein, & Soto, 2005).
- Fetal exposure to xenoestrogens in laboratory animals contributed to the risk of breast cancer later in life by causing persistent changes in mammary glands when the organs are being formed in the womb (Soto, et al., 2013)
- In a large human study, Cohn, et al. (2015) found that the exposure of DDT (a known xenoestrogen) in utero in 1960s has correlated with increased breast cancer risk by age 52.





Nurse Advocacy

Nurses need to take an official stance

- This includes chemicals in cosmetics, skin products, baby products, household furniture, food additives, etc.
- Nurses can give a professional position on the danger of these unnecessary chemicals.
- The media is the only informant and educators of these topics, creating confusion and anxiety for the public.

Advocate for the review of BPA and other similar chemicals in household products

- The last EPA risk assessment for BPA was in the 1980s. Since then there has been an overwhelming amount of evidence that BPA is linked to breast cancer.
- The European Union has banned the use of BPA in certain applications, including in baby bottles.
- Currently, only high doses of BPA are tested under the assumption made by the chemical industry that BPA is only unsafe at higher levels.
- Chemicals of similar molecular structure should not replace BPA without rigorous studies (Albini, et al., 2014). Bisphenol S (BPS) is now replacing BPA and is most likely just as harmful.

Test new chemicals before they are used in infant and children's products to ensure their safety before they are used.

- Brominated and chlorinated flame retardants are in the foam of infant products and on sleepwear to improve the flame retardancy.
- Studies have shown that flame retardants only resist igniting for an additional few seconds compared to no flame retardant (Shaw, et al., 2010).
- More than 155 scientists convened to urge the cease of using these chemicals in the San Antonio Statement.

Be an expert voice for the public

- A detailed questionnaire asking respondents about the threat of chemicals, resulted in the majority of respondents stating that they think the threat posed by everyday exposure to toxic chemicals is serious, with 73% of respondents saying it is a threat, with 33% saying it is very serious.
- 78% said the threat posed to children by exposure to everyday toxic chemicals is serious with 45% saying it is very serious (Safer Chemicals, Healthy Families, 2010).

Promote the Right to Know what is in consumer products

- The presence of methylparaben and propylparaben are found in a majority of cosmetics, including deodorants, creams and lotions (Shen *et al*., 2007).
- The most recent federal legislation that came for vote is the Safe Chemical Act of 2011 and the Safe Cosmetics Act of 2011, which were both turned down by Congress (Govtrack.us, 2011a; Govtrack.us, 2011b).
- Nurses need to stand by the limited number of legislators that are fighting to get xenoestrogens out of American households.
- In the meantime, voluntary labeling by cosmetic industries should be supported so consumers can make better and more informed choices (Donovan, et al., 2007).

Nurse epidemiology studies need to advance knowledge about the dangers of xenoestrogens

- Breast cancer epidemiology must take into account the burden of multiple xenoestrogens in consumer products and other environmental sources (Kortenkamp, 2006).
- There should be an effort to increase the voluntary release of what chemicals are in our products, as it is very difficult to pinpoint what we are actually putting on our body even when the public is educated.
- Nurse epidemiologists have the opportunity to take on the difficult task of studying what the chemical burden is of women who have been diagnosed with breast cancer (Darbre & Harvey, 2008; Darbre & Charles, 2010).

Nurse Health Coach Education

- Nurse health coaches are in a special position to educate their patients about the risks of xenoestrogens and the actions that can be taken to limit the amount of xenoestrogen burden.
- Reducing the overall xenoestrogen burden is a task that needs to be spread out over time.
- A household can slowly reduce its xenoestrogen burden by looking at labels of their personal care items. The cosmetic industry is not required to disclose certain chemicals, and it is hard to find xenoestrogens just by looking at the labels sometimes, so buying from companies who state 'no parabens, phthalates, or phenols' should be considered.
- Xenoestrogens applied to the breast and under the arm include metalloestrogens (aluminium found in antiperspirant), parabens, UV screeners, phthalates, aloe Vera extracts, triclosan (antimicrobial), cyclosiloxanes (dry cleaning agent), musks, and phthalates (Darbre, 2006). Educate patients about the risk of applying xenoestrogens under the arm and breasts in addition to the rest of the body.
- Studies show that adipose tissue in obese menopausal women is a major contributor to the estrogen stores, including xenoestrogens, that contribute to breast cancer risk. Healthy weight loss programs should be encouraged for those that are overweight (Wang, et al., 2012).
- Curcumin was shown to inhibit the effects of BPA in breast cancer by reversing the proliferation of cancer cells formed by BPA (Li, et al., 2014). Turmeric root is where curcumin is derived. Cooking with turmeric daily shows protective effects. Curcumin and Turmeric can be found in pill form in health food stores.
- Discourage the use and exposure to Teflon, a common non-stick material used in many cooking products. Encourage the use of other cooking surfaces, such as stainless steel and cast iron, as they have no known dangerous chemicals.
- Avoid tin cans that are lined with BPA, microwave popcorn bags that contain Teflon, Styrofoam cups for your coffee, use stainless steel water bottles in place of plastic, use glass baby bottles, and avoid plastic baby toys. Throw out plastic Tupperware containers and exchange for glass and/or stainless steel. Avoid disposable plastic containers as much as possible. Bringing glass containers in to a store that carries bulk food bins is an option to eliminate some plastic use.
- Do not heat plastic that is coming into contact with food and do not reuse plastic containers, as the repeated washing and heating of plastics encourages xenoestrogens to leach out from the plastic and into food that touches it.
- While buying products that state "BPA-free" seems like a better choice, it does not mean xenoestrogen free. These companies are using "BPA-free" as a marketing tactic.
- Avoid buying children sleepwear with flame retardants embedded into it. Consider buying organic mattresses that do not use flame retardants.
- Household furniture with foam, such as sofas also contain this flame retardant, causing household dust to contain these toxic chemicals.
- Buying organic foods- and at the very least, avoiding foods with the highest pesticide residues can cut down on exposure.
- Thousands of food, cleaning, and cosmetic products have been listed and rated for safety on the Environmental Working Group's website based on the product's ingredients to help make healthier choices.

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