



# PHTHALATES: RISK FACTORS FOR BREAST CANCER

Phthalates are a family of synthetic chemicals used in a wide variety of consumer products including plastics, nail polish, perfumes, skin moisturizers, baby care products and toys, flavorings and solvents. These chemicals don't stay in the plastics they soften or in the countless other products in which they are used. Instead, they migrate into the air, into food and/or into people, including babies in their mother's wombs. Phthalates have been found in indoor air and dust,<sup>i</sup> and in human urine, blood, and breast milk.<sup>ii</sup> Levels are highest in children ages 6 to 11 and in women, and blacks have higher levels of phthalates than whites.<sup>iii</sup>

Much of the research on phthalates has focused on endocrine disrupting effects in males. However, more recent studies link phthalate exposure to early puberty in girls and suggest that females are affected in other ways that may increase the risk of breast cancer.

Some phthalates including butyl benzyl phthalate (BBP) and di-n-butyl phthalate (DBP) act as weak estrogens in cell culture systems. They can bind to estrogen receptors (ER), induce estrogen-appropriate cellular responses and act additively with the body's own estradiol to alter these systems.<sup>iv v</sup> BBP, DBP and another common phthalate, di-(2-ethylhexyl) phthalate (DEHP) significantly increased cell proliferation in MCF-7 breast cancer cells. In addition, these three phthalates inhibited the anti-tumor action of tamoxifen in MCF-7 breast cancer cells.<sup>vi</sup>

A new study found that neonatal/prepubertal exposure to BBP induced changes in gene expression in the rat mammary gland. This exposure also increased proliferation in terminal end buds and in lobules. Researchers noted that terminal end buds "are the most susceptible epithelial structures to malignant transformation."<sup>vii</sup>

As with all exposures, timing matters. Early life exposure to phthalates holds the greatest risk for harm and prenatal exposure to very low doses can have irreversible, lifelong effects. Therefore it is essential to protect children and women of childbearing age from exposure to phthalates.

The effects of phthalate exposure depend not only on timing, but also on mixtures of phthalates and their interaction with other environmental factors. All of us are exposed to more than one phthalate as well as multiple other chemicals. A recent study reported in *Pediatrics* found measurable levels of seven out of nine phthalates tested in the urine of infants born between 2000 and 2005. Levels were closely correlated with use of infant care products (lotion, powder, shampoo) within 24 hours of urine sample collection,<sup>viii</sup> making it clear that what goes on baby also goes into baby.

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<sup>i</sup> Rudel RA, Brody JG, Spengler JD, Vallarino J, Geno PW, Sun G, Yau A (2001). Methods to detect selected potential mammary carcinogens and endocrine disruptors in commercial and residential air and dust samples. *Journal of Air and Waste Management Association* 51(4):499-513.

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- <sup>iii</sup> CDC (2005). *Third National Report on Human Exposure to Environmental Chemicals*. Atlanta: Centers for Disease Control and Prevention.
- <sup>iv</sup> Jobling S, Reynolds T, White R, ParkerMG, Sumpter JP (1995). A variety of environmentally persistent chemicals, including some phthalate plasticizers, are weakly estrogenic. *Environmental Health Perspectives* 103: 582-587.
- <sup>v</sup> Kang SC, Lee BM (2005). DNA methylation of estrogen receptor *α* gene by phthalates. *Journal of Toxicology and Environmental Health Part A* 68: 1995-2003.
- <sup>vi</sup> Kim IY, Han SY, Moon A (2004). Phthalates inhibit tamoxifen-induced apoptosis in MCF-7 human breast cancer cells. *Journal of Toxicology and Environmental Health* 67:2025-2035.
- <sup>vii</sup> Moral R, Wang R, Russo IH, et al. (2007). The plasticizer butyl benzyl phthalate induces genomic changes in rat mammary gland after neonatal/prepubertal exposure. *BMC Genomics* 8:453. doi:10.1186/1471-2164-8-453
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