

Rostrum

Chemical Exposures via Personal Care Products and the Disproportionate Asthma Burden Among the U.S. Black Population

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An evolving body of literature links chemicals commonly found in personal care products (PCPs) to an increased risk of both developing asthma and worsening existing asthma. Phthalates, parabens, environmental phenols, such as triclosan and bisphenol A, and other endocrine-disrupting compounds have been implicated in asthma and related allergic conditions in epidemiological studies. Because Black individuals have increased exposure to these chemicals through hair care products and feminine hygiene products, disproportionate exposure to these chemicals through PCPs could contribute, in part, to the disproportionate asthma prevalence and morbidity among the U.S. Black population. Increased exposure to these chemicals among Black individuals is explained, in part, by more frequent use of hair care products that can contain higher concentrations of these chemicals and greater use of feminine hygiene products, which are also sources of exposure to these chemicals. Epidemiological evidence using urinary biomarkers of exposure demonstrates associations between PCPs and exposure to these chemicals and that the U.S. Black population has greater exposure to these chemicals than the non-Black population. Should chemical exposures through PCPs contribute to the excess burden of asthma among the U.S. Black population, reducing these exposures would reduce this disparity. © 2021 American Academy of Allergy, Asthma & Immunology (J Allergy Clin Immunol Pract 2021;■:■-■)

Key words: Asthma; Asthma disparities; Endocrine-disrupting compounds; Personal care products

An evolving body of literature links chemicals commonly found in personal care products (PCPs) to an increased risk of both developing asthma^{1,2} and worsening existing asthma.^{3,4} Phthalates, parabens, environmental phenols, such as triclosan and bisphenol A (BPA), and other endocrine-disrupting compounds (EDCs) have been implicated in asthma and related allergic conditions in epidemiological studies.¹⁻⁵ Because Black individuals have increased exposure to these chemicals through

Black hair care products^{6,7} and feminine hygiene products,⁸ disproportionate exposure to these chemicals through PCPs could contribute, in part, to the disproportionate asthma prevalence and morbidity among the U.S. Black population.^{9,10}

Increased exposure to these chemicals among Black individuals is explained, in part, by more frequent use of hair care products that can contain higher concentrations of these chemicals^{6,7} and greater use of feminine hygiene products,⁸ which are also sources of exposure to these chemicals.^{9,11} These use patterns are rooted in longstanding racial stereotypes. Because racist assumptions about the intellect and social refinement of Black people is entangled with hair texture and styling, attaining an appearance acceptable to a majority White society has been and remains a critical component to social and economic success.⁹ Racial discrimination based on the pursuit of achieving European or Western beauty standards can lead to internalized racism, body shame, and skin tone dissatisfaction, elements that can influence product use to achieve straighter hair or lighter skin. Thus, beauty product use may be 1 mechanism by which structural discrimination becomes biologically embedded.^{12,13} Societal pressures associated with meeting Western or European beauty norms imply that women of color use more beauty products and are, thus, likely exposed to higher levels of EDCs and other potentially harmful chemicals. It is not surprising, then, that products designed to change hair texture, such as relaxers and texturizers, are more frequently used by Black people. Feminine hygiene products, which contain chemicals that may affect respiratory health and endocrine processes,¹¹ have also been more heavily used by Black women likely owing to longstanding historical prejudices regarding the cleanliness and presumed promiscuity of Black women.^{9,14,15} In fact, Black women are 4 times more likely to use feminine powders, washes, wipes, and douches than non-Latina White women.^{8,11}

Chemical straighteners, hair lotions, root stimulators, antifizz serums, and hot oil treatments are among some of the products marketed for Black hair care.^{7,16} Phthalates, parabens, and BPA are often found in greater concentrations in Black hair care

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*Abbreviations used**BPA- Bisphenol A**EDC- Endocrine-disrupting compound**PCP- Personal care product*

products,^{6,17} and these products are often used at a greater frequency¹⁸ than hair care products commonly used by the general population, suggesting that Black hair care product exposure may contribute to greater EDC exposure observed among Black populations.¹⁰ Although certain chemicals may be present, or present in higher concentrations, in Black hair care products because of specific functions such as changing hair texture, maintaining a thick coating on hair for detangling, spreadability, and fragrance, there is little information about the rationale for the chemical composition of these specific products, likely because it is considered proprietary. To what extent more frequent use versus chemical composition of PCPs contributes to the well documented higher EDC exposures among Black individuals remains to be elucidated. Feminine hygiene products commonly contain several other EDCs in addition to phthalates, such as parabens and bisphenols, that have been previously linked to respiratory and allergic disease.¹¹ Although there are other sources of exposure to EDCs,¹⁹ epidemiological evidence using urinary biomarkers of exposure demonstrates associations between PCPs and exposure to these chemicals^{8,20} and that the U.S. Black population has greater exposure to these chemicals than the non-Black population.¹⁰

Multiple studies, which are collectively examined in recent systematic reviews,^{1,2} have linked phthalates, parabens, bisphenols, and triclosan to incident and prevalent asthma. Although there are some limitations among the studies examining links between these chemicals and asthma risk, overall, the evidence supports the hypothesis that exposure to these chemicals increases the risk of asthma and associated allergic diseases. Given that Black hair care products are commonly used starting as young as 5 years,¹⁶ and that both Black hair products and feminine hygiene products are used by women who are pregnant and breastfeeding, the disproportionate exposure to EDCs via these PCPs affect people across the lifespan—from the fetal period to adulthood.

Although the fetal and early childhood windows may be most important for influencing risk of incident disease, exposure to EDCs throughout the lifespan could influence asthma control. Fewer studies examine associations between exposure to these chemicals and exacerbation of existing asthma, so this literature has not been reviewed systematically. According to a U.S. 12-month study of Black low-income children ages 5 to 17 years, elevated urinary BPA concentrations were associated with increased odds of worse asthma control, especially among boys, as measured by days with asthmatic symptoms and emergency department visits.³ In a U.S. population-based study, methyl and propyl paraben exposure was associated with asthma exacerbations, also among boys.⁴ Conversely, an earlier study found that BPA was associated with allergic asthma in a dose-response manner to girls, but not to boys.²¹ Phthalates have also been implicated in worsening of asthma and allergic disease. In 1 study, low molecular weight phthalates were also reported to be associated with more asthmatic symptoms, such as wheeze, and high molecular weight phthalates were positively associated with allergic rhinitis and eczema in children.²² The findings from a

handful of studies suggesting an association between phthalates and BPA and measures of worsening of existing disease are intriguing; together with the literature demonstrating frequent detection of these EDCs among PCPs commonly used by Black individuals^{6,11} and higher urinary concentrations of biomarkers of exposure to these EDCs among Black individuals,¹⁰ it is plausible that PCP-associated exposure to these EDCs contribute to racial disparities in asthma control and exacerbations.

There are multiple possible mechanisms by which phthalates, parabens, and environmental phenols, such as triclosan and BPA, may affect respiratory health and allergic disease, and children may be more susceptible to the potentially immunotoxic effects of these chemicals. These chemicals can alter cell differentiation within the airways, reduce innate immunity, and alter gut microbiota.² Oxidative stress induced by many of these compounds may be a potential mechanism for the development of allergic responses and direct interference in lung development is also possible. Exposure to phthalates, parabens, and BPA may also influence the cytokine profiles,^{23,24} supporting an immunological mechanism for respiratory and allergic effects of these chemicals. The structures of many of the target chemicals discussed also closely resemble endogenous hormones, which enable them to affect a variety of biological and physiological processes that are influenced by hormones.²⁵ In fact, a unifying theme across the literature synthesized herein is the sexually dimorphic effects of the target chemicals,^{3,4} supporting the notion that endocrine disruption may be a potential mechanism of action. For example, some EDCs have estrogenic activity, and estrogens are known immune modulators, have been linked to asthma, and their actions may manifest differently between males and females.^{26,27} In addition, although the focus of some existing literature is on females across the lifespan and *in utero* exposure, population-based studies have documented higher concentrations of select EDCs often found in PCPs among the U.S. Black population, irrespective of sex.^{4,28,29} Altogether, this emerging body of evidence supports the hypothesis that chemical exposure through PCPs may contribute to racial disparities in asthma. The PCPs used by the Black population may contain high concentrations of asthma-related and EDCs and are used at a greater frequency. Black people have greater exposure to these chemicals as evidenced by urinary biomarker studies.¹⁰ In addition, these chemicals have been linked to increased risk of asthma and potentially worsening of the clinical and biological manifestations of existing asthma. The potential mechanisms by which these chemicals can increase the risk of incident asthma and worsen existing disease point to the biological plausibility of this hypothesis. Importantly, should chemical exposures through PCPs contribute to the excess burden of asthma among the U.S. Black population, reducing these exposures would reduce this disparity. This body of evidence, together with seemingly recalcitrant racial asthma disparities, underscores the importance of conducting studies that test this specific hypothesis.

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