New Study Links Hair Chemicals to Breast Cancer

A new study reports that endocrine-disrupting chemicals and other carcinogenic compounds found in hair dyes and straighteners may increase breast cancer risk, particularly in women of color. The study, conducted by the epidemiology branch of the National Institute of Environmental Health Sciences (NIEHS), located in Research Triangle Park, North Carolina, appears in the *International Journal of Cancer* (published online December 3, 2019. doi:10.1002/ijc.32738).

Although similar links between the use of hair dyes and straighteners and risk of breast cancer have been suggested before, study results have been inconsistent because of differences in study design, characteristics of the study populations, and changes in the composition of some products over time. To the authors’ knowledge, this is the first study to observe a positive association between chemical straighteners and breast cancer based on data obtained from a large prospective cohort. In addition, “this study includes more than 4000 African American women who have been understudied in previous studies,” says Mia M. Gaudet, PhD, a scientific director of epidemiology research at the American Cancer Society who was not a member of the study team. “These results, if replicated, lend support to the ongoing efforts to celebrate natural hair among all women, and especially those of African ancestry.”

According to study senior author Alexandra J. White, PhD, MSPH, a Stadtman investigator in the epidemiology branch at NIEHS, this distinction is important. Not only did researchers find that women who used permanent hair dye and chemical straighteners were at a higher risk of breast cancer compared with women who did not use those products, they also discovered that the association with permanent hair dye use varied based on race. “We found black women have a higher risk associated with the use of permanent hair dye compared to the risk for white women,” says Dr. White.

**Study Details**

Researchers used data from the Sister Study, which was launched by the NIEHS in 2003 to explore environmental and genetic risk factors for breast cancer. This prospective cohort study includes women aged 35 to 74 years who are living in the United States and Puerto Rico. Subjects included women who did not have a breast cancer diagnosis at the time of study recruitment (between 2003-2009) and who had 1 or more sisters diagnosed with breast cancer. After completing detailed questionnaires and undergoing telephone interviews regarding their family history and personal medical history as well as health behaviors and environmental exposures potentially associated with breast cancer risk, subjects were visited at home by examiners who recorded their height and weight. Questionnaires requested information regarding the use of hair dyes and straighteners within the

**KEY POINTS**

- The use of permanent hair dye increases breast cancer risk to a greater extent among black women than among white women.
- The use of hair-straightening products also increased breast cancer risk.
- More research is needed to identify the specific constituents in permanent hair dye and straighteners that may be contributing to this higher risk.
12 months prior to study enrollment. Those women who had used these types of products were asked how often they applied permanent hair dye, semipermanent hair dye, temporary dye, and straighteners on themselves during that period. Options were “did not use,” “1 to 2 times per year,” “every 3 to 4 months,” “every 5 to 8 weeks,” “once a month,” and “more than once a month.” Participants also reported instances in which they had applied permanent dye, semipermanent dye, and straighteners to other individuals during the previous year.

Participants reported whether they used dark colors or light colors, including red. They also were asked how long they had used the products, with responses ranging from “did not use” to 5 or more years.

The study subjects updated their health records every year and had detailed follow-up assessments every 2 to 3 years. “Women in the study were followed for self-reported (confirmed by medical records in 80% of cases) breast cancer over an average of 8.3 years,” says Dr. White.

According to Dr. White, researchers considered whether associations varied by the extent of the tumor (invasive or ductal carcinoma in situ), estrogen receptor status (for invasive cancers only), or patient menopausal status at the time of diagnosis.

**Study Results**

Researchers found a total of 2794 incident breast cancer cases reported over a total of 386,338 person-years. Approximately 55% of the participants said they had used permanent hair dye within the 12 months before study enrollment. Women who used permanent dye tended to be younger and less educated. They also were more likely to be cigarette smokers and to use oral contraceptives. Investigators also found that permanent hair dye was used less often by black and postmenopausal women and reported no correlation based on body mass index or age at menarche.

Using multivariable Cox regression models adjusting for likely confounding variables, the researchers found that the use of permanent hair dye was associated with breast cancer risk (hazard ratio [HR], 1.09; 95% CI, 1.01-1.17). In analyses restricted to black women, this association was even stronger (HR, 1.45; 95% CI, 1.10-1.90). The risk increased for black women with frequency of use (P for trend = .006), with dye use every 5 to 8 weeks found to be associated with a 60% higher risk of developing breast cancer (95% CI, 1.11-2.30).

Among black women, associations were similar regardless of dye color (dark-colored dye: HR, 1.51 [95% CI, 1.12-2.05] vs light-colored dye: HR, 1.46 [95% CI, 0.91-2.34]). Conversely, for white women, light-colored permanent dye had a stronger association with breast cancer than dark hair dye (HR, 1.12 [95% CI, 1.01-1.23]) for light colors; and HR, 1.04 [95% CI, 0.94-1.16] for dark colors). The researchers found no excess breast cancer risk for women who used temporary dyes. The nonprofessional application of semipermanent dye to others was associated with breast cancer risk (HR, 1.28; 95% CI, 1.05-1.56), although personal use was not.

Hair-straightening products were used by approximately 9.9% of women in the overall study population and were much more commonly used by black women (74.1%). Any personal use of straighteners was associated with an excess risk that approached statistical significance (HR, 1.18; 95% CI, 0.99-1.41) and the same was found when applying straighteners to others (HR, 1.27; 95% CI, 0.99-1.62). However, the association with personal use at least every 5 to 8 weeks was found to be statistically significant (HR, 1.31; 95% CI, 1.05-1.63).

**Study Analysis**

“Hair dye and straighteners have been relatively understudied in relation to breast cancer, especially given their common use among US women,” says Dr. Gaudet. “This study provides more detailed data on associations of hair dye and straightener products with breast cancer risk among US women with African and European ancestry. Although previous studies examined hair dye, the Sister Study survey was able to examine frequency, duration, type (permanent, semipermanent, and temporary), and mode of exposure (self, applicator, etc) of hair dye application.”

Dr. White notes that more research is needed to confirm the links found in the study between hair care products and cancer, “especially in large study populations that are able to consider hair product use in black women.” In addition, she says, “more research is needed to identify the specific constituents in permanent dye and straighteners that may be contributing to this higher risk.”

With the media attention that may occur from the publication of this study, Dr. Gaudet can envision women seeking advice about hair dye and straighteners from their clinicians. Although the study’s results need to be confirmed, she believes this will present clinicians with the opportunity to pivot and discuss other factors under their patients’ control. “They should take this opportunity to remind their patients that maintaining a healthy weight, avoiding alcohol and smoking, exercising, and eating a diet heavy on plant-based foods are known to lower risk of cancers, including breast cancer,” she says. “These factors are all supported by numerous studies showing their health benefits.”

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