Commonly asked questions

1. **What is the background for this study?**

   Hair products such as hair dyes and chemical straighteners contain many different chemicals that may act as carcinogens or endocrine disruptors and thus may be important for breast cancer risk. There has been longstanding interest in understanding the relationship between hair dye and breast cancer. The previous research on both hair dye and chemical straighteners has been inconclusive.

2. **What are the main findings?**

   Women who used permanent hair dye and chemical straighteners were at a higher risk of breast cancer compared to women who did not use those products. The association with permanent hair dye differed by race; black women had a higher risk associated with the use of permanent hair dye compared to the risk for white women.

   - Overall, use of permanent hair dyes in the year before study enrollment was associated with a 9 percent increase in risk of breast cancer. For non-Hispanic white women, the associated increase in risk was 7%; for black women it was 45%.
   - Breast cancer risk was increased 60% for black women who used permanent dyes every 5-8 weeks or more.
   - Frequent use of chemical straighteners was associated with a 31% increase in breast cancer risk.
   - Personal use of semi-permanent or temporary dyes was not associated with increased breast cancer risk.

3. **How large was the study and how long were women followed?**

   This study included 46,709 women who are participants in the Sister Study, a prospective nationwide study of environmental and genetic risk factors for breast cancer. During an average follow-up of 8.3 years, 2,794 women were diagnosed with breast cancer.

4. **What should readers take away from your report/what are the implications of this research?**

   These findings suggest that women should consider their use of hair products in light of the fact that the chemicals in hair dye and chemical straighteners may influence their risk of developing breast cancer. However, the overall risk is not large and chemical hair products are just one of many factors that may influence a woman’s chances of getting breast cancer. Our study estimated relative risks, comparing the risk of breast cancer among women who did or did not use specific hair products. We did not estimate the added number of breast cancers that could be due to use of these products. More research is needed before firm recommendations can be made.

   Healthcare experts could consider sharing this evidence with others to inform their decisions regarding hair product use.

5. **What recommendations do you have for future research as a result of this study?**
More research is needed to confirm these findings and to identify the specific constituents in permanent dye and straighteners that may be contributing to this higher risk.

6. **What could explain the difference in the associations of hair products by race?**

The association for chemical straighteners did not vary by race; women who used hair straighteners at least every 5-8 weeks, regardless of race, were 31% more likely to get breast cancer. However, 74% of black women and 3% of white women reported using chemical straighteners. Therefore, chemical straighteners may be a more important contributor to breast cancer in black women.

For hair dye, the risk estimate for the association with breast cancer was higher in black women although frequency of use was not very different (56% of white women, 42% of black women used in the past 12 months). It is possible that type of dye or application of dye is different for black women compared to white women. It is also possible that hair texture plays a role in how much dye is needed or absorbed. It is important to keep in mind that the results for black women, especially for high frequency users, were based on a much smaller number of study participants.

7. **Are there specific chemicals in permanent dyes and straighteners that are associated with breast cancer risk? Are these chemical absent in temporary hair dyes?**

There are many different formulations of both hair dye and straighteners which have changed over time. This makes it very challenging to pin down individual compounds that may increase risk of developing breast cancer. Additionally, the application of these products varies by the type of dye. Differences in formulation or application may explain the differing associations for permanent dye and semi-permanent or temporary dyes. Our study did not ask participants about the specific dyes used and we were unable to evaluate individual components of the products in our study.

8. **Did you find a difference for light compared to dark dye?**

There were no meaningful differences by dye color

9. **What about women from other race/ethnicity groups, such as Hispanic women or Asian women?**

Unfortunately, we did not have enough women in these groups to evaluate the associations in either Hispanic women or Asian women. We hope to be able to address this in the future.

10. **Is this the first conclusive evidence from a study to state that women who use permanent hair dye and chemical hair straighteners have a higher risk of developing breast cancer than women who don't use these products?**

This study is the first to observe a positive association between chemical straighteners and breast cancer in a prospective cohort setting. These results confirm recent published findings from studies that ask women who have already been diagnosed with breast cancer about their hair product use. However, such studies cannot rule out the fact that women who have breast cancer may be more likely to recall their use of hair products compared to women who do not have breast cancer. A strength of our study is that we obtained information on hair product use before women developed breast cancer. More research is needed before we can say that the findings are conclusive.

11. **What should be done in light of these findings?**
Women should be informed of the possibility that hair product use may influence breast cancer risk in order to make their own decisions regarding their use of hair dye and straighteners. Since semi-permanent dyes were not associated with breast cancer risk in this study, women might consider switching from permanent to semi-permanent products if those products would work for them. Women who apply the dye themselves should make sure that they wear gloves and follow the directions about how long to leave the dye in their hair and carefully rinse it out as instructed.

12. The study statistical models adjusted for a lot of factors including age, menopausal status, race, ethnicity, education, BMI, smoking history, oral contraceptive use, and age of first birth. Did this affect the results?

We adjusted for factors that could be related to both breast cancer risk and to use of hair dyes. Adjustment for these factors did make some difference in the magnitude of the associations but did not alter any conclusions. Without adjustment for these factors, permanent hair dye use and straighteners were still positively associated with breast cancer risk.

13. In the paper, it says that most past studies on this topic solely looked at white women. Why is it important to include women of all races? Is this the first study to do so?

It is important to include women of all races because breast cancer risk and mortality tends to differ by race. For example, in the US African American women are more likely to develop more aggressive types of breast cancer. Furthermore, women of different races may use different types of hair products and at vastly different frequencies. For example, in our study 74% of black women reported using chemical straighteners in the past year whereas 3% of white women did. Although this is not the first study to evaluate these associations in both black and white women, we had a large population of women who were asked about hair product use years before their diagnosis which reduces the possibility of bias.

14. Since there are many factors that lead to the development of an oncological disease, is it correct that this observed association does not constitute a cause-and-effect connection?

This was an observational study that investigated the association of hair dye and straightener use with breast cancer risk. Thus, we cannot conclude that these observed findings are causal. Further research is necessary to support these findings.

15. Increased breast cancer risk was observed for women who used permanent hair dyes and for women who used hair straighteners. What about women who used both?

Unfortunately, we were not able to directly study the risks among women who used only one type of hair product or who used both, because of small numbers. However, when we looked at hair dye, adjusting for use of straighteners and vice versa, our results did not change. This suggests that both hair dye and straighteners contribute to risk.

16. Women in the study all have a sister with breast cancer, how could that impact your findings?

The women in our study have a wide range of familial risk, with some women in our study having only a half-sister with breast cancer. Most have a single sister who had breast cancer. Only a small percentage have known breast cancer genes. We are not studying only high-risk women with extensive family histories of cancer. Women in our study are similar to women overall who participate in research studies. Therefore, we believe these
results are likely generalizable to women in the US although it is possible that the magnitude of our results may differ from a population without a familial risk.

17. What is the Sister Study?

The Sister Study, led by researchers from the National Institute of Environmental Health Sciences (which is part of the National Institutes of Health – NIH), is a prospective cohort study of 50,884 women from across the United States including Puerto Rico. Women enrolled in the study between 2003 and 2009 and have been followed annually ever since to study the incidence of breast cancer and other health conditions that are of importance to women. To be eligible for the study, women had to be between the ages of 35 and 74, could not have had breast cancer before they enrolled, and had to have a full or half-sister who had been diagnosed with breast cancer.

18. Was the age at which girls started using these products a factor in whether or not they could potentially develop breast cancer?

In this paper, we did not consider the association based on starting age of use. It is something we hope to study in the future.

19. Were there differences in risk for women who applied the hair dye themselves or had their hair colored at a salon?

Unfortunately, we were not able to study this using the information we collected. We reported on risk associated with having a woman's hair dyed (personal use), regardless of who did it or where it was done. We also looked at the association between applying hair dye to others, but not as a professional. Overall, applying permanent hair dye to others, for example coloring a friend’s hair, was not associated with increased breast cancer risk.