



FROM BEAUTY PRACTICES TO HEALTH OUTCOMES:

Contemporary Evidence and Emerging Questions on Relaxers and Chemical Exposures

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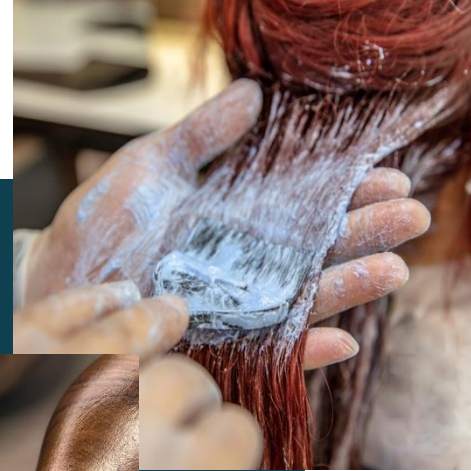
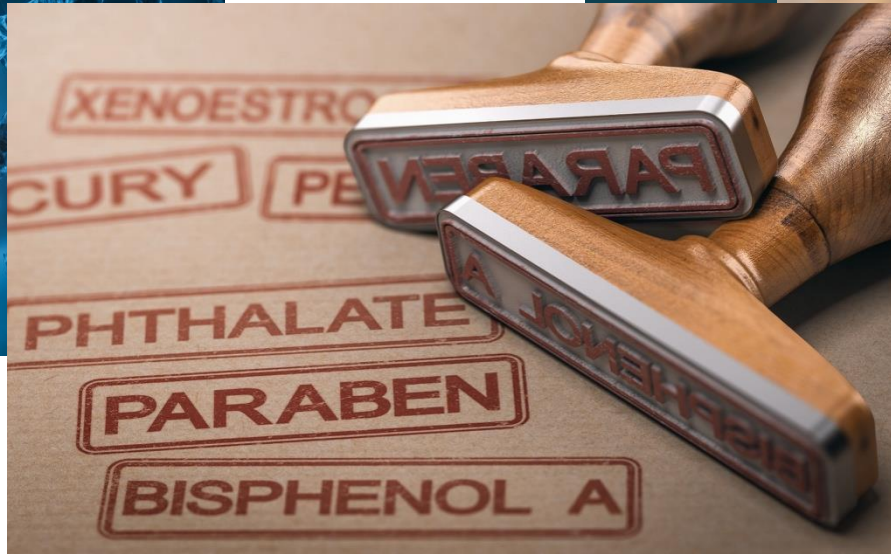
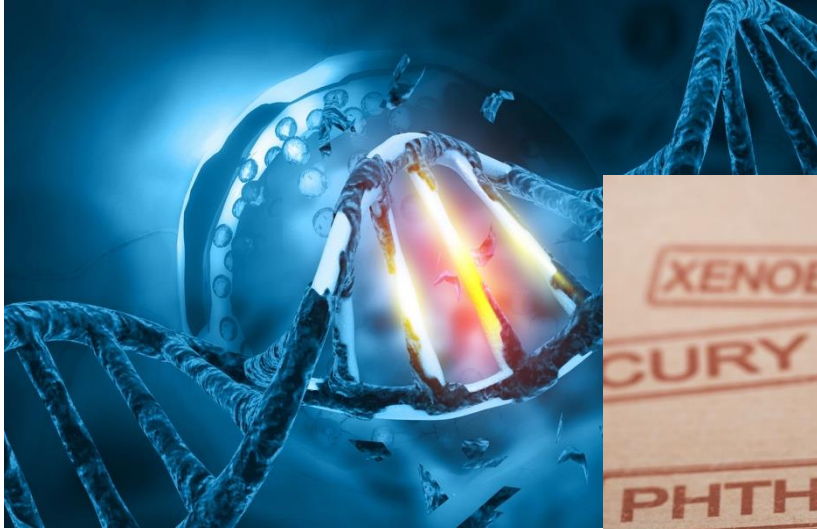
Columbia University



A woman with dark, curly hair is shown from the chest up, wearing a white robe. She is holding a light-colored towel over her head, drying her hair. The background is a bright, out-of-focus indoor setting.

HAIR PRODUCT USE AS AN IMPORTANT SOURCE OF ENVIRONMENTAL CHEMICAL EXPOSURE

Harmful chemicals in hair products and other personal care products (PCPs)



Hair products and harmful chemicals – endocrine-disrupting chemicals (EDCs)



- Hair oils
- Hair lotions
- Root stimulators
- Leave-in conditioners
- Perms/relaxers
- Hair dyes
- Edge control
- Pomade
- Hair gel

Endocrine-disrupting chemicals (EDCs)

Abnormal hormone levels (e.g., higher or lower than they should be)

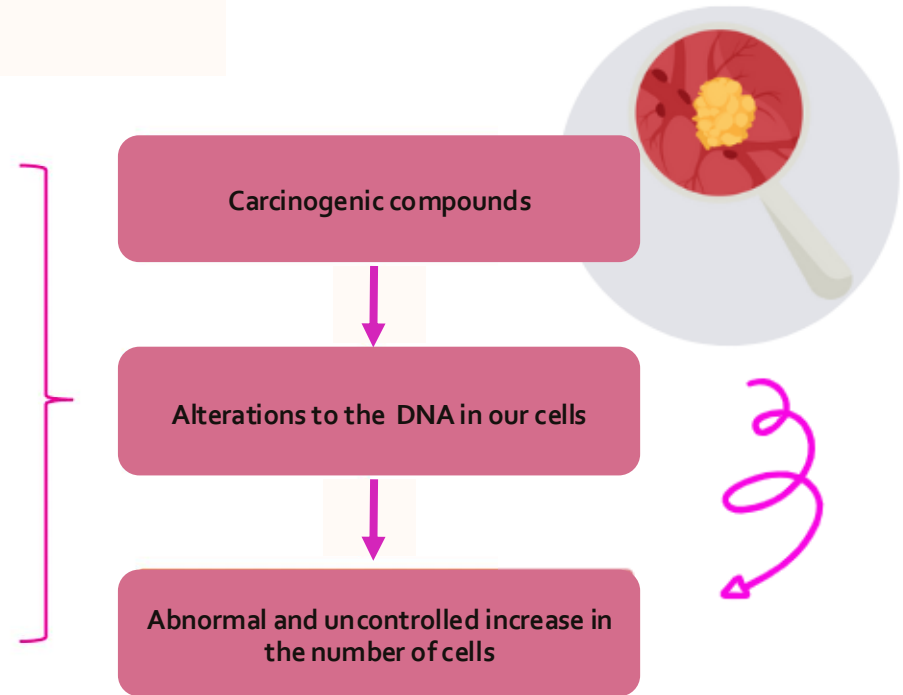
Interference with the way hormones in our bodies work



Hair products and harmful chemicals – carcinogens



- Hair oils
- Hair lotions
- Root stimulators
- Leave-in conditioners
- Perms/relaxers
- Hair dyes
- Edge control
- Pomade
- Hair gel



Unequal burden of hair product use and EDC exposure in women of African Ancestry



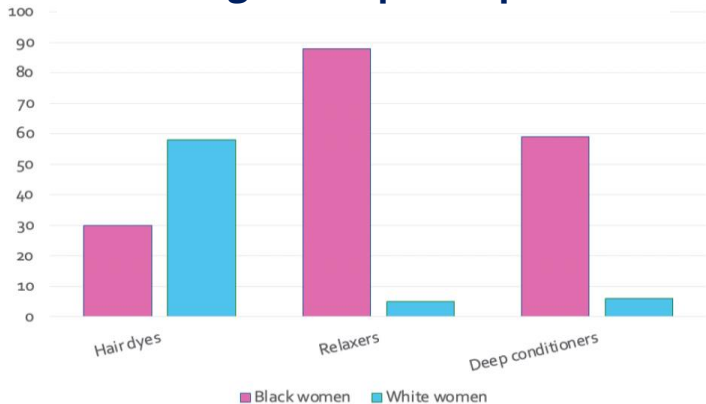
- Greater burden of exposure of EDC-containing hair products among Black women,¹ including greater childhood use²
- While the prevalence of hair dye use tends to be higher in White women relative to Black women,^{3,4} chemical relaxer use is substantially higher among Black women, with variation by population⁴⁻⁷
- Epidemiologic analysis of association between hair product use – namely hair dye use – with breast cancer historically focused on White women⁸

**CONTEMPORARY EVIDENCE LINKING
HAIR PRODUCT USE WITH VARIOUS
HORMONE-RELATED CANCERS**

Hair product use and breast cancer in the Women's Circle of Health Study (WCHS)

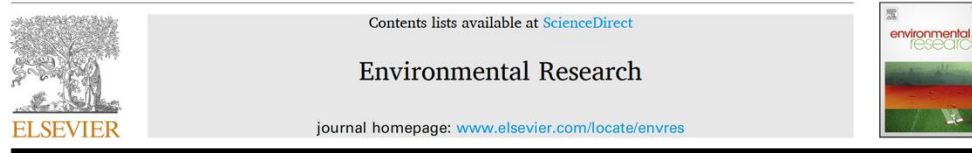


Prevalence of hair product use among WCHS participants



- Use of dark hair dye shades was associated with significantly increased odds of BC
 - Black women: OR 1.51, 95% CI: 1.20, 1.90
 - White women: OR 1.22, 95% CI: 0.87, 1.73
- Stronger associations for ER+ BC
 - Black women: OR 1.72, 95% CI: 1.30, 2.26
 - White women: OR 1.54, 95% CI: 1.01, 2.33
- Use of chemical relaxers was not associated with BC among Black women (OR 0.99, 95% CI: 0.79, 1.26), but was associated with significantly increased odds of among White women (OR 1.74, 95% CI: 1.11, 2.74)
- Use of both relaxers and hair dyes was associated with >2-fold increased odds of BC (OR 2.40, 95% CI: 1.35, 4.27)

Among WCHS participants with breast cancer (N = 2,998), we tested the hypothesis that hair product use is associated with more aggressive tumor features.



Associations of hair dye and relaxer use with breast tumor clinicopathologic features: Findings from the Women's circle of Health Study

Rohan Rao^a, Jasmine A. McDonald^{b,c}, Emily S. Barrett^{d,e}, Patricia Greenberg^f, Dede K. Teteh^g, Susanne B. Montgomery^h, Bo Qinⁱ, Yong Lin^{d,i}, Chi-Chen Hong^j, Christine B. Ambrosone^j, Kitaw Demissie^k, Elisa V. Bandera^{d,i}, Adana A.M. Llanos^{d,i,*}

Key findings:

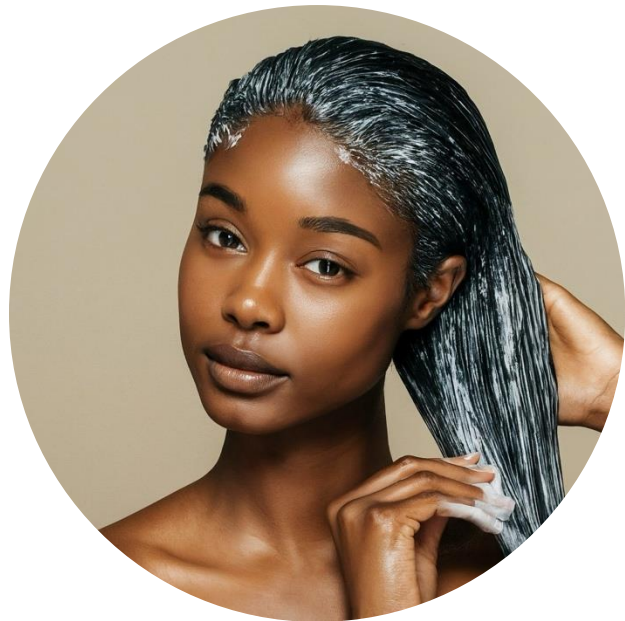
- Combination application (home kit + salon application) of permanent hair dye was associated with increased risk of more aggressive breast tumor characteristics including:
 - Larger tumor size
 - Higher tumor grade
- Longer duration of relaxer use (>10 years) and use beginning at younger ages (before age 12) were associated with larger tumor size

Hair relaxer use and breast cancer risk in the Ghana Breast Health Study

- 90% prevalence of chemical relaxer use among population-based control participants
- Use of **chemical relaxers** was associated with a significant increase in breast cancer risk (OR 1.58, 95% CI: 1.15, 2.18) overall, with evidence of dose-response with increasing years of use
 - Risk was higher among women in Accra (OR 2.31, 95% CI: 1.40, 3.82) than Kumasi (OR 1.22, 95% CI: 0.80, 1.88)
- Use of **non-lye relaxers** was more strongly associated with breast cancer risk (OR 1.88, 95% CI: 1.34, 2.64) than **lye-based relaxers** (OR 1.38, 0.86, 3.30)



Hair dye and relaxer use and breast cancer risk in the Sister Study



- Use of **permanent hair dye** was associated with increased breast cancer incidence among Black women (HR 1.45, 95% CI: 1.10, 1.90), with evidence of dose-response with increasing frequency of use
- Use of **chemical relaxers** was associated with a marginally significant increase in breast cancer incidence (HR 1.18, 95% CI: 0.99, 1.41), with evidence of dose-response with increasing frequency of use

Hair dye and relaxer use and ovarian and uterine cancer risk in the Sister Study

Ovarian cancer

- Use of **permanent hair dye** was associated with 94% increased risk non-serous ovarian tumors (HR 1.94, 95% CI: 1.12, 3.37)
- **Frequent use of relaxers** (>4 times/year) was associated with more than 2-fold increased risk of ovarian cancer (HR 2.19, 95% CI: 1.12, 4.27)

Uterine cancer

- **Use of relaxers** was associated with 80% increased risk of uterine cancer overall (HR 1.80, 95% CI: 1.12, 2.88)
- **Frequent use of relaxers** (>4 times/year) was associated with more than 2-fold greater risk of uterine cancer (HR 2.55, 95% CI: 1.46, 4.45)



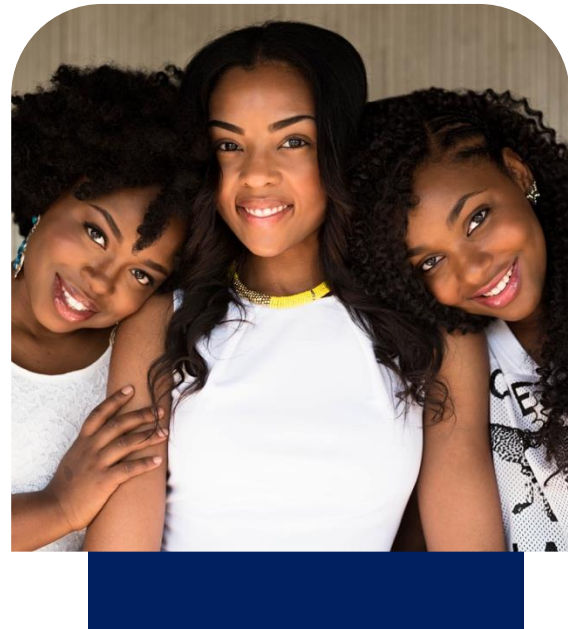
Relaxer use and breast and uterine cancer risk in the Black Women's Health Study (BWHS)

Breast cancer

- **Heavy use of relaxers** (≥ 15 years of use and ≥ 7 times/year) was associated with a modest increase in the risk of breast cancer (HR 1.13, 95% CI: 0.96, 1.33)
- Use of **lye-based relaxers** was associated with an increased risk of ER+ breast cancer (HR 1.32, 95% CI: 0.97, 1.80)

Uterine cancer

- **Heavy use of relaxers** among postmenopausal women was associated with 64% increased risk of uterine cancer (HR 1.64, 95% CI: 1.01, 2.64)
- **≥ 20 years of use** regardless of frequency was associated with 71% increased risk of uterine cancer (HR 1.71, 95% CI: 1.08, 2.72)



Hair dye use and prostate cancer risk in the Alpha-Tocopherol, Beta-Carotene Cancer Prevention Study



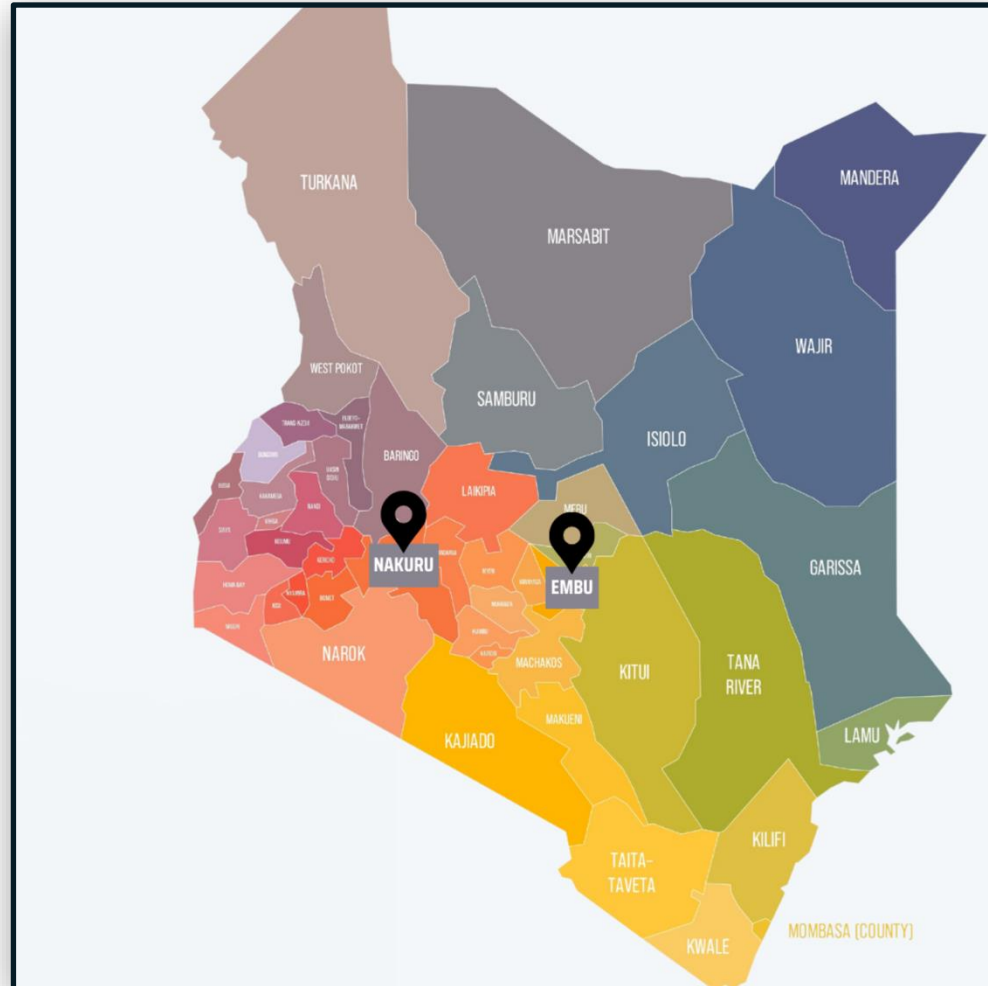
- Among **men who used hair dye**, there was a 77% increased risk of prostate cancer relative to men who did not use these products (HR 1.77, 95% CI: 1.03, 3.05)
- More research investigating the health implications of hair dye and other personal care product use among men is warranted

**PREVALENCE OF HAIR DYE AND
RELAXER USE AMONG WOMEN IN
KENYA**

Nakuru and Embu Counties

Why did we select these counties?

- High burden of breast cancer
- Represent rural/urban areas
- Expressed need for identification of breast cancer risk factors as a health research priority



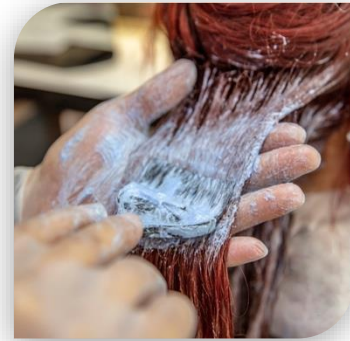
Characteristics of Study Participants, N = 746

Characteristics	Overall sample n (%)
Age (years), mean $\pm$ SD	30.4 $\pm$ 8.1
Marital status	
Currently married	348 (46.6)
Formerly married	52 (7.0)
Never married	344 (46.1)
Education level	
Less than high school certificate	142 (19.0)
High school certificate	283 (37.9)
Some college but no degree	253 (33.9)
Bachelor's degree and above	67 (9.0)
Current occupation field	
Business and administration	155 (20.8)
Education, government, and law enforcement	34 (4.6)
Farming and agriculture	60 (8.0)
Sales and service	364 (48.8)
Science, technology, and engineering	17 (2.3)
Student	61 (8.2)
Unemployed or casual work	49 (6.6)

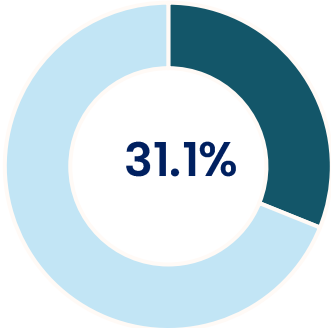
Characteristics of Study Participants, N = 746 (cont.)

Characteristics	Overall sample n (%)
Current income (KES per month)	
<10,000	427 (57.2)
10,000-50,000	279 (37.4)
>50,000	12 (1.6)
Household size	
1-2	159 (21.3)
3-4	358 (48.0)
≥5	223 (29.9)
Menopausal status	
Premenopausal	654 (87.7)
Postmenopausal	87 (11.7)
Personal history of breast cancer	
No	726 (97.3)
Yes	18 (2.4)
Currently pregnant	
No	688 (92.2)
Yes	47 (6.3)

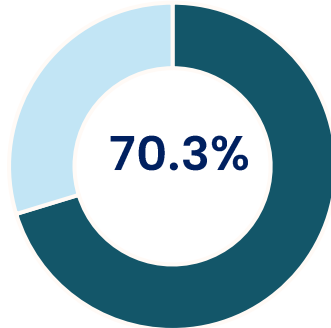
Prevalence and patterns of hair dye use among women in Embu and Nakuru



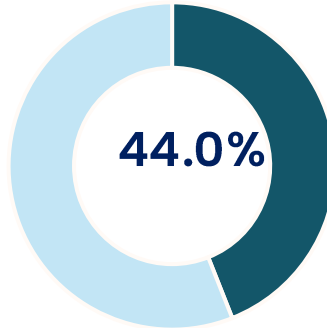
Ever Use of Permanent Dyes



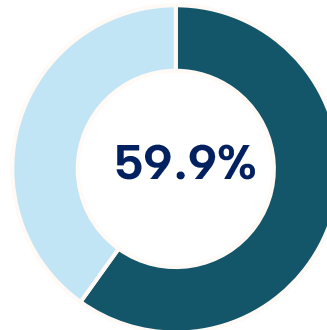
Older Age (≥ 20 yrs) at First Hair Dye Use



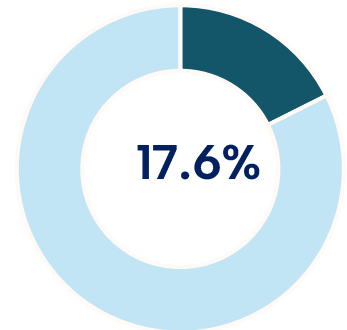
Darker Shades of Dye Typically Used



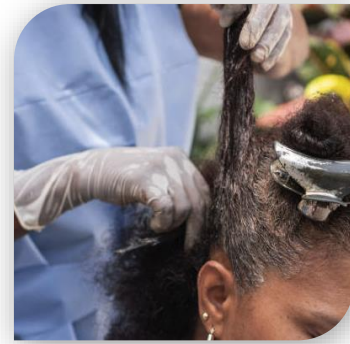
Professional Dye Application in Salons



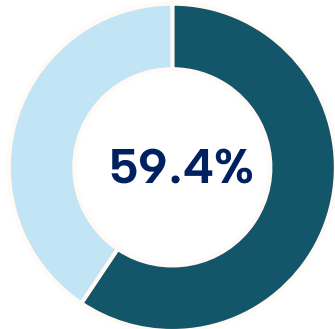
Current Use of Permanent Dyes



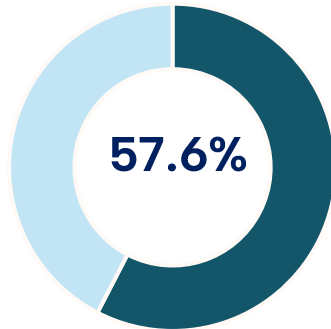
Prevalence and patterns of chemical relaxer use among women in Embu and Nakuru



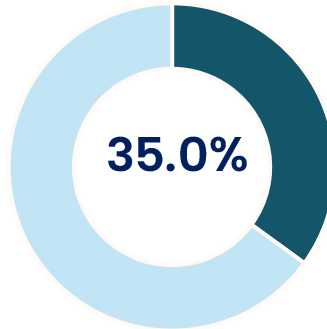
Ever Use of
Chemical Relaxers



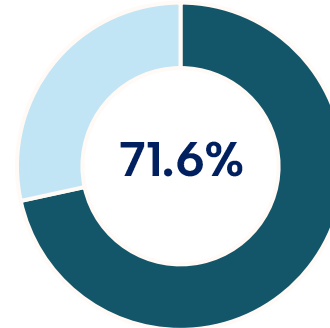
Older Age (≥ 20 yrs)
at First Relaxer Use



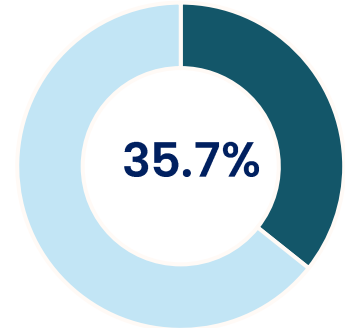
Ever Use of Lye-
Containing Relaxers



Professional Relaxer
Application in Salons



Current Use of
Chemical Relaxers



A background image showing several pieces of laboratory glassware. In the foreground, there are two Erlenmeyer flasks and a beaker. One flask on the left contains a red liquid, and another in the center contains a yellow liquid. A beaker on the right contains a red liquid. The glassware has measurement markings, with '50ml APPROX.' and '40' visible on the flasks. The background is slightly blurred, showing more glassware and a bright light source.

**CHEMICALS OF CONCERN
IDENTIFIED IN HAIR RELAXERS
COMMONLY USED AND SOLD IN
KENYA**

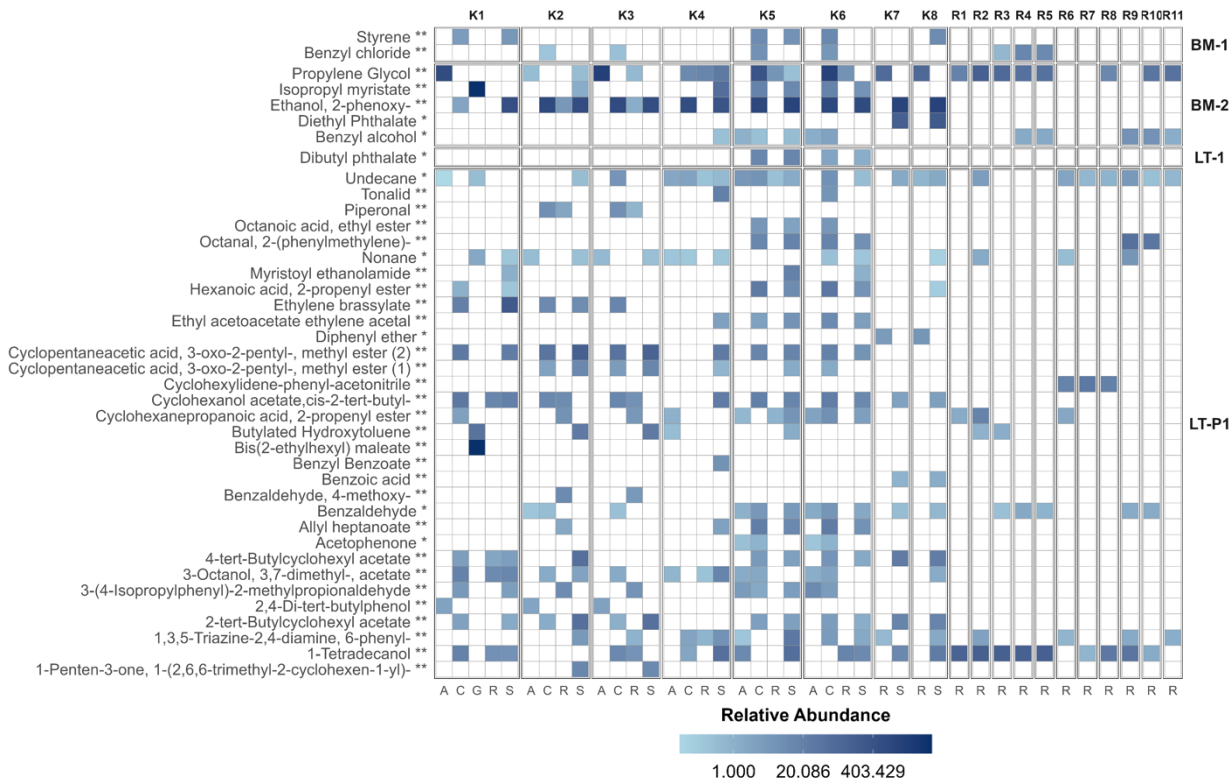
Methods: Chemical Screening Analysis by Mass Spectrometry and Atomic Absorption

We purchased 19 hair relaxers (11 jar, 8 multi components):
42 individual samples analyzed



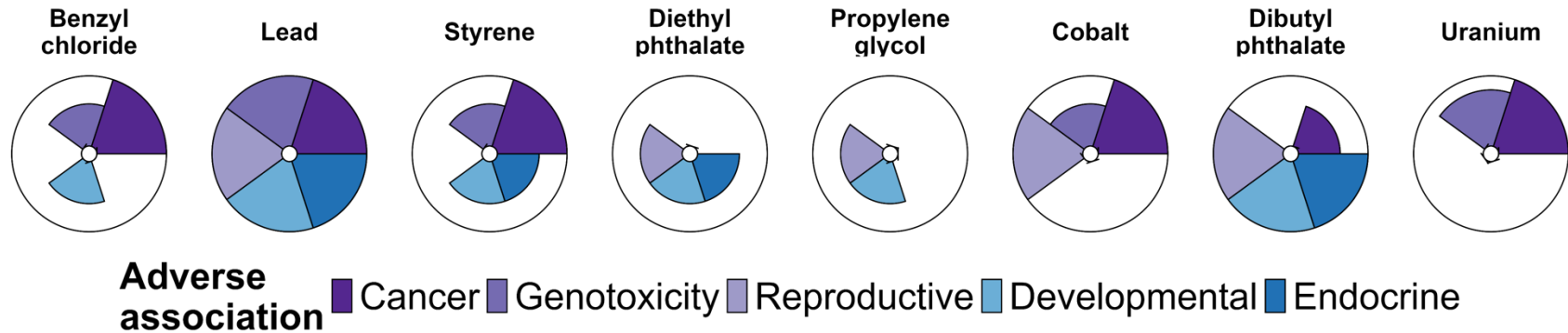
1. Non-targeted analysis of semi-volatiles by two-dimensional gas chromatography time-of-flight (GCxGC-TOF) mass spectrometry (MS)
 - a. Data processed using LECO's chromatograph software and compared against NIST library
 - b. Classification: Tentatively identified compound or unknown
2. PFAS screened by liquid chromatography - quadrupole time-of-flight (LC-qTOF) Mass Spectrometry (MS)
3. Metals analyzed by Inductively Coupled Plasma (ICP) MS for 18 metals and atomic absorption (AA) for mercury

Chemicals of concern identified in commonly used hair relaxers on the market in Kenya



- NTA detected >5600 chemical signals across all relaxer samples.
- A total of 353 unique chemical signatures were identified and confirmed, and we tentatively identified 83 unique compounds.
- Each of the nineteen relaxer products contained chemicals of known or potential concern.

Hazard profiles of chemicals of concern identified in commonly used hair relaxers on the market in Kenya





Discussion and Implications



Hair dye and relaxer use is common among women in the US and in Kenya and linked to a variety of hormone-related cancers.



Our findings highlight the importance of multisector collaboration—spanning research, regulation, policy, industry, and community engagement—to reduce chemical exposure burdens from personal care product use, particularly among populations at heightened health risk.



The identification of numerous chemicals of concern in hair relaxers points to regulatory gaps and reinforces the need for policy reform and equity-focused interventions to reduce harmful chemical exposures in consumer products.

Acknowledgements



**COUNTY GOVERNMENT
OF EMBU**
The Land of Opportunities



**African-Caribbean
Cancer Consortium**



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THANK YOU!

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