

# Personal care product use among diverse women in California: Taking Stock Study

Robin E. Dodson<sup>1\*</sup>, Bethsaida Cardona<sup>1</sup>, Ami R. Zota<sup>2</sup>, Janette Robinson Flint<sup>3</sup>, Sandy Navarro<sup>4</sup>, Bhavna Shamasunder<sup>5\*</sup>

<sup>1</sup>Silent Spring Institute

<sup>2</sup>Department of Environmental and Occupational Health, George Washington University Milken Institute School of Public Health

<sup>3</sup>Black Women for Wellness

<sup>4</sup>LA Grit Media

<sup>5</sup>Occidental College, Urban and Environmental Policy Department

\*corresponding authors:

Robin E Dodson  
Silent Spring Institute  
320 Nevada Street, Suite 302  
Newton, MA 02460  
[dodson@silentspring.org](mailto:dodson@silentspring.org)

Bhavna Shamasunder  
Occidental College  
1600 Campus Rd  
Los Angeles, CA 90041  
[bhavna@oxy.edu](mailto:bhavna@oxy.edu)

## **Abstract**

*Background:* Personal care product use may contribute to elevated body burdens of consumer product chemicals among women of color; however, racial/ethnic differences in product use has been understudied. Community-engaged research can support the recruitment of diverse participants.

*Objective:* To document personal care product use among a diverse group of women (aged 18-34 years) living in California.

*Methods:* Through a community-academic partnership, we surveyed 357 women in California about product use information for 54 cosmetic, hair, menstrual/intimate care, and leave-on and rinse-off personal care products. We compared type and frequency of product use among Black, Hispanic/Latinx, Asian, and White women. We also summarized use of scented products and reasons women select products.

*Results:* Women reported using a median of 8 products daily, with some women reporting up to 30 products daily. Hispanic/Latinx and Asian women used more cosmetics, and Black women used more hair and menstrual/intimate products than other women. Of the 54 products compared, there were significant differences in use by race/ethnicity for 28 products, with the largest number of significant differences between Black and White women.

*Significance:* There is growing information on chemical exposures from personal care products and consequent adverse health effects, with implications for health disparities. Yet, there remains limited information on the range and types of products used by diverse racial/ethnic communities. This study helps close an important gap on product use inventories that can enable more informed public health interventions to limit exposures from personal care products.

## **Keywords**

Personal care products, fragrance, community-based participatory research, women's health, race/ethnicity, endocrine disrupting chemicals, environmental health disparities

## Introduction

Reproductive-aged women are frequent users of personal care products, including cosmetics, hair, menstrual/intimate, and skincare products. Women of color, particularly Black women, have higher exposures to personal care product chemicals, many of which are hormonally-active (1-7). Exposure to these chemicals is associated with hormone-mediated health conditions such as uterine fibroids, preterm birth, and breast cancer—all of which disproportionately impact Black women. Differences in product use may contribute to observed exposure and health inequities. Environmental health research documenting the breadth of product use across women from diverse racial and ethnic categories is limited. Without these critical data, we may be underestimating the cumulative burdens from personal care product use on health inequities.

Prior studies suggest important differences in product use among racial/ethnic groups. Some of these product categories are tied to historic and ongoing forms of racial discrimination such as colorism and hair texture preferences, and shaped by factors such as racial and ethnic marketing (8). In a California study with a limited number of women of color, African-American women reported less frequent use of shampoo and conditioner than other (mostly White) women (9), and Asian women reported more frequent use of skincare products but less frequent use of makeup and deodorant compared to other women (9). Whereas, African-American and African-Caribbean women in New York City were more likely to use hair oil, root stimulator, and hair relaxer/perm compared to White women (10). In a separate, nationally-representative study, Black women were more likely than White women to use fragranced menstrual/intimate care products including vaginal douches, feminine sprays and wipes (3). However, few studies have attempted to examine racial/ethnic differences across multiple product types in samples that include populations other than Black and White women. In addition, existing research has had very limited inclusion of Asian and Latinx communities. There is increasing racial/ethnic

diversity in the US, with Asians and Latinos among the fastest growing populations (11, 12). There is also limited information on multi-racial populations, which is a growing category.

Product use is associated with higher exposures to endocrine disrupting chemicals (EDCs), as assessed via biomonitoring, however most of these studies do not provide data on racial and/or ethnic dimensions of product use and associations with biomonitoring data. Exposure studies generally report that a greater number of products results in higher urinary concentrations of parabens and phthalate metabolites (13-15). Use of specific product types is also associated with higher phthalate and paraben exposures (14, 16-19). For example, use of nail polish, eye makeup and perfume is associated with higher exposure to diethyl phthalate (DEP) and dibutyl phthalate (DBP) (14, 18, 20). Vaginal douche use is associated with higher DEP exposure (3). Sunscreen, lotions, shaving cream, and some cosmetics use is associated with higher levels of the UV filter benzophenone-3 (13, 19, 21-24). Use of lotions, sunscreen, cosmetics, some hair products, nail polish, and mouthwash is associated with higher urinary concentrations of parabens (16, 19, 21-25).

Product use, particularly hair product use, is associated with adverse reproductive health outcomes, particularly for Black women. For example, use of hair oil and hair relaxers has been associated with earlier menarche (10, 26) and use of hair relaxers with higher incidence of fibroids (27). Use of hair dye and hair relaxers is associated with increased breast cancer risk, with Black women experiencing higher risk than White women (28-31). Another study found more frequent use of beauty and skincare products, and not hair products generally, is associated with increased risk of breast cancer (32).

Given the mounting evidence linking EDC exposures with health disparities and the paucity of data on product use in communities of color, we sought to gather data on personal care product use among diverse women. Through a community-based approach, we conducted a survey covering over 50 types of personal care products, including cosmetics, menstrual/intimate care products, hair products, and leave-on and rinse-off products, among

reproductive-aged women in California. We hypothesized that product use varies across race/ethnicity since factors such as racialized beauty norms and differential racial/ethnic marketing can shape product use (8).

## **Methods**

The Taking Stock Study ([takingstockstudy.org](http://takingstockstudy.org)) is a community-academic partnership with Occidental College, Black Women for Wellness (BWW), local *promotores de salud* (community health workers), George Washington University Milken School of Public Health, and the Silent Spring Institute. The Taking Stock Study examines consumer product use with a focus on Black women and Latinas, using community generated research questions and collaborative methods of inquiry. BWW is a community-based organization with offices across California and a national presence. BWW is committed to the health and well-being of Black women and girls. A network of local *promotores de salud* operates as a longstanding informal community institution that utilizes a nationally recognized community health outreach model to provide culturally accessible in-home education, primary prevention, and advocacy for families in low-income communities of color. The study's Community Advisory Board (CAB) includes Black Women's Network, Communities for a Better Environment, and California Latinas for Reproductive Justice. We integrated these community resources to develop and implement culturally sensitive and linguistically-appropriate outreach materials, including a logo and outreach materials and survey instruments in Spanish and English.

### *Survey Development*

BWW has conducted many surveys with their membership, and their experiences on the ground helped shape survey questions. We also drew upon surveys used in other consumer product-related research studies (10, 13, 16, 33, 34). Community feedback among *promotores de salud* and our CAB was iterative, and as a result we added several products to our lists and altered product names to be more relevant.

Our survey focused on a broad range of personal products, including cosmetics (e.g., mascara), hair products (e.g., hair oils), menstrual/intimate care products (e.g., douches), and other leave-on and rinse-off personal care products (e.g., body lotions). For each product category, we asked participants to select products from a list that they are currently using or have used in the past year, and for product selected, we asked participants to select how often they use each product. For some product categories we also asked about if the products were “scented” or “fragrance-free.” The survey was developed in English and translated into Spanish (see Supplemental Material). Protocols, including the survey, were reviewed and approved by Occidental College’s Institutional Review Board.

### *Survey Dissemination*

We relied on community networks as well as online outreach and social media to disseminate the online survey. BWW statewide staff and Sandy Navarro (who led the work among *promotores de salud*) disseminated the survey at local meetings, parent groups, community centers, city council districts, and church and neighborhood organizations. Staff were based in Los Angeles County and San Joaquin County, but outreach was focused statewide. At in person events, staff handed out postcards with a QR code where interested respondents could access the survey later, and also had a tablet available where the survey could be taken at the tables. These were events such as community festivals, and were not environmental health or environmental justice focused, to ensure the broadest range of participants in our survey. Postcards were also disseminated by our CAB members during door-to-door canvassing for other issues. At community outreach events with smaller groups of women, in some instances, each participant was given the survey link or could access it through the QR code on the flier, and the *promotora de salud* would read each question as the group followed along on their own phones. For five surveys where the participant was low literacy, the *promotora de salud* verbally read the questions and responses and administered the survey

orally while she entered the responses for the participant. To increase representation of women with less than a college education, we utilized a Qualtrics panel to survey women—an equal number of women of each race/ethnicity—across California. This yielded 71 participants for this analysis. In addition, emails were sent via BWW's statewide membership list, distributed to college campuses, and posted to BWW's social media pages.

### *Data Analysis*

We focused on use of cosmetic, hair, menstrual/intimate care, and leave-on and rinse-off personal care products. We characterized the number of products used, the frequency of products used, correlations across products, the number of scented products used; and how these vary by race/ethnicity.

We limited our analysis to participants who completed all of the questions pertaining to product use in the survey, who completed the survey prior to March 31, 2020, and who lived in a California zip code. For the majority of the analysis, with exceptions noted, we focused only on those participants who exclusively self-identified as “White,” “Black or African American,” “Asian,” or “Hispanic/Latinx.” We separately report product use among women reporting multiple races/ethnicities or “other” race/ethnicity.

Through the survey, we asked participants about their current/past year-use of 54 personal care products: 13 cosmetic products, 14 hair products, 12 menstrual/intimate care products, 8 leave-on personal care products, and 7 rinse-off personal care products. Specifically, participants were asked about products that they “currently use or use within the past year.” We focus our analyses on current use products rather than daily use products in order to capture important products that may not be used on a daily basis (e.g., some hair products and vaginal care products). Participants could either select the products that they used within each of these four product categories or skip product categories entirely, which we interpreted to mean that they used none of the products within the skipped category.

We compared the number of products used within each category across the four different race/ethnicity groups using the Kruskal Wallis test. If a product category differed significantly in the average number of products used by racial/ethnic group ( $p < 0.05$ ), we conducted a pairwise Wilcoxon rank-sum test. We used Bonferroni corrections in all of the multiple comparison pairwise tests.

For each of the 54 products in the survey, we calculated the percent of participants who use the product and identified differences in use by race/ethnicity using Fisher's exact test. If product use by race/ethnicity was significantly different ( $p < 0.05$ ), we used Fisher's pairwise testing to identify the groups that differed after Bonferroni adjustment. Because the age distribution varied by race/ethnicity (i.e., White and Asian women tended to be younger than Hispanic/Latinx and Black women), we tested differences in product use among only the younger women (18-24 years old) to evaluate the sensitivity of our results to the age imbalance.

We also evaluated product use among women who did not self-categorize exclusively as "White," "Black or African American," "Asian," or "Hispanic/Latinx." Additional self-identities included "American Indian or Alaska Native," "Native Hawaiian or Pacific Islander," "Other" (which had a write-in option), "Prefer not to answer," and multi-racial (selecting more than one of the identities). People with multiracial ancestries often identify with more than one of them, but these populations also self-identify according to norms that are less well established than for those who consider themselves solely Black or White (35). We visualized the product-use responses of each of these participants using a heatmap to show use versus no use of products, for each of the 54 products.

We also summarized and compared the frequency of use for each product. If a participant indicated the use of a product, the survey then prompted participants to answer questions about the frequency of use, for said product, within the past year. Frequency questions were asked using categorical variables and ranged from "Very rarely (less than once a month) to "More than once per day." For each of these products, we compared the frequency of product use between



users by race/ethnicity. Each answer choice for frequency was re-coded as an ordinal variable with “1” indicating the lowest frequency of use. We used the Kruskal–Wallis test to test for differences in frequency of use by race/ethnicity followed by pairwise Wilcoxon rank-sum tests to identify the differing groups. We also present the number of products used daily in order to provide comparable data to previous product use studies.

We evaluated the correlations among self-reported product use with the phi statistic, a measure of association between two dichotomous (yes/no) variables. The larger the phi statistic, the more correlated the variables. For each chemical, we modeled associations one-by-one for each individual product.

We also asked about the use of scented products for two of the menstrual/intimate care products, three hair products, and ten other personal care products. For each of the 15 products, we calculated the percentage of people who indicated using scented version. We excluded participants who were unsure of the scent status. We identified differences in scented product use by race/ethnicity using Fisher’s exact test followed by pairwise Fisher tests for significant products ( $p < 0.05$ ).

To learn more about influences on product choice, participants were asked to indicate the characteristics they felt were important when purchasing products (e.g., scent, long-lasting, ingredients, price, brand, effectiveness, or some other characteristic), and where they received their product recommendations or learned more about products (e.g., advertisements, social media, friends, family, internet search, or some other source) for each of the four product categories. We conducted a Fisher’s exact test, followed by pairwise Fisher tests, to test for differences by race/ethnicity.

All data were processed and analyzed using R (version 3.6.3).

## Results

### *Participant characteristics*

A total of 357 California women, including nonbinary (n = 8), transgender (n = 1), and self-described gender (n=1), between the ages of 18-34 completed the survey. Of these, 20% self-categorized as Black or African American, 28% as Hispanic/Latinx, 14% as Asian, 22% as White, and 15% as Other or Multi-Racial (Table 1). Of the 357 completed surveys, 2% were conducted in Spanish via our outreach, 20% were conducted in English by women recruited through Qualtrics, and the remaining 78% were conducted in English by women recruited through our networks. There were slightly more women in the 18-24 year category (58%) than in the 25-34 year category (42%). The age distribution varied by race/ethnicity: younger women comprising a greater percentage of Asian and White women and older women a greater percentage of Black and Hispanic/Latinx women. Of the 357 women, 21% completed some high school or all of high school, 37% completed some college, 40% obtained a 2-year or 4-year college degree, and 12% completed a professional or graduate degree. The distribution of education by race/ethnicity reflects the age distribution, with younger Asian and White women not yet completing college degrees.

In this study, women reported using an average of 8 products per day, with some women reporting as many as 30 products (Figure S1). There were no significant differences between the number of products used daily by race/ethnicity; however, there were differences by race/ethnicity in the number of currently used products.

### *Differences in product use and frequency of use by race/ethnicity*

The number of products used (currently or within the past year) within a product category varied, sometimes significantly, by race/ethnicity (Figure 1, Table S1). Black and White women reported using a fewer number of cosmetic products (median = 7 products for each group) than Hispanic/Latinx women and Asian women (medians = 10 and 9 products, respectively),

although these differences were not significantly different. For menstrual/intimate care products, White, Hispanic/Latinx, and Asian women reported using a median of 2 menstrual/intimate care products whereas Black women reported slightly more (median = 3 products). Black women reported using a significantly greater number of hair products (median = 7 products) than other women, followed by Hispanic/Latinx women (median = 5 products) who used more than Asian (median = 4 products) and White women (median = 3 products). Use of leave-on personal care products was similar (median = 5 products) among Black, Hispanic/Latinx, and White women, and Asian women reported using slightly fewer leave-on products (median = 4). For rinse-off personal care products, White women (median = 5 products) used fewer of these products compared to Asian (median = 6 products) and Black (median = 6 products) women and significantly fewer products than Hispanic/Latinx women (median = 6 products).

Of the 54 products compared, there were significant differences in use by race/ethnicity for 28 products (Table 2). Black and White women reported the greatest differences in product use (significant differences in 17 products) whereas Asian and White women reported the least number of differences (significant differences in 4 products).

Among the 13 cosmetic products queried, the most commonly used by all women were mascara (82%), nail polish (75%), and lipstick (72%), while the least used were makeup primer (42%), powder/baking powder makeup (42%) and setting spray (37%). There were significant differences in use by race/ethnicity for powder/rouge/blush, lipstick/other lip color, and makeup primer (Table 2). Use of powder/rouge/blush was significantly more prevalent among Hispanic/Latinx women (62%) than among Black women (33%). Use of lipstick was significantly more prevalent among Hispanic/Latinx women (83%) compared with Black (62%) and White (65%) women. Makeup primer was more common among Asian women (51%) and Hispanic/Latinx women (50%) compared to Black (36%) and White (31%) women.

The most frequently used cosmetics were foundation/beauty balm (bb) cream, concealer, powder/baking powder, and lipstick. There were significant differences in frequency of use for

several cosmetics (Table 2, Figure 2, Figure S2). Of the 214 women who reported using nail polish, 70% report using it  $\geq 1$ -3 times/month, and Asian women reported using nail polish significantly less frequently than Black women. White women reported using lipstick significantly less frequently than Black and Hispanic/Latinx women, the majority of whom used lipstick more than 1-5 times/week. For cosmetics applied near the eyes, Hispanic/Latinx women reported using eye liner significantly more frequently than Asian, Black, and White women and mascara significantly more than Asian women. For cosmetics applied to the face, Hispanic/Latinx and Asian women used foundation/beauty balm significantly more frequently than Black and White women, and Hispanic/Latinx women used concealer significantly more than Asian women.

Menstrual/intimate care product use, except use of tampons (52%) and sanitary pads/panty liners (76%), was not prevalent (Table 2). A minority of women reported using menstrual/intimate care products beyond those for menstruation, with shaving cream (26%) used the most out of these. Seven of the twelve menstrual/intimate care products varied significantly by race/ethnicity. Menstrual cup use, although not common overall (11%), was used significantly more by White women (23%) compared to Black (5%) and Asian (4%) women. White women also reported greatest use of tampons (66%), significantly more than the lowest user group, Hispanic/Latinx women (41%). Vaginal/personal lubricant was used by 16% of women overall, with White women (26%) using it significantly more than Hispanic/Latinx women (9%). Black women reported greatest use of douche (14% compared to 6% overall), and use of vaginal wipes/towelettes (29% compared to 17% overall) and vaginal washes/cleaners (19% compared to 12%). There were no significant differences in the frequency of use of menstrual/intimate care products by race/ethnicity. Most menstrual/intimate care product use occurred  $< 1$ -3 times per month or during menstruation, with the exception of vaginal washes, which were used  $\geq 1$ -3 times/month by 55% of users.

Use of hair products was significantly different by race/ethnicity for most of the fourteen products except for three: shampoo, conditioner, and hairspray (Table 2). A higher proportion of

Black women reported using hair oil, hair shine, hair styling gel/edge control gel, curl cream/smoothie/pudding/leave-in conditioner, pomade/grease/wax, hair glue, and detangler than other women. Hispanic/Latinx women were the second most prevalent user group of many of these products. For example, while 74% of Black women used hair oil, a significantly higher proportion than other groups, 52% of Hispanic/Latinx women and 47% of Asian women also used hair oil versus 31% of White women. Use of hair styling gel/edge control gel followed a similar pattern: 77% of Black women (significantly more than other groups), 31% of Hispanic/Latinx women, 12% of Asian women, and 10% of White women. Asian and Black women reported a greater use of hair perm/relaxer/chemical straightener (16% and 14%, respectively) than Hispanic/Latinx (3%) and White women (1%). Hair dye was used by more Hispanic/Latinx women (46%) compared to other women (25% Asian, 29% Black, and 31% White women).

While there were many significant differences in the use of hair products, there were fewer significant differences by race/ethnicity in the frequency of hair product use (Figure S2). Among the few White women who reported using hair shine (n=8), they used it more frequently than other women. Hair shampoo, conditioner, and co-wash was used less frequently by Black women than other women. For example, 12% of Black women reported using shampoo  $\geq 6$  times/week compared to 36% of other women. Hispanic/Latinx women reported more frequent use of hair spray, followed by Asian women although this was not significant in pairwise comparison.

The most commonly used leave-on personal care products were deodorant/antiperspirant (91%), hand or body lotions/creams (81% of women), perfume/cologne/scented body spray (68%), and sunscreen (66%). Deodorant was used by significantly fewer Asian women (75%). Sunscreen use was highest among Asian (82%) and White (77%) women, followed by Hispanic/Latinx women (67%), and use was significantly lowest among Black women (42%). Perfume was most commonly used by Black women (81%) and least common among White

women (55%). Body oil was used by 53% of Black women, which was significantly higher than use among Hispanic/Latinx (21%), Asian (18%), and White women (16%).

The most frequently used leave-on personal care products were deodorant, lotion/creams, and face creams. Asian women use deodorant less frequently than other women. Nearly 40% of Asians reported using sunscreen almost daily, which is significantly more than near daily use among Black women (11% of users) and Hispanic/Latinx women (22% of users). Nearly 33% of women reported using perfume  $\geq 6$  times/week, and Hispanic/Latinx women reported using perfume significantly more frequently than Asian women.

Among the rinse-off personal care products, toothpaste (95% of women), hand soap (88%), and body soap/shower gel (85%) were the most commonly used. Mouthwash used varied by race/ethnicity; significantly more Black women (77% of women) and Hispanic/Latinx women (74% of women) reported using mouthwash compared to Asian (47%) and White (44%) women. Approximately 57% of women reported using makeup remover, with significantly more Hispanic/Latinx women (68%) using it compared to Black women (48%). This was consistent with reported makeup use. The most frequently used rinse-off products were similar to the most frequently used rinse-off products.

Because more White and Asian women surveyed fell into the younger age group compared to the older age group and we were concerned that the product use results reflected differences in age and not differences in race/ethnicity, we evaluated product use among only the younger age group (18-24 years old) and compared results to the full cohort of women (Table S3). Of the 55 products surveyed, there were significant differences in use for 25 products, compared to 28 differences in the full cohort. Notable differences between the younger women and the full cohort include tampon use (more common among younger women so significant differences in race/ethnicity were no longer observed in this subset) and vaginal wipe use (less common among younger women, specifically younger Black women, so differences in full cohort not

observed in subset). Age (categorized by two groups) does not substantially influence observed differences in product use by race/ethnicity in this study.

#### *Product use among those reporting multiple races/ethnicities*

As part of a descriptive analysis, we separately evaluated product use among women who reported multiple race/ethnicities, or chose “Other” or “Prefer Not to Answer (PNA)” (Figure S2). Among the seven women who selected “Other,” responses included “Pakistani,” “Mixed Race,” “Mixed Ethnicity,” “Middle Eastern,” and “Arab.” We present product use responses for these 55 women without summary (i.e., individual results shown) alongside the percent of reported use within the four race/ethnicity categories (Figure S3).

#### *Concurrent use of products*

Product use was correlated for many products within a product category and for products across product categories (Figure S4). Since nearly all women reported using toothpaste and hand soap, it is not surprising that use of those products was highly correlated. Use of cosmetic products was highly correlated; if a woman reported using one cosmetic product (e.g., mascara), she likely reported using another (e.g., lipstick). Among menstrual/intimate care products, use of feminine powders and feminine sprays was correlated as was use of vaginal washes and vaginal wipes. As expected, use of hair products like shampoo and conditioner was highly correlated. Across product categories, use of makeup remover and face masks were highly correlated with use of several cosmetic products and use of shampoo and conditioner were correlated with other cleansers such as body washes and hand soap, as expected.

We compared product use between women who reported using the greatest number of products (top 10% of total products used) and women who reported using the least number of products (bottom 10%) (Figure S5). Among the top 10% of users, women reported using 36 to 42 products, whereas women among the bottom 10% of users reported using three to 14 products. The differences were driven by greater use of cosmetics among the top 10% of users.

### *Use of scented products*

The majority of women report using scented personal care products. The median number of scented products was 6 out of the 15 that we asked about, and there were no statistically significant differences in the number of scented products used by race/ethnicity (Table S4). Across all women, the products most often reported as scented (>80% of reported products) were shampoo, conditioner, co-wash/conditioner and hand soap (Figure 3). Among personal care products left on the skin, resulting in potentially greater exposure, 70% of hand/body lotions and 54% of body oils were reported as 'scented'. A small percentage of women reported using scented tampons (9%) and scented sanitary pads/napkins/panty liners (11%). The only scented product that varied significantly by race/ethnicity was makeup remover, which was used significantly more by Hispanic/Latinx women than White women.

### *Other factors related to product use*

We asked participants what factors help determine why they buy certain product types (Figure 4a, Table S5). Across all four product categories (leave-on and rinse-off personal care products combined), price and effectiveness were the top considerations when purchasing products. Half of women reported that scent was important when choosing hair and personal care products. Scent was less important when selecting cosmetic and menstrual/intimate care products. About half of respondents said that ingredients were important when selecting products and ingredients appeared to be more important when selecting personal care products compared to other product types. Less than half of women selecting "Brand" as important when selecting products. There were only a few differences across race/ethnicity: Black women less often selected "effectiveness" and "price" as important for reasons for why they chose products and White women selected fewer reasons why they chose hair products. Black women were also more likely to report selecting hair products for their ingredients, brand, and longevity compared to other women, and significantly more than White women.



We also asked participants where they go to learn more about products (Figure 4b, Table S6). Friends seemed to be an important source of information, with over 50% of respondents relying on friends for all product types except menstrual/intimate care products. For menstrual/intimate care products, family was the most commonly reported source of information, followed by an internet search and friends. Social media was used more than other advertisements across all product types, although women reported using social media less often for menstrual/intimate care products. Across race/ethnicity, Black women reported relying less on internet searches to learn more about cosmetics, relatively more on family and less on advertisements to learn about hair products, and relatively less on advertisements for menstrual/intimate care products compared to other women. Asian women report a greater reliance on friends to learn about personal care products compared to other women.

## **Discussion**

We documented product use, differences in use, and frequency of use across women of diverse races/ethnicities. Women across all racial/ethnic groups reported commonly using many cosmetic, hair, menstrual/intimate care, and other personal care products, with an average of 8 products per day. Use of specific products was correlated, particularly among cosmetics, so aggregate chemical exposures are a concern, and may contribute to cumulative impacts. There were significant differences in use by race/ethnicity for about half of the product types. Hispanic/Latinx and Asian women reported greater use of cosmetics than Black and White women, and Black women reported a significantly higher number of hair products and greater use of certain menstrual/intimate care products. Scented product use was common; with 70% of women reporting at least half of products asked about as scented. As many personal care products contain EDCs (36, 37), daily product use may be a substantial source of exposure to these chemicals. Further, differences in product use may explain differences in exposure and contribute to elevated burden of certain health outcomes among women of color.

*Categorizing Race and Ethnicity*

We sought to learn about product use among diverse women. Our analysis focused on comparing four racial/ethnic categories. Participants could also self-report their racial or ethnic identity. Asking women to self-identify and categorize themselves into racial and ethnic categories can be problematic. It can reify socially constructed racial categories and does not capture personal experiences of racism or other forms of discrimination women may face. Further, even within certain categories, there are differences in experiences that may influence products use; for example, acculturation has been associated with increased product use among foreign-born Chinese women (38). The US multiracial population is also growing and in 2000, the US Census added the option for the first time to check more than one race. Race is a fluid construct, with multiracial populations reporting shifts in identity over time (39). Multiracial individuals are able to adopt a variety of racial identities that include choosing a single racial identity, switching, or choosing multiracial identification. Numerous studies have shown that multiracial people are prone to shifts in their identity over time and could change self-reported racial identity (40). Since race primarily reflects social categories based on phenotypes and is not a biological construct, differences in product use must be considered in the context of external social, cultural, and/or economic drivers. Yet, these differences can have real biological consequences, including worsened health (41, 42).

Prior research on product use has often focused on narrow racial comparisons, with very limited inclusion of Asian and Latinx communities. Our survey presents an important step forward to include women reflected in the broader California population. The US shows increased racial and ethnic diversity with Asians and Latinos among the fastest growing populations in the United States (11, 12). Our study is also the first to specifically examine product use among multi-racial women. These women have chosen not to adopt a monoracial identity, and our preliminary analysis suggests that product use among this population is unique.

In addition, future research should strive to avoid racial essentialism and consider improved malleability in categorizations (39, 40).

Future work should also explicitly integrate principles of intersectionality, which emphasizes the influence of interlocking systems of privilege and oppression on the lives of multiple marginalized populations. Specifically, future studies should examine how intersections of racism, sexism, classism, and heterosexuality may influence personal care product use and consequent health risks. This type of research would help identify vulnerable and at-risk populations and help secure environmental justice by moving interventions further upstream (43).

#### *Product use differences by race/ethnicity*

Nearly half of the women in our study reported using at least one cosmetic a day, with some women using multiple cosmetics daily. We also found that use of individual cosmetic products was highly concordant, meaning that if a woman used makeup primer she also likely used setting spray. As a result, many women may have substantial aggregate exposure to chemicals found in cosmetics. For example, previous studies have found parabens, which have estrogenic and adipogenic activity (44-49), in many cosmetics (36, 37, 50, 51).

Because of the greater absorption of chemicals by vaginal skin, menstrual/intimate care products are potentially important sources of chemical exposure for women (52). While use of menstrual/intimate care products not related to menstruation (e.g., tampons, sanitary pads, menstrual cups) was not prevalent in our study, some women are regularly using these products. The use of douches, vaginal wipes/towelettes, and vaginal washes/cleaners that was more common among Black women in our study is consistent with previous studies (53, 54), including an analysis of the National Health and Nutrition Examination Survey (NHANES) that reported greater proportion of Black women using douches, feminine spray, feminine spray, and wipes/towelettes compared to White and Mexican American women (3). That same analysis

demonstrated that greater use of vaginal douches among Black women substantially contributed to racial/ethnic differences in phthalate exposure. Recent testing studies have shown that some menstrual/intimate care products contain EDCs, such as phthalates and parabens, and also VOCs, and that, under certain scenarios, menstrual/intimate care product use may contribute substantially to body burden of phthalates (52, 55-57). Of even greater potential concern is the use of scented menstrual/intimate care products like scented tampons. While tampon use was higher among White women, Black women more often selected scented tampons when they use tampons. Historical and ongoing odor discrimination, particularly against Black women (58), may contribute to these product use patterns.

Use of certain hair products—hair relaxers and hair dyes—has been associated with increased breast cancer risk (28-31), among other adverse health conditions. In this study, use of hair perms/relaxers/chemical straighteners was similarly prevalent among Black and Asian women although used more slightly more frequently by Black women. Hair dye was used by a third of women, with no significant differences in use by race/ethnicity. Overall, Black women reported use of more hair products than other women in our survey. However, we note that the hair products we asked about had been previously identified as more commonly used among Black women (34), who often face pressures to change or chemically treat natural hair (8). Many of these products likely contain EDCs (59), which could support explanations of higher exposures among Black women.

Use of leave-on personal care products, compared to rinse-off products, may be a significant source of exposure to some consumer product chemicals due to the extended duration of exposure. Recent product intake fraction estimates for parabens in leave-on products ranged from 50-80%, which is the proportion of parabens in the product that is taken up by the body to the amount of parabens in the product (60). Eighty percent of women in this study reported using hand or body lotions. Use of body lotions has been associated with significantly higher concentrations of parabens and benzophenone-3 in urine (13). Another

leave-on personal care product that warrants additional study is body oil. Body oil use was less prevalent than lotion use in this study (27% of all women); however, significantly more Black women reported using body oils compared to other women. The most common leave-on product was deodorant, used by 91% of women in this study, although less commonly used by Asian women, consistent with a previous California-based study (61). Deodorant use is socially driven—women use it to fit cultural norms (62)—resulting in potentially unnecessary chemical exposures.

### *Scented product use*

Women are widely using scented products, regardless of race, with a majority of women in this study reported using multiple scented products. In addition to concerns about irritation and exacerbation of asthma symptoms for some (63-65), fragranced products may contain VOCs and EDCs. Product testing has revealed synthetic fragrance chemicals with estrogenic activity in commonly used products and correlation between fragrance compounds and fragrance compounds with DEP (36). This is reflected in biomonitoring studies in which perfume use was associated with DEP exposure and greater use of fragranced products was correlated with higher DEP exposure (14). However, avoiding exposure to specific chemicals in scented products is difficult because of product ingredient regulations that permit use of the term “fragrance” on labels, which could include hundreds of chemicals, including several phthalates.

### *Factors contributing to product choice*

We queried women about why they choose their products and where they go to learn more about products. This information is important because it will inform strategies to limit exposures to consumer product chemicals and future intervention studies. Given the importance of price and effectiveness as reasons why women chose products, future outreach should focus on the relative cost differences between products and research on the effectiveness of potential alternative products. Scent is important for some women and should be considered in outreach.

The minority of women relied on brand when selecting products, suggesting women may be receptive to new product recommendations. Understanding where women go to learn more about products informs outreach strategies. For example, many women reported relying on friends to learn more about products, which suggests that peer-to-peer and community-based outreach programs may be effective. To be most effective, any outreach efforts or intervention studies should be relevant to the community and informed by community-based collaborations.

### *Limitations*

The characteristics of survey participants reflects our community-engaged recruitment strategy, which may limit the generalizability of our findings. We have greater representation among Black and Hispanic/Latinx women, reflecting the organizing networks of this study's community partnerships. Women were recruited by community partner and community advisory board staff through in-person, online, social media, and event outreach. Postcards were distributed at events and respondents came from cities across California. Community engaged outreach allowed for us to survey residents that can be difficult to reach through other methods. One limitation is that the survey was primarily online, unless a respondent learned about it at an in-person event, and there was a staff person to administer the survey. Because nearly all (>97%) of adults aged 18-49 years use the internet (66), we chose to disseminate our survey online. However, some women may not have been able to complete our survey because it was online and if a research staff was unavailable to support them as was possible during in-person data collection. Also limiting generalizability is that our survey was available in English and Spanish only. California is a diverse state with numerous language groups. This likely limited potential respondents, particularly among monolingual and/or immigrant non-English or Spanish speaking women, due to language barriers. Reaching diverse women across racial/ethnic groups in the future will require translation and outreach in multiple languages. Product use was self-reported so there may be recall problems.

Lastly, like other studies, we broadly asked women about product use without collecting information about specific brand names and product ingredients. The lack of detailed product data precludes quantifying exposure to chemicals in consumer products. The next phase of our study, however, will collect more detailed product use information, including brand, when they are used, and the ingredients in the specific products used, so that we may correlate product use with biomonitoring data and quantify exposure. These data will be complemented by qualitative data from focus groups designed to understand motivations and cultural norms around product use.

### *Conclusion*

We documented use of personal care product use among a sample of diverse, reproductive-aged women, providing some of the first comparative data from Asian and Hispanic/Latinx women. We found significant differences in use and frequency of use across race/ethnicities, which may help explain observed inequities of exposure and health. We also report some of the first product use data for women self-identifying as multi-racial or a race/ethnicity that is not Black, Hispanic/Latinx, Asian, or White, noting that future studies should evaluate the role of racial identity and social inequalities, as well as other identities subject to marginalization, in product choices. Data collected in this study are important for developing strategies to limit exposure to unwanted personal care product chemicals and studies of exposure and health inequities. Product use studies can also be used by health advocates to develop consumer and market-based campaigns.

### **Acknowledgements**

We would like to thank Marissa Chan for her help developing the survey and kicking off the study, Karin Michels for helpful feedback on the survey, and Kimberly Robinson and Brianna VanNoy for their help disseminating the survey. This project is funded by the California Breast Cancer Research Program (Grant # 23UB-6511).

## Conflict of Interest

We declare no competing financial interests.

## References

1. James-Todd T, Chiu Y, Zota A. Racial/Ethnic Disparities in Environmental Endocrine Disrupting Chemicals and Women's Reproductive Health Outcomes: Epidemiological Examples Across the Life Course. *Current Epidemiology Reports*. 2016;3(2):161-80.
2. James-Todd TM, Meeker JD, Huang T, Hauser R, Seely EW, Ferguson KK, et al. Racial and ethnic variations in phthalate metabolite concentration changes across full-term pregnancies. *Journal of Exposure Science & Environmental Epidemiology*. 2017;27(2):160-6.
3. Branch F, Woodruff TJ, Mitro SD, Zota AR. Vaginal douching and racial/ethnic disparities in phthalates exposures among reproductive-aged women: National Health and Nutrition Examination Survey 2001-2004. *Environ Health*. 2015;14:57.
4. Varshavsky JR, Zota AR, Woodruff TJ. A Novel Method for Calculating Potency-Weighted Cumulative Phthalates Exposure with Implications for Identifying Racial/Ethnic Disparities among U.S. Reproductive-Aged Women in NHANES 2001-2012. *Environ Sci Technol*. 2016;50(19):10616-24.
5. Kobrosly RW, Parlett LE, Stahlhut RW, Barrett ES, Swan SH. Socioeconomic factors and phthalate metabolite concentrations among United States women of reproductive age. *Environ Res*. 2012;115:11-7.
6. CDC. Fourth National Report on Human Exposure to Environmental Chemicals: Updated Tables. Department of Health and Human Services, Centers for Disease Control and Prevention; 2019.
7. Nguyen VK, Kahana A, Heidt J, Polemi K, Kvasnicka J, Jolliet O, et al. A comprehensive analysis of racial disparities in chemical biomarker concentrations in United States women, 1999-2014. *Environ Int*. 2020;137:105496.
8. Zota AR, Shamasunder B. The environmental injustice of beauty: framing chemical exposures from beauty products as a health disparities concern. *American Journal of Obstetrics and Gynecology*. 2017;217(4):418.e1-.e6.
9. Wu XM, Bennett DH, Moran RE, Sjodin A, Jones RS, Tancredi DJ, et al. Polybrominated diphenyl ether serum concentrations in a Californian population of children, their parents, and older adults: an exposure assessment study. *Environ Health*. 2015;14:23.
10. James-Todd T, Terry MB, Rich-Edwards J, Deierlein A, Senie R. Childhood hair product use and earlier age at menarche in a racially diverse study population: a pilot study. *Ann Epidemiol*. 2011;21(6):461-5.
11. Fey WH. The nation is diversifying even faster than predicted, according to new census data. Brookings Institute; 2020.
12. U.S. Census Bureau. 2017 National Population Projections Tables: Main Series. 2017.
13. Dodson RE, Boronow KE, Susmann H, Udesky JO, Rodgers KM, Weller D, et al. Consumer behavior and exposure to parabens, bisphenols, triclosan, dichlorophenols, and benzophenone-3: Results from a crowdsourced biomonitoring study. *Int J Hyg Environ Health*. 2020:113624.



14. Just AC, Adibi JJ, Rundle AG, Calafat AM, Camann DE, Hauser R, et al. Urinary and air phthalate concentrations and self-reported use of personal care products among minority pregnant women in New York city. *J Expo Sci Environ Epidemiol*. 2010;20(7):625-33.
15. Berger KP, Kogut KR, Bradman A, She J, Gavin Q, Zahedi R, et al. Personal care product use as a predictor of urinary concentrations of certain phthalates, parabens, and phenols in the HERMOSA study. *J Expo Sci Environ Epidemiol*. 2018.
16. Braun JM, Just AC, Williams PL, Smith KW, Calafat AM, Hauser R. Personal care product use and urinary phthalate metabolite and paraben concentrations during pregnancy among women from a fertility clinic. *J Expo Sci Environ Epidemiol*. 2014;24(5):459-66.
17. Buckley JP, Palmieri RT, Matuszewski JM, Herring AH, Baird DD, Hartmann KE, et al. Consumer product exposures associated with urinary phthalate levels in pregnant women. *J Expo Sci Environ Epidemiol*. 2012;22(5):468-75.
18. Parlett LE, Calafat AM, Swan SH. Women's exposure to phthalates in relation to use of personal care products. *J Expo Sci Environ Epidemiol*. 2013;23(2):197-206.
19. Berger KP, Kogut KR, Bradman A, She J, Gavin Q, Zahedi R, et al. Personal care product use as a predictor of urinary concentrations of certain phthalates, parabens, and phenols in the HERMOSA study. *J Expo Sci Environ Epidemiol*. 2019;29(1):21-32.
20. Wesselink AK, Fruh V, Hauser R, Weuve J, Taylor KW, Orta OR, et al. Correlates of urinary concentrations of phthalate and phthalate alternative metabolites among reproductive-aged Black women from Detroit, Michigan. *J Expo Sci Environ Epidemiol*. 2020.
21. Ashrap P, Watkins DJ, Calafat AM, Ye X, Rosario Z, Brown P, et al. Elevated concentrations of urinary triclocarban, phenol and paraben among pregnant women in Northern Puerto Rico: Predictors and trends. *Environ Int*. 2018;121(Pt 1):990-1002.
22. Ferguson KK, Colacino JA, Lewis RC, Meeker JD. Personal care product use among adults in NHANES: associations between urinary phthalate metabolites and phenols and use of mouthwash and sunscreen. *J Expo Sci Environ Epidemiol*. 2017;27(3):326-32.
23. Meeker JD, Cantonwine DE, Rivera-Gonzalez LO, Ferguson KK, Mukherjee B, Calafat AM, et al. Distribution, variability, and predictors of urinary concentrations of phenols and parabens among pregnant women in Puerto Rico. *Environ Sci Technol*. 2013;47(7):3439-47.
24. Philippat C, Bennett D, Calafat AM, Picciotto IH. Exposure to select phthalates and phenols through use of personal care products among Californian adults and their children. *Environ Res*. 2015;140:369-76.
25. Nassan FL, Coull BA, Gaskins AJ, Williams MA, Skakkebaek NE, Ford JB, et al. Personal Care Product Use in Men and Urinary Concentrations of Select Phthalate Metabolites and Parabens: Results from the Environment And Reproductive Health (EARTH) Study. *Environ Health Perspect*. 2017;125(8):087012.
26. McDonald JA, Tehranifar P, Flom JD, Terry MB, James-Todd T. Hair product use, age at menarche and mammographic breast density in multiethnic urban women. *Environmental Health*. 2018;17(1):1.
27. Wise LA, Palmer JR, Reich D, Cozier YC, Rosenberg L. Hair relaxer use and risk of uterine leiomyomata in African-American women. *Am J Epidemiol*. 2012;175(5):432-40.
28. Llanos AAM, Rabkin A, Bandera EV, Zirpoli G, Gonzalez BD, Xing CY, et al. Hair product use and breast cancer risk among African American and White women. *Carcinogenesis*. 2017;38(9):883-92.
29. Brinton LA, Figueroa JD, Ansong D, Nyarko KM, Wiafe S, Yarney J, et al. Skin Lighteners and Hair Relaxers as Risk Factors for Breast Cancer: Results from the Ghana Breast Health Study. *Carcinogenesis*. 2018.
30. Heikkinen S, Pitkaniemi J, Sarkeala T, Malila N, Koskenvuo M. Does Hair Dye Use Increase the Risk of Breast Cancer? A Population-Based Case-Control Study of Finnish Women. *PLoS One*. 2015;10(8):e0135190.

31. Eberle CE, Sandler DP, Taylor KW, White AJ. Hair dye and chemical straightener use and breast cancer risk in a large US population of black and white women. *Int J Cancer*. 2020;147(2):383-91.
32. Taylor KW, Troester MA, Herring AH, Engel LS, Nichols HB, Sandler DP, et al. Associations between Personal Care Product Use Patterns and Breast Cancer Risk among White and Black Women in the Sister Study. *Environ Health Perspect*. 2018;126(2):027011.
33. Zota AR, Geller RJ, Calafat AM, Marfori CQ, Baccarelli AA, Moawad GN. Phthalates exposure and uterine fibroid burden among women undergoing surgical treatment for fibroids: a preliminary study. *Fertil Steril*. 2019;111(1):112-21.
34. James-Todd T, Senie R, Terry MB. Racial/ethnic differences in hormonally-active hair product use: a plausible risk factor for health disparities. *J Immigr Minor Health*. 2012;14(3):506-11.
35. Roth WD. Establishing the Denominator: The Challenges of Measuring Multiracial, Hispanic, and Native American Populations. *The ANNALS of the American Academy of Political and Social Science*. 2018;677(1):48-56.
36. Dodson RE, Nishioka M, Standley LJ, Perovich LJ, Brody JG, Rudel RA. Endocrine disruptors and asthma-associated chemicals in consumer products. *Environ Health Perspect*. 2012;120(7):935-43.
37. Guo Y, Kannan K. A survey of phthalates and parabens in personal care products from the United States and its implications for human exposure. *Environ Sci Technol*. 2013;47(24):14442-9.
38. Wang VA, Chu MT, Chie L, Gaston SA, Jackson CL, Newendorp N, et al. Acculturation and endocrine disrupting chemical-associated personal care product use among US-based foreign-born Chinese women of reproductive age. *J Expo Sci Environ Epidemiol*. 2020.
39. Doyle JM, Kao G. Are racial identifies of multiracials stable? Changing self-identification among single and multiple race individuals. *Social Psychology Quarterly*. 2007;70:405-23.
40. Paulker K, Meyers C, Sanchez DT, Gaither SE, Young DM. A review of multiracial malleability: Identity, categorization, and shifting racial attitudes. *Soc Personal Psychol Compass*. 2018;12:e12392.
41. Paradies Y, Ben J, Denson N, Elias A, Priest N, Pieterse A, et al. Racism as a Determinant of Health: A Systematic Review and Meta-Analysis. *PLoS One*. 2015;10(9):e0138511.
42. Banks TL. Funding Race as Biology: The Relevance of "Race" in Medical Research. *Minnesota Journal of Law, Science & Technology*. 2011;12:571-618.
43. Zota AR, VanNoy BN. Integrating Intersectionality Into the Exposome Paradigm: A Novel Approach to Racial Inequities in Uterine Fibroids. *Am J Public Health*. 2020:e1-e5.
44. Hu P, Chen X, Whitener RJ, Boder ET, Jones JO, Porollo A, et al. Effects of parabens on adipocyte differentiation. *Toxicol Sci*. 2013;131(1):56-70.
45. Hu P, Kennedy RC, Chen X, Zhang J, Shen CL, Chen J, et al. Differential effects on adiposity and serum marker of bone formation by post-weaning exposure to methylparaben and butylparaben. *Environ Sci Pollut Res Int*. 2016;23(21):21957-68.
46. Hu P, Overby H, Heal E, Wang S, Chen J, Shen CL, et al. Methylparaben and butylparaben alter multipotent mesenchymal stem cell fates towards adipocyte lineage. *Toxicol Appl Pharmacol*. 2017;329:48-57.
47. Morohoshi K, Yamamoto H, Kamata R, Shiraishi F, Koda T, Morita M. Estrogenic activity of 37 components of commercial sunscreen lotions evaluated by in vitro assays. *Toxicol In Vitro*. 2005;19(4):457-69.
48. Pereira-Fernandes A, Demaegdt H, Vandermeiren K, Hectors TL, Jorens PG, Blust R, et al. Evaluation of a screening system for obesogenic compounds: screening of endocrine disrupting compounds and evaluation of the PPAR dependency of the effect. *PLoS One*. 2013;8(10):e77481.

49. Routledge EJ, Parker J, Odum J, Ashby J, Sumpter JP. Some alkyl hydroxy benzoate preservatives (parabens) are estrogenic. *Toxicol Appl Pharmacol.* 1998;153(1):12-9.
50. Rastogi SC, Schouten A, de Kruijf N, Weijland JW. Contents of methyl-, ethyl-, propyl-, butyl- and benzylparaben in cosmetic products. *Contact Dermatitis.* 1995;32(1):28-30.
51. Shen HY, Jiang HL, Mao HL, Pan G, Zhou L, Cao YF. Simultaneous determination of seven phthalates and four parabens in cosmetic products using HPLC-DAD and GC-MS methods. *J Sep Sci.* 2007;30(1):48-54.
52. Nicole W. A question for women's health: chemicals in feminine hygiene products and personal lubricants. *Environ Health Perspect.* 2014;122(3):A70-5.
53. Zhang J, Thomas AG, Leybovich E. Vaginal douching and adverse health effects: a meta-analysis. *Am J Public Health.* 1997;87(7):1207-11.
54. Martino JL, Vermund SH. Vaginal douching: evidence for risks or benefits to women's health. *Epidemiol Rev.* 2002;24(2):109-24.
55. Gao CJ, Kannan K. Phthalates, bisphenols, parabens, and triclocarban in feminine hygiene products from the United States and their implications for human exposure. *Environ Int.* 2020;136:105465.
56. Ding N, Batterman S, Park SK. Exposure to Volatile Organic Compounds and Use of Feminine Hygiene Products Among Reproductive-Aged Women in the United States. *J Womens Health (Larchmt).* 2020;29(1):65-73.
57. Lin N, Ding N, Meza-Wilson E, Manuradha Devasurendra A, Godwin C, Kyun Park S, et al. Volatile organic compounds in feminine hygiene products sold in the US market: A survey of products and health risks. *Environ Int.* 2020;144:105740.
58. Ferranti MJ. An Odor of Racism: Vaginal Deodorants in African-American Beauty Culture and Advertising. *Advertising & Society Review.* 2011;11(4).
59. Helm JS, Nishioka M, Brody JG, Rudel RA, Dodson RE. Measurement of endocrine disrupting and asthma-associated chemicals in hair products used by Black women. *Environ Res.* 2018;165:448-58.
60. Csiszar SA, Ernstoff AS, Fantke P, Jolliet O. Stochastic modeling of near-field exposure to parabens in personal care products. *J Expo Sci Environ Epidemiol.* 2017;27(2):152-9.
61. Wu XM, Bennett DH, Ritz B, Cassady DL, Lee K, Hertz-Picciotto I. Usage pattern of personal care products in California households. *Food and Chemical Toxicology.* 2010;48(11):3109-19.
62. Rodriguez S, Steer CD, Farrow A, Golding J, Day IN. Dependence of deodorant usage on ABCC11 genotype: scope for personalized genetics in personal hygiene. *J Invest Dermatol.* 2013;133(7):1760-7.
63. Steinemann A. Health and societal effects from exposure to fragranced consumer products. *Prev Med Rep.* 2017;5:45-7.
64. Steinemann A. Fragranced consumer products: effects on asthmatics. *Air Qual Atmos Health.* 2018;11(1):3-9.
65. Caress SM, Steinemann AC. Prevalence of fragrance sensitivity in the American population. *J Environ Health.* 2009;71(7):46-50.
66. Pew Research Center. Internet/Broadband Fact Sheet. 2019 June 12, 2019.

## Tables and Figures

Table 1. Characteristics of survey respondents<sup>1</sup> aged 18-34 years living in California.

Table 2: Product use and frequency of product use by race/ethnicity

Figure 1. Median number of products used currently or within the past year in each product category by race/ethnicity. Number (n) represents the total number of products that we asked about in that product category.

Figure 2. Frequency of use for products with significant differences by race/ethnicity. Darker shades correspond to more frequent use and dashed black line delineates the median. See Supplemental Material for frequencies for all products.

Figure 3. Percent of scented product use by product type. Respondents include all women within one of four race/ethnicity categories (not multi-racial/other).

Figure 4. Reasons why women choose their products (a) and where women go to learn more about products or receive product recommendations (b) by product type. Women could select all that applied. Note that we did not ask about “long lasting” for feminine care products and only about “beauty professional” for hair products.

Table 1. Characteristics of survey respondents<sup>1</sup> aged 18-34 years living in California.

	Black	Latina	Asian	White	Other/ Multi-Racial
N	73	101	51	77	55
Age Group (%)					
18 - 24 years	39 (n=29)	40 (n=41)	73 (n=37)	81 (n=62)	67 (n=37)
25 - 34 years	60 (n=44)	59 (n=60)	27 (n=14)	19 (n=15)	32 (n=18)
Education (%)					
Less than high school	1.4 (n=1)	5.0 (n=5)	NA	NA	NA
High school graduate	12 (n=9)	19 (n=19)	27 (n=14)	26 (n=20)	10 (n=6)
Some college	29 (n=21)	21 (n=21)	39 (n=20)	57 (n=44)	47 (n=26)
2 year college degree	6.9(n=5)	1.0 (n=1)	1.7 (n=1)	1.3 (n=1)	3.6 (n=2)
4 year college degree	34 (n=25)	35 (n=35)	20 (n=10)	12 (n=9)	27 (n=15)
Professional or other graduate degree	15 (n=11)	20 (n=20)	9.9 (n=5)	4.0 (n=3)	9.1 (n=5)
Missing or prefer not to answer	1.4 (n=1)	NA	2.0 (n=1)	NA	1.8 (n=1)

<sup>1</sup>includes respondents who self-identified as nonbinary (n = 8), transgender (n = 1), and a person who chose to self-describe (n=1)

NA = not applicable/not available

Table 2: Product use and frequency of product use by race/ethnicity

Product	% of users [median frequency of use] <sup>1</sup>					Pairwise comparisons on use <sup>2</sup>						Pairwise comparisons on frequency <sup>3</sup>					
	All (N=302)	Asian (N=51)	Black (N=73)	Latinx (N=101)	White (N=77)	A:B	A:L	A:W	B:L	B:W	L:W	A:B	A:L	A:W	B:L	B:W	L:W
<b>Cosmetics<sup>3</sup></b>																	
Concealer	55 [3]	63 [2]	42 [2.5]	55 [3]	60 [3]												
Eye brow products	58 [3]	59 [3]	60 [3]	64 [4]	45 [3]												
Eye liner	61 [2]	73 [2]	55 [2]	62 [3]	58 [2]												
Eye shadow	64 [2]	67 [2]	56 [2]	68 [2]	65 [2]												
Foundation or beauty balm (bb cream)	61 [3]	65 [3]	52 [2]	67 [3]	58 [2]												
Lipstick or other lip color	72 [3]	76 [3]	62 [3]	83 [3]	65 [2]												
Makeup primer	42 [2]	51 [2]	36 [2]	50 [2.5]	31 [2]												
Mascara	82 [3]	84 [2]	74 [3]	85 [3]	86 [3]												
Nail polish remover	65 [2]	67 [1]	66 [2]	70 [2]	56 [2]												
Nail polish, gel, acrylic, or wrap	75 [2]	76 [1.5]	77 [2]	79 [2]	68 [2]												
Powder or baking powder makeup	42 [3]	45 [2]	37 [2]	49 [3]	35 [2]												
Powder or rouge or blush	51 [3]	51 [2]	33 [3]	62 [3]	55 [2]												
Setting spray	37 [NA]	29 [NA]	41 [NA]	45 [NA]	30 [NA]												
<b>Menstrual/Intimate Products<sup>4</sup></b>																	

Product	% of users [median frequency of use] <sup>1</sup>					Pairwise comparisons on use <sup>2</sup>						Pairwise comparisons on frequency <sup>3</sup>					
	All (N=302)	Asian (N=51)	Black (N=73)	Latinx (N=101)	White (N=77)	A:B	A:L	A:W	B:L	B:W	L:W	A:B	A:L	A:W	B:L	B:W	L:W
Anti-itch cream	5 [1]	10 [1]	3 [1]	4 [1]	4 [1]												
Douche	6 [1]	2 [2]	14 [1]	6 [1]	3 [1.5]												
Feminine powder	3 [2]	2 [2]	4 [3]	2 [1]	3 [1.5]												
Feminine spray	7 [1]	2 [1]	12 [1]	9 [1]	4 [3]												
Menstrual cup	11 [NA]	4 [NA]	5 [NA]	9 [NA]	23 [NA]												
Sanitary napkins/pads/panty liners	76 [2]	88 [2]	79 [2]	79 [2]	62 [2]												
Shaving cream	26 [1]	16 [1]	30 [1]	25 [1]	32 [1]												
Tampons	52 [2]	51 [2]	53 [2]	41 [2]	66 [2]												
Vaginal deodorant suppositories	2 [1]	4 [1.5]	4 [1]	2 [2]	0 [NA]												
Vaginal washes/cleansers	12 [3]	4 [1.5]	19 [3]	16 [3]	4 [3]												
Vaginal wipes/towelettes	17 [2]	14 [2]	29 [3]	17 [2]	8 [2.5]												
Vaginal/personal lubricant	16 [1]	16 [1]	16 [1]	9 [1]	26 [1]												
<b>Hair Products<sup>3</sup></b>																	
Conditioner	88 [3]	86 [3]	88 [2]	86 [3]	91 [3]												
Co-wash/conditioning hair cleanser	17 [3]	8 [2]	41 [2]	17 [3]	1 [4]												

Product	% of users [median frequency of use] <sup>1</sup>					Pairwise comparisons on use <sup>2</sup>						Pairwise comparisons on frequency <sup>3</sup>					
	All (N=302)	Asian (N=51)	Black (N=73)	Latinx (N=101)	White (N=77)	A:B	A:L	A:W	B:L	B:W	L:W	A:B	A:L	A:W	B:L	B:W	L:W
Curl cream/smoothie/pudding, leave-in conditioner	41 [3]	16 [2.5]	71 [3]	48 [3]	22 [3]	■	■		■	■	■						
Curl mousse, foam	26 [2]	10 [2]	33 [2]	40 [2]	12 [3]	■	■			■	■						
Detangler	28 [3]	8 [3]	55 [3]	23 [3]	22 [3]	■			■	■							
Hair oil	51 [3]	47 [2]	74 [3]	52 [3]	31 [2]	■			■	■	■						
Hair shine	24 [2]	16 [2]	44 [2]	26 [2]	8 [3]	■				■	■		■		■		■
Hair spray	35 [2]	31 [2]	27 [2]	42 [2]	38 [2]												
Hair styling gel, edge control gel	33 [3]	12 [2]	77 [3]	31 [3]	10 [2.5]	■			■	■	■						
Pomade, grease, wax	11 [2]	0 [NA]	34 [2]	5 [2.5]	4 [2]	■			■	■							
Shampoo	92 [3]	96 [3]	88 [2]	91 [3]	96 [3]							■			■	■	
<b>Other Hair Products</b> <sup>5</sup>																	
Hair dye	34 [1]	25 [1]	29 [1]	46 [1]	31 [1]												
Hair glue (ex: for extensions, wigs, weaves)	4 [1]	0 [NA]	11 [1]	1 [1]	3 [1.5]				■								
Hair perm, relaxer, or chemical straightener	7 [1]	16 [1]	14 [1.5]	3 [1]	1 [1]		■	■		■							
<b>Leave-on Personal Care Products</b> <sup>3</sup>																	
Body oil	27 [3]	18 [3]	53 [3]	21 [3]	16 [2.5]	■			■	■							
Deodorant and/or antiperspirant	91 [4]	75 [4]	93 [4]	94 [4]	96 [4]	■	■	■				■	■	■			
Face cream or face moisturizers with sunscreen	53 [4]	55 [4]	37 [4]	58 [4]	61 [4]				■	■							



Product	% of users [median frequency of use] <sup>1</sup>					Pairwise comparisons on use <sup>2</sup>						Pairwise comparisons on frequency <sup>3</sup>					
	All (N=302)	Asian (N=51)	Black (N=73)	Latinx (N=101)	White (N=77)	A:B	A:L	A:W	B:L	B:W	L:W	A:B	A:L	A:W	B:L	B:W	L:W
Face cream or face moisturizers without sunscreen	55 [4]	61 [4]	47 [4]	51 [4]	62 [4]												
Hand or body lotions or creams	81 [4]	86 [4]	82 [4]	80 [4]	78 [3]												
Mouthwash	62 [3]	47 [3]	77 [3]	74 [3]	43 [3]												
Perfume, cologne, or scented body spray	68 [3]	59 [3]	81 [3]	73 [3]	55 [3]												
Skin lighteners	1 [3]	2 [3]	3 [2.5]	0 [NA]	1 [3]												
Sunscreen	66 [2.5]	82 [3]	42 [2]	67 [2]	77 [2]												
<b>Rinse-off Personal Care Products<sup>3</sup></b>																	
Body soap or shower gel	85 [4]	82 [4]	82 [4]	86 [4]	90 [4]												
Face masks	60 [2]	73 [2]	55 [2]	61 [2]	53 [2]												
Facial soap, cleanser, or face wipes	78 [4]	82 [4]	75 [4]	76 [4]	82 [4]												
Hand soap	88 [5]	86 [5]	86 [5]	89 [5]	91 [5]												
Makeup remover	57 [3]	57 [3]	48 [3]	68 [3]	51 [3]												
Toothpaste	95 [4]	98 [5]	93 [4]	95 [4]	94 [5]												

<sup>1</sup> Percent of users and median frequency of product use for each group (all, Asian, Black, Hispanic/Latinx, White), supplied in one column. Median frequency of product use shown in brackets.

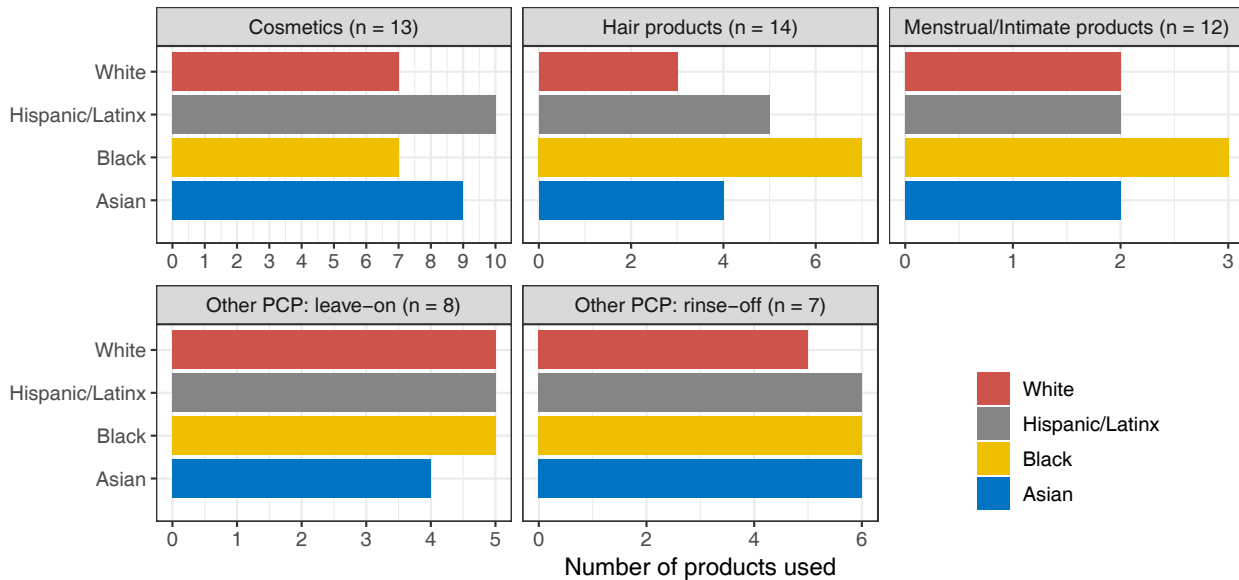
<sup>2</sup> A = Asian women; B = Black Women; L = Latinx/Hispanic; W = White women; shaded cells indicate significant differences in pairwise comparisons ( $p < 0.05$ )

<sup>3</sup> For frequency of cosmetic, hair product, rinse-off and leave-on personal care products: 1 = Very rarely (less than once a month); 2 = Occasionally (once a month to a few times per month); 3 = Regularly (1-5 times per week); 4 = Every day/almost every day (6 or more times per week); 5 = More than once per day

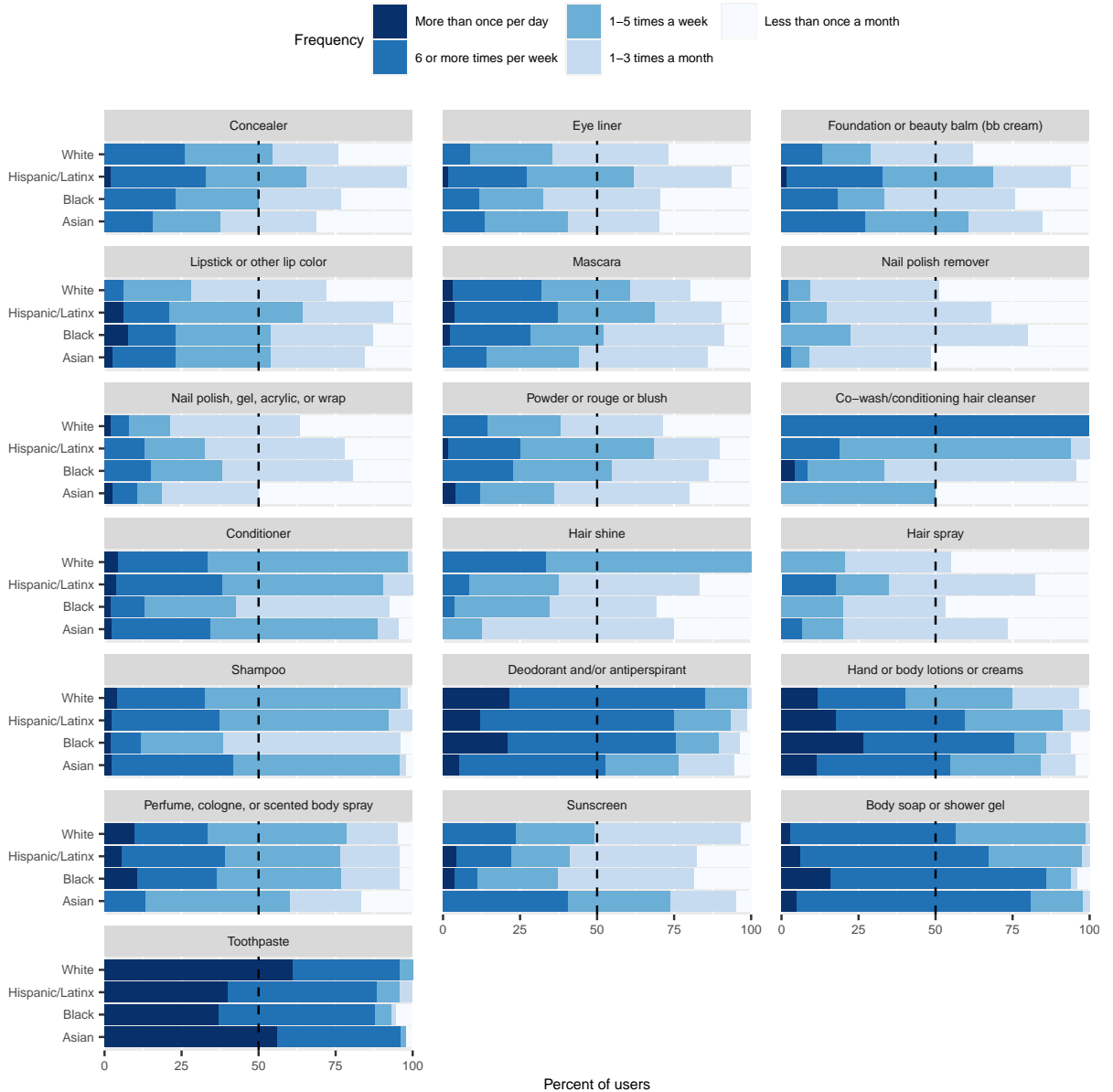
<sup>4</sup> For frequency of menstrual/intimate products: 1 = Very rarely (less than once a month) or Occasionally (1-3 times a month); 2 = During menstrual cycle; 3 = Regularly (1-5 times a week) or Every day (6 or more times per week) or More than once per day

<sup>5</sup> For frequency of other hair product use: 1 = 1-2 times (every 5 to 12 months); 2 = 3-4 times (every 3 to 4 months); 3 = 5-12 times (every 1 to 2 months); 4 = More than once a month

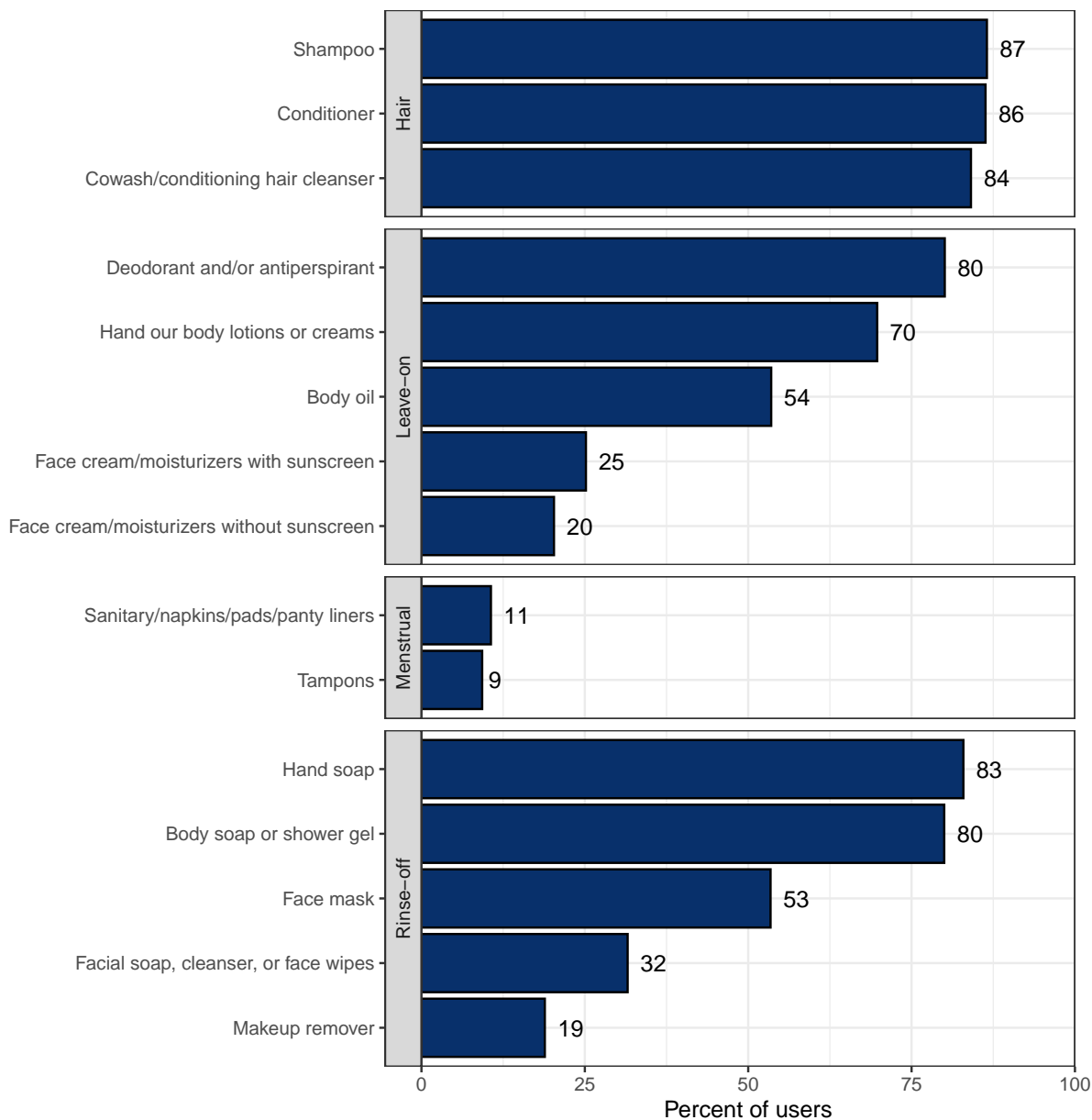
AUTHOR'S COPY



# AUTHOR'S COPY

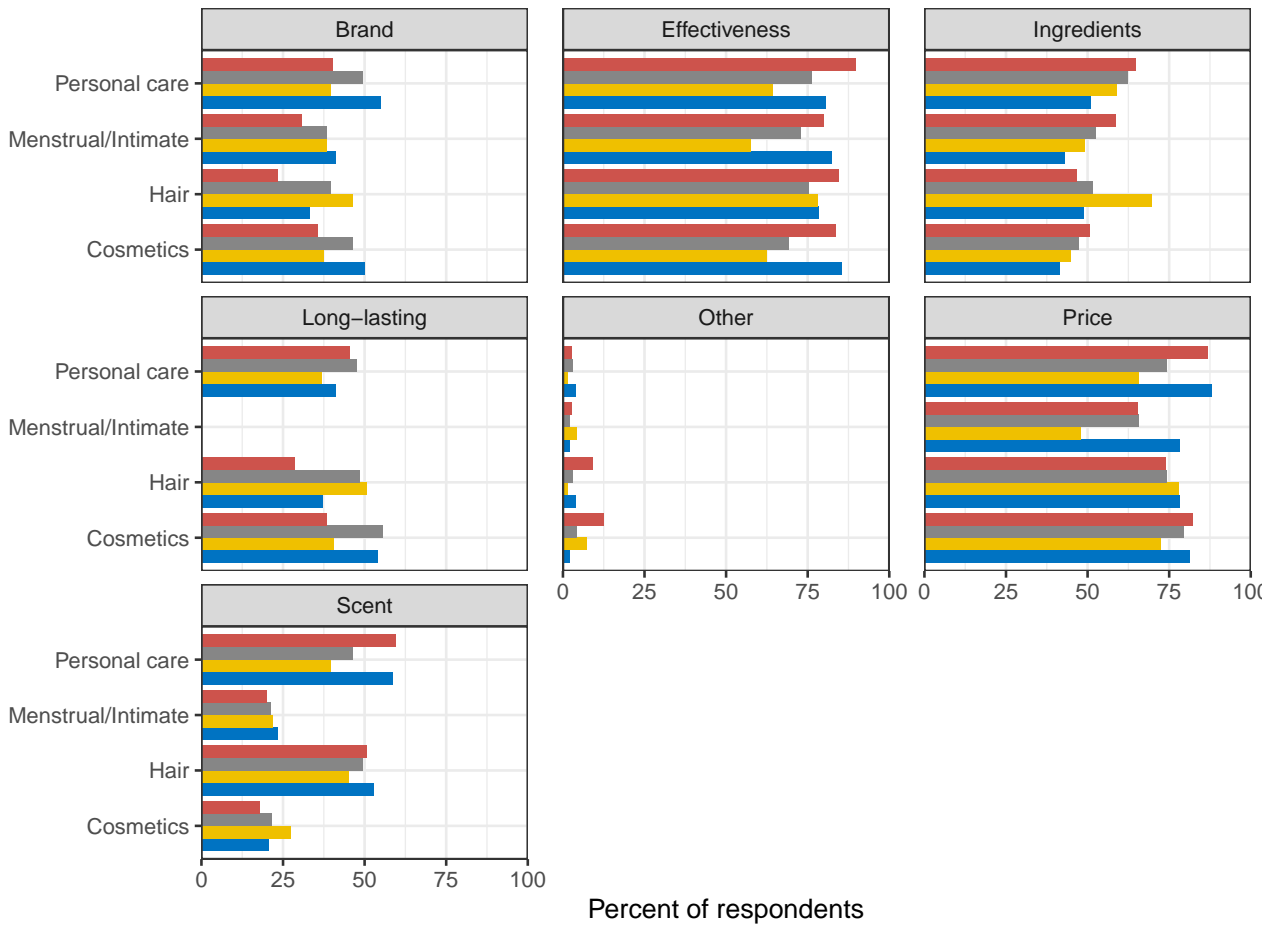


AUTHOR'S COPY

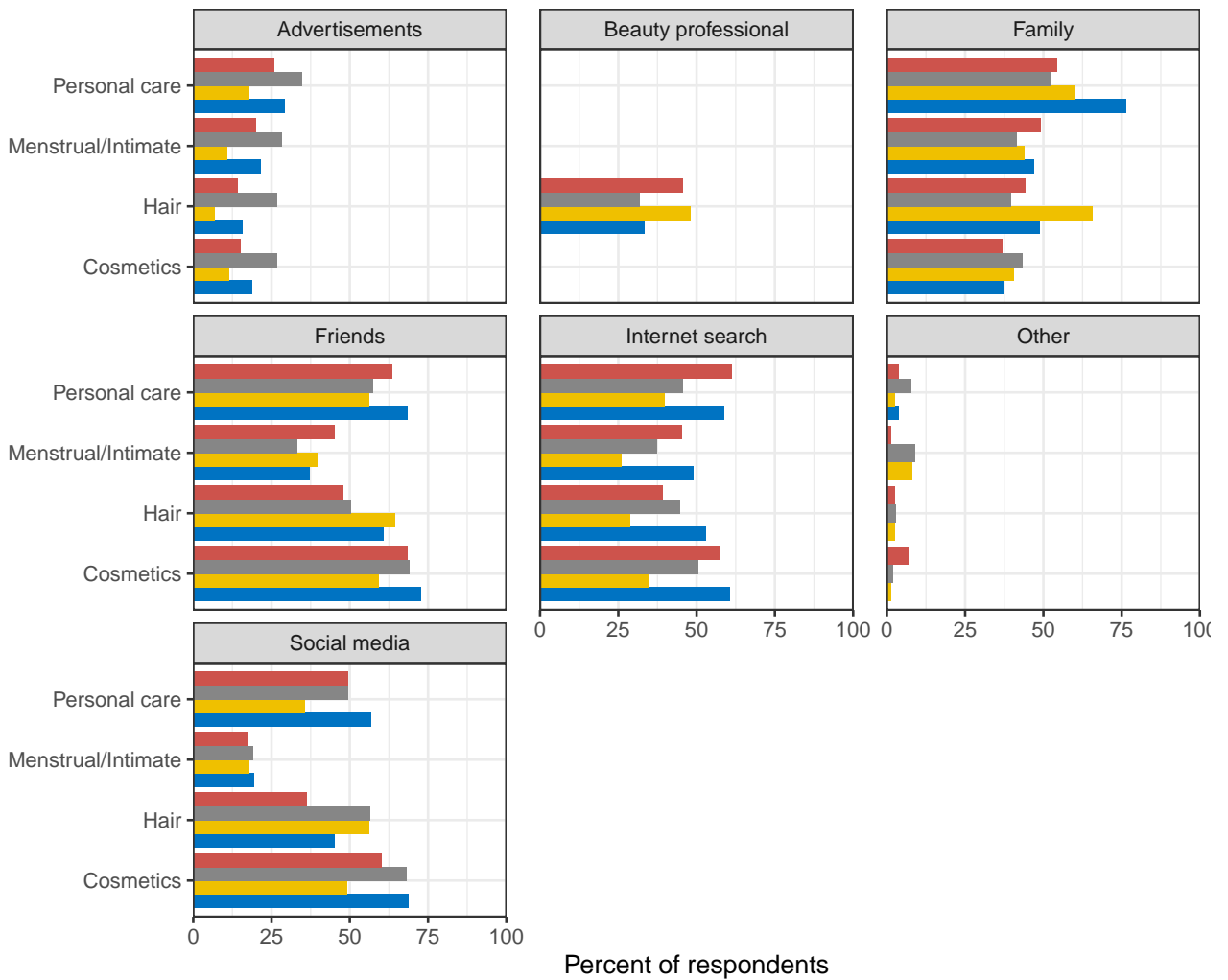


**A**

White Hispanic/Latinx Black Asian



**B**



Supplemental Material for:

**Personal care product use among diverse women in California: Taking Stock Study**

Robin E. Dodson, Bethsaida Cardona, Ami R. Zota, Janette Robinson Flint, Sandy Navarro, Bhavna Shamasunder

Contents:

Number of products used per day

Stacked bar graphs of frequency of product use by race/ethnicity.

Product use by women self-identifying as multi-racial or “other”

Concurrent product use

Product use by the top 10% and bottom 10% of product users

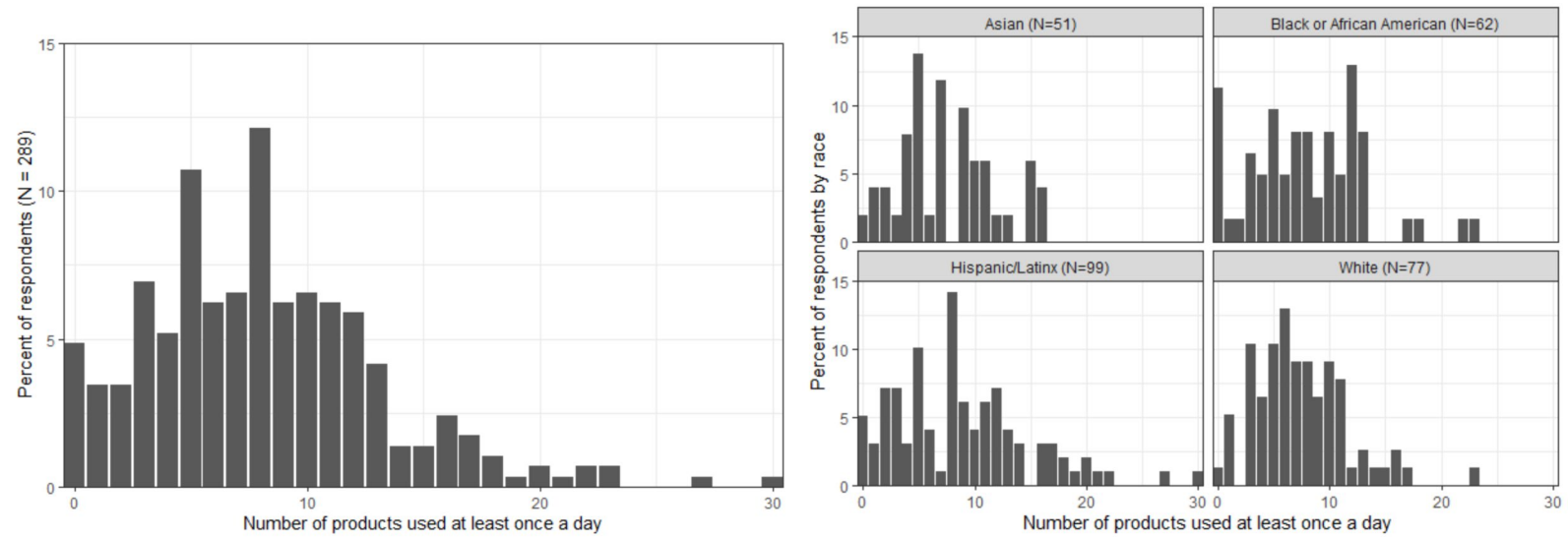


Figure S1. Number of products used at least once per day by all (across four race/ethnicity categories) women and by race/ethnicity.



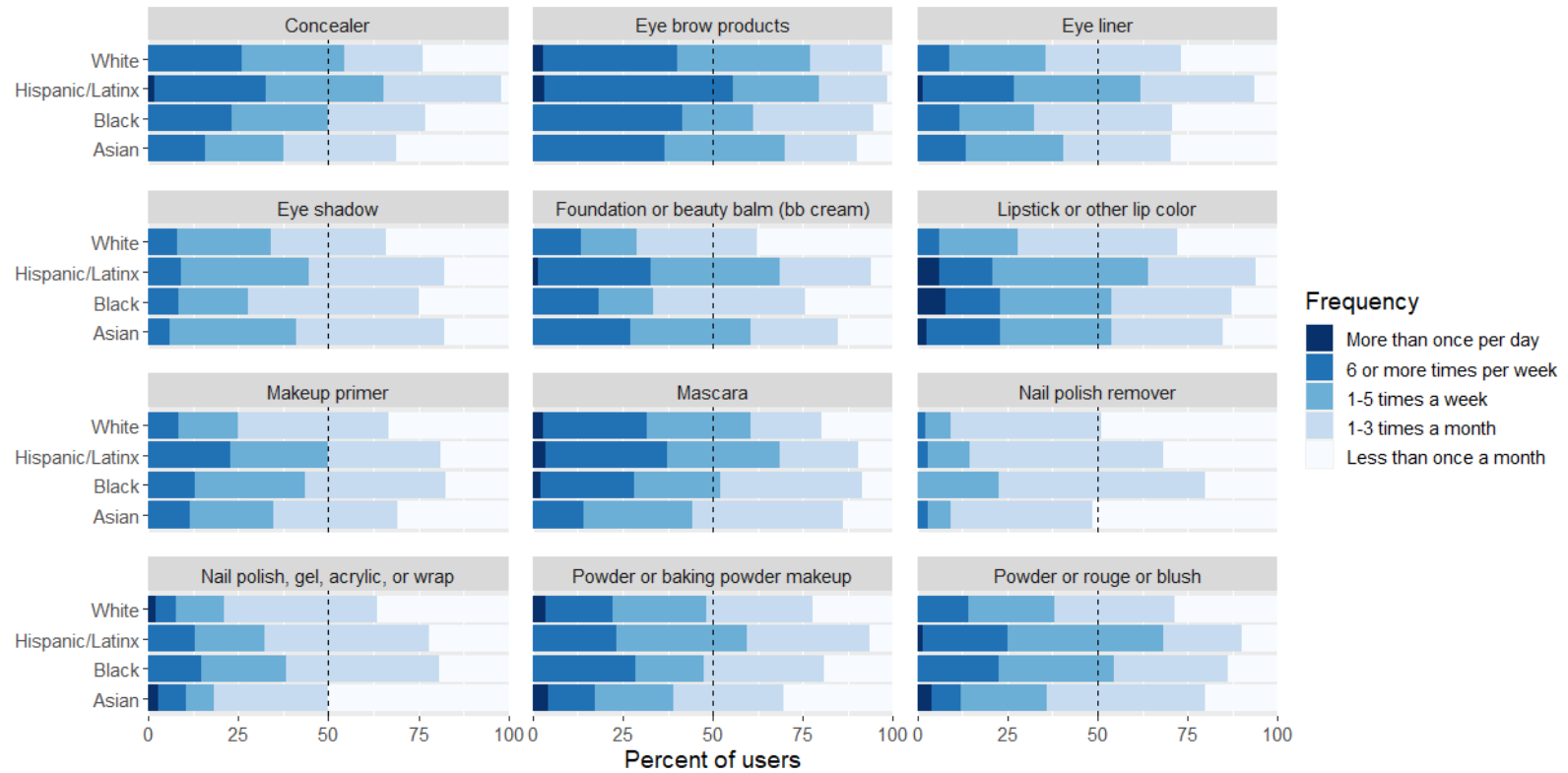


Figure S2a: Frequency of cosmetic product use. Darker shades correspond to more frequent use while a dotted black line delineates the median.

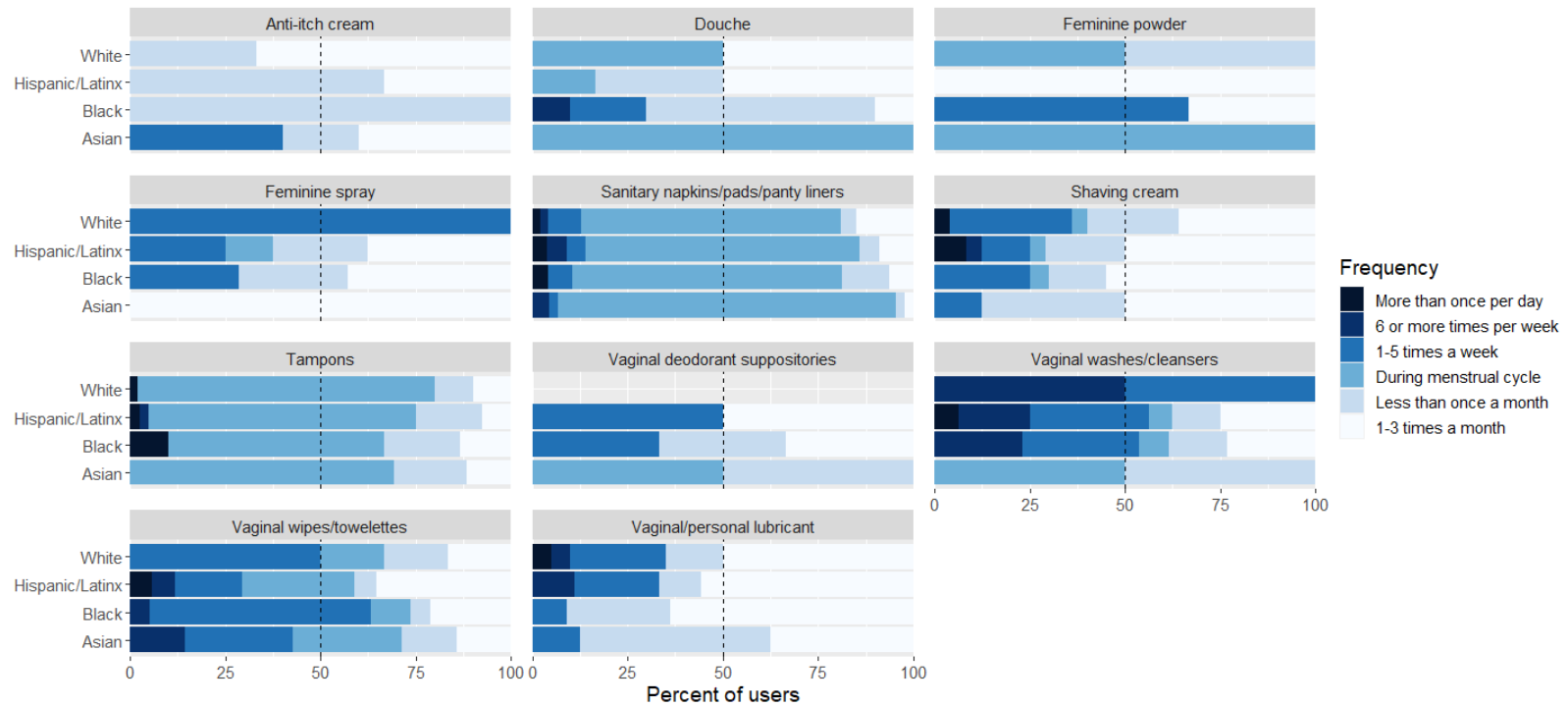


Figure S2b: Frequency of menstrual/intimate product use. Darker shades correspond to more frequent use while a dotted black line delineates the median.

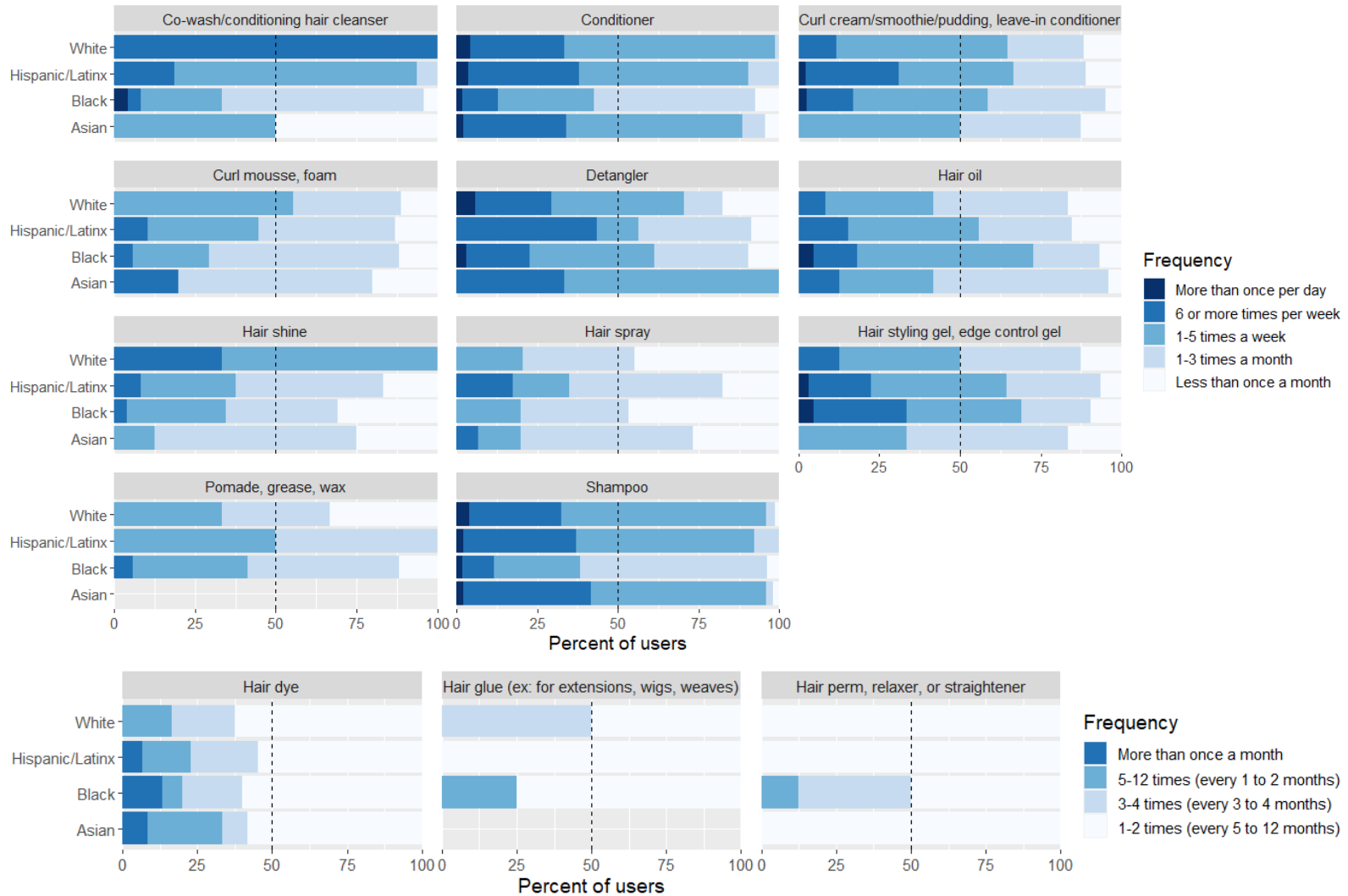
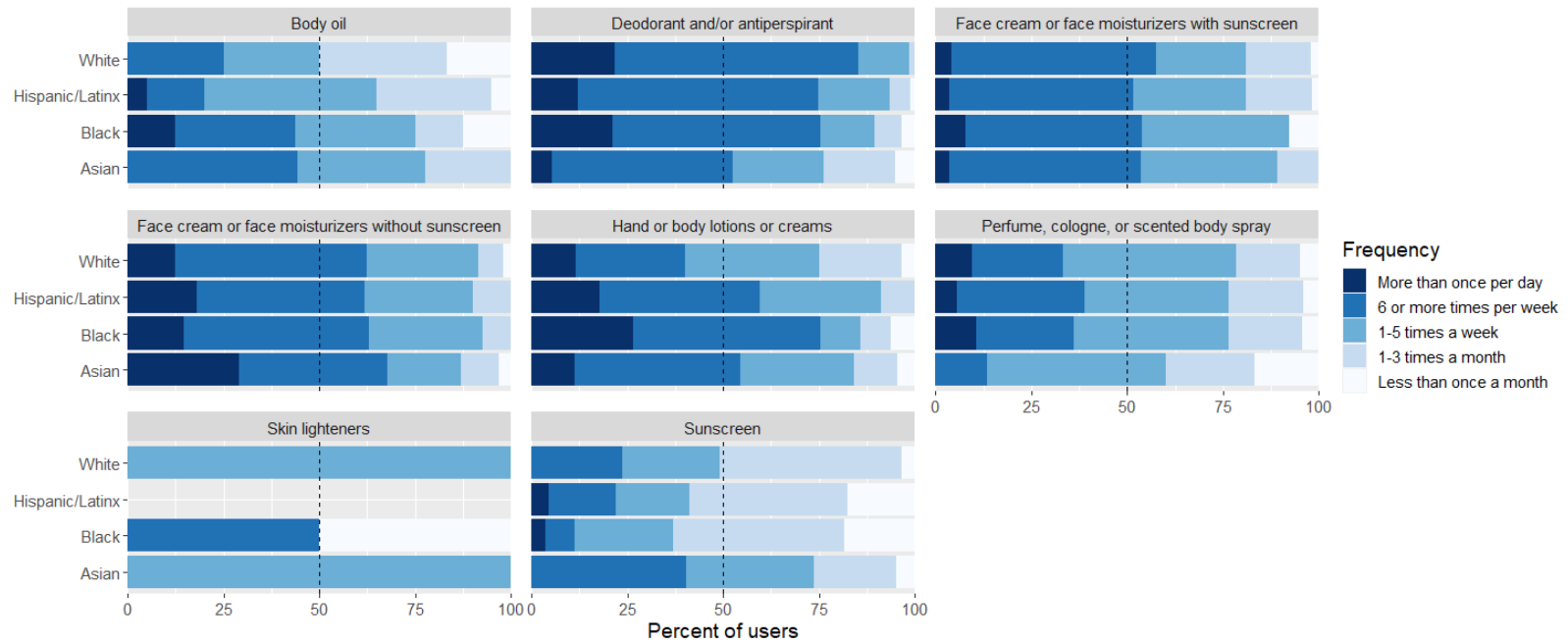


Figure S2c: Frequency of hair product use. Darker shades correspond to more frequent use while a dotted black line delineates the median.



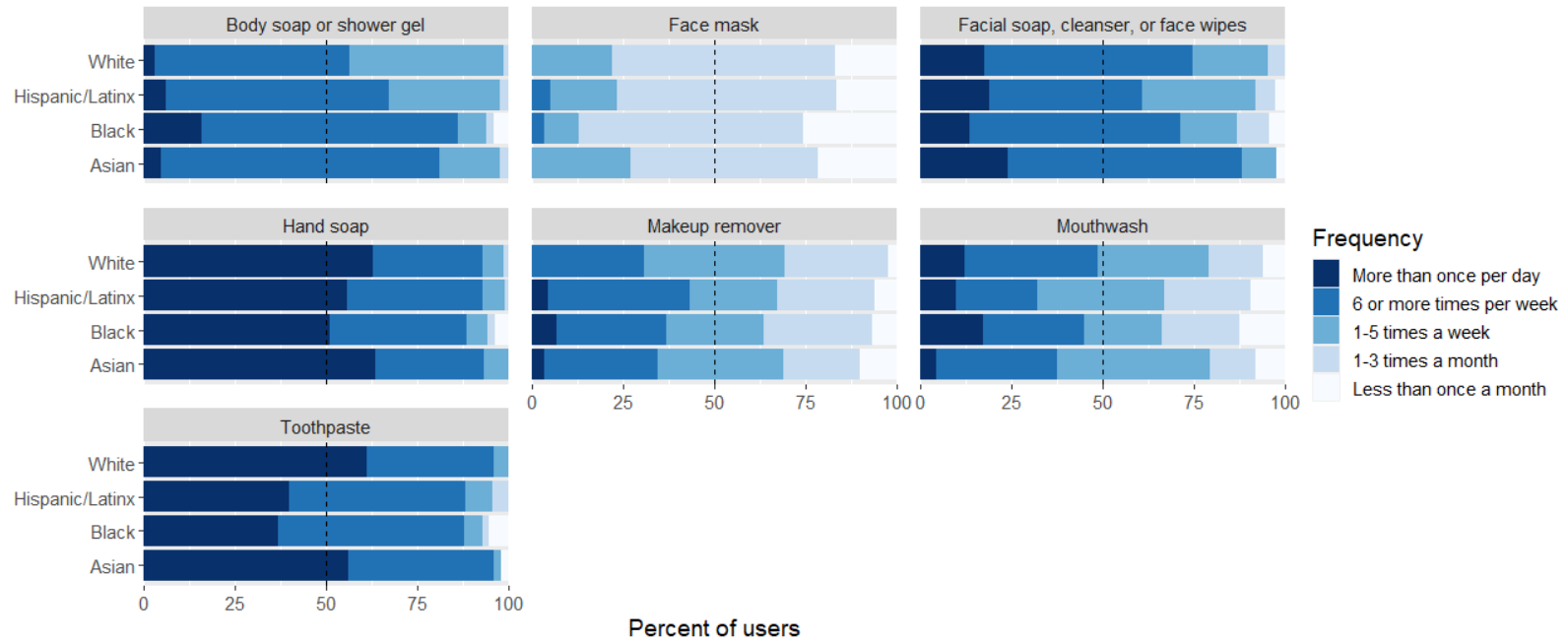


Figure S2e: Frequency of rinse-off personal care product use. Darker shades correspond to more frequent use while a dotted black line delineates the median.

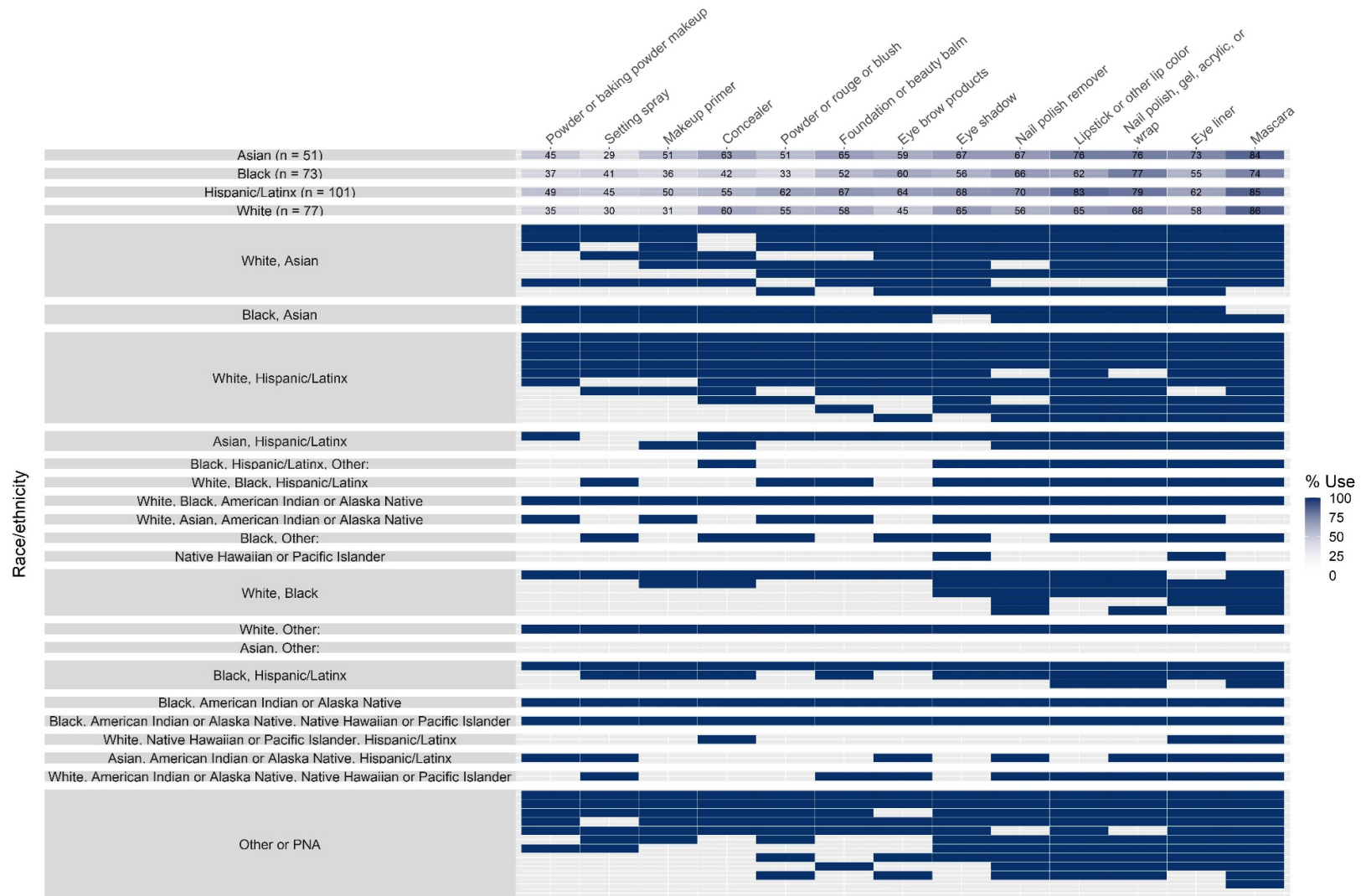


Figure S3a. Cosmetic product use among women who self-reported as multiple races/ethnicity or as “Other.”

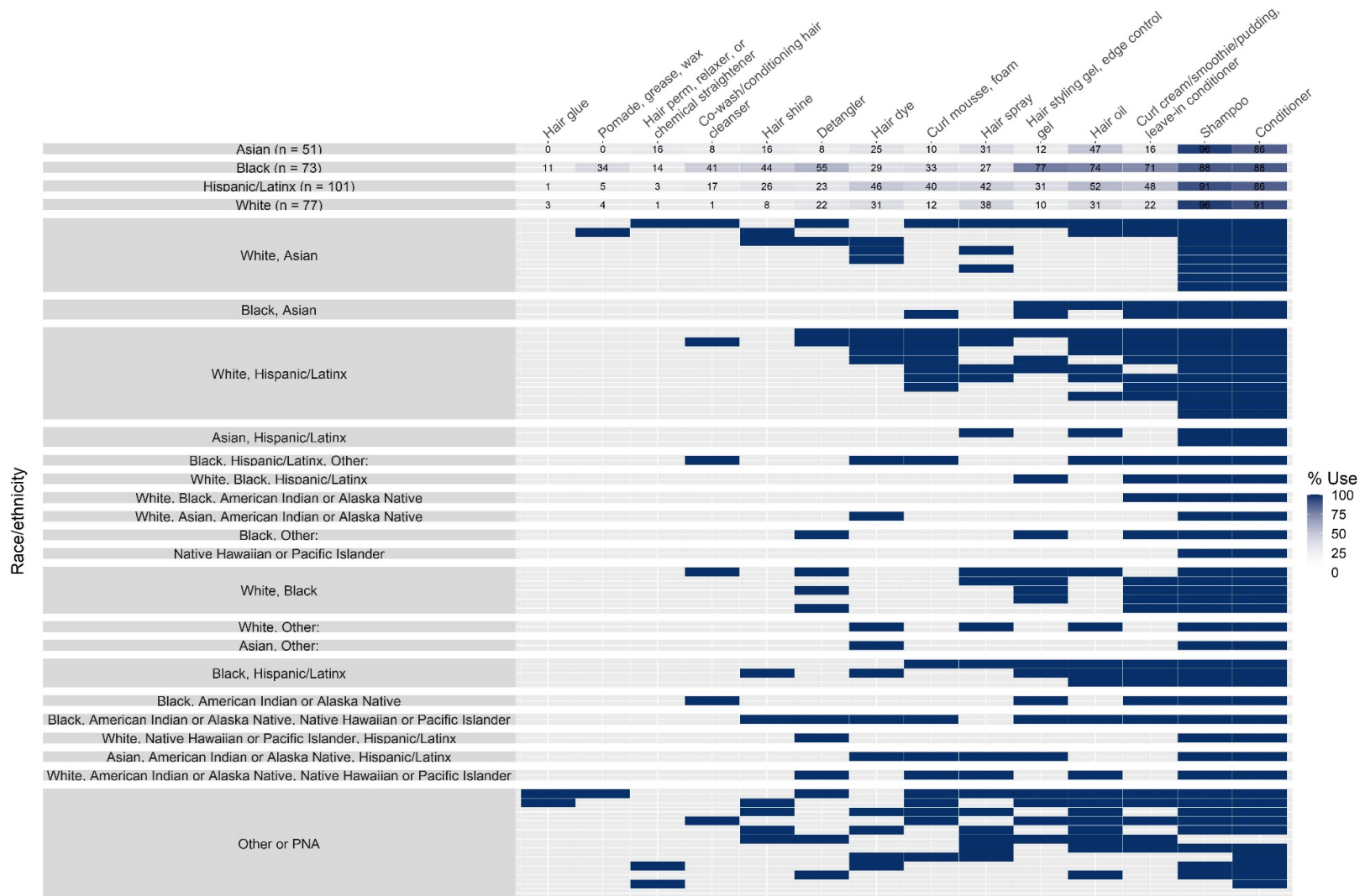


Figure S3b. Hair product use among women who self-reported as multiple races/ethnicity or as “Other.”

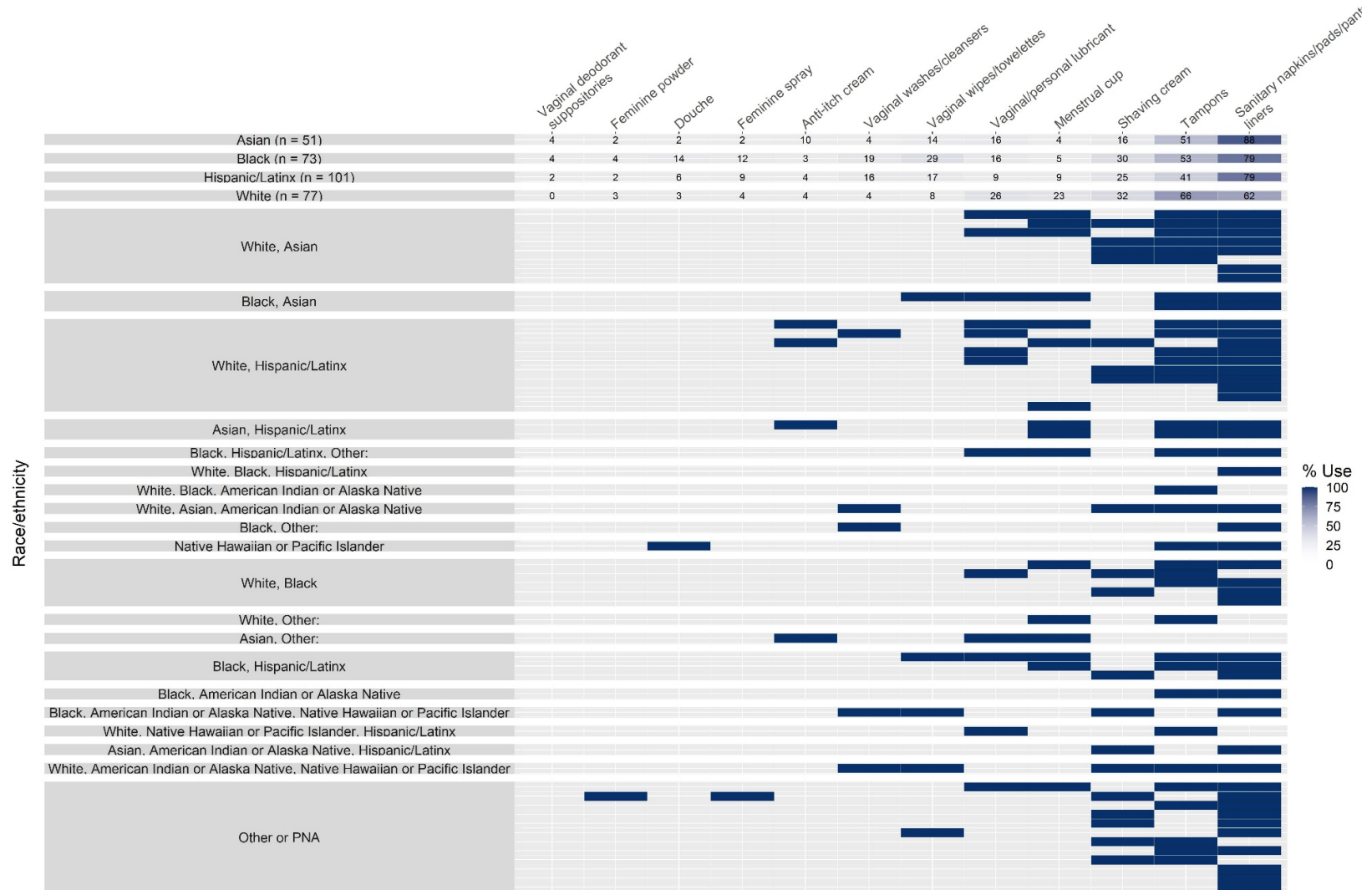


Figure S3c. Menstrual/intimate product use among women who self-reported as multiple races/ethnicity or as “Other.”



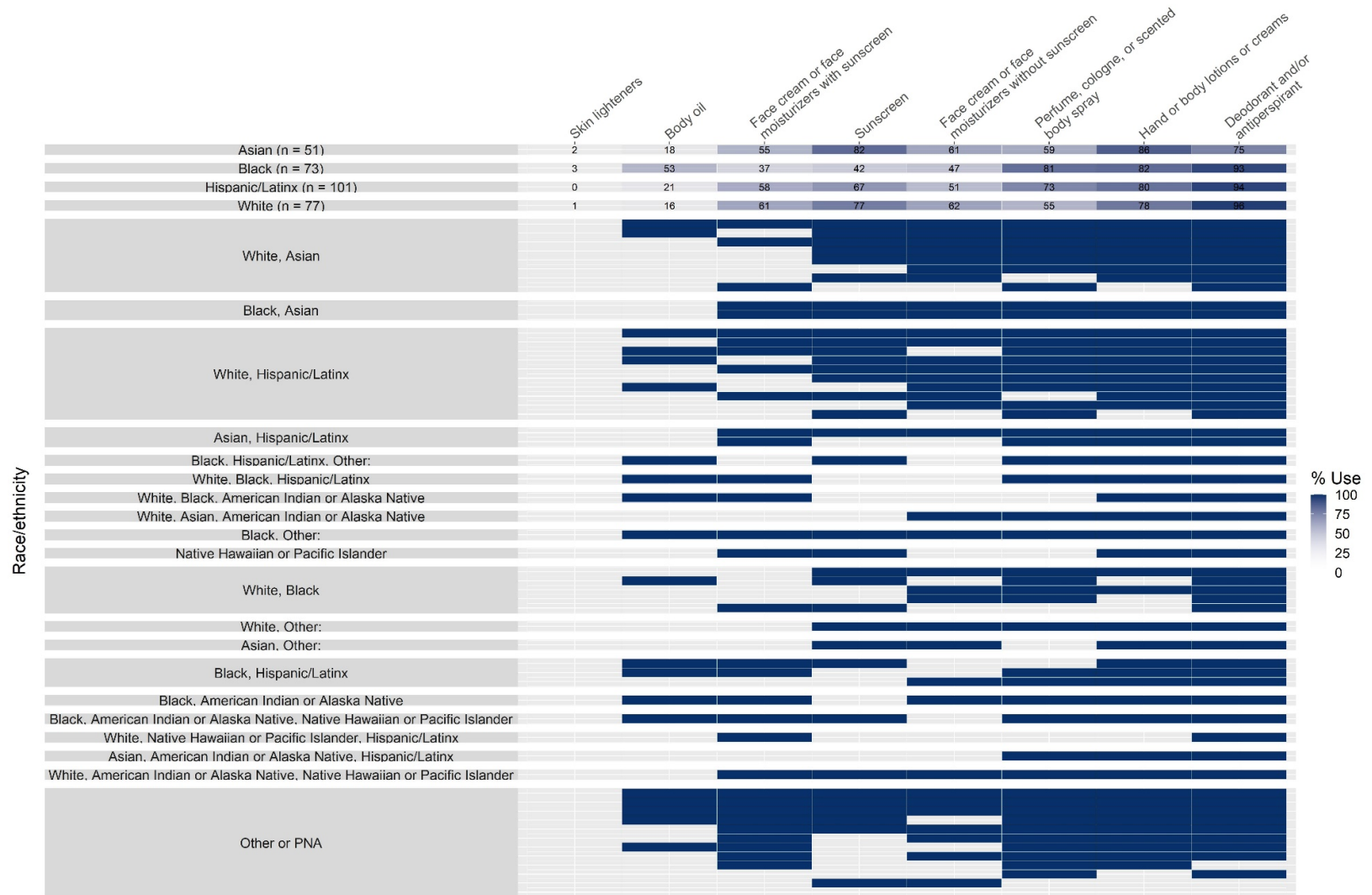


Figure S3d. Leave-on personal care product use among women who self-reported as multiple races/ethnicity or as "Other."

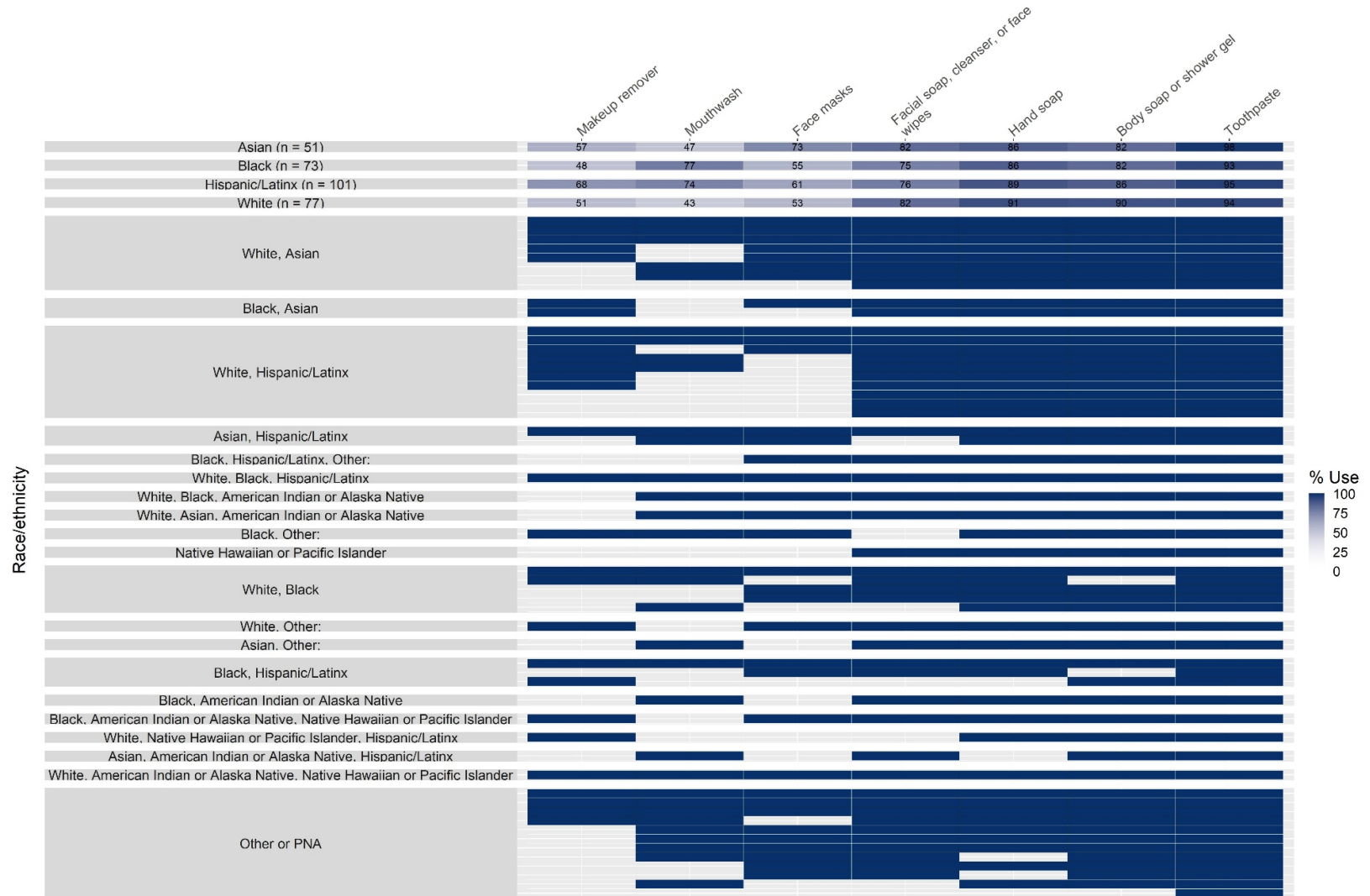


Figure S3e. Rinse-off personal care product use among women who self-reported as multiple races/ethnicity or as “Other.”

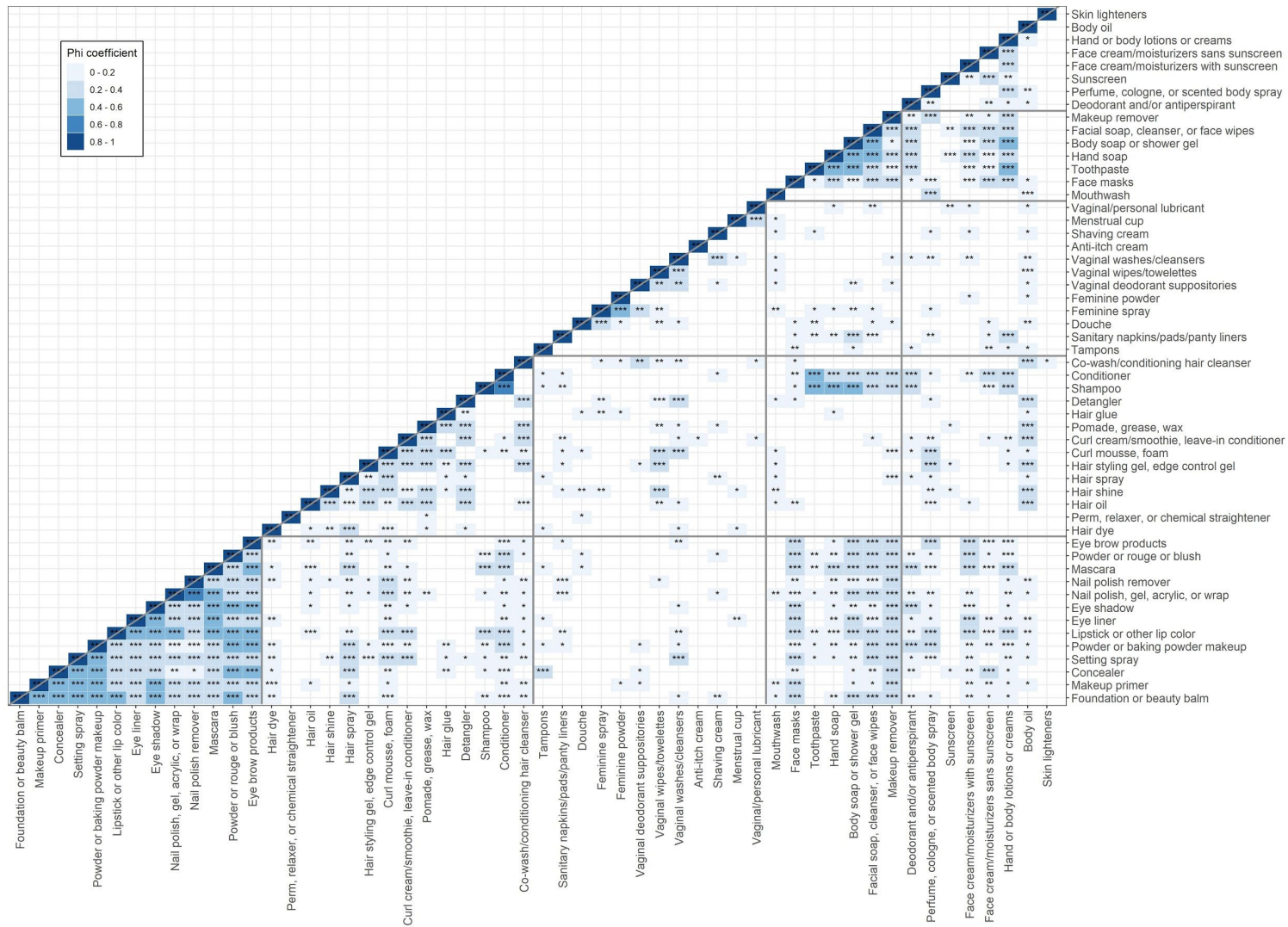


Figure S4. Concordance in product use. Higher concordance (phi estimate) indicated by darker shades. Statistically significant concordance indicated by asterisks (\*  $p < 0.05$ ; \*\*  $p < 0.01$ ; \*\*\*  $p < 0.001$ ). Products grouped by product categories.

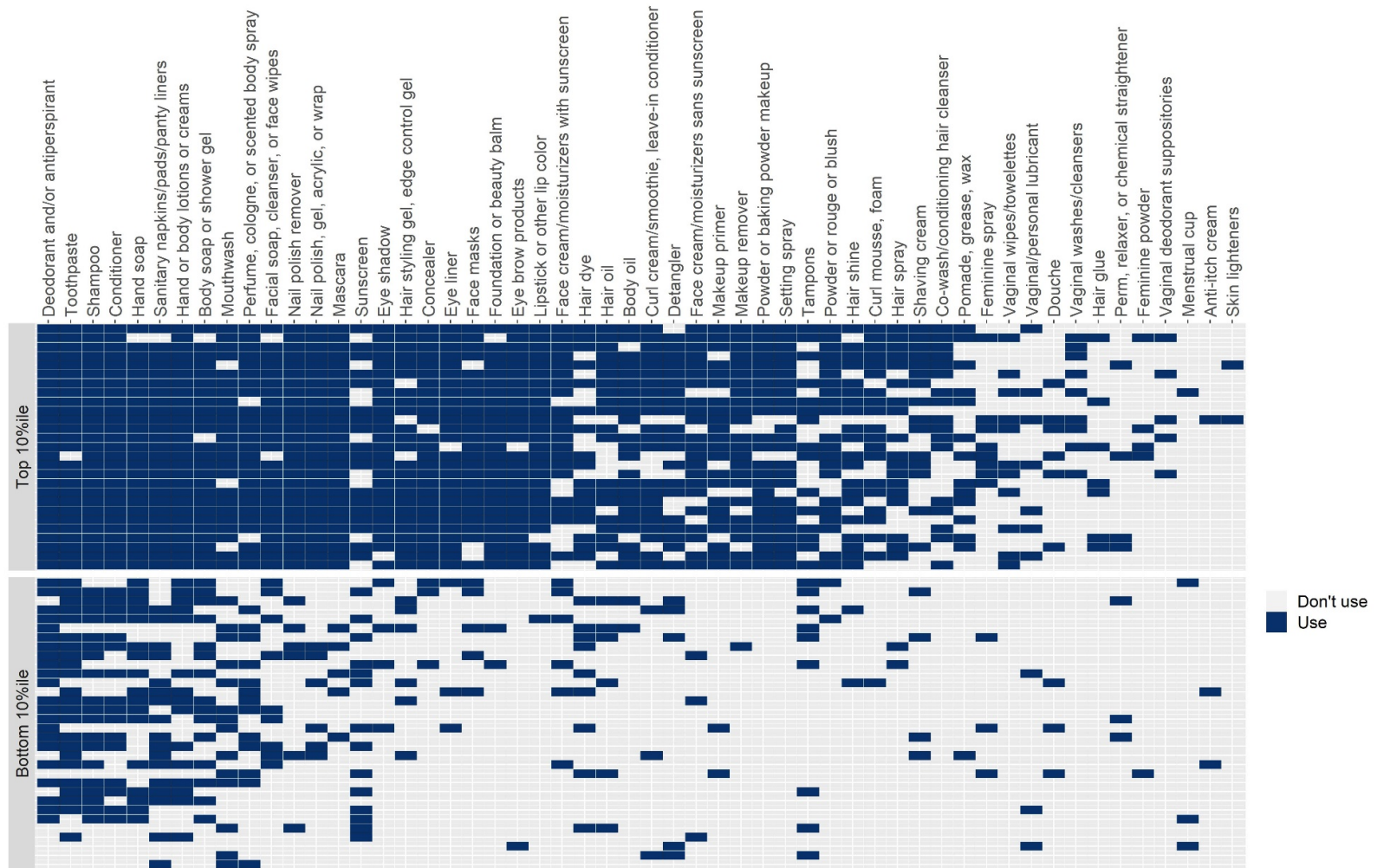


Figure S5. Product use among the top 10% of users and bottom 10% of users. Products sorted by prevalence of use (most commonly used products to the left).

AUTHOR'S COPY

Supplemental Material for:

Personal care product use among diverse women in California: Taking Stock Study

Robin E. Dodson, Bethsaida Cardona, Ami R. Zota, Janette Robinson Flint, Sandy Navarro, Bhavna Shamasunder

S1- Number of products used per product type; by race/ethnicity

S2 - Product use and frequency for all women (ages 18-34); by race/ethnicity

S3 - Product use and frequency of use for younger women ages (18-24); by race/ethnicity

S4 - Scented product used; by race/ethnicity

S5 - Product characteristics that are important for women when buying products; by race/ethnicity

S6 - Where women learn about products, or get product recommendations from; by race/ethnicity

Table S1 - Number of products by product type												
Product type	Number of products used per product type						Comparison p-values					
	mdn. # of products (N = 305)	Overall p-value	mdn # products - Asian (N=51)	mdn # products - Black (N=73)	mdn # products - Hispanic/Latinx (N=102)	mdn # products - White (N=79)	A:B	A:L	A:W	B:L	B:W	L:W
	Cosmetics (n = 13)	8	0.051	9	7	10	7					
Menstrual/Intimate products (n = 12)	2	0.03	2	2	2	2	0.044					
Hair products (n = 14)	4	<0.001	4	7	5	3	0	0.003		0	0	0
Leave-on personal care products (n = 8)	5	0.959	4	5	5	5						
Rinse-off personal care products (n = 7)	6	0.03	6	6	6	5						0.031

mdn = median, A = Asian, B = Black, L = Latinx, W = White

Table S2. Product use and Frequency of Use												
Product	Product Use						Pairwise comparisons					
	% of users	Overall p-value	% Asian (N=51)	% Black (N=73)	% Latinx (N=101)	% White (N=77)	A:B	A:L	A:W	B:L	B:W	L:W
	<b>Cosmetics</b>											
Foundation or beauty balm (bb cream)	61	0.202	65	52	67	58						
Makeup primer	42	0.03	51	36	50	31						
Concealer	55	0.09	63	42	55	60						
Setting spray	37	0.12	29	41	45	30						
Powder or baking powder makeup	42	0.241	45	37	49	35						
Lipstick or other lip color	72	0.005	76	62	83	65						
Eye liner	61	0.225	73	55	62	58						
Eye shadow	64	0.409	67	56	68	65						
Nail polish, gel, acrylic, or wrap	75	0.343	76	77	79	68						
Nail polish remover	65	0.251	67	66	70	56						
Mascara	82	0.214	84	74	85	86						
Powder or rouge or blush	51	0.002	51	33	62	55						
Eye brow products	58	0.081	59	60	64	45						
<b>Hair Products</b>												
Hair oil	51	<0.001	47	74	52	31						
Hair shine	24	<0.001	16	44	26	8						
Hair spray	35	0.236	31	27	42	38						
Hair styling gel, edge control gel	33	<0.001	12	77	31	10						
Curl mousse, foam	26	<0.001	10	33	40	12						
Curl cream/smoothie/pudding, leave-in conditioner	41	<0.001	16	71	48	22						
Pomade, grease, wax	11	<0.001	0	34	5	4						
Detangler	28	<0.001	8	55	23	22						
Shampoo	92	0.183	96	88	91	96						
Conditioner	88	0.781	86	88	86	91						
Co-wash/conditioning hair cleanser	17	<0.001	8	41	17	1						
<b>Other hair products</b>												
Hair dye	34	0.037	25	29	46	31						
Hair perm, relaxer, or chemical straightener	7	0.001	16	14	3	1						
Hair glue (ex: for extensions, wigs, weaves)	4	0.003	0	11	1	3						
<b>Menstrual/Intimate Products</b>												
Tampons	52	0.009	51	53	41	66						
Sanitary napkins/pads/panty liners	76	0.005	88	79	79	62						
Douche	6	0.028	2	14	6	3						
Feminine spray	7	0.092	2	12	9	4						
Feminine powder	3	0.895	2	4	2	3						
Vaginal deodorant suppositories	2	0.232	4	4	2	0						
Vaginal wipes/towelettes	17	0.008	14	29	17	8						
Vaginal washes/cleansers	12	0.003	4	19	16	4						
Anti-itch cream	5	0.335	10	3	4	4						
Shaving cream	26	0.156	16	30	25	32						
Menstrual cup	11	0.001	4	5	9	23						
Vaginal/personal lubricant	16	0.025	16	16	9	26						
<b>Leave-on Personal Care Products</b>												
Deodorant and/or antiperspirant	91	0.001	75	93	94	96						
Perfume, cologne, or scented body spray	68	0.002	59	81	73	55						
Sunscreen	66	<0.001	82	42	67	77						
Face cream or face moisturizers with sunscreen	53	0.013	55	37	58	61						
Face cream or face moisturizers without sunscreen	55	0.178	61	47	51	62						
Hand or body lotions or creams	81	0.695	86	82	80	78						
Body oil	27	<0.001	18	53	21	16						
Skin lighteners	1	0.321	2	3	0	1						
<b>Rinse-off Personal Care Products</b>												
Mouthwash	62	<0.001	47	77	74	43						
Face masks	60	0.126	73	55	61	53						
Toothpaste	95	0.66	98	93	95	94						

AUTHOR'S COPY

Product	Product Use						Pairwise comparisons					
	% of users	Overall p-value	% Asian (N=51)	% Black (N=73)	% Latinx (N=101)	% White (N=77)	A:B	A:L	A:W	B:L	B:W	L:W
Hand soap	88	0.779	86	86	89	91						
Body soap or shower gel	85	0.533	82	82	86	90						
Facial soap, cleanser, or face wipes	78	0.65	82	75	76	82						
Makeup remover	57	0.028	57	48	68	51						

A = Asian women; B = Black Women; L = Latinas; W = White women; shaded cells indicate significant differences in pairwise comparisons (p<0.05)

For cosmetics: 1 = Very rarely (less than once a month); 2 = Occasionally (once a month to a few times per month); 3 = Regularly (1-5 timesper week); 4 = Every day/almost every day (6 or more times per week)

For hair products: 1 = Very rarely (less than once a month); 2 = Occasionally (once a month to a few times per month); 3 = Regularly (1-5 timesper week); 4 = Every day/almost every day (6 or more times per week)

For other hair products: 1 = 1-2 times (every 5 to 12 months); 2 = 3-4 times (every 3 to 4 months); 3 = 5-12 times (every 1 to 2months); 4 = More than once a month

For menstrual/intimate products: 1 = Very rarely (less than once a month) or Occasionally (1-3 times a month); 2 = During menstrual cycle; 3 = Regularly (1-5 times a week) or Every day (6 or more times per week)

For other personal care products: 1 = Very rarely (less than once a month); 2 = Occasionally (once a month to a few times per month); 3 = Regularly (1-5 times per week); 4 = Every day/almost every day (6 or more times per week)



Table S2. Product use and Frequency of Use													
Product	Frequency of Use						Pairwise comparisons						
	Median frequency	Overall p-value	Asian (med. freq.)	Black (med. freq.)	Latinas (med. freq.)	White (med. freq.)	A:B	A:L	A:W	B:L	B:W	L:W	
<b>Cosmetics</b>													
Foundation or beauty balm (bb cream)	3	<0.001	3 (n=33)	2 (n=33)	3 (n=67)	2 (n=45)							
Makeup primer	2	0.138	2 (n=26)	2 (n=23)	2.5 (n=48)	2 (n=24)							
Concealer	3	0.014	2 (n=32)	2.5 (n=26)	3 (n=55)	3 (n=46)							
Setting spray													
Powder or baking powder makeup	3	0.311	2 (n=23)	2 (n=21)	3 (n=47)	2 (n=27)							
Lipstick or other lip color	3	<0.001	3 (n=39)	3 (n=39)	3 (n=81)	2 (n=50)							
Eye liner	2	0.001	2 (n=37)	2 (n=34)	3 (n=63)	2 (n=45)							
Eye shadow	2	0.261	2 (n=34)	2 (n=36)	2 (n=67)	2 (n=50)							
Nail polish, gel, acrylic, or wrap	2	0.008	1.5 (n=38)	2 (n=47)	2 (n=77)	2 (n=52)							
Nail polish remover	2	0.009	1 (n=33)	2 (n=40)	2 (n=69)	2 (n=43)							
Mascara	3	0.038	2 (n=43)	3 (n=46)	3 (n=83)	3 (n=66)							
Powder or rouge or blush	3	0.011	2 (n=25)	3 (n=22)	3 (n=60)	2 (n=42)							
Eye brow products	3	0.161	3 (n=30)	3 (n=36)	4 (n=63)	3 (n=35)							
<b>Hair Products</b>													
Hair oil	3	0.069	2 (n=24)	3 (n=44)	3 (n=52)	2 (n=24)							
Hair shine	2	0.012	2 (n=8)	2 (n=26)	2 (n=24)	3 (n=6)							
Hair spray	2	0.043	2 (n=15)	2 (n=15)	2 (n=40)	2 (n=29)							
Hair styling gel, edge control gel	3	0.187	2 (n=6)	3 (n=42)	3 (n=31)	2.5 (n=8)							
Curl mousse, foam	2	0.712	2 (n=5)	2 (n=17)	2 (n=38)	3 (n=9)							
Curl cream/smoothie/pudding, leave-in conditioner	3	0.427	2.5 (n=8)	3 (n=41)	3 (n=45)	3 (n=17)							
Pomade, grease, wax	2	0.72		2 (n=17)	2.5 (n=4)	2 (n=3)							
Detangler	3	0.783	3 (n=3)	3 (n=31)	3 (n=23)	3 (n=17)							
Shampoo	3	<0.001	3 (n=48)	2 (n=52)	3 (n=89)	3 (n=74)							
Conditioner	3	<0.001	3 (n=44)	2 (n=54)	3 (n=84)	3 (n=69)							
Co-wash/conditioning hair cleanser	3	0.003	2 (n=4)	2 (n=24)	3 (n=16)	4 (n=1)							
<b>Other hair products</b>													
Hair dye	1	0.884	1 (n=12)	1 (n=15)	1 (n=44)	1 (n=24)							
Hair perm, relaxer, or chemical straightener	1	0.07	1 (n=8)	1.5 (n=8)	1 (n=3)	1 (n=1)							
Hair glue (ex: for extensions, wigs, weaves)	1	0.779		1 (n=4)	1 (n=1)	1.5 (n=2)							
<b>Menstrual/Intimate Products</b>													
Tampons	2	0.739	2 (n=26)	2 (n=30)	2 (n=40)	2 (n=50)							
Sanitary napkins/pads/panty liners	2	0.673	2 (n=45)	2 (n=48)	2 (n=78)	2 (n=47)							
Douche	1	0.554	2 (n=1)	1 (n=10)	1 (n=6)	1.5 (n=2)							
Feminine spray	1	0.125	1 (n=1)	1 (n=7)	1 (n=8)	3 (n=3)							
Feminine powder	2	0.57	2 (n=1)	3 (n=3)	1 (n=1)	1.5 (n=2)							
Vaginal deodorant suppositories	1	0.91	1.5 (n=2)	1 (n=3)	2 (n=2)								
Vaginal wipes/towelettes	2	0.407	2 (n=7)	3 (n=19)	2 (n=17)	2.5 (n=6)							
Vaginal washes/cleansers	3	0.429	1.5 (n=2)	3 (n=13)	3 (n=16)	3 (n=2)							
Anti-itch cream	1	0.379	1 (n=5)	1 (n=1)	1 (n=3)	1 (n=3)							
Shaving cream	1	0.528	1 (n=8)	1 (n=20)	1 (n=24)	1 (n=25)							
Menstrual cup													
Vaginal/personal lubricant	1	0.324	1 (n=8)	1 (n=11)	1 (n=9)	1 (n=20)							
<b>Leave-on Personal Care Products</b>													
Deodorant and/or antiperspirant	4	<0.001	4 (n=38)	4 (n=57)	4 (n=91)	4 (n=74)							
Perfume, cologne, or scented body spray	3	0.036	3 (n=30)	3 (n=47)	3 (n=72)	3 (n=42)							
Sunscreen	2.5	0.003	3 (n=42)	2 (n=27)	2 (n=68)	2 (n=59)							
Face cream or face moisturizers with sunscreen	4	0.92	4 (n=28)	4 (n=26)	4 (n=58)	4 (n=47)							
Face cream or face moisturizers without sunscreen	4	0.782	4 (n=31)	4 (n=27)	4 (n=50)	4 (n=48)							
Hand or body lotions or creams	4	0.005	4 (n=44)	4 (n=49)	4 (n=79)	3 (n=60)							
Body oil	3	0.281	3 (n=9)	3 (n=32)	3 (n=20)	2.5 (n=12)							
Skin lighteners	3	1	3 (n=1)	2.5 (n=2)		3 (n=1)							
<b>Rinse-off Personal Care Products</b>													
Mouthwash	3	0.482	3 (n=24)	3 (n=47)	3 (n=72)	3 (n=33)							
Face masks	2	0.56	2 (n=37)	2 (n=31)	2 (n=60)	2 (n=41)							
Toothpaste	4	0.004	5 (n=50)	4 (n=57)	4 (n=93)	5 (n=72)							

AUTHOR'S COPY

Product	Frequency of Use						Pairwise comparisons					
	Median frequency	Overall p-value	Asian (med. freq.)	Black (med. freq.)	Latinas (med. freq.)	White (med. freq.)	A:B	A:L	A:W	B:L	B:W	L:W
Hand soap	5	0.443	5 (n=44)	5 (n=53)	5 (n=86)	5 (n=70)						
Body soap or shower gel	4	0.001	4 (n=42)	4 (n=50)	4 (n=82)	4 (n=69)						
Facial soap, cleanser, or face wipes	4	0.075	4 (n=42)	4 (n=45)	4 (n=74)	4 (n=63)						
Makeup remover	3	0.901	3 (n=29)	3 (n=30)	3 (n=67)	3 (n=39)						
A = Asian women; B = Black Women; L = Latinas; W = White												
For cosmetics: 1 = Very rarely (less than once a month); 5 = More than once per day												
For hair products: 1 = Very rarely (less than once a month); 5 = More than once per day												
For other hair products: 1 = 1-2 times (every 5 to 12 months); 5 = More than once per day												
For menstrual/intimate products: 1 = Very rarely (less than once per week); 5 = More than once per day												
For other personal care products: 1 = Very rarely (less than once per week); 5 = More than once per day												

Product	Product Use											
	Overall p-value	% users	% Asian (N=51)	% Black (N=73)	% Hispanic/Latinx (N=101)	% White (N=77)	Comparison p-values					
							A:B	A:L	A:W	B:L	B:W	L:W
<b>Cosmetics</b>												
Foundation or beauty balm (bb cream)	0.351	62	59	55	73	58						
Makeup primer	0.136	41	49	38	51	31						
Concealer	0.465	60	68	48	61	61						
Setting spray	0.132	37	27	52	44	32						
Powder or baking powder makeup	0.915	40	41	41	44	37						
Lipstick or other lip color	0.018	72	73	55	88	68				0.027		
Eye liner	0.136	57	70	41	56	58						
Eye shadow	0.411	65	68	52	71	66						
Nail polish, gel, acrylic, or wrap	0.733	75	81	72	76	71						
Nail polish remover	0.676	63	70	66	63	58						
Mascara	0.791	84	84	79	83	87						
Powder or rouge or blush	0.001	50	49	21	68	53				0.001	0.035	
Eye brow products	0.117	56	59	66	63	44						
<b>Menstrual/Intimate products</b>												
Tampons	0.189	57	51	62	46	66						
Sanitary napkins/pads/panty liners	0.018	75	89	86	71	65						
Douche	0.177	4	0	7	7	2						
Feminine spray	0.006	4	0	10	10	0						
Feminine powder	0.817	3	3	3	5	2						
Vaginal deodorant suppositories	0.399	1	3	0	2	0						
Vaginal wipes/towelettes	0.538	12	11	14	17	8						
Vaginal washes/cleansers	0.003	10	3	17	22	3						0.037
Anti-itch cream	0.15	3	8	0	0	3						
Shaving cream	0.103	25	14	17	32	32						
Menstrual cup	<0.001	10	0	3	2	24			0.005			0.013
Vaginal/personal lubricant	0.001	12	8	7	0	24						0.002
<b>Hair products</b>												
Hair oil	0.001	49	51	76	51	32					0.001	

Product	Product Use											
	Overall p-value	% users	% Asian (N=51)	% Black (N=73)	% Hispanic/Latinx (N=101)	% White (N=77)	Comparison p-values					
							A:B	A:L	A:W	B:L	B:W	L:W
Hair shine	0.002	17	16	34	24	5					0.003	0.032
Hair spray	0.554	33	24	31	39	35						
Hair styling gel, edge control gel	<0.001	29	14	86	32	10	<0.001			<0.001	<0.001	0.05
Curl mousse, foam	0.001	23	11	34	41	13		0.026				0.011
Curl cream/smoothie/pudding, leave-in	<0.001	37	14	76	51	24	<0.001	0.004			<0.001	0.038
Pomade, grease, wax	<0.001	7	0	28	2	3	0.004			0.017	0.008	
Detangler	<0.001	25	8	62	22	21	<0.001			0.006	0.002	
Shampoo	0.535	94	95	90	93	97						
Conditioner	0.796	89	86	90	88	92						
Co-wash/conditioning hair cleanser	<0.001	12	5	41	15	0	0.003				<0.001	0.019
<b>Other hair products</b>												
Hair dye	0.018	31	24	31	51	23						0.02
Hair perm, relaxer, or chemical straightener	0.003	8	16	14	7	0			0.012			
Hair glue (ex: for extensions, wigs, weaves)	0.002	5	0	21	2	3	0.031					
<b>Leave-on personal care products</b>												
Deodorant and/or antiperspirant	0.004	89	73	93	90	97			0.005			
Perfume, cologne, or scented body spray	0.034	66	59	83	76	56						
Sunscreen	<0.001	69	86	38	59	79	<0.001				0.002	
Face cream or face moisturizers with sunscreen	0.001	49	43	21	49	65					0.001	
Face cream or face moisturizers without sunscreen	0.186	57	65	41	54	63						
Hand or body lotions or creams	0.762	80	81	86	76	81						
Body oil	<0.001	20	16	52	10	15	0.019			0.001	0.002	
Skin lighteners	1	1	0	0	0	2						
<b>Rinse-off personal care products</b>												
Mouthwash	0.001	53	43	72	71	37					0.018	0.007
Face masks	0.044	65	78	76	63	53						
Toothpaste	0.641	95	97	93	93	97						
Hand soap	0.459	88	84	90	83	92						
Body soap or shower gel	0.189	85	78	79	85	92						
Facial soap, cleanser, or face wipes	0.187	80	86	69	76	85						
Makeup remover	0.139	58	57	52	73	52						

A = Asian women; B = Black Women; L = Hispanic/Latinx; W = White women; shaded cells indicate significant differences in pairwise comparisons (p < 0.05).  
 For cosmetics: 1 = Very rarely (less than once a month); 2 = Occasionally (once a month to a few times per month); 3 = Regularly (1-5 times per week)  
 For hair products: 1 = Very rarely (less than once a month); 2 = Occasionally (once a month to a few times per month); 3 = Regularly (1-5 times per week)  
 For other hair products: 1 = 1-2 times (every 5 to 12 months); 2 = 3-4 times (every 3 to 4 months); 3 = 5-12 times (every 1 to 2 months); 4 = More than 12 times (every 1 to 2 months)  
 For menstrual/intimate products: 1 = Very rarely (less than once a month) or Occasionally (1-3 times a month); 2 = During menstrual cycle; 3 = Regularly (more than once a month)  
 For other personal care products: 1 = Very rarely (less than once a month); 2 = Occasionally (once a month to a few times per month); 3 = Regularly (more than once a month)

Table S3. Product use and frequency of												
Product	Frequency (Ordinal scale)						Comparison p-values					
	Overall p-value	median frequency	Asian med. freq.	Black med. freq.	Hispanic/Latinx med. freq.	White med. freq.	A:B	A:L	A:W	B:L	B:W	L:W
	<b>Cosmetics</b>											
Foundation or beauty balm (bb cream)	0.001	2	3 (n=22)	2 (n=11)	3 (n=29)	2 (n=36)				0.021		0.002
Makeup primer	0.5	2	2 (n=18)	2 (n=8)	2 (n=20)	2 (n=19)						
Concealer	0.022	2	2 (n=25)	2 (n=9)	3 (n=24)	2.5 (n=38)		0.014				
Setting spray												
Powder or baking powder makeup	0.063	2	2 (n=15)	2 (n=7)	3 (n=17)	2 (n=23)						
Lipstick or other lip color	0.006	2	2 (n=27)	3 (n=11)	3 (n=34)	2 (n=42)						0.007
Eye liner	0.005	2	2 (n=26)	2 (n=7)	3 (n=23)	2 (n=36)						0.004
Eye shadow	0.044	2	2 (n=25)	2 (n=10)	3 (n=28)	2 (n=41)						0.047
Nail polish, gel, acrylic, or wrap	0.014	2	1 (n=29)	3 (n=13)	2 (n=28)	2 (n=44)	0.044					
Nail polish remover	0.025	2	1 (n=25)	2 (n=11)	2 (n=24)	1.5 (n=36)					0.04	
Mascara	0.087	3	2 (n=31)	3 (n=16)	3 (n=32)	3 (n=54)						
Powder or rouge or blush	0.019	2	2 (n=17)	2 (n=5)	3 (n=26)	2 (n=33)						0.029
Eye brow products	0.555	3	3 (n=22)	3 (n=13)	4 (n=25)	3 (n=27)						
<b>Menstrual/Intimate products</b>												
Tampons	0.252	2	2 (n=19)	2 (n=10)	2 (n=18)	2 (n=40)						
Sanitary napkins/pads/panty liners	0.872	2	2 (n=33)	2 (n=15)	2 (n=27)	2 (n=39)						
Douche	0.624	1.5		2 (n=2)	1 (n=3)	2 (n=1)						
Feminine spray	0.346	1.5		1 (n=1)	2 (n=3)							
Feminine powder	0.392	1	2 (n=1)	1 (n=1)	1 (n=1)	1 (n=1)						
Vaginal deodorant suppositories	0.317	2	1 (n=1)		3 (n=1)							
Vaginal wipes/towelettes	0.55	2.5	2.5 (n=4)	3 (n=2)	2 (n=7)	2 (n=5)						
Vaginal washes/cleansers	0.486	3	1 (n=1)	3 (n=4)	3 (n=9)	3 (n=1)						
Anti-itch cream	0.182	1	3 (n=3)			1 (n=2)						
Shaving cream	0.191	1	1 (n=5)	2.5 (n=4)	1 (n=13)	1 (n=20)						
Menstrual cup												
Vaginal/personal lubricant	0.527	1	1 (n=3)	1 (n=1)		1 (n=15)						
<b>Hair products</b>												
Hair oil	0.575	3	2 (n=19)	3 (n=14)	3 (n=21)	2 (n=20)						

Product	Frequency (Ordinal scale)						Comparison p-values					
	Overall p-value	median frequency	Asian med. freq.	Black med. freq.	Hispanic/Latinx med. freq.	White med. freq.	A:B	A:L	A:W	B:L	B:W	L:W
Hair shine	0.008	2	2 (n=6)	1.5 (n=4)	2 (n=9)	3 (n=3)						
Hair spray	0.735	2	2 (n=8)	1.5 (n=4)	2 (n=16)	1 (n=22)						
Hair styling gel, edge control gel	0.364	3	2 (n=5)	3 (n=14)	3 (n=13)	3 (n=6)						
Curl mousse, foam	0.475	2	2 (n=4)	2 (n=4)	2 (n=16)	3 (n=8)						
Curl cream/smoothie/pudding, leave-in	0.122	3	2 (n=5)	3 (n=12)	3 (n=19)	3 (n=15)						
Pomade, grease, wax	0.732	2		2 (n=3)	2 (n=1)	2.5 (n=2)						
Detangler	0.835	3	3 (n=2)	3 (n=9)	4 (n=9)	3 (n=13)						
Shampoo	<0.001	3	3 (n=34)	2 (n=16)	3 (n=36)	3 (n=60)	<0.001			<0.001	<0.001	
Conditioner	<0.001	3	3 (n=32)	2 (n=16)	3 (n=34)	3 (n=57)	0.001			<0.001	<0.001	
Co-wash/conditioning hair cleanser	0.018	3	1 (n=2)	2 (n=6)	3 (n=5)							
<b>Other hair products</b>												
Hair dye	0.517	1	1 (n=8)	1 (n=4)	1.5 (n=20)	1 (n=14)						
Hair perm, relaxer, or chemical straightener	0.223	1	1 (n=6)	1 (n=3)	1 (n=3)							
Hair glue (ex: for extensions, wigs, weaves)	0.472	1		1 (n=2)	1 (n=1)	1.5 (n=2)						
<b>Leave-on personal care products</b>												
Deodorant and/or antiperspirant	<0.001	4	3 (n=27)	4 (n=17)	4 (n=35)	4 (n=60)	0.011		<0.001			0.016
Perfume, cologne, or scented body spray	0.018	3	3 (n=22)	4 (n=15)	3 (n=30)	3 (n=35)	0.027					
Sunscreen	0.087	3	3 (n=32)	2 (n=8)	2 (n=24)	3 (n=49)						
Face cream or face moisturizers with SPF	0.617	4	3.5 (n=16)	3 (n=5)	4 (n=19)	4 (n=40)						
Face cream or face moisturizers without SPF	0.959	4	4 (n=24)	4 (n=6)	4 (n=21)	4 (n=39)						
Hand or body lotions or creams	0.274	3	3.5 (n=30)	4 (n=15)	4 (n=30)	3 (n=50)						
Body oil	0.96	3	3 (n=6)	3 (n=8)	3 (n=3)	3 (n=9)						
Skin lighteners												
<b>Rinse-off personal care products</b>												
Mouthwash	0.881	3	3 (n=16)	3.5 (n=14)	3 (n=27)	3 (n=23)						
Face masks	0.816	2	2 (n=29)	2 (n=13)	2 (n=25)	2 (n=33)						
Toothpaste	0.033	5	5 (n=36)	4 (n=17)	4 (n=36)	5 (n=60)						0.038
Hand soap	0.97	5	5 (n=31)	5 (n=16)	5 (n=31)	5 (n=57)						
Body soap or shower gel	0.025	4	4 (n=29)	4 (n=14)	4 (n=32)	4 (n=57)						
Facial soap, cleanser, or face wipes	0.107	4	4 (n=32)	4 (n=11)	4 (n=29)	4 (n=53)						
Makeup remover	0.217	3	3 (n=21)	2 (n=11)	3 (n=29)	3 (n=32)						
A = Asian women; B = Black Women; L<0.05												
For cosmetics: 1 = Very rarely (less than once a week); 4 = Every day/almost every day (6 or more times per week); 5 = More than once per day												
For hair products: 1 = Very rarely (less than once a week); 4 = Every day/almost every day (6 or more times per week); 5 = More than once per day												
For other hair products: 1 = 1-2 times (once a month)												
For menstrual/intimate products: 1 = Varily (1-5 times a week) or Every day (6 or more times per week) or More than once per day												
For other personal care products: 1 = V(1-5 times per week); 4 = Every day/almost every day (6 or more times per week); 5 = More than once per c												

Table S4. Scented product use													
Scented product use													
								Comparison p-values					
Product	Product type	% users	Overall p-value	% Asian	% Black	% Hispanic/Latinx	% White	A:B	A:L	A:W	B:L	B:W	L:W
Deodorant and/or antipersp	Other	80	0.338	89	75	82	78						
Hand our body lotions or cr	Other	70	0.465	70	77	71	63						
Hand soap	Other	83	0.932	84	80	82	85						
Body soap or shower gel	Other	80	0.466	85	73	79	83						
Makeup remover	Other	19	0.013	16	16	30	3						0.014
Shampoo	Hair	87	0.849	85	84	89	87						
Face cream or face moisturi	Other	25	0.837	26	21	29	22						
Body oil	Other	54	0.718	67	57	45	50						
Conditioner	Hair	86	0.781	85	82	88	88						
sanitary/napkins/pads/pant	Menstrual	11	0.778	12	12	11	7						
Face cream or face moisturi	Other	20	0.268	24	21	27	11						
Face mask	Other	53	0.254	57	37	54	62						
Facial soap, cleanser, or faci	Other	32	0.055	30	24	45	24						
Tampons	Menstrual	9	0.127	12	15	12	2						
Cowash/conditioning hair cl	Hair	84	0.467	75	78	94	100						

A = Asian, B = Black, L = Latinx, W = White

Table S5. Characteristics when choosing products													
What characteristics are important when choosing a product to purchase?													
								Comparison p-values					
Product type	Characteristics	% selected	Overall p-value	% Asian	% Black	% Hispanic/Latinx	% White	A:B	A:L	A:W	B:L	B:W	L:W
cosmetic	Scent	22	0.576	21	28	22	18						
cosmetic	Long-lasting	47	0.066	54	41	56	38						
cosmetic	Ingredients	47	0.789	42	45	47	51						
cosmetic	Price	79	0.527	81	72	79	82						
cosmetic	Brand	42	0.291	50	38	46	36						
cosmetic	Effectiveness	74	0.005	85	62	69	84	0.041				0.028	
cosmetic	Other	7	0.114	2	7	4	12						
hair	Scent	49	0.849	53	45	50	51						
hair	Long-lasting	42	0.016	37	51	49	29					0.044	
hair	Ingredients	54	0.019	49	70	51	47					0.03	
hair	Price	76	0.889	78	78	74	74						
hair	Brand	36	0.021	33	47	40	23					0.021	
hair	Effectiveness	79	0.526	78	78	75	84						
hair	Other	4	0.125	4	1	3	9						
menstrual/intimate	Scent	21	0.967	24	22	21	20						
menstrual/intimate	Ingredients	52	0.37	43	49	53	59						
menstrual/intimate	Price	63	0.005	78	48	66	65	0.004					
menstrual/intimate	Brand	37	0.61	41	38	38	31						
menstrual/intimate	Effectiveness	72	0.006	82	58	73	80	0.022				0.026	
menstrual/intimate	Other	3	0.895	2	4	2	3						
personal	Scent	50	0.045	59	40	47	60						
personal	Long-lasting	43	0.545	41	37	48	45						
personal	Ingredients	60	0.431	51	59	62	65						
personal	Price	78	0.003	88	66	74	87	0.034				0.02	
personal	Brand	46	0.233	55	40	50	40						
personal	Effectiveness	77	0.003	80	64	76	90					0.002	
personal	Other	3	0.865	4	1	3	3						

A = Asian, B = Black, L = Latinx, W = White



Table S6. Where go to learn more and get recommendations													
Where do you go to get product recommendations or learn more about products?													
Product Type	Sources	% selected	Overall p-value	% Asian	% Black	% Hispanic /Latinx	% White	Comparison p-values					
								A:B	A:L	A:W	B:L	B:W	L:W
cosmetic	Advertisements	19	0.077	19	12	27	15						
cosmetic	Social media (ex: beau	62	0.069	69	49	68	60						
cosmetic	Friends	67	0.438	73	59	69	68						
cosmetic	Family	40	0.845	38	41	43	37						
cosmetic	Internet search	50	0.017	60	35	51	58	0.049				0.045	
cosmetic	Other	3	0.149	0	1	2	7						
hair	Advertisements	17	0.005	16	7	27	14				0.004		
hair	Social media (ex: beau	49	0.03	45	56	56	36						
hair	Hair stylist or beauty p	39	0.083	33	48	32	45						
hair	Friends	55	0.133	61	64	50	48						
hair	Family	49	0.006	49	66	40	44				0.004		
hair	Internet search	41	0.041	53	29	45	39						
hair	Other	2	0.774	0	3	3	3						
menstrual/intimate	Advertisements	21	0.047	22	11	28	20				0.045		
menstrual/intimate	Social media	18	0.98	20	18	19	17						
menstrual/intimate	Friends	39	0.449	37	40	33	45						
menstrual/intimate	Family	45	0.75	47	44	41	49						
menstrual/intimate	Internet search	39	0.031	49	26	37	45						
menstrual/intimate	Other	5	0.017	0	8	9	1						
personal	Advertisements	27	0.098	29	18	35	26						
personal	Social media (ex: beau	47	0.102	57	36	50	49						
personal	Friends	61	0.441	69	56	57	64						
personal	Family	59	0.027	76	60	52	55		0.03				
personal	Internet search	50	0.027	59	40	46	61						
personal	Other	5	0.468	4	3	8	4						

A = Asian, B = Black, L = Latinx, W = White