Usage pattern of personal care products in California households

Xiangmei (May) Wu [a], Deborah H. Bennett [a,*], Beate Ritz [b], Diana L. Cassady [a], Kiyoung Lee [c], Irva Hertz-Picciotto [a]

[a] Department of Public Health Sciences, University of California, Davis, CA, United States
[b] Department of Public Health Sciences, University of California, Los Angeles, CA, United States
[c] Graduate School of Public Health and Institute of Health and Environment, Seoul National University, Seoul, South Korea

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ABSTRACT

Given the concern over the potential for health risks associated with certain ingredients (e.g., phthalates) in personal care products, usage patterns of ~30 types of personal care products (e.g., shampoo, sunscreen, fragrance, etc.) were collected in 604 California households through a telephone interview. Preferences in selecting products, e.g., scented or unscented, aerosol, and brand loyalty, were also investigated. Participants were recruited in three age groups, children (mostly preschoolers), their parents, and adults age 55 or older. Use frequencies of various product types varied by sex, age group, race, education, and climatic region. Product use by parent and child from the same household were correlated. Use frequencies of products in the same class (e.g., skincare) were moderately correlated, which may impact aggregate exposures. Use frequencies observed in this study were generally in the same range as those reported in the EPA Exposure Factor Handbook, but we found differences for some individual products. Our study provides additional data on population-based usage patterns of a large collection of commonly used personal care products pertaining to several age groups and socio-demographic strata. This information will be valuable for exposure and risk assessments.

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1. Introduction

Personal care products are widely and regularly used by people, often on a daily basis. Some chemicals that are found in personal care products, e.g., phthalates, oxybenzone, triclosan, heavy metals (e.g., lead and arsenic), nitrosamines, hydroquinone, and 1,4-dioxane, may be related to allergy, endocrine disruption, neurotoxicity, birth defects, or cancers (CDC, 2005; Golden et al., 2005; Levy et al., 1999; Schettler, 2006; Stickney et al., 2003; Szczurko et al., 1994; Topping et al., 2007). While applying personal care products, people may be exposed to these constituent chemicals through multiple exposure routes, including dermal absorption, inhalation and ingestion.

To assess exposure to chemicals in personal care products, one must know the ingredients of products and the relevant exposure scenarios, including both the use frequency and the amount of product used per time (Engelen et al., 2007). Further, to assess the potential health risks for the population, probabilistic models are often used, requiring distributions of product use across the population to generate a distribution of exposure (McNamara et al., 2007; Van Veen et al., 2001). However, as pointed out by Weegels and van Veen (2001), there is great variability in product usage between individuals. To quantify such population variability requires data collected in large-scale population-based studies (Wormuth et al., 2005).

In recent years, the European Union has established exposure factor databases for European population (Hall et al., 2007; US GAO, 2005; Vuori et al., 2006). The EIS-ChemRisks toolbox (http://web.jrc.ec.europa.eu/eis-chemrisks/toolbox.cfm) and the TNS European Toiletries and Cosmetics Database (http://www.tns-global.com/uk/etcdneeds) contain information on exposure factors, exposure scenarios, and measured and modeled exposure data. In the US, the EPA Exposure Factors Handbook provides what the US EPA determines to be the most relevant information (US EPA, 1997). Studies conducted by cosmetic companies or their associations mostly targeted at user groups, in order to obtain information on the amount of product used (Loretz et al., 2006, 2008, 2005; Weegels and van Veen, 2001). Additional data on use prevalence and use frequency of personal care products are needed to establish distributions of use for populations.

As a part of the Study of Use of Products and Exposure-Related Behavior (SUPERB), use patterns of more than thirty types of

personal care products were investigated among California residents. In this paper, we focus on the distribution of use frequency for personal care products as reported in the baseline survey of two population subgroups, and present a preliminary exploration of product perception and preference.

2. Methods

2.1. Study population

A total of 655 households participated in this study which included multiple elements, of which 604 completed the section on personal care products. Of these, 453 were households from northern California with young children (97% had a child 5 years or younger). These were identified from birth certificate records of children born between 2000 and 2005 in this area (Hertz-Picciotto et al., in press). Households in which the mother had less than 12 years of education were oversampled, as a means to counter the well-known low rates of participation in research for this socio-demographic group (Korkeila et al., 2001). In each household, we enrolled two family members: one adult and one child (not necessarily the child identified through the birth certificate). The other 151 households included an older adult (generally aged 55 or above) living in the southern portion of California's Central Valley (hereafter referred to as central California), a population-based sample selected randomly from housing units (Hertz-Picciotto et al., in press). Thus, the study population consisted of several age groups, which allowed us to examine the variability of use patterns across age.

2.2. Data collection

Thirty and twenty-five types of personal care products were investigated in this study for adults and children respectively (see Tables 1 and 2 for a full list), including general hygiene products (e.g., bath products and hand soaps), skincare, makeup, hair styling products, and special care products (e.g., nasal spray and contact lens solution). These classes of products were selected because they are widely used by consumers. We investigated use frequency, purchase frequency, and product perception and preference.

Trained interviewers collected data through structured questionnaires in three consecutive annual telephone interviews between October 2006 and November 2009. The team of interviewers included bilingual staff (English/Spanish) and the questionnaires used were the same throughout the study, except for some questions on products we added or removed in the second year. More details on the study design of the SUPERB are available in Hertz-Picciotto et al., in press. This paper presents data collected during the first year telephone interview only. Data collected in the following years and variation of use over time will be presented in future publications.

2.3. Data analysis

Distributions of use frequencies for personal care products are summarized by age group, younger adults (parents of young children, 99% under 55-years of age), older adults (98% at 55 or above), and children (1–16 years old) respectively. We examined the differences in prevalence of use and differences in the distribution of use frequency by sex (male/female), adult's age (noting that these two populations live in different regions of California); child's age (5 years or younger/over 5 years), and education (adults with/without college degree), using the Chi-square or Fisher test (for differences in prevalence of use) and the Wilcoxon–Mann–Whitney test (for differences use frequency). Variation by race/ethnicity (African American/Asian/White (not Latino)/Multiple races (not Latino)/Other races (not Latino)/Latino) was evaluated among northern California female participants using the Kruskal–Wallis test. Spearman correlation coefficients for the use frequencies between adult and child in the same household were calculated. The correlations between use frequencies of different products and between use frequency and purchase frequency were calculated for selected products. Furthermore, we compared our data with comparable statistics from the EPA Exposure Factors Handbook (US EPA, 1997).

We additionally describe the proportions of participants who used scented vs. unscented bath products, who used aerosol products, and who self-treated their hair and nails vs. seeking professional care. We also present data on participants' brand loyalty.

As an internal consistency check, we asked "when was the last time you used the product" and determined if the answer was consistent with use frequency reported. For example, a response for last use as "today" or "within the last 3 days" would be considered consistent with a use frequency of once per day. Over ninety percent of responses (91–99%, depended on product) appeared to be consistent. In order to check for possible systematic error related to the season in which the interview was conducted, we also examined whether participants' responses regarding usual use of products were likely to have a seasonal trend varied by the season in which they were surveyed.

For questions about frequency of use, the respondent provided the number of times, and then selected whether it was per day, week, month or year. In evaluating outliers during the data cleaning step, we searched for numeric peaks that were indicative of the wrong unit having been selected. For example, if shampoo was reported to have been used 7 times a day, we recoded the answer to be 7 times a week. In other cases, outliers were excluded from further data analysis. All analyses were performed using SAS Version 9.2. Statistical significance was set as 0.05, where a *p*-value less than 0.05 was considered a statistically significant difference, unless otherwise noted.

3. Results

3.1. Demographics

We considered four age groups: children 5 years or under, children above age 5, parents of young children (mostly under 55), and older adults (mostly aged 55 or above). We have more female than male adult respondents in this study in both northern (83%) and central (66%) California. The younger adult cohort is race-diversified, with 55% White (not Latino), 22% Latino (regardless of race), 12% Asians (not Latino), 3% African Americans (not Latino), and 15% multiple or other or missing races; the older adult cohort was predominantly White (78%), reflective of the less diverse population of older adults living in this region of the state. Sixty-four percent of the adult participants had a college degree. Other demographic information on our study population can be found elsewhere (Hertz-Picciotto et al., in press).

3.2. Use patterns among adults

Both the proportion of the population using the products and the frequency of use varied greatly among products. Table 1 gives the summary data for adult participants by age group and sex. Most personal hygiene products, e.g., shampoo and deodorant, were – as expected – widely used by adult participants and use varied greatly by sex and age group. Use of skincare, makeup, and hair styling products was less prevalent, with various products