Endocrine Disrupting Chemicals in Personal Care Products: Knowledge, Attitudes, and Perceptions Among Pregnant Women in South Africa

by

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Submitted to the University of Cape Town in partial fulfillment of the requirements for the degree Master of Public Health in Environmental Health

Date of Submission: February 2024

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ACKNOWLEDGEMENTS

First and foremost, I would like to extend my deepest gratitude to my supervisor, Professor Hanna-Andrea Rother, for her invaluable guidance and continuous support throughout the research process. Her expertise, insightful feedback, and encouragement have been instrumental in shaping this research.

I would like to thank the participants of this research, whose willingness to share their knowledge and insights on harmful chemicals in beauty and hygiene products has greatly enriched the findings. Their contribution is highly appreciated and acknowledged.

I am grateful to the UCT Division of Environmental Health for providing the necessary resources, that enabled the completion of this research. The support from the department has been crucial in carrying out data collection and analysis.

Finally, I am indebted to my husband, family, and friends for their unwavering support, understanding, and patience throughout this research journey. Their constant encouragement and belief in me have been a source of inspiration.

THESIS ABSTRACT

The widespread and frequent use of cosmetics has led to increased exposure to harmful chemicals including endocrine-disrupting chemicals (EDCs), which are known to interfere with the endocrine system. Exposure to EDCs is particularly concerning during pregnancy with research indicating potential health effects such as gestational diabetes, birth defects, neurological disorders, and endocrine cancers. While high-income countries have started to take steps to raise public awareness, as well as develop and enforce regulation of EDCs in cosmetics, South Africa lags in this regard. Research shows that there is a need to ensure that risk communication measures of hazardous chemicals in products are effective and comprehended as intended by consumers. This will support informed product choices, thereby promoting consumer safety and well-being. However, the extent to which pregnant women are aware of harmful chemicals in their cosmetics and how they perceive their health risks remain unexplored in South Africa.

This study investigated knowledge, attitudes, and perceptions regarding EDCs in cosmetics among 102 pregnant women attending antenatal healthcare visits in Cape Town, South Africa. The research protocol (Part A) provides an overview of the widespread use of cosmetics, cosmetic regulation in South Africa, common EDCs found in cosmetics, their characteristics, and exposure routes. The justification for the research was grounded on the potential health risks associated with these chemicals, especially during windows of vulnerability such as pregnancy. Furthermore, the protocol underscored the existing gaps in knowledge and awareness concerning EDCs among women globally and justified the need for similar research in South Africa. A mixed-method cross-sectional study design was used as it allowed for collecting both quantitative and qualitative variables at a single point in time. Pregnant women aged 18 years and above, who could speak English, IsiXhosa, or Afrikaans were included in the study. The data collection tools, face-to-face questionnaires, were specified, along with a discussion on their development and adaptation to suit the research context. The questionnaire was piloted to enhance its validity and reliability and collected information on demographic details, reasons for PCP use, knowledge of EDCs effects on health, identification of EDCs on cosmetic labels, attitudes toward EDCs risk, and perceptions of EDC exposure risk. The informed consent process for participants was explained, prioritizing

transparency and participant autonomy, while confidentiality and data protection measures were clearly outlined to uphold the ethical integrity of the research.

The journal-ready manuscript (part B) presents the South African case study research findings on pregnant women's knowledge of EDCs and their attitudes and perceptions of EDC risks. To determine if the same EDCs commonly reported in literature from high-income countries are also available in cosmetics commonly used in South Africa, a label analysis was conducted on products sampled from common shops. A few images of cosmetics captured during this survey were used to evaluate if pregnant women can identify any EDCs on these labels. The study found that no participant could identify EDCs on cosmetic labels. Our study participants generally did not possess a culture of reading labels before buying their products. Instead, factors such as the scent and product price took precedence. When questioned about their reluctance to read labels, most participants expressed unawareness of their responsibility to scrutinize cosmetics before purchasing them. Additionally, participants did not perceive EDCs as a substantial threat to their health or foetuses. While some women demonstrated awareness of health effects such as eczema and allergies, participants did not perceive these conditions as severe or attributable to EDC exposure. There was a notable lack of comprehensive understanding regarding how chemicals in cosmetics enter their bodies through various exposure routes, their potential transfer to the foetus in utero, concentration in breast milk, and their impact on future generations. Endocrine-related disorders such as diabetes were least associated with EDC exposure. Despite the notable gaps in awareness, women showed an interest in enhancing their understanding of these chemicals through accessible communication channels, including social media and antenatal care clinics. This presented a unique opportunity to bridge the knowledge gap by disseminating information in a simple clear language tailored to the health literacy levels of South African pregnant women. Healthcare providers can be used as trusted sources for information dissemination. Enforcement of cosmetic legislation is imperative to mitigate EDCs risks, protect maternal and foetal health, and ensure the safety of cosmetic products in the South African market. The appendices (Part C) provide additional materials that support and help understand the study results such as questionnaires and informed consent forms.

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PART A: PROTOCOL

1. Study background

As the health effects of environmental toxicants continue to gain more attention globally, the scientific community has raised concerns regarding the safety of some chemical ingredients used to manufacture personal care products (PCPs) (Schug et al., 2016). Of particular concern is early life, in-utero exposure to a group of chemicals known as endocrine-disrupting chemicals (EDCs), which pose significant health risks to both pregnant women and their developing foetuses (Gingrich et al., 2020). EDCs refer to synthetic chemicals that structurally resemble the body's natural hormones. When absorbed into the body, they can negatively interfere with hormonal processes, leading to diseases (Gore et al., 2015). The PCPs, sometimes referred to as cosmetics, are products applied to the skin, hair, and mouth for beauty, grooming, and hygienic purposes.

The past decade has seen a growing trend in the production and use of cosmetics, especially among young women of the reproductive age group 16-49 years (Preston et al., 2021). Increased attention to physical appearance, self-care, and aggressive marketing of cosmetic products through social media have been identified as some of the reasons for these growing trends (Bharathi & Dinesh, 2018). On the other hand, the current body of knowledge on EDCs suggests that cumulative exposure to chemicals added to PCPs as preservatives or additives is linked to adverse human health outcomes (Bilal et al., 2020). Epidemiological and animal studies suggest associations between EDC exposure and hormone-related cancers (Buoso et al., 2020), infertility (Green et al., 2021), asthma (Casas & Gascon, 2020), allergies (WHO, 2017), and preterm births (Wu et al., 2022). EDCs, otherwise known as endocrine disruptors, are also found in consumer products such as plastic food packages, detergents, pesticides, and toys (Gao & Kannan, 2020). Although food is the main source of exposure to EDCs, the skin as the largest body organ is a significant route of exposure to EDCs found in cosmetic products (Ju & Zouboulis, 2016).

Despite a growing body of literature recognizing the human health impacts of EDCs, the risks associated with EDC exposure may be significantly higher than currently recognised (Newendorp et al., 2021). Research suggests that more than 75% of the world's population has been exposed to EDC-related health risks throughout their lifespan (Rattan & Flaws, 2019). Phthalates, parabens, benzophenones and triclosan commonly found in cosmetics, are examples of EDCs that have been associated with adverse health effects in women. Several studies conducted in non-pregnant healthy women have linked phthalate exposure to increased risks of endometriosis and infertility (EL-Desouky et al., 2022; S. H. Kim et al., 2011; Smarr et al., 2016). Additionally, exposure to phthalates and phenols in PCPs has been associated with the early onset of puberty in girls (Gea et al., 2023; Lopez-Rodriguez et al., 2021; Papadimitriou & Papadimitriou, 2021; Wolff et al., 2010). In a study conducted on middle-aged Mexican women, results showed that exposure to parabens, and phthalates is associated with increased risk of breast cancer and diabetes (Zamora et al., 2021). Similarly, a study in Finland reported an increased risk of breast cancer associated with exposure to EDCs found in hair dyes (Heikkinen et al., 2015). It is important to note that while these studies provide evidence of associations, they do not establish causation. However, they support that exposure to EDCs increases the disease risk in the general population. Although EDC exposure occurs in all humans throughout their lifespan, pregnant women and their developing foetuses are more vulnerable to the health effects of these chemicals.

Pregnancy is a critical and vulnerable window of exposure where potential adverse effects of EDCs can be detrimental to the health of the developing foetuses and the well-being of pregnant women. The intricate and dynamic nature of developmental and tissue programming that occurs during pregnancy makes this period particularly vulnerable (Sun et al., 2022). During pregnancy, the foetus and the expecting mother share an interdependent relationship. They share important hormonal communication through the fetoplacental unit, an interface, and a site for hormone production and secretion (Thibeault et al., 2014). Hormones such as oestrogen and progesterone produced at this site, play a crucial role in controlling the growth and development of foetal tissue and organs as well as maintaining and regulating maternal blood volume (Clifton et al., 2012).

The fetoplacental unit and the developing tissue have a high abundance of hormone receptors which makes them particularly vulnerable to EDCs (Fowden et al., 2015). When EDCs such as phthalates, benzophenones, triclosan, and parabens are introduced to the maternal environment, even in small amounts, they can bind to these hormonal receptors thereby initiating unintended hormonal activity, leading to poor pregnancy outcomes (Varshavsky et al., 2020). Furthermore, EDCs can also cross the placenta and affect foetal tissue development. For instance, EDCs can affect changes in foetal thyroid hormone levels which can have implications on the development and function of foetal brain tissue (Napso et al., 2018). It is important to note that some of the effects attributed to EDC exposure during pregnancy may only become apparent later in adulthood. The long-term consequences of these disruptions can manifest as developmental delays, reproductive issues, and an increased risk of non-communicable diseases (NCDs) later in life (Lite et al., 2022; Vaiserman, 2014).

In addition to the well-documented effects on foetal health, exposure to EDCs can also have implications for the health of pregnant women themselves. Recent scientific evidence has shown a correlation between EDC exposure during pregnancy and the disruption of the mother's immune system (Kelley et al., 2019). Epidemiological studies have further revealed associations between exposure to specific EDCs, such as parabens and phenols, and a cascade of inflammatory responses that can increase the risk of conditions like pre-eclampsia and gestational diabetes (Johns et al., 2015; Kelley et al., 2019; Shaffer et al., 2019).

During pregnancy, it is important to recognise that EDCs do not only affect pregnant women and their foetuses directly but can also concentrate in breast milk and be transferred to the baby postnatally via breast milk (Iribarne-Durán et al., 2022). To show that EDCs can be absorbed into the bodies of pregnant women and find their way to their foetuses through various pathways, researchers have identified EDCs such as triclosan and benzophenone-3 in the maternal umbilical cord and breastmilk (N. Y. Park et al., 2019; Vindenes et al., 2021). Moreover, the impact of EDCs is not limited to the immediate generation. Some EDCs found in cosmetics have been associated with transgenerational effects, meaning they can induce sensitivity to diseases in subsequent offspring over generations (Xin et al., 2015). This suggests that increased incidences of metabolic and reproductive effects seen today could be

partly due to exposures encountered by previous generations and these health effects can increase in generations to come.

With these repercussions in mind, it is important to limit exposure to EDCs, particularly during pregnancy to maintain hormones at levels that support the healthy development of the foetus in utero. Given the known and suspected health effects of EDCs and the vulnerability of pregnant women and foetuses, it is paramount to raise awareness of these health effects and prevent early life exposure to EDCs.

1.2. Problem statement

Adverse changes in the health of upcoming generations are a public health concern in South Africa (Shung-King et al., 2019). The rising prevalence of endocrine and metabolic diseases such as obesity, type 2 diabetes, endocrine cancers, and early onset of puberty is prompting researchers to explore modifiable factors that may be contributing to these disease trends (Bigna & Noubiap, 2019). Identifying the direct causes of these diseases remains a challenge because the causes of diseases are rarely single but multifactorial and complex. However, there is accumulating evidence that supports that maternal exposure to EDCs found in PCPs could be associated with increased susceptibility to endocrine-related diseases identified later in adulthood (Sheikh, 2017).

In South Africa, the informal production of cheap PCPs targeting the low-income market has become vast and unquantifiable over the years (Kraemer-Mbula, 2016). Although the expansion of the informal cosmetics industry creates a form of employment and livelihood for most poor South Africans, the management of chemicals added to cosmetics remains a challenge. Due to the absence of stringent laws that govern the safe use of PCPs, the rate of informal production of PCPs does not match the rate of product safety evaluation by cosmetic regulatory bodies such as the South African Health Products Regulatory Authority (Kraemer-Mbula, 2016). This regulatory loophole suggests that manufacturers can be more liberal when choosing ingredients to add to their products. What is concerning is some of the chemicals added to these cosmetics may have detrimental health effects, especially during pregnancy (Siti Zulaikha et al., 2015). Since cosmetics do not undergo stricter premarket assessments

unlike food and drugs, EDCs may be present in a variety of cosmetic products resulting in daily exposure to these toxic chemicals (Ferreira et al., 2022).

Pregnant women are exposed to EDCs in PCPs often without knowing how much risk these products pose to their health and that of the developing foetuses. The uncertainties around EDCs and human health problems make it challenging for healthcare professionals to provide meaningful antenatal health education on EDCs (Ashley et al., 2015). Research also shows that healthcare professionals are generally insufficiently trained in environmental health, and neither are they expected by their organisations to educate pregnant women on these toxic chemicals (Sharma et al., 2014). Furthermore, producers of cosmetics do not provide information regarding potential risks associated with cosmetic use except labels with a long list of ingredients. No extra information or warning signs are provided to rightfully inform consumers of the potential risks of hazardous chemicals found in cosmetic products (Klaschka & Rother, 2013). As a result, pregnant women are not well-informed about exposure to EDCs in PCPs they use every day.

Every time pregnant women purchase cosmetics, they bear the responsibility of making the best decisions for themselves and their unborn children, even if they may not be fully aware of it. Yet very little is known about their awareness and perceptions of the risk posed by chemicals found in their cosmetic products or how they would prefer to receive information regarding these risks. Since women are responsible for purchasing cosmetics, their purchases impact how much the foetuses are exposed. Therefore, this research offers an important opportunity to engage pregnant women and evaluate their awareness, attitudes, and perceptions of exposure to EDCs found in PCPs. Knowledge gained through this research can be used to identify risk reduction interventions for limiting exposure during sensitive periods of development such as pregnancy.

1.3. Rationale

While it is acknowledged that exposures to hazardous chemicals may not be eliminated, research reports that preventive mechanisms such as limiting the use of PCPs have the potential to reduce chemical exposure in human beings (Koch et al., 2014). Furthermore, pregnancy is a window of opportunity, where access to simple and understandable

information on EDCs can empower women to make informed PCP choices that can reduce in-utero exposure to EDCs (El Ouazzani et al., 2022). However, before preventive action can be taken, there is a need to first evaluate the knowledge levels of pregnant women, their attitudes, and perceptions regarding EDC exposure in PCPs in the South African context. Interventions that target behavioural change in cosmetic use can be more effective if they can be customised to address individuals' perceptions of risk and the perceived benefits of acting.

2. Study aim

This study focuses on evaluating knowledge, attitudes, and perceptions, regarding exposure to EDCs in PCPs among pregnant women attending antenatal clinics at Mowbray Maternity Hospital (MMH), Cape Town, South Africa.

2.1. Study objectives

The objectives of this study are as follows**:**

- To describe pregnant women's knowledge, attitudes, and perceptions about EDCs in PCPs.
- To analyse how knowledge, attitudes, and perceptions differ across various demographic variables such as age, educational level, and socioeconomic status.
- To identify opportunities for risk reduction interventions that may reduce women's exposures to EDCs in PCPs during pregnancy.

3. Summary of literature review

3.1. Characteristics of EDCs

EDCs have various characteristics which make them a public health concern. When absorbed into the human body, they can mimic hormones and bind to hormonal receptors, leading to unintended hormonal action (Combarnous & Diep Nguyen, 2019). Recent studies have reported that EDCs can also cause non-receptor-mediated responses. This means they can act through alternative pathways for example, via germ cells, and consequently lead to epigenetic changes in future generations (Xin et al., 2015). In a review of EDCs and hormones, laboratory studies on animals show that the relationship between EDC exposure dose and health effects is non-linear. As such, EDC effects that are observed at low doses are not predictive of effects at higher doses. Exposure to EDCs at low doses presumed to be safe can have more devastating health effects compared to higher doses (Anway & Skinner, 2006). This contradicts the concept of toxicology by some scientists which explains that “the dose makes the poison” (Vandenberg et al., 2012). Due to the unpredicted effects of EDCs at different doses, no dose of EDCs can be considered safe (Lee & Jacobs, 2019). In addition, (Vandenberg et al., 2012) argues that the “cocktail effects'' of EDCs also pose challenges to human health. When mixed with other EDCs from various products, they can combine additively or synergistically to form more toxic compounds.

Despite this scientific evidence, the cosmetic industry still argues that if the manufacturers keep the concentration of the chemicals low these chemicals are safe for human use (Nicolopoulou-Stamati et al., 2015). However, such expositions are unsatisfactory. It is not solely the concentrations of the EDCs that are concerning, rather it is the cumulative exposure to small daily doses of EDCs from the air, water, and food, and a wide range of cosmetic products that is problematic (Gore et al., 2015).

3.2. Common EDCs found in cosmetics and their potential health effects

Several known or suspected EDCs are found in PCPs. This study will focus on phthalates, benzophenones, triclosan, and parabens because they are relatively cheap hence, they are extensively used during the manufacture of a wide range of PCPs (Nicolopoulou-Stamati et al., 2015). In addition, these chemicals have been classified and listed as chemicals of concern

due to their potential endocrine-disrupting properties under the California Safe Cosmetics Program Reportable Ingredient list, the Environmental Working Group (EWG) skin deep database, and the Endocrine Disruption Exchange (TEDX) list among other lists (Johnson et al., 2022). There is a consensus among scientists that exposure to phthalates for example through breastmilk is associated with poor cognitive and developmental effects such as low IQ (Chopra et al., 2014), neurobehavioral effects such as hyperactivity and attention problems (Trasande et al., 2015), and impaired development of the reproductive system (Braun et al., 2013).

Phthalates are mainly used to increase pliability and flexibility in plastic hence they are found in plastic containers used for packaging PCPs (Lim & Lee, 2020). These remain physically unbound to the plastic during manufacture hence they can leach from the plastic container and contaminate the product (M. K. Kim et al., 2020). In a recent study to evaluate EDCs present in PCPs, results showed that out of the 77 products analysed, phthalates were present in more than 90% of the products (Gao & Kannan, 2020). A complementary study by Guo and Kannan also revealed that significant concentrations of phthalates were identified in products intended to stay in prolonged contact with the skin (leave-on products) such as body lotions, deodorants, and face creams. Rinse-off products which include body wash and shampoos also had phthalates and other EDCs (Guo & Kannan, 2013).

Parabens are antimicrobial and preservative agents added during the production of PCPs such as antiperspirants, soaps, and body creams (Nowak et al., 2021). Both in vitro and in vivo studies have confirmed the association between parabens exposure and male infertility and increased risk of breast cancer (Nicolopoulou-Stamati et al., 2015). In a study conducted in Sweden, 204 PCPs including liquid soap and shampoos were examined for parabens. Findings from the study revealed that of the PCPs analysed, 44% contained parabens (Yazar et al., 2011). In the same vein, a study conducted in the United States of America (USA) also reported that more than 80% of PCPs such as creams, deodorants, and face powders contained parabens, with methylparaben and ethyl parabens reported in greater proportions (Guo & Kannan, 2013).

In addition to parabens and phthalates, benzophenones have been identified in a variety of PCPs. Benzophenones are primarily used as ultraviolet filters thereby protecting the skin from the harmful effects of Ultraviolet (UV) light (EU Petition, 2019). However, studies have shown that long-term exposure to benzophenones is linked to abnormal foetal development, endocrine disruption, and neurotoxicity (W. Wnuk et al., 2022). In a study that examined 75 sunscreen products from European and US markets, products were found to contain elevated levels of benzophenones. A study conducted in Italy analysed 283 samples of PCPs and identified the presence of benzophenone-1 and benzophenone-3 in 19% of the products (Panico et al., 2019).

Triclosan is an antibacterial chemical agent found in PCPs such as hand soaps, shampoos, and toothpaste. It is intentionally added to PCPs to prevent bacterial growth on products thereby elongating product shelf life (Dix-Cooper & Kosatsky, 2019). According to (Weatherly & Gosse, 2017), triclosan acts as a thyroid agonist and increases the risk of abnormal thyroid function. Exposure to triclosan has also been associated with breast cancer and increased allergic reactions such as asthma and eczema in children (Jackson-Browne et al., 2019; Lee-Sarwar et al., 2018). Following environmental photodegradation in water sources, triclosan forms dioxin which is an environmental toxin and threat to aquatic life (Sanchez-Prado et al., 2006). Rule et al (2005) also argue that a triclosan-free environment is of utmost importance because when combined with disinfectants such as chlorine, triclosan forms phenols that are potentially carcinogenic.

Evidence presented in this section confirms the presence of phthalates, parabens, benzophenones, and bisphenols (triclosan) in shampoos, body lotions, body soaps (bar and liquid), deodorants, and makeup products. However, most studies that confirm the presence of these chemicals in PCPs have been conducted in high-income countries. In low- and middle-income countries (LMICs) such as South Africa, studies that analyse the chemical composition of cosmetic products are still scarce. The laboratory assessment of chemical ingredients in cosmetics is often restricted by budgetary constraints and a lack of supporting research on cumulative exposure and the long-term human health effects of EDCs (Bornman et al., 2017). In a study evaluating environmental levels of triclosan in wastewater plants in South Africa, researchers pointed out that the widespread use of PCPs containing triclosan is the major

route of environmental contamination. To validate their results, the researchers triangulated their study results with market survey data on cosmetics containing triclosan in South Africa. They identified that deodorants, liquid soaps, face treatment creams, and toothpaste were the predominant products on the South African market with the highest concentration of triclosan (Lehutso et al., 2017).

The lack of sufficient studies evaluating the chemical composition of cosmetic products should not be interpreted as an absence of exposure to EDCs in South Africa. On the contrary, there are several potential avenues through which pregnant women might be exposed to EDCs in PCPs. One potential avenue of exposure is the use of commercially manufactured products that contain EDCs as part of their ingredients. Additionally, informally produced cosmetics may find their way into the market without undergoing proper premarket assessments, increasing the likelihood of EDCs being present in these products (Kraemer-Mbula, 2016). This poorly regulated sector could expose pregnant women to potentially harmful chemicals without their knowledge. Furthermore, the rise of online retail introduces another dimension of risk. Purchasing PCPs from other countries, especially where products may not have undergone thorough testing and assessments, increases the chances of exposure to EDCs unknowingly (Kraemer-Mbula, 2016).

3.3. Cosmetic regulation in South Africa

Public health policy is one of the most effective ways of reducing exposure to environmental toxicants such as EDCs at a population level. However, its progress has been stalled worldwide (Crighton et al., 2013). Research shows that as of 2022 even in high-income countries such as the USA, where regulations are far-reaching, the United States Food, Drug, and Cosmetic Act (FDA), also lacks provisions that specifically govern EDC exposure in PCPs (Khalid & Abdollahi, 2021).

In South Africa the cosmetic industry is self-regulated. The industry sets up its committee to self-police its products without regulatory power from the government. Although the cosmetic industry is self-regulated, manufacturers are expected to comply with ISO standards (ISO 22716) and Good Manufacturing Practices (GMP), set up by cosmetic regulatory bodies such as the South African Bureau of Standards (SABS). SABS serves as the country's official

body for setting and advancing standards and technical specifications, specifically known as South African National Standards (SANS). In the cosmetics industry, these standards include guidelines for product labelling (South African Bureau of Standards, 2012). However, it is essential to note that adherence to these guidelines is not mandatory, and industry participants are not legally obliged to comply with them. Instead, the use of these standards and specifications is voluntary, giving manufacturers the flexibility to choose whether to follow them or not. The SABS plays a crucial role in maintaining and developing these guidelines to ensure safety, quality, and consistency within the cosmetics industry, but they do not impose compulsory regulations on the industry.

The Foodstuffs, Cosmetics, and Disinfectants Act of 2007, overseen by the South African National Department of Health, serves as the primary regulatory framework for cosmetics (Town, 2008). However, its effectiveness has been hindered by the limited number of amendments made to keep up with the rapidly evolving cosmetics market. Notably, in December 2017, the department drafted a regulation concerning the labelling and advertising of cosmetics under Act No. 54 of 1972. Despite this effort, as of 2023, the regulation has yet to be enacted into law, creating delays in updating and enhancing the regulatory landscape (Jackison, 2021). While the Act has played a crucial role in providing some level of regulatory control for cosmetics, the dynamic nature of the industry demands continuous updates and adjustments to keep pace with technological advancements, new ingredients, and changing consumer trends (Sukhnandan, 2021). The lack of significant updates to the Act has resulted in several challenges which include outdated standards, lack of international harmonization, and regulatory gaps which can contribute to inadequate consumer protection (Sukhnandan, 2021).

The Cosmetics Toiletry and Fragrance Association (CTFA) is the industry body in South Africa that is tasked with the responsibility of creating and overseeing the Cosmetic Advertising Code of Practice, which is heavily influenced by the EU Cosmetic regulations. This code is then submitted to the Advertising Regulatory Board (ARB), an independent board responsible for reviewing, and approving the Cosmetic Advertising Code of Practice and overseeing advertising standards and practices in South Africa (Sukhnandan, 2021). The CTFA aims to ensure that cosmetic advertisements in South Africa meet similar standards to those in the

European market. However, there is one key difference: the requirement to register cosmetic products. Unlike the EU, which mandates product registration before they can be placed on the market, South Africa may not have the same requirement. While the South African Health Products Regulatory Authority (SAHPRA) is responsible for cosmetic product registration, the process of registering cosmetics with SAHPRA is not mandatory (Sukhnandan, 2021). High registration costs further discourage local manufacturers from registering, while those aiming to export or sell in retail markets comply with registration to align with the required standards. This allows some manufacturers to bypass registration, potentially leading to the presence of substandard products in the market (Kraemer-Mbula, 2016). This means that while the advertising standards may align, the process of getting products approved for sale might differ between the two regions (Sukhnandan, 2021).

Despite the existence of regulatory bodies, there remains a concerning lack of effective action to ensure the safe manufacturing and use of PCPs. The lack of effective action and oversight has created a worrisome situation where untested products, both from local and international sources, with the potential to harm consumers, find their way into the South African market. The current regulatory system appears to be insufficient in preventing unsafe PCPs from reaching consumers. There seems to be a gap between the existing regulations and their actual enforcement, allowing unscrupulous manufacturers and suppliers to circumvent the law. As a result, the South African market becomes susceptible to the infiltration of products that may pose health risks to unsuspecting consumers.

3.4. Consumers' right to know

Consumers have the fundamental right to be informed about the contents of the products they use, especially when the chemicals used in the products are potentially harmful (Klaschka & Rother, 2013). In line with this, Ferreira (2022) emphasizes the importance of implementing effective risk communication strategies to clearly and comprehensibly convey the risks associated with the use of PCPs to consumers (Ferreira et al., 2022). However, in South Africa, the current cosmetic regulations only mandate producers to list chemical ingredients on product labels. There is no requirement for manufacturers to provide additional information on labels to communicate potential chemical hazards to consumers. This means that any consumer interested in knowing the chemical hazards in the ingredients

should perform a risk assessment of the ingredients before deciding to purchase the product. Considering that labels are difficult to read and comprehend, especially among low-literacy consumers, this unfairly shifts the burden of proof of product safety to consumers who often do not have the scientific literacy to comprehend information written on labels (Klaschka & Rother, 2013).

As Klaschka & Rother (2013) assert, the burden of proof of product safety should be firmly placed on manufacturers. Rather than burdening consumers with the responsibility of product safety verification, the onus should lie with the producers of PCPs. Manufacturers should be required to provide clear and understandable information about potential hazards associated with their products directly on the labels. This approach would promote consumers' right to know and empower them to make informed choices without the need for complex risk assessments, promoting transparency and accountability within the cosmetic industry (Klaschka & Rother, 2013).

3.5. The precautionary principle

In South Africa, the National Environmental Management Act (NEMA) (Act No. 107 of 1998) provides umbrella guidelines for dealing with issues such as environmental chemical pollution. According to NEMA, one of the core principles that form a foundation for making decisions to protect human health and the environment in this legislation is the 'precautionary principle'. The precautionary principle states that "when an activity raises threats of harm to human health and the environment, precautionary measures should be taken, even if some cause-and-effect relationships are not fully established scientifically (Felix Pinto-Bazurco, 2020). This implies that despite the scientific uncertainty and inconclusive evidence about the effects of EDCs on human health, the best available knowledge and evidence should be used to prevent long-term environmental and health costs that can occur if action is not taken (Rosner & Markowitz, 2020). In the case of South Africa, the precautionary principle can also be applied to encourage more research on EDCs and human health and motivate a multi-disciplinary approach to solve complex environmental health risks such as EDCs (Martuzzi & Tickner, 2004).

Considering the precautionary principle, alternatives to EDCs should be explored in response to the limitations of science. For example, in 2011 South Africa became the first African country to ban the import and export of infant feeding bottles containing BPA. This decision was made based on the precautionary principle and scientific evidence which recognizes the potential adverse effects of BPA on human health (Bornman et al., 2017). Safer alternatives to limit BPA exposure which include breastfeeding and using glass bottles have since been encouraged to reduce exposure to BPA in infants and children. Using the same initiative, recommendations for limiting exposure can be implemented to protect human health and the environment.

3.6. Gaps in literature

Numerous studies have examined the awareness and perceptions of EDCs in cosmetics in other women, such as female University students (Chan et al., 2015), new mothers (Crighton et al., 2013; Koester et al., 2021), hairdressers and nail technicians (Lteif et al., 2020), and the general population (Kelly et al., 2020). Findings from these studies consistently indicate that women, in general, have limited knowledge regarding EDCs found in cosmetic products, highlighting a significant gap in awareness.

In high-income countries such as France and Canada, a considerable amount of literature has been published on pregnant women's attitudes, knowledge, behaviours, and perceptions regarding exposure to EDCs in PCPs. Results from a cross-sectional study conducted in France showed that 53% of the pregnant women who participated in the study had never heard about EDCs (Rouillon et al., 2017). In Canada, similar findings have been observed. A survey conducted (Crighton et al., 2013) reported that 45% of pregnant women felt that there was no risk of EDC exposure, associated with PCP use during pregnancy. In another study conducted in France, less than half, 45% of pregnant women portrayed no intentions to change cosmetics during pregnancy as they did not associate cosmetic use with the risk of EDC exposure (Marie et al., 2016). Collectively, these studies support the notion that in general, vulnerable populations like pregnant women have limited knowledge and varied perceptions regarding exposure to EDCs found in cosmetics.

In South Africa, much of the current literature on EDCs is on pesticide use and exposure (Dalvie et al., 2009; River, 2015), contamination of water sources by EDCs (Dabrowski, 2015; Olujimi et al., 2010), EDCs contamination in plastic products (de Jager et al., 2019), and reproductive effects of EDC exposure in human beings and wildlife (Olaniyan & Okoh, 2020). Although research on EDCs is gaining prominence in South Africa, less attention has been given to women's awareness of EDC exposure in hygiene and grooming products and the prevention of exposure in early life.

Given that causality is difficult to ascertain, it might not be known whether it is the parabens in a certain shampoo that caused breast cancer, but it is known that limiting exposure is likely to reduce the effects of not acting. Findings from the literature review have identified the common EDCs in PCPs and illustrated evidence of the effect of EDCs on vulnerable populations like pregnant women. Research from developed countries also shows that pregnant women generally display low knowledge levels about EDC exposure in PCPs. However, little is known about how South African women understand and perceive EDC exposure. This study aims to contribute to this growing area of research by identifying knowledge gaps in this regard and informing risk reduction interventions focusing on early-life disease prevention.

4. Methodology

4.1. Study design

This study will use a descriptive cross-sectional study design to collect data between August and September 2023. A cross-sectional study design will be used because it is a relatively easy way of collecting data without being concerned about the retention of study participants (Levin, 2006). It will also allow for assessing variables such as age, income status, and level of education and evaluating how they relate to knowledge, attitudes, and perception variables hence fulfilling the objectives of this study. Data will be collected using a combination of both quantitative and qualitative research methods. Quantitative methods will be used to generate numerical data for descriptive statistics. Qualitative research methods will aid in understanding the binary (yes/no) answers thereby giving richer explanations to the

responses given by participants. Using different research methods in a complementary way makes results more credible and strengthens the validity of the results (Ziyani I, King L, 2004).

4.2. Study setting

Data collection for this study will be conducted at Mowbray Maternity Hospital (MMH), a public sector facility located in the Metro West district, Cape Town, South Africa. MMH is the largest dedicated maternity hospital in South Africa, delivering over 800 babies every month. Antenatal clinics are conducted every weekday from Monday to Friday. Pregnant women from both low and middle-income areas such as Mowbray, Rosebank, Newlands, and Claremont register their pregnancies and attend antenatal care visits at the hospital. MMH is a level two referral hospital. This means that it also accepts referral maternity cases from midwife obstetric units (MOUs) such as Mitchells Plain, Gugulethu MOU, Retreat MOU, and Hanover Park MOU and provides specialist health care support to these facilities.

Communities served by MMH are predominantly low-income populations. MMH has an expanded catchment area to ensure that basic maternal healthcare services are accessible to every woman (Kennedy et al., 2012). Due to the nature of its referral system, MMH attracts pregnant women from diverse socioeconomic and ethnic groups such as Xhosa and Afrikaans. In this study, enrolling pregnant women attending antenatal clinics at MMH allows for assessing diverse individuals with varied knowledge, attitudes, and perception levels, thereby increasing the richness of the responses. MMH is also affiliated with the University of Cape Town Faculty of Health Sciences. It participates in and supports academic research which makes it a good study site for this research (http://wwwobstetricsandgynaecology.uct.ac.za).

4.3. Sample size calculation

The sample size calculations will be conducted using G*power software (version 3.1.9.4). Expert advice to calculate sample size will be sought from a UCT biostatistician. A review of the literature shows that no studies on knowledge, attitudes, and perceptions about EDCs have been conducted previously in South Africa. However, a single cross-sectional study conducted among French pregnant women revealed that 53% of the participants did not know about EDCs (Rouillon et al., 2017). Using this knowledge prevalence as a reference and guide to come up with a reasonable sample size approximation, the researcher speculates

that knowledge of EDCs will be lower, approximately (30-35%) in an LMIC like South Africa. These speculations are based on literature that reports that differences in socioeconomic bracketing greatly impact knowledge, attitudes, and perception levels regarding EDC exposure.

Considering the research question, study design, type of outcome measures, and intended statistical tests, an effect size of 0.35, with a 95% level of confidence, and an 80% level of precision was used as the best estimates to calculate the sample size. The parameters were entered into G power software and a sample size of 105 was yielded.

4.4. Study population and sampling

4.4.1. Study population

While it is understood that recruiting a control group for this study will allow for comparative analysis across different populations and increase the generalisability of the findings, the researcher has chosen to narrow their focus to pregnant women only. By focusing solely on this vulnerable group, the researcher can delve deeper into the unique concerns, knowledge gaps, and decision-making processes regarding PCP use during pregnancy. This targeted approach allows for a more comprehensive understanding of the specific needs and challenges faced by pregnant women when it comes to EDCs awareness. Additionally, conducting a comparative study involving multiple groups will require additional resources, including recruitment efforts, data collection, and analysis.

Given the constraints of a mini dissertation, focusing solely on pregnant women will allow for a more feasible use of available resources. By concentrating efforts on a single group, the researcher will ensure that data collection is thorough and rigorous, leading to a more comprehensive understanding of EDCs awareness among pregnant women. Therefore, this study population will consist of pregnant women aged 18-49 years, residing in the catchment suburbs serviced by Mowbray Maternity Hospital. Residence from these areas vary in socioeconomic status, age, and ethnicity with English, Afrikaans, and Xhosa being the most spoken languages. Participants will be recruited from prenatal clinics conducted at the hospital. A sample size of 105 participants will be recruited for the study.

4.4.2. Convenience sampling

The use of a statistically representative sample is a well-established approach in research as it allows the generalizability of study findings to the broader population. To increase the chances of getting a representative sample, probability sampling methods should be used (Apuke, 2017). However, in this study, the application of random sampling methods is limited because recruitment and enrolment depend on participants' availability and willingness to participate. Pregnant women from different catchment communities will be approached as they come for their booked antenatal clinics, and those who agree to participate will be enrolled in the study (see section 4.6 on recruitment).

4.5. Inclusion and exclusion criteria

The following outlines the inclusion and exclusion criteria for participants in this study.

4.5.1. Inclusion criteria

Participants with the following eligibility criteria will be recruited into the study:

- a clinically confirmed pregnancy (all women with hospital files at MMH)
- aged 18-49 years
- residing in South Africa at the time of the study
- who can speak English, Xhosa, or Afrikaans

Literature reports that cosmetic use is common among women of the reproductive age group that is 16-49 years (Amoateng et al., 2022). However, according to South African law, 18 years is the minimum legal age of consent for research. Participants below 18 years are considered minors and require special permission from the Department of Health and consent from guardians. Therefore, this study will approach pregnant women 18 years and above who can give independent informed consent.

4.5.2. Exclusion criteria

Participants with the following characteristics will be excluded from the study. Any women visiting the clinic:

- who is not pregnant
- aged below 18 years
- who does not speak English, Xhosa, or Afrikaans

4.6. Recruitment and enrolment

Before recruiting participants, ethics approval will be sought from the UCT Human Research Ethics Committee (UCT-HREC). After permission is granted, the researcher will secure institutional permission from the Western Cape Provincial Department of Health to recruit pregnant women attending antenatal care clinics at the hospital. On the days when the pregnant women attend the antenatal clinic, the researcher and the research assistants will come and address all pregnant women attending the clinic, as they wait to be given their files by the hospital administration clerk at the Outpatients department. The verbal information will include the study purpose, the expected value of research, how the data will be used, the expected time required to complete the questionnaire, and whom to contact regarding concerns about rights as a participant.

Participants will be given time to ask questions and decide whether to participate or not to participate in the research. Participants who agreed to participate will be given an informed consent form to read (Appendix 1.0) before signing. The researcher and the research assistants will verify the eligibility of interested participants by asking questions on age, and language proficiency, before enrolling them in the study.

4.7. Data collection methods

Data will be collected through the implementation of a face-to-face questionnaire (Appendix 2.0). The advantage of this type of data collection technique is that it overcomes literacy barriers. Before data collection, the questionnaire will be piloted with a randomly selected group of three pregnant women aged between 18-49 years from MMH, and these women will be excluded from the main study. This will be done to test the comprehensibility of the questionnaire in the different languages, cultural appropriateness, and ease of administration thereby improving the validity of the questionnaire. Feedback from the pilot will be used to update the questionnaire. The final questionnaire will be uploaded on the CommCare HQ application, and the researchers and the research assistants will access the questionnaire via cell phones used for data collection. The researcher will hold a two-day training workshop with two research assistants to ensure data collection consistency. As the researcher is only English proficient, two research assistants (UCT MPH students) proficient in Afrikaans and IsiXhosa will assist with transcribing the relevant questionnaires and administering these. Two

students from the UCT Faculty of Humanities will translate the questionnaires from Xhosa and Afrikaans to English, hence improving the validity of the questionnaires.

The questionnaire (Appendix 2.0) consists of five sections. The first section comprises closed-ended demographic questions on participants' age, area of residence, parity and gravidity, income status, and educational attainment. The second section consists of questions that evaluate participants' knowledge of EDCs. This section and subsequent sections consist of a mixture of closed and open-ended questions. For example, a closed-ended question that requires a yes/no response will be asked first, followed by an open-ended question that requires the participants to explain their answers. The third, fourth, and fifth sections consist of questions on practice, attitudes, and perceptions regarding EDC exposure in PCPs respectively.

For the closed-ended questions, the researcher and research assistants will select and tick the responses in the spaces provided on the questionnaire. For the open-ended questions, transcribed verbatim will be used to avoid changing the meaning of the response and losing data. Translation of the questionnaires will be conducted after data collection to avoid introducing bias during data collection. It is important to note that unlike in interviews, the data collectors will not probe further to clarify responses. The questionnaires will be administered for approximately 25-30 minutes.

5. Data management plan

Access to research data will be restricted to the researcher and supervisor only. No identification details will be used to ensure that information that may link participants to their responses is excluded. In place of identification details, participant codes in the form of numbers will be assigned. The researcher will assure participants that consent forms will be stored separately from questionnaires and that participants' information will not be discussed with anyone except the researcher and the supervisor.

During the data collection and analysis phase, data will be backed up monthly to the researcher's UCT Google Drive account with non-identifiable respondent numbers. To enhance data storage, data will be stored on two portable hard drives that will be stored in

two different storage locations. A final backup will be done after submitting the final thesis draft for examination. Hard copy data (questionnaires and signed informed consent) will be stored in a safety cabinet in the departmental office at UCT for five years. Electronic data will be stored on UCT Google Drive and will be password-protected to restrict access. Once the dissertation is complete, the researcher will curate and archive the completed dataset on the Zivahub repository platform for five years, after which it will be discarded.

6. Data analysis

Quantitative data will be exported to Microsoft Excel and then imported to SPSS (version 20.0) for data analysis. Before launching into statistical analysis, the researcher will review the raw data to check for completeness, errors, and missing variables. The researcher will create a codebook, which provides a list of variables in the dataset, a description of the variables, types of data, possible response options, and how the response is coded. Demographic information such as age and monthly income will be analysed using descriptive summary statistics. For categorical variables, frequencies of observations in each category will be presented as percentages. Characteristics of the participants, knowledge, and attitudes will be compared across the level of education, and monthly income using the Chi-square statistical tests. Exact p-values will be presented.

Qualitative data will be analysed in NVivo (version 12.6.1). Thematic data analysis will be used to explore qualitative data. Thematic data analysis entails reading through a qualitative data set to analyse, identify and report repeated patterns (Kiger & Varpio, 2020). Using thematic data analysis, the researcher will read through the participants' responses to the open-ended questions to identify key issues and themes that relate to the predetermined themes from the Health Belief Model (HBM). The predetermined themes are perceived severity, perceived susceptibility, perceived benefits, perceived barriers, self-efficacy, and cues to action.

7. Conceptual framework: The Health Belief Model (HBM)

The HBM is an individual-level, health promotion model which postulates that behaviour change is influenced by how an individual perceives a threat to their health and how they value actions aimed at reducing the threat. Using the HBM as a conceptual framework in this study helped to understand how susceptible pregnant women will feel towards exposure to

EDCs found in cosmetics (perceived susceptibility), whether they perceive exposure as serious (perceived severity) and whether they believe that taking action to limit exposure can be beneficial to their health and that of the unborn baby (perceived benefits). The model also helps to evaluate if participants can identify sources of information that may prompt action for example pamphlets or health education from health professionals (cues to action), if they believe that the costs of acting are outweighed by the benefits (perceived barriers), and whether they feel confident to take advice to reduce exposure to EDCs (self-efficacy) (Abraham & Sheeran, 2014).

8. Ethical considerations

To ensure ethical conduct for this research, a prominent health sciences ethics code: the Helsinki Declaration (2013) will be used. Ethical principles of beneficence, non-maleficence, justice, and autonomy will be applied as a guiding framework to ensure the protection of human dignity throughout the research (Communication & Principles, 2010). Ethics clearance will be sought from the University of Cape Town Human Research Ethics Committee (UCT-HREC) before commencing the study.

8.1. Potential risks and benefits

Due to the nature of this study, there is no anticipated physical risk to both the pregnant woman and the unborn foetus. However, the questionnaire can potentially induce fear and anxiety (psychological stress) among pregnant women about the use of PCPs containing EDCs and the safety of their unborn children. To address this, the researcher and research assistants will explain to participants that the study aims to collect their perceptions, which can be used to consider risk reduction interventions around ECDs in PCPs. Participants will be given a chance to ask any questions of clarity to ensure that they understand before participating in the study. Participants will also be provided with an information sheet (Appendix 4.0), summarising in non-technical language what harmful chemicals (EDCs) in cosmetics are and tips that can guide them when choosing and using PCPs during pregnancy. Participants will be advised to discuss further issues of concern with midwives and other healthcare workers whenever they come for their antenatal healthcare visits.

8.2. Voluntary informed consent process (Appendix 1.0)

The study summary and the informed consent will be explained in non-technical terms and in all three languages (Xhosa, English, and Afrikaans) to ensure participants' comprehension. Additionally, consent forms will be available in English, isiXhosa, and Afrikaans hence participants will be allowed to choose a consent form translated into a language of their choice. Participants will be informed at the beginning of the survey that they can withdraw at any point during the research process, even after giving their informed consent. They will also be reassured that deciding not to participate or withdrawing will not negatively affect them. Participants will read the informed consent forms and sign them to show that they understand the study and voluntarily agree to participate.

8.3. Private interview room and confidentiality

To ensure personal privacy, participants will be interviewed in a separate room provided by MMH. Participants who do not wish to participate and share any information will be respected for their decision and not coerced. To honour the participant's right to confidentiality, all the information gathered will be kept confidential, and data access will be restricted to the researcher and supervisor only. During the research, the researcher will ensure that data was password-protected to restrict access.

8.4. Reimbursement

As the participating women predominantly came from a low socio-economic community, they will be provided with a KFC lunch voucher for participating in this study and giving their time.

9. Budget

Table 1. Estimated budget for the research.

Item	Cost
KFC LUNCH vouchers	**R5250 @ R50 per participant**
Stationery (PRINTING CONSENT FORMS)	**R500**
Travel costs to and from the hospital	**R500**
Paying research assistants @R2000 EACH	**R5000**
TOTAL	**R11 250**

10. Timeframe

Table 2. Timeline for key research activities

Activity	Jan-2022	Feb-2022	Mar-2022	Apr-2022	May-2022	Jun-2023	July-2023	Aug-2023	Sept-2023
Ethics approval									
DOH approval									
Data collection									
Data analysis									
Thesis write up									
Thesis submission									

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PART B: JOURNAL READY MANUSCRIPT

Target journal: Environmental Research Journal (Appendix L)

Title of manuscript: Endocrine Disrupting Chemicals in Personal Care Products: Knowledge, Attitudes, and Perceptions Among Pregnant Women in South Africa**.**

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Abstract

Personal care products (PCPs), such as shampoos and deodorants, contain chemical ingredients that can disrupt the endocrine system. Women frequently use numerous PCPs, often unaware of the risks posed by these endocrine-disrupting chemicals (EDCs). This renders them more vulnerable, especially during pregnancy. Research on pregnant women's awareness and perceptions of EDCs is scarce in low- and middle-income countries (LMICs) like South Africa. However, research conducted in high-income countries shows evidence of perinatal health effects of EDCs, highlighting the need for public health interventions. To gain insights into pregnant women's awareness, attitudes, and perceptions of EDCs risks in PCPs, we conducted a mixed-methods cross-sectional study at Mowbray Maternity Hospital in Cape Town, South Africa. Of the 102 pregnant women sampled using convenience sampling, 40% were aged between 26-33 years, 71% fell into the no-income to low-income category and 43% had obtained a high school education. The qualitative responses were entered into NVivo ("Nudge Visual Information and Voice Organization." and analysed using the Health Belief Model (HBM). A chi-square test was conducted in SPSS to explore associations between quantitative variables. Our findings revealed that no participant could identify EDCs on cosmetic labels. Fifty-four percent of the participants did not perceive their foetuses to be at risk of EDC exposure from PCPs, however, 96% expressed willingness to learn more about these chemicals. The association between educational attainment and the ability to identify EDCs on labels was statistically insignificant (p=0.284). Fifty-four percent of participants reported using 11-20 different PCPs, with 53% using PCPs such as soaps, and body lotions twice daily. Protective and effective cosmetics regulation is essential yet lacking in South Africa to reduce risks for women and the unborn. There is a need for improved legislation and the development of different risk communication mechanisms in local languages on the potential health effects of chemicals found in PCPs. Exposure to EDCs could be reduced with enhanced legislation and awareness among end users and by providing policymakers with evidence-based information about EDCs risks.

Keywords: Endocrine disrupting chemicals, personal care products, pregnant women, knowledge, perceptions, South Africa.

Highlights

- Because pregnancy is a vulnerable period of exposure to potentially harmful EDCs commonly found in PCPs, more must be done to provide risk information to the public.
- Participating South African pregnant women do not perceive EDC exposure as a substantial threat to their health and that of their foetuses.
- Participant's EDCs knowledge was mostly limited to health effects like eczema, rashes, and skin cancer with little consideration of potential endocrine disruption.
- The frequent use of PCPs is common among study participants, with an average usage of products like soaps, lotions, and toothpaste twice a day.
- Irrespective of income status, most of the participants (86%) incorporated more than 10 products in their grooming routine.

1. Introduction

Chemicals play a crucial role in manufacturing consumer products, including cosmetics or personal care products (PCPs) such as body lotions and shampoos, yet they also pose health risks (Brosché Sara, 2020). Purposefully incorporated into PCPs, chemicals serve various essential functions, including preventing bacterial growth, ensuring product safety, extending shelf life, and enhancing consumer experience (Khalid & Abdollahi, 2021). While chemicals offer numerous benefits, it is crucial to acknowledge and address the potential health risks associated with various chemical ingredients found in PCPs including endocrine-disrupting chemicals (EDCs). The World Health Organization (WHO) acknowledges the importance of addressing and reducing exposure to EDCs to mitigate health risks and safeguard public health (Neira & Prüss-Ustün, 2016).

EDCs, such as benzophenones and parabens, commonly found in PCPs are synthetic chemicals with hormone-like properties (Schug et al., 2016). They can disrupt the hormonal system by binding to hormone receptors, thereby altering hormone production, metabolism, and gene expression (Perera & Herbstman, 2011; Yilmaz et al., 2020). EDCs can infiltrate the body through diverse exposure pathways. Inhalation, stemming from fragrances, hairsprays, and aerosolized products, and oral absorption via products like toothpaste and mouthwash, constitute potential avenues of exposure (Yilmaz et al., 2020). However, most of these PCPs are directly applied to the skin, the body's largest organ. This mode of application, coupled with the frequency and number of products used, allows EDCs to be absorbed through the skin via transdermal absorption and enter the bloodstream (Myers et al., 2015). Numerous laboratory experiments, animal studies, and epidemiological research have provided evidence documenting the potential hazards associated with these chemicals. Table S1 presents a global overview of examples of potential EDCs, their usage in PCPs, examples of PCPs containing EDCs, hazard traits identified in vitro and in vivo studies, and insights from human studies regarding their potential health risks.

While EDC exposure is concerning across populations, the prenatal period emerges as a critical stage of foetal development, amplifying vulnerability to EDCs (Yan et al., 2023). Amidst the myriad of factors influencing pregnancy outcomes, EDC exposure is an overlooked factor. EDC exposure during this sensitive developmental period can impart lasting and potentially

irreversible effects on both foetal and maternal health, with some impact affecting future generations (Alampi et al., 2021). Emerging scientific research has demonstrated associations between EDC exposure and weight gain in pregnancy (Philips et al., 2020; Rodríguez-Carmona et al., 2019), gestational diabetes (James-Todd et al., 2018; Shaffer et al., 2019), preeclampsia, (Han et al., 2020; Werner et al., 2015), neurodevelopmental problems, asthma, allergic reactions, and obesity in children (Alampi et al., 2021; Casas & Gascon, 2020; Darbre, 2017; Kumar et al., 2020; Lee-Sarwar et al., 2018). Additionally, EDCs can concentrate in breast milk during the prenatal period and can be passed to the baby postnatally through breastfeeding (K. Li et al., 2022). Despite these findings, studies exploring EDCs impact on pregnancy outcomes and EDC awareness, especially in low- and middle-income countries like South Africa, remain limited.

In high-income countries like Canada, the USA, France, and Sweden, extensive research has been conducted on knowledge and perceptions of EDC exposure among pregnant women and other population groups (Crighton et al., 2013; Koester et al., 2021; Rouillon et al., 2017). For instance, a study conducted in France revealed that of the 300 pregnant women who participated, 77% of whom had university education, 53% had never heard about EDCs (Rouillon et al., 2017). Similarly, research involving 602 Scandinavian consumers from Denmark, Norway, and Sweden showed that the average knowledge score regarding EDCs was 53% (Sigurdsson et al., 2024). In Canada, survey results showed that 45% of the study pregnant women perceived that there was no risk of EDC exposure, associated with PCP use during pregnancy (Crighton et al., 2013). Another study among female university students in the USA found that most students associated environmental health issues primarily with broader concerns like poor air quality and pollution (77%), as well as water contamination (26%), rather than chemicals in PCPs (3%) (Chan et al., 2015). Studies conducted in these countries have helped to inform public health measures to raise awareness of cosmetic product risks.

In the USA, the Environmental Working Group (EWG), created an accessible database for chemical ingredients of concern in cosmetic products, including EDCs (https://www.ewg.org/skindeep/). The Swedish Chemicals Agency (KEMI) conducts risk assessments of chemicals, including those present in PCPs, and provides information to

pregnant women about EDCs in PCPs (Swedish Chemicals Agency, 2020). Similarly, Health Canada engages in public education campaigns and research through the Maternal-Infant Research on Environmental Chemicals (MIREC) studies (Alampi et al., 2021; Arbuckle et al., 2015; Borghese et al., 2023; Lester et al., 2018). Globally, the United Nations Environment Programme (UNEP) and WHO publish reports on EDCs, and advocate for policy change to protect maternal and child health from EDC exposure (International Panel on Chemical Pollution, 2017; United Nations Environment Programme, 2017). Contrasting with high-income countries, many low and middle-income countries, including South Africa, lack such initiatives. This raises concerns about the vulnerability and access to information on potential health risks associated with EDC exposure.

The topic of EDCs and their impact on pregnancy outcomes is underexplored in the South African context (Lakshmi & Babu, 2019). While research underscores the associations between EDC exposure and adverse pregnancy outcomes globally, there is limited South African research on the presence of these chemicals in PCPs and their potential impact on maternal health (Bornman et al., 2017). With the continued and increasing usage of beauty products, where skincare routines are an integral part of daily living, especially for expectant women, it is important to understand pregnant women's knowledge regarding the ingredients in their products, the potential effects of these chemicals during pregnancy, and how to prevent maternal and foetal exposure to harmful chemicals (Bilal et al., 2020). It is also important to determine if pregnant women can decipher ingredient lists, discern potential risks, and make choices that reduce exposure risks to harmful chemicals. The need for awareness is especially crucial given the potential health concerns associated with EDC exposure during pregnancy.

Our study objectives were to describe pregnant women's knowledge, attitudes, and perceptions regarding EDCs in PCPs, analyse differences in these factors across various demographic variables such as age, educational level, and socioeconomic status, and identify opportunities for risk reduction interventions aimed at minimizing women's exposures to EDCs in PCPs during pregnancy. Our study used the Health Belief Model as a theoretical framework to analyse our findings. However, to align with our research question and study objectives, we selectively adapted four key constructs from the model. These constructs

include perceived susceptibility, perceived barriers, perceived benefits, and perceived severity.

2. Materials and methods

2.1. Study design

We used a cross-sectional study design to collect both qualitative and quantitative data, between August and September 2023. Quantitative data were obtained by using categorical, close-ended questions, which yielded numeric data suitable for descriptive statistics. To complement the quantitative data, qualitative follow-up questions were incorporated to elaborate on participants' responses, adding depth and nuance to the findings. This enhanced the overall validity and credibility of the study results.

2.2. Study setting

The study took place at Mowbray Maternity Hospital (MMH), the largest and one of the busiest maternity hospitals in South Africa, with an average of approximately 800 deliveries per month. Situated in the Metro West district, in the Southern suburbs of Cape Town, MMH serves as a vital maternal healthcare facility in the region. The antenatal care sessions at MMH are held throughout the week, from Monday to Friday, allowing regular and consistent contact with pregnant women attending the hospital. Most women seeking care at MMH come from low and middle-income backgrounds, residing in neighbouring areas. The hospital also receives referrals for high-risk cases from local obstetric units, further attracting individuals from various social, cultural, and multilingual ethnic groups, including Xhosa and Afrikaans. The choice of MMH as the study site offered advantages such as its large patient volume, convenience and accessibility for the researcher, diverse patient population, and the availability of antenatal care services throughout the week. These factors contributed to the feasibility of recruiting an adequate sample size and enhancing the generalizability of the findings.

2.3. Study population and sampling

Participants were sampled using convenience sampling, and simultaneously enrolled in the study as they attended their antenatal appointments. The convenience sampling method was

chosen due to its practicality and feasibility in recruiting participants attending antenatal care visits. The sample size was determined using G*Power software wherein the researcher populated sample estimates onto the software which yielded a sample size of 105. However, three participants were used to pilot the questionnaire, resulting in a total sample size of 102 participants. The inclusion criteria encompassed the following: 1) clinically confirmed pregnancy, as indicated by their hospital files; 2) aged between 18 and 49 years; and 3) proficiency in English, IsiXhosa, or Afrikaans languages. Women without clinically confirmed pregnancies, those who could not speak English, IsiXhosa, or Afrikaans languages, and those below the age of 18 years were excluded from the study.

2.4. Selection of EDCs and label analysis

We selected parabens, phthalates, benzophenones, and triclosan as the focus chemicals for this study, primarily due to their ubiquitous presence in PCPs and their potential endocrine-disrupting properties (Sun et al., 2022). These chemicals have been extensively researched, leading to their inclusion in prominent databases and lists of chemicals of concern in cosmetics. Examples of the databases and lists include The Endocrine Disruption Exchange (TEDx), the Environmental Working Group's Skin Deep (EWG) database, and the California Safe Cosmetics Program Reportable Ingredient List.

To ascertain the presence of EDCs in PCPs commonly used in South Africa; a label analysis was conducted of products sampled from common shops that sell cosmetics. Twenty-eight cosmetic shops within the catchment areas served by MMH were located through a Google search and categorized into pharmacies, supermarkets, beauty stores, clothing shops, and beauty salons, to ensure a comprehensive selection. Given that visiting and collecting data from multiple shops within each category can be resource-intensive in terms of time, money, and labour, only two shops were randomly selected from each category for inclusion in the survey. The main author physically inspected all products available in the selected shops, meticulously examining both the front and back labels of cosmetic items. The focus was on identifying the presence of specific chemicals of interest, namely parabens, phthalates, benzophenones, and triclosan. This involved scanning each label to locate any mention of these targeted ingredients. To maintain a record, the researcher took photographs of each cosmetic product's front and back labels. Selected label pictures of popular cosmetic brands

commonly found in all shops were used to determine if pregnant women know any EDCs written on these labels (see questionnaire). Upon completing the survey, we compiled the collected data into a table (Table S2).

2.5. Data collection

We recognized that no standardized Knowledge, Attitudes, and Perceptions (KAP) questionnaire was available on the topic in the South African context. Based on a review of similar studies conducted in France and the USA (Crighton et al., 2013; Koester et al., 2021; Rouillon et al., 2017), we designed a 40-item questionnaire to meet the study objectives and gather information relevant to the South African context. The questionnaire encompassed five sections, covering demographic details, reasons for PCP use, knowledge of EDCs effects on health, identification of EDCs on cosmetic labels, attitudes toward EDCs risk, and perceptions of EDC exposure risk. The questionnaire was designed and uploaded into Commcare HQ, a mobile telephone data collection application. To accommodate the three Western Cape official languages, the researcher designed the questionnaire in English, which the research assistants translated into IsiXhosa and Afrikaans. Before data collection, the questionnaire underwent a pilot test with three pregnant women, not part of the main study, to assess comprehensibility across different languages, cultural appropriateness, and ease of administration.

Before data collection, the researcher conducted interviews to select two research assistants proficient in Afrikaans and Xhosa. The research assistants were selected based on their previous experiences in qualitative and quantitative research and in using the languages in a research setting. The researcher also selected research assistants with letters from previous employers attesting to their language skills and the quality of their work as a research assistant. This process ensured that the research assistants were proficient in the required languages and had relevant experience in conducting research. However, due to limited resources and time, no language proficiency tests were conducted to further check their proficiency in their respective languages.

The researcher held a two-day training workshop with two research assistants, one proficient in Xhosa and the other proficient in Afrikaans, to ensure consistency in data collection. During

the workshop, the researcher focused on providing guidance and instruction to the research assistants to ensure consistency in data collection procedures. The training included an overview of the research objectives, methodology, and the specific role of each research assistant in the data collection process. Specific techniques to be followed during qualitative data collection were discussed, with an emphasis on the need for attention to detail when capturing participant's responses to open-ended questions. Practical demonstrations were conducted to familiarize the research assistants with the questionnaires.

Throughout the data collection process, interactive feedback sessions were held, where the researcher and the assistants addressed potential challenges or issues they faced during data collection. Strategies for resolution were provided during these sessions, ensuring that any issues encountered during data collection were promptly addressed and resolved.

2.6. Data analysis

Quantitative responses were exported from Commcare HQ to Microsoft Excel. The main author cleaned and checked the data for completeness, and identified any errors, and missing responses. The cleaned data were imported into SPSS (version 20.0) for further analysis. Categorical variables such as age, area of residence, and monthly income were analysed by reporting frequencies and percentages to provide a descriptive summary of the sample characteristics. Associations between knowledge of EDCs and educational attainment were assessed using the Chi-square test in SPSS. The resulting p-values were reported to determine the statistical significance of any observed associations.

The responses to the open-ended questions were transferred from Commcare HQ into NVivo (version 12.6.1), a qualitative data analysis software program. A thematic analysis approach was employed, wherein the main author identified recurring ideas and key issues linked to themes from the Health Belief Model (Abraham & Sheeran, 2014; Kiger & Varpio, 2020). To align with our research question and objectives, we selectively adapted four HBM constructs: perceived susceptibility, perceived barriers, perceived benefits, and perceived severity. The other two constructs (self-efficacy and cues to action) were less applicable in our study (Abraham & Sheeran, 2014). Since the study aimed to understand knowledge, attitudes, and perceptions of EDCs risk we did not explore the factors that could influence women to limit

EDC exposure (cues to action). Additionally, results showed that our study participants did not engage in any EDCs risk reduction behaviours due to limited awareness of these chemicals hence assessing self-efficacy (confidence in taking action to reduce EDC exposure) would be less relevant. However, future research could consider exploring self-efficacy as a potential area of focus, particularly if interventions aimed at increasing EDC awareness and promoting risk-reduction behaviours are implemented.

2.8. Ethical considerations

Ethical clearance was obtained from the University of Cape Town Human Research Ethics Committee (UCT HREC), REF: 229/2023. Additionally, institutional permission was obtained from the Provincial Department of Health to collect data at the study site (REF: WC_202307_018).

3. Results

3.1. Demographic characteristics

Forty percent of participants were within the 26-33 age range, with 37% identifying as IsiXhosa speaking, 29% as English, and 19% as Afrikaans. Other languages are listed in Table 1. Geographically, most participants were distributed across several areas, with each of the following residential areas representing 10.8% of the total: Claremont (middle to upper-middle-income residential area), and Gugulethu and Hanover Park (both lower-income residential areas) (FigS1 and S2). Over half of the participants (59%) had employment while 4% were students (post-matric). In terms of income, 35% of participants reported having no income and 36% reported a monthly income between R1 and R5999 ($0.054- $322 equivalent). Educational attainment varied among participants, with the highest proportion (43%) reporting matric (the South African equivalent of high school completion) as their highest level of education. One participant had not completed any formal education. Notably, 78% reported having at least one child. Table 1 provides a comprehensive summary of the demographic characteristics of the study participants.

Table 1. Demographic characteristics of study participants (N=102).

Variable	n	%
Age		
18-25 years	33	32.4
26-33 years	41	40.1
34-41 years	28	27.5
Home language		
IsiXhosa	38	37.3
English	30	29.4
Afrikaans	19	18.6
Other languages		
Shona (Zimbabwe)	7	6.9
Chewa (Malawi)	3	2.9
French (DRC)	3	2.9
Swahili (Kenya and Tanzania)	2	2.0
Residential areas		
Predominantly low-income		
Gugulethu	11	10.8
Hanover Park	11	10.8
Retreat	1	1.0
Predominantly middle to upper middle income		
Claremont	11	10.8
Mowbray	10	9.8
Rondebosch	7	6.9
False bay	4	3.9
Newlands	2	2.0
Other residential areas (referral areas)		
Predominantly low-income		
Philippi	7	6.9
Manenberg	3	2.9
Samora	3	2.9
Nyanga	3	2.9
Khayelitsha	1	1.0
Heideveld	1	1.0
Lavender Hill	1	1.0
Predominantly low to middle income		
Mitchelles plain	4	3.9
Hout Bay	3	2.9
Athlone	3	2.9
Lotus river	3	2.9
Pelican park	2	2.0
Fish hook	2	2.0
Grassy park	1	1.0

Lansdowne	1	1.0
Delft	1	1.0
Rylands	1	1.0
Westlake	1	1.0
Sea Winds	1	1.0
Predominantly middle to upper middle		
Wynberg	2	2.0
Steenberg	1	1.0
Employment Status		
Full time employed	43	42.2
Unemployed	38	37.3
Part-time employed	15	14.7
Student	4	3.9
Seasonally employed	2	1.9
Monthly income		
No income	36	35.3
R1-R5999	37	36.3
R5600- R40 000	29	28.4
Highest level of education		
No education	1	1.0
Grade 1-8	6	5.9
Grade 9-11	28	27.5
Completed Matric (Grade 12)	44	43.1
Certificate (post matric)	19	18.6
Tertiary degree/ Post graduate diploma	4	3.9
Number of children		
0 ((1st pregnancy)	23	22.5
1	35	34.3
2	25	24.5
3	12	11.9
4	4	3.9
>4	3	2.9

3.2. Patterns of PCP use and purchase

The study investigated the patterns of PCP use among pregnant women, describing their habits and preferences (Table 2). As product usage varies in frequency by day, week, or season, we did not access daily use but general product usage (with no specific daily, weekly, or monthly frequency specified). Of the 31 common products evaluated, 54% of participants reported using between 11 and 20 PCPs, with a notable preference for facial products such as makeup products, cited by 88% of the participants. When asked about the frequency of

PCP application, 53% of participants reported using PCP products such as soaps, body lotions, and toothpaste twice a day. Over half of participants (59%) reported buying their PCP products from pharmacies, with none purchasing online or from spaza shops (informal convenient stores, that sell basic groceries, toiletries, and other everyday household products). In terms of factors influencing their choice of PCPs, most of the participating women (76%) reported price as the influential factor, followed by special offers and promotions (58%), and brand loyalty to those they always buy (27%). Safety considerations, such as the type of product ingredients, were less commonly reported as influential factors, with only two participants citing this. Participants expressed a range of motivations for using PCPs, with 94% using PCPs such as soaps and body wash to clean the body, 69% using PCPs like deodorants to prevent body odour, and 66% using PCPs such as makeup to enhance appearance. When investigating the relationship between monthly income and the number of products used, no statistically significant association was observed (p=0.297).

Table 2. Patterns of PCP use among study participants (N=102).

Variable	Categories	n	(%)
Number of PCPs used (n=31)	0-10 products	13	12.7
	11-20 products	55	54.0
	21-31 products	34	33.3
Number of PCPS uses per day	Once a day	48	47.1
	Twice a day	54	52.9
Where products purchased	Pharmacy	60	58.4
	Grocery stores	58	56.9
	Cosmetic shops	38	37.3
	Beauty saloons	4	3.9
Considerations when purchasing PCPs	Price	80	76.2
	Special offer/ promotion	59	57.8
	Brands specific to skin type	50	49.0
	Brands always buy	27	26.5
	Convenience	18	17.6
	Scent	15	14.7
	Well-known brand	15	14.7
	Recommendations from friends	9	8.8

	Brands advertised on social media	5	4.9
	Product ingredients	2	2.0
	Packaging	1	1.0
	Recommended on social media	1	1.0
Reasons for use	Body cleaning	96	94.1
	Prevent body odour	70	68.6
	Enhance appearance	67	65.7
	Boost self-esteem	33	32.4
	Keep skin moisturized	24	23.5
	Conceal blemishes	21	20.6

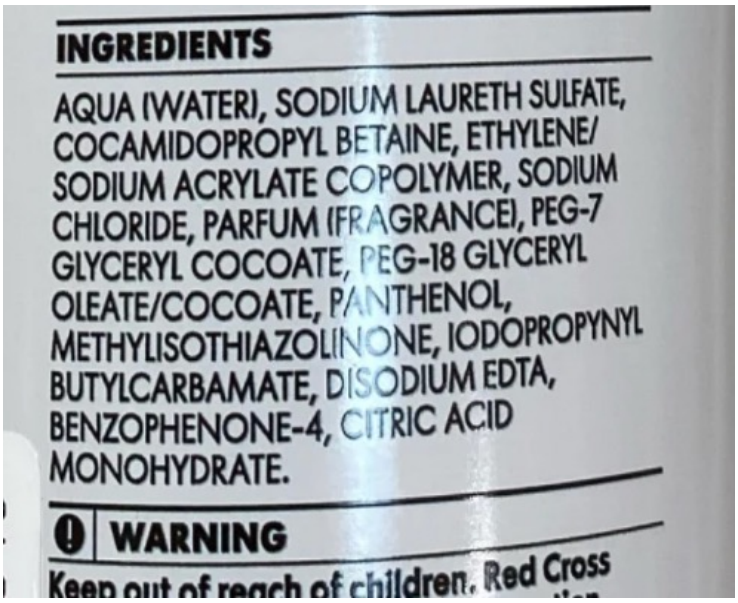
3.3. Participants' knowledge of harmful chemicals

A notable finding was that 46% believed that the chemicals found in beauty and hygiene products could harm their health. When presented with a list of diseases linked to EDC exposure, most women (91%) selected allergies, while 61% chose cancer, particularly skin cancer. Only three participants selected diabetes. Additionally, 70% of participants believed that women were more likely to be affected by chemicals in beauty and hygiene products than men. Sixty-seven percent of the participants were certain that using PCPs during pregnancy was safe. When presented with product labels (Fig 1), only three participants could identify methylparaben, benzophenone 4, and triclosan as EDCs. However, these participants could not justify why they selected these chemicals. Furthermore, none of the participants knew if chemicals were listed in any specific order on product labels. There was no significant association between educational level and the ability to identify EDCs on cosmetic labels ($p=0.284$).

Regarding the route of chemical exposure, 47% of the participants acknowledged that chemicals in cosmetics can enter their bodies. Among those who believed that chemicals in cosmetics can enter their bodies (47%), 35% reported exposure through the skin, followed by through the nose (3%) and through the mouth (2%). A few participants (3%) also mentioned other routes of chemical exposure, such as through an open wound or skin cut and one participant mentioned genito-urinary exposure (by using feminine hygiene products). The other two participants could not explain how the chemicals enter the body. Additionally, a few participants (18%) recognized the potential for maternal transfer of chemicals to an

unborn baby. Although 47% acknowledged personal exposure to EDCs, more participants (61%) acknowledged the potential for infant exposure through breast milk. Only a small proportion of participants (10%) were aware of the transgenerational effects of EDC exposure.

A B



C

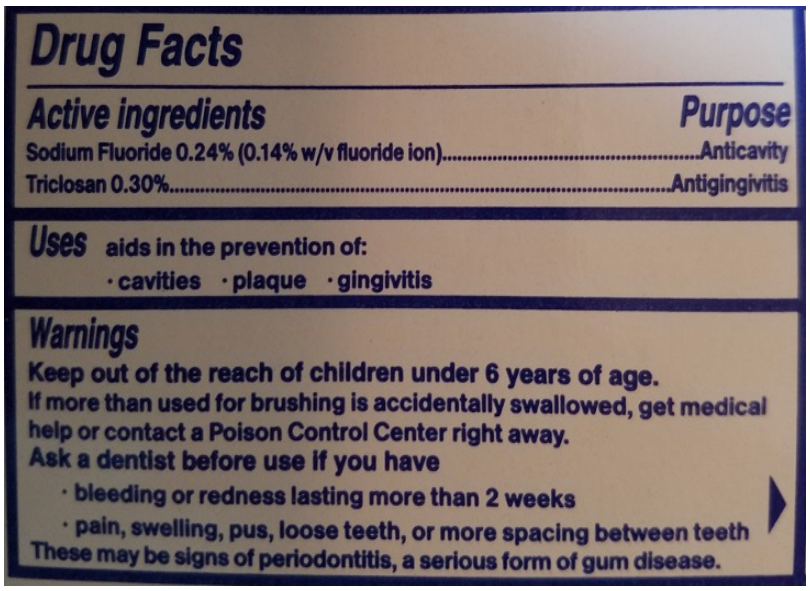


Fig. 1. Images of PCP ingredient labels used to evaluate knowledge of EDCs, a) hair conditioner; b) body cream; c) toothpaste.

3.4. Participant's attitudes and perceptions towards harmful chemicals

The study found that 13% of participants had considered before the chemicals in their beauty and hygiene products. Of the 102 participants, only 4% expressed concerns over the possible long-term effects of these chemicals on their unborn babies' health. However, 91% of the participants recognized the importance of knowing which products are safe to use during pregnancy, and 81% believed that all pregnant women should receive information about beauty and hygiene products during pregnancy. While 73% of participants believed that hygiene and beauty products are tested for harmful chemicals in South Africa, 59% believed that the government ensures product safety before they are placed on the market. Only a small proportion of pregnant women (4%) agreed that they possessed sufficient knowledge about the effects of chemical ingredients found in cosmetics (perceived awareness). Among those who believed they had enough knowledge, the internet, social media, and friends and family were the primary sources of information, while product label was mentioned by only one participant. No participants mentioned healthcare professionals as a source of information. Regarding perceived susceptibility to harmful chemicals, most participants (82%) perceived their foetus as less susceptible than themselves (Fig 2).

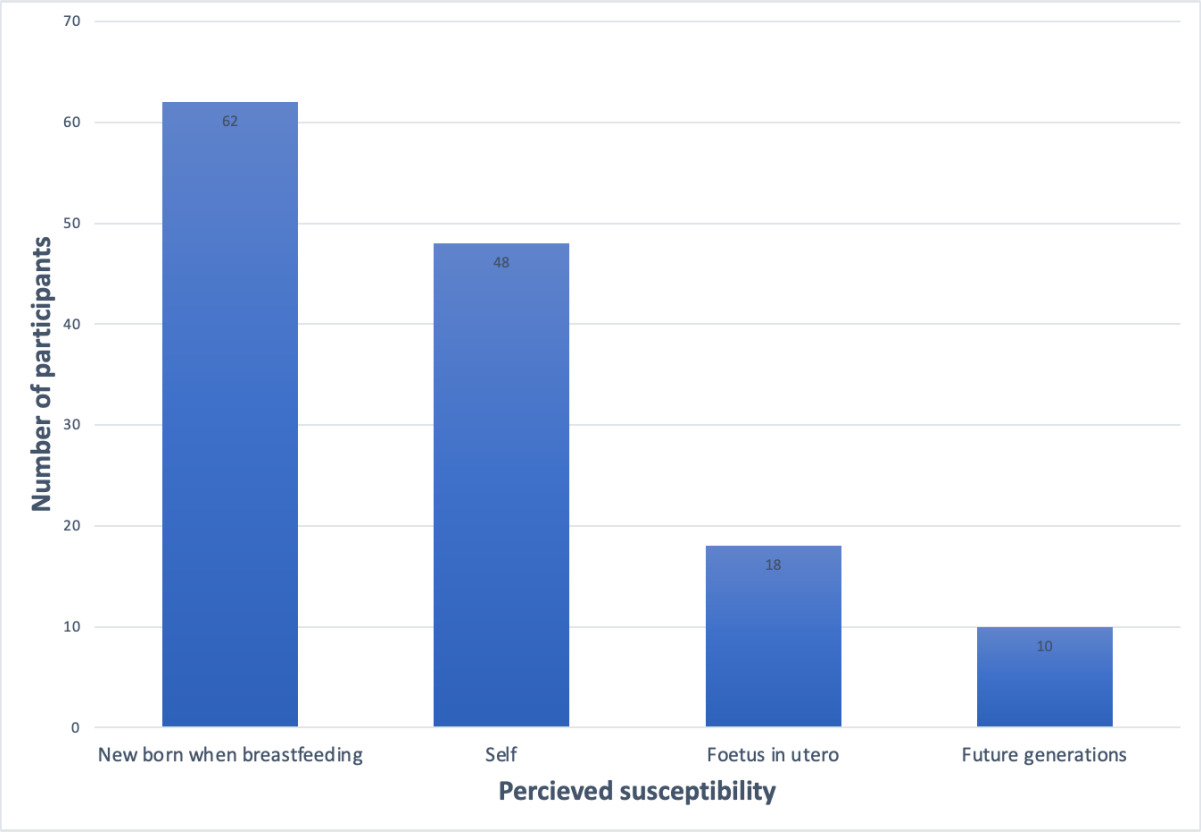


Fig. 2. Participants' perceived EDC's susceptibility at various developmental milestones (N=102).

Out of the 102 participants, a majority (96%) perceived the topic as interesting and expressed their willingness to learn more about harmful chemicals in beauty and hygiene products. Among those who expressed interest in learning more, the internet and social media were the preferred sources of information for 57% of participants, followed by healthcare professionals (36%). Regarding reading cosmetic labels before purchasing products, only 5% reported always doing so, while 40% never read the labels. Among those who always read cosmetic labels before buying cosmetic products (5%), three perceived them as providing sufficient information to protect their health. Additionally, 32% disagreed that companies that produce beauty and hygiene products make the information about their products easy to understand.

3.5. Qualitative analysis using the Health Belief Model

3.5.1. Perceived severity of EDC-related diseases

While acknowledging the potential for allergies and skin cancer, all participants struggled to establish a connection between EDC exposure and other metabolic and endocrine disorders such as diabetes. When asked to explain why they thought chemicals in cosmetics could harm their health, some participants (15%) reported that although the chemicals may be associated with allergies, the conditions were not considered severe health problems. One participant highlighted this perspective, stating:

> *"These products are applied to the skin, so maybe they can cause some allergies, but we can't say they are really dangerous. The chemicals cannot enter our bodies."* (respondent E17)

Among the participants who did not believe that EDCs can harm their health (33%), a few (10%) cited that they had never seen or heard of anyone falling ill due to EDC exposure. One participant explained:

"I have never seen anyone who got sick after using these products, so personally, I do not believe that chemicals in cosmetics can harm my health." (respondent E77)

Another participant even expressed reluctance to change their products unless there were fatalities associated with their use. They expressed this sentiment, saying:

"I am not sure if I would like to change my products unless maybe people are dying, then obviously I would change." (respondent E12)

3.5.2. Perceived benefits of EDCs awareness

Most participants (91%) strongly believed in the importance of knowing which products are safe to use during pregnancy, and 81% believed that all women should receive information about harmful chemicals in their cosmetics. Eighty-one percent of participants believed that by understanding the potential risks and being knowledgeable about EDCs, they could actively choose safer alternatives and minimize their exposure to harmful chemicals. One participant stated:

"Knowing is better than not knowing, it helps me to make better choices and avoid the products that can harm me and the baby." (respondent E95)

On the other hand, 9% of the participants did not see the importance of knowing about these chemicals. One participant expressed doubt about the effectiveness of avoiding harmful chemicals, stating:

"I don't think too much about these chemicals so I will keep using my usual products." (respondent E42)

3.5.3. Perceived barriers to awareness

Participants highlighted three major barriers that could hinder their efforts to reduce exposure to EDC health risks and enhance their awareness of these chemicals. One prominent barrier was the overwhelming volume of information available on the topic. When asked about the factors that might motivate them to change their current products to protect their health, about a third of participants (33%) expressed feeling overwhelmed by the daunting

task of discerning credible and reliable sources. Consequently, they emphasized the need for information from more trusted sources to help them navigate this complex landscape. One participant noted:

> *"I really need to be educated about these chemicals. If there is research that has been done before with proper evidence, I would like to know more about it. There is so much information out there, so I need to get information from more trusted and legit sources." (*respondent *E79)*

Another participant echoed similar sentiments, stating:

> *"I would be lying if I say I could change my products. People say a lot about good products and bad products, and it is hard to know who is telling the truth. So, I just don't want to be confused, I will stick to the products I have used for years."* (respondent E31)

Moreover, 32% of the participants highlighted limited access to comprehensive and understandable information about EDCs as another barrier. When asked about the clarity of information currently provided by manufacturers, they expressed frustration with the lack of clear labels and information that offers detailed insights into specific chemicals, and their potential health effects. Participants felt that without such information, making informed decisions was challenging. As one participant pointed out:

> *"...they [cosmetic manufacturers] just write the chemical ingredients, but they don't explain which one is bad or which one is not."* (respondent E25)

Others shared similar concerns, with comments such as:

> *"Sometimes the font is too small and the words they use are so big [complex terminology]). You really need to look it up in a medical dictionary." (respondent E84)*

"I *do not think they write every single detail for every ingredient; it is never enough. On some products, they do not even write in English."* (respondent E73)

Another notable barrier identified was the limited availability and affordability of safer alternatives to PCPs containing EDCs. While 81% of participants expressed the desire to protect their baby and switch to safer alternatives, some (15%) were also aware of the financial constraints they may face. Some participants (12%) expressed the importance of making safe alternatives not just available but affordable, ensuring that they can make their choices without compromising their budgets. One participant emphasized this concern, stating:

"I think when you are pregnant you just want to learn information to have a healthy baby. So, if anyone tells me that my products are bad because of 1, 2, 3 reasons I will take that advice and use different products but also the safe products should be affordable for me because I cannot leave the cheap ones from Shoprite [a local consumer goods retailer] and start buying the expensive ones. " (respondent E83)

3.5.4. Perceived susceptibility to EDCs

The study's findings revealed that nearly half of the participants (46%) believed EDCs in cosmetic products could harm their health. However, most women (70%), including those with a lower perceived susceptibility to harm, held the belief that women were more likely to be affected by these chemicals compared to men. An example of this perspective was provided by a participant who did not feel personally at risk from harmful chemicals in cosmetics, stating:

"Women use makeup products, lipstick, and other products to look good. Men only use the basic things [PCPs], so they are not affected." (respondent E78)

Furthermore, over a third of participants (36%) did not perceive that chemicals could enter their bodies. As a result, they did not feel susceptible to harm. However, among the 47% who believed that these chemicals could enter their bodies, there was a lack of understanding in

how these chemicals might be transferred to their unborn babies. One participant expressed this uncertainty, stating:

> *"I don't know how to explain it, but they [EDCs] can get to the baby*." (respondent E69)

Many individuals (73%) believed that the products they purchased were inherently safe due to the rigorous regulatory standards set by the government before allowing products to enter the market. One participant explained why they perceive these chemicals as harmless:

> *"In my mind, I thought I was trusting the lotion I was buying not knowing that I had to check the products."* (respondent E85)

4. Discussion

This study assessing pregnant women's knowledge, attitudes, and perceptions about EDCs in the PCPs they use yielded five key findings: 1) the explored associations between demographic variables were statistically insignificant, 2) none of the participants could identify EDCs on cosmetic labels, indicating a lack of knowledge and familiarity about these chemicals, 3) despite gaps in EDC awareness, a majority of the participants expressed a willingness to learn more about these chemicals, 4) perceptions of health risks to the unborn baby were low, especially regarding the long term intergenerational effects and 5) better risk communication of EDCs is needed to enhance awareness about EDCs and their potential risks during pregnancy.

4.1. Associations between demographic variables

The diverse demographic profile of our participants included a broad age range, various home languages (IsiXhosa, Afrikaans, English, Shona, Chewa, French, and Swahili), and a representation from different residential areas, employment statuses, income levels, and education backgrounds. This diversity was valuable for capturing a wide range of perspectives on EDC exposure during pregnancy. Recognizing and appreciating the diversity among pregnant women is a crucial step when considering interventions. Tailoring interventions to address the specific needs and challenges faced by different demographic groups ensures that no woman is left behind, promoting equity and inclusivity in healthcare initiatives. It ensures

that cultural nuances and language preferences are considered in interventions, making them more inclusive and effective. Additionally, the knowledge of socio-economic diversity among pregnant women is essential for designing interventions that are accessible and relevant to women with varying economic resources and educational backgrounds.

There was no significant association between the level of education and the ability to identify EDCs on labels, indicating that education did not enhance understanding or awareness of EDCs in PCPs. This contrasts with results from previous studies indicating a positive relationship between education and health-related knowledge, including knowledge of chemical exposures (Hartmann & Klaschka, 2017; Yoon & Kim, 2022). The lack of association between education and EDCs awareness could indicate that there is limited emphasis on EDCs and their presence in PCPs in schooling programs and media platforms such as radio, television, and newspapers. Consequently, if the educational curriculum does not adequately cover topics related to environmental health and chemical exposures, even those with higher education levels may not possess the knowledge to identify these chemicals on product labels.

Income status and the number of products used had no statistical significance. These findings contrast with previous studies that have reported a positive association between income and product use, suggesting that individuals with higher income may have greater purchasing power and access to a wider range of PCPs (Hoque, 2018; Lang et al., 2016; G. H. Park et al., 2018). This lack of association may be due to factors such as market accessibility, affordability of PCPs, and study power. For example, if there are many affordable options or a lot of different-priced PCPs in the market, it can make the influence of income on how many products women use less important. Additionally, the use of a small sample size could have underpowered the study such that the association between income and product use could not be detected. Notably, a study conducted in Malaysia reported comparable results where they found no association between income and product use among the general population (Mohammed et al., 2021).

4.2. Knowledge of EDCs

Our study findings highlight awareness and knowledge gaps regarding the ability to identify EDCs on cosmetic labels, the importance of listing chemicals in a specific order, and routes of chemical exposure. When presented with cosmetic labels, most of the participants could not identify EDCs on these labels. The few participants who could identify benzophenone and triclosan could not indicate that the chemicals were endocrine disruptors or explain how they could harm their health. This suggests a lack of awareness of EDCs in PCPs and their potential effects on the endocrine system. Given this lack of understanding about EDCs, the need to raise awareness about these chemicals becomes evident. If consumers become aware of the risks associated with certain ingredients, they may better comprehend the reasoning behind avoiding specific chemicals in cosmetics. Our findings are consistent with previous research conducted on pregnant and non-pregnant women that highlighted a significant gap in consumer knowledge and understanding of the health effects of EDCs (Kelly et al., 2020; Koester et al., 2021; Rouillon et al., 2017).

Our study also revealed a lack of awareness among participants regarding the specific order of listing chemicals on product labels. This deficiency in understanding poses a potential challenge for consumers, which can hinder their ability to make informed choices based on ingredient concentrations, especially for those with allergies or sensitivities. The emphasis on listing ingredients in descending order of percentage concentration for those at one percent or more allows consumers to identify the predominant components in the formulation. The findings underscore the need for educational efforts to empower consumers to make more health-conscious choices. It is noteworthy to mention that there is no current literature analysing awareness regarding the specific order of listing chemicals on product labels. The available literature confirming these results is outdated, emphasising the need for updated research in this area (Klaschka & Rother, 2013).

Interestingly, there was a discrepancy in participants' understanding of exposure routes related to EDCs in cosmetics. While a larger proportion of participants were aware of the transfer of chemicals via breast milk, fewer participants acknowledged that chemicals could enter their bodies. This indicates that while some participants may acknowledge the concept of chemicals being transferred through breastfeeding, they may not fully grasp the pathways

by which these chemicals enter their bodies and potentially reach breast milk. This highlights the importance of addressing not only the awareness of exposure routes but also providing clear information on how chemicals in cosmetics can enter the body and impact the foetus in utero, the new-born when breastfeeding, and future generations. Previous research conducted among French pregnant and postpartum women has shown that women often have limited knowledge about the absorption potential of EDCs through the skin, transfer through breastmilk, and via the placenta (Kelly et al., 2020; Rouillon et al., 2017).

4.3. Attitudes and perceptions of EDC risk

Nearly all participants expressed interest in learning more information about EDCs. Most participants believed that it is important to know which cosmetics are safe to use during pregnancy. However, this belief did not correspond with their knowledge of EDC exposure. While participants may lack detailed knowledge about EDCs, their expressed belief in the importance of safety indicates a concern for maternal and foetal health. With three-quarters of participants indicating a willingness to change their product choices to reduce EDC exposure, this highlights a potential for behaviour modification, an opportunity the government can use to teach women to take control of their product choices. By ensuring product transparency through labels (for example by implementing compulsory labels that communicate the health risks associated with EDCs in cosmetics) and making information about EDCs easily accessible, consumers can be empowered to make informed product choices. A study conducted among pregnant women in France reported that despite limited awareness of EDCs, 40% of the participants already used or intended to use EDCs-free cosmetics during pregnancy (Rouillon et al., 2017).

The differences in results are largely due to the variations in survey questions, study focus, and participant demographics. Our survey questions, which focused on EDCs in cosmetics, could have motivated participants to express a willingness to prevent exposure. In contrast, the French survey had a broader focus on EDCs awareness, extending beyond cosmetics, potentially leading to a less pronounced focus on cosmetics. In our study, where participants were more willing to change their products to protect their health, targeted education on the harmful effects of these chemicals could empower pregnant women.

In our study, the concept of long-term intergenerational effects appeared distant and abstract to some individuals. This suggests that when the consequences are not perceived as immediate or directly affecting the individual, there may be a tendency to downplay the risks. In a study conducted on public perception of EDCs risks in Northern Ireland, participants in female focus groups were aware of the potential intergenerational effects of EDCs. They were concerned about their intergenerational effects despite being indifferent about their exposure. This suggests that there is a clear need for targeted educational campaigns to bridge the gap in understanding. Providing information about the potential long-term intergenerational effects could help individuals connect the dots between their current actions and future consequences. Understanding why individuals are indifferent despite awareness is crucial for tailoring communication to resonate with their values, concerns, and motivations.

Many women perceived the products they purchased as inherently safe due to the rigorous regulatory standards set by the government before allowing products to enter the market. Notably, participants were not aware of their responsibility to scrutinize products for harmful chemicals before purchasing cosmetics. Our findings revealed that women placed a significant level of trust in the products they were buying, often assuming that thorough safety evaluations had already been conducted. This reliance on governmental regulations can significantly influence people's overall risk perception of potential hazards associated with chemicals in products (Kaushik et al., 2023). When individuals unquestioningly trust that regulatory bodies are infallible in their assessments, they may become less vigilant in assessing product safety themselves. These findings align with the results of a survey conducted in the UK, where 74% of the respondents believed that the government had a legal obligation to ensure that all household products were safe (Number, 2020). This false sense of security can make people more susceptible to potential risks, as they may underestimate the hazards posed by certain substances, including EDCs.

This finding underscores the deficiencies in South African cosmetic regulations. In South Africa cosmetics producers, especially those aiming for global markets or retail placement must assess product safety before registering their products with SAHPRA (Sukhnandan, 2021). These assessments include evaluating allergic reactions and skin sensitization, but the long-

term effects of EDCs, being an inconclusive topic, are not taken into consideration. Manufacturers are required to follow labelling guidelines outlined in SANS 98:2012 and communicate health risks associated with product ingredients (South African Bureau of Standards, 2012). The assumption is that consumers interested in knowing the risks associated with ingredients should conduct a risk assessment on their own (Klaschka and Rother, 2013). However, as our study reveals, consumers are unaware of this expectation, indicating a gap in effective risk communication mechanisms.

4.4. Opportunities for interventions

To address the risks associated with exposure to EDCs in PCPs, a comprehensive public health approach is necessary. This study illustrates potential interventions for reducing exposure to EDCs using the Hierarchy of Control approach, a framework used to prioritise and implement measures to prevent environmental health risks.

The Hierarchy of Control

Utilising the hierarchy of control approach to prevent EDC exposure risks offers a structured framework for implementing effective public health interventions. This approach categorises control measures into six levels: elimination, substitution, engineering, administrative, behavioural, and personal protective equipment (PPE)(Beach et al., 2020). However, we have excluded PPE from our discussion. PPE such as gloves and safety goggles is designed to protect against external hazards, typically in occupational settings, hence it does not apply when limiting exposure to EDCs in PCPs. Each level of control represents a different strategy for reducing or eliminating hazards such as EDCs, with elimination being the most effective and behavioural controls being the least effective.

Elimination

This level of control involves completely removing EDCs from PCPs and it is the most effective strategy for limiting EDC exposure. Although challenging to implement, regulatory authorities, such as the National Department of Health and SAHPRA should develop and enforce stringent regulations that specifically ban or restrict the use of known EDCs in cosmetics. This entails identifying and listing EDCs that are prohibited in cosmetic products, mandating safety assessments for all cosmetic ingredients, and establishing penalties for non-

compliance. Since ensuring compliance with these regulations requires robust monitoring systems and resources for product inspections and testing, there is a need for sufficient funding from the government to enforce the regulations effectively. Engagement with international regulatory agencies such as the European Chemicals Agency (ECHA) could provide insights into best practices and promote harmonisation with global standards.

Substitution

Substituting EDCs with non-toxic or less toxic alternatives is a crucial strategy for safeguarding public health and the environment when elimination is not feasible. However, this level of control requires substantial investment in research and development. Identifying and testing alternative ingredients for safety and efficacy can be a costly and time-consuming process for manufacturers. By providing dedicated funding, the government can significantly accelerate the discovery and implementation of safer substitutes. Moreover, the South African Department of Trade, Industry, and Competition (DTIC) should actively incentivise companies to prioritize non-toxic formulations. Offering grants or tax incentives can motivate cosmetic manufacturers to invest in manufacturing safer products.

Engineering controls

Engineering controls involve redesigning products or processes to minimise or eliminate exposure to harmful substances. In the context of PCPs, this means cosmetic manufacturers should reformulate manufacturing processes to ensure that EDCs do not pose risks to cosmetic users. For example, certain EDCs such as phthalates are used as plasticisers during the manufacture of containers used for packaging cosmetics. These are added to plastics to impart certain properties, like flexibility. However, because EDCs like phthalates are not chemically bound to the plastic matrix, they can leach out of the plastic over time, and contaminate the cosmetic product(Gao & Kannan, 2020). Replacing these EDCs with less harmful plasticisers that are less likely to leach into products can reduce health risks without compromising the effectiveness of the products. Additionally, the nature of plastic packaging and the environmental conditions to which the plastic can be exposed also contribute to the leaching of EDCs. For example, when plastic containers are exposed to UV light or warm storage conditions, EDCs can migrate out of the plastic more quickly (Martín-Pozo et al., 2021). Using alternative packaging materials, such as glass, can help maintain the safety and

quality of products over time since glass is less likely to degrade or interact with the product contents. Implementing these engineering controls requires a commitment to rigorous testing and continuous research by scientists to ensure that new formulations and packaging solutions effectively mitigate the risks associated with EDCs.

Administrative controls

This level of control involves implementing policies, procedures, and guidelines to reduce exposure to EDCs in PCPs. Although these controls are less effective than elimination or substitution they remain essential components of a comprehensive risk management strategy. In the case of EDCs in PCPs, administrative controls include improved product labelling and packaging. Regulatory bodies such as SAHPRA should mandate full disclosure of all ingredients on product labels, including EDCs, along with clearer labelling requirements and standardised formats. This will enable women to make informed choices when purchasing PCPs.

The regulatory framework should involve a multi-disciplinary team effort from scientific experts such as the South African Medical Research Council (SAMRC), cosmetic industry stakeholders including CTFA and SABS, and public health officials such as the National Department of Health. Multiple key areas must be addressed to effectively mitigate the risks associated with EDCs in PCPs. These measures include launching public education campaigns to raise awareness about EDCs in PCPs and training healthcare providers to recognise and address health issues related to EDC exposure. Additionally, information about EDCs and their risks should be integrated into the school health education programs to inform younger populations. By addressing these areas comprehensively, the regulatory framework can provide effective protection against the risks posed by EDCs in PCPs.

Behavioural controls

Behavioural interventions focus on promoting safety practices through health education and changing people's behaviours that foster reducing exposure to EDCs. This includes education and training programs aimed at raising awareness about EDCs, particularly their links to reproductive and perinatal health. In 2014, The Cancer Association of South Africa (CANSA) published a fact sheet on "Possible Harmful Chemicals in Personal Care Products"(Herbst et

al., 2014). This demonstrates its commitment to raising awareness about the potential health risks associated with cosmetic ingredients, including EDCs. Organizations like the CANSA should collaborate with the Department of Health and disseminate information about EDC risks to women. However, the information should be easy to understand and accessible to women with varying levels of health literacy in South Africa.

Despite our participants reporting a lack of previous messaging about EDCs, research shows that platforms like the MomConnect app present valuable opportunities to deliver information directly to pregnant women (Kabongo et al., 2019). By utilizing simple text messages, these platforms can effectively communicate EDC risks and promote informed decision-making. However, education alone is insufficient without practical demonstrations of reading and interpreting product labels and making informed choices. NGOs like the Women's Health Project (WHP) and groundwork South Africa could, with funding, provide these by organising community workshops and support groups to provide practical guidance on EDC exposure and safer alternatives. These hands-on sessions are essential for empowering women with the skills needed to identify and avoid harmful chemicals. However, starting health education on EDCs long before pregnancy should also be considered, as it allows individuals to adopt preventive measures and make informed choices regarding exposure to EDCs well in advance. Furthermore, extending education efforts to include a broader audience, such as men and individuals of reproductive age, could enhance overall awareness and promote proactive measures to mitigate EDC exposure across the population.

4.5. Strengths and limitations

Despite its valuable contributions, our study had some limitations that warrant acknowledgment. The utilization of a small sample size, attributed to budgetary and time constraints, may have implications for the power of the study and the generalisability of the findings. While a larger sample size may not inherently address the issue of representativeness, future research should consider employing more rigorous sampling methods such as random sampling to yield more robust and generalisable findings. Additionally, future studies should score variables and use larger sample sizes to explore statistical relationships more thoroughly and uncover correlations between variables.

Another potential limitation lies in the reliance on self-reported data, which introduces the possibility of recall and social desirability biases. While participants' responses were essential in capturing their perceptions, attitudes, and awareness regarding EDC exposure, the subjective nature of self-reporting warrants caution when interpreting the results. Future studies could address the subjective bias inherent in self-reporting by incorporating objective measures and diverse data sources. Utilising biomonitoring techniques to directly measure EDCs levels in participants, alongside self-reported data, would provide a more comprehensive and reliable understanding of cosmetic usage and EDC exposure levels.

Another weakness, which introduces potential bias, lies in the qualitative data collection and analysis. This includes the absence of checks to ensure interviewers transcribed women's responses verbatim, without summarising or translating them, and the reliance on single-coder analysis. Although the researcher held feedback sessions and encouraged verbatim transcription, their limited proficiency in the Xhosa and Afrikaans made it difficult to verify if assistants were summarising responses instead of transcribing them accurately. Future research should address these limitations by implementing rigorous quality control measures for transcription, such as regular checks by people who are proficient in the languages of the interviewers and more training sessions for interviewers. Recording participants' responses using audio recorders and transcribing them later would help prevent data loss and ensure accuracy. Additionally, employing multiple coders for data analysis should be employed. Ideally, numerous coders for data analysis should enhance the reliability and validity of findings. However, this was not possible due to the time and cost restraints of this mini dissertation for degree purposes.

Notwithstanding these limitations, our study's strengths lie in its pioneering evaluation of awareness, attitudes, and perceptions regarding EDC exposure in South Africa. The mixed methods approach allowed for in-depth exploration and a rich understanding of pregnant women's perspectives on this health risk. The study also highlights areas for risk communication and public health interventions. By acknowledging these limitations and recognising the study's strengths, researchers and decision-makers can use the findings to develop risk communication materials targeted for pregnant and inform future research and interventions in EDC exposure awareness.

4.6. Recommendations and implications for future research

Future research should investigate the chemicals in cosmetics and usage patterns across different income brackets and cultural groups in South Africa. Sociocultural factors such as cultural beauty standards, social norms and peer influence, religious beliefs, and traditional practices can significantly shape how individuals perceive and respond to the risks associated with these chemicals. For example, research shows that in cultures where fair skin is highly valued, skin-lightening creams with potentially harmful chemicals might be more commonly used despite associated health risks (Motlohi, Mugomeri and Tarirai, 2023). Additionally, religious beliefs and practices may influence perceptions of cleanliness and beauty, leading individuals to choose specific cosmetic products that align with their religious teachings. For example, Muslim women may prefer halal-certified cosmetics, which may have different formulations compared to other products, impacting their exposure to harmful chemicals such as EDCs (Karabulut, Aytac, and Akin, 2020). Focus group discussions could further enrich our research findings and identify cultural influences, preferences, and safety considerations in PCP choices through interactive discussions with pregnant women. Moreover, increased research is necessary to understand the extent of EDC exposure, specific EDCs in South African PCPs, their health effects. Longitudinal studies tracking changes in PCP choices over time can offer insights into evolving consumer behaviours and preferences.

5. Conclusion

This study represents the examination of awareness and perceptions regarding exposure to EDCs among pregnant women in South Africa. It reveals that pregnant women in South Africa have limited knowledge about EDCs commonly found in their daily cosmetic products. However, they expressed interest in learning more and taking proactive measures to protect their health and that of their children. By leveraging this eagerness to learn, targeted educational campaigns and resources could be developed that empower women with accurate information about EDCs. Raising awareness can protect the health of current and future generations and foster a culture of conscious consumer choices and safe product usage. Given the health concerns associated with EDCs in cosmetics, it is crucial to emphasise the necessity for informed consumer choices and to advocate for robust legislation globally, especially in LMICs. Our study results could inform and contribute to ongoing efforts to

enhance South African legislation regarding harmful chemicals in PCPs, aligning with global initiatives for safer product usage worldwide.

Declarations

All authors have read, understood, and have complied as applicable with the statement on "Ethical responsibilities of Authors" as found in the Instructions for Authors."

Funding

This study received funding from the University of Cape Town Division of Environmental Health, which contributed to its successful completion.

CRediT authorship contribution statement

Lissa Paul: Methodology, Writing-original draft. **Hanna-Andrea Rother**: Writing- review& editing, Funding acquisition, Supervision.

Conflict of interest

The authors assert that they have no financial or personal relationships that could have unduly influenced the content of this paper.

Data availability

Data will be made available on request.

Acknowledgments

The authors express gratitude to the pregnant women who participated in this study. They would like to thank the dedicated staff of Mowbray Maternity Hospital for their invaluable support and assistance.

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Supplementary material

Table S1. A summary of potential EDCs identified on common PCP labels (SA products) and their hazard traits.

Name of potential EDC (alternative name)	Use in PCPs	Examples of PCPs with the potential EDC	Hazard traits in in vitro studies	Hazard traits in in vivo studies	Hazards traits in human studies
Benzophenone-1[1,3] (2,4- Dihydroxy benzophenone)	ultraviolet absorber	nail polish, nail polish remover, lip gloss	metastasis in ovarian cancer cultures (M. A. Park et al., 2013; Shin et al., 2016) proliferation of breast cancer cells (In et al., 2015)	estrogenic activity in rats (Suzuki et al., 2005)	increased risk of endometriosis (Peinado et al., 2021)
Benzophenone-3[1,2,3] (oxybenzone)	ultraviolet absorber	sunscreen, lip balm with SPF, foundation, lotions	altered function of the mammary gland (Altamirano et al., 2020)	neurodevelopmental effects on brain tissue in mice (A. Wnuk et al., 2018) premature ovarian failure in rats (Santamaría et al., 2019)	reduced gestational age(Tang et al., 2013), suboptimal foetal growth (Ferguson et al., 2018)
Benzophenone-4[1,2,3,4] (4- hydroxybenzoate)	ultraviolet absorber	liquid hand soap, shampoos, hair conditioner		low oestrogenic activities in fish (Kunz et al., 2006) altered expression of genes that control sex hormones in zebrafish (Zucchi et al., 2011)	skin allergies (Hughes & Stone, 2007)

Table 2 (continues)

Name of potential EDC (alternative name)	Use in PCPs	Examples of PCPs with the potential EDC	Hazard traits in in vitro studies	Hazard traits in in vivo studies	Hazards traits in human studies
Ethyl paraben [1,3,,4] (4-hydroxy-ethyl ester benzoic acid)	preservative	foundation, moisturizer, concealer, facial cleanser	cytotoxic effects on human placental cell walls (M. J. Kim et al., 2020) Genotoxicity (Finot et al., 2017)	decreased hatching rate in fish (Liang et al., 2022)	associated with increased BMI in adolescent girls (Hatch et al., 2008) high risk of mortality (Hendryx & Luo, 2022) increased risk of endometriosis (Peinado et al., 2021)
Butyl paraben[1,3,4] (butyl 4-hydroxybenzoate)	preservative	foundation, concealer, eyeliner, eye shadow	proliferation of breast cancer cells (Wróbel & Gregoraszczuk, 2013) increased risk of malformation in offspring (Liang et al., 2022)	impaired oxidative metabolism in rats (Ulusu et al., 2020), decreased gestational age at birth (Geer et al., 2017) disrupted implantation in mice (Shaw & deCatanzaro, 2009) neurodevelopmental impairment in rats (Ali & Elgoly, 2013)	Increased birth weight in boys (W. Li et al., 2020) reduced odds of live births (Dodge et al., 2015), increased risk of endometriosis (Peinado et al., 2021)

Table 2 (continues)

Name of potential EDC (alternative name)	Use in PCPs	Examples of PCPs with the potential EDC	Hazard traits in in vitro studies	Hazard traits in in vivo studies	Hazards traits in human studies
Methylparaben[1,2,3,4] (Methyl p-Hydroxybenzoate	preservative	foundation, eye shadow, blush, lip liner	proliferation of breast cancer cells (Byford et al., 2002)	reduced male fecundity and fertility(Dodge et al., 2015), reduced body length in fish (Liang et al., 2022)	reduced fecundity (Smarr et al., 2017) increased risk of endometriosis (Peinado et al., 2021)
Propylparaben[1,3] (4-hydroxy-propylester benzoic acid	preservative	foundations, eyeliner, eye shadow	proliferation of breast cancer cells (Wróbel & Gregoraszczuk, 2013) Cytotoxic effects on lymphocytes	increased concentration of female sex hormones (Pollock et al., 2017)	increased risk of cryptorchidism (Fernández et al., 2016) increased risk of kidney damage (Arfaeinia et al., 2021)
*Dibutyl phthalate[1,2,3,4] (DBP)	fragrance, plasticiser	perfume, nail polish	anti-androgenic (Shen et al., 2009) altered gene expression in ovarian cells (Adir et al., 2017) reduced ovarian follicle growth (Rasmussen et al., 2017)	cryptorchidism in rodents (K. Liu et al., 2005) decreased testosterone levels (Lehmann et al., 2004) decreased progesterone in female rats (Gray et al., 2006) testicular lesions in rats (Barlow et al., 2004)	Inflammatory responses in pregnancy (Welch et al., 2021), suppressed action of male sex hormones(P. C. Huang et al., 2009) increased risk of preterm delivery (Y. Huang et al., 2014)

Table 2 (continues)

Name of potential EDC (alternative name)	Use in PCPs	Examples of PCPs with the potential EDC	Hazard traits in in vitro studies	Hazard traits in in vivo studies	Hazards traits in human studies
*Diethyl-hexyl phthalate[1,3,4] (DEHP)	fragrance, plasticiser	bath oils	decreased oestradiol levels in cultured follicles (Hannon et al., 2015), antiandrogenic activity (Shen et al., 2009) decreased testosterone production in cultured human tissue (Desdoits-Lethimonier et al., 2012)	reproductive toxicity in sea snails (Y. Liu et al., 2009) transgenerational reproductive toxicity in female rodents (Rattan et al., 2019) suppression of hormone synthesis in rats (Borch et al., 2004)	preterm birth(Ferguson et al., 2014) increased risk of endometriosis (Upson et al., 2013) increased odds of ADHD in children (Chopra et al., 2014) reduced testosterone production (Pan et al., 2006)
*Dihexyl phthalate[1,2,] (DHP or di- n- hexyl phthalate)	solvent, plasticisers	sunscreen, facial moisturiser, tanning oils	weak estrogenic activity	reproductive toxicity in male rats (Saillenfait et al., 2009) cell hyperplasia in rats (Ye et al., 2020) increased serum thyroid hormones in both male and female rats (Aydoĝan Ahbab & Barlas, 2013)	

Table 2 (continues)

Name of potential EDC (alternative name)	Use in PCPs	Examples of PCPs with the potential EDC	Hazard traits in in vitro studies	Hazard traits in in vivo studies	Hazards traits in human studies
*Di isobutyl phthalate[4] (DIBP)	plasticiser	nail polish, lacquer	affects sperm viability (Ospedaliero & Careggi, 2019)	developmental toxicity in male rats (Yost et al., 2019), reproductive toxicity in female rats (Hannas et al., 2011) anti-androgenic in rats (Borch et al., 2006)	inflammatory responses in pregnancy (Welch et al., 2021), suppressed action of male sex hormones(P. C. Huang et al., 2009) increased risk of preterm delivery (Y. Huang et al., 2014)
Triclosan[1,2,3,4] (TCS)	antimicrobial	toothpaste, antibacterial soaps , body wash	androgenic activity (Christen et al., 2010), increased risk of pancreatic cancer (Shin et al., 2016)	immunosuppression in fish (Bera et al., 2020), altered glucose metabolism and gut microbiota in adult rat offspring (Ma et al., 2020) obesity in mice offspring (Hua et al., 2019)	respiratory allergies in children (Bertelsen et al., 2013) intrauterine growth retardation(Zhang et al., 2022) reduced semen quality (Nassan et al., 2019) reduced telomere length in boys (Michels et al., 2020)

[1] Listed on The Endocrine Disruption Exchange(TEDX) list of potential endocrine disruptors https://endocrinedisruption.org/interactive-tools/tedx-list-of-potential-endocrine-disruptors/search-the-tedx-list

[2] Of concern and under assessment for endocrine disruption by the European Chemical Agency(ECHA) https://echa.europa.eu/information-on-chemicals

[3] Listed as a chemical of concern under the Environmental Working Group (EWG) skin-deep database https://www.ewg.org/skindeep/

[4] Listed as potential endocrine disruptors under the California Safe Cosmetics Program Reportable Ingredient List https://cdph.ca.gov/cosmetics

* In our survey, the presence of all phthalates used as plasticizers during the manufacturing of packaging containers was not disclosed on product labels. These phthalates, which are not chemically bound to the plastic material, can leach from the container and contaminate the contents they hold. Consequently, to accurately identify the presence of phthalates in products, extensive laboratory analysis methods are commonly employed in research studies

Table S2. Identification of EDCs in common cosmetic products: Label analysis in South Africa

Product category	Examples of PCPs	Potential EDCs identified on product labels	Images of product labels
General	nail polish, nail polish remover, parfum, hand cream, roll-on, fragrance mist	benzophenone-1, benzophenone-3, benzophenone-3, benzophenone4, methylparaben, propylparaben,	Click here for images
Makeup	foundation, mascara, face powder, eye shadow, concealer	methylparaben, propylparaben, ethyl paraben, butylparaben, benzophenone-4,	Click here for images
Bath and shower	facial scrub, body wash, shower gel, face wash	methylparaben, propylparaben, ethyl paraben, butylparaben, triclosan, benzophenone-4,	Click here for images
Haircare	hair conditioner, hair styling gel, hairstyling gel, hair dye, hair oil , hair food, hair moisturiser, hair spray, shampoo	methylparaben, propylparaben, ethyl paraben, butylparaben, iso- butylparaben, benzophenone-3, benzophenone-4	Click here for images
Skincare	sunscreen, body lotion, body cream,	benzophenone-3, methylparaben, propylparaben, ethyl paraben, butylparaben, iso- butylparaben, triclosan	Click here for images

Facial	night face cream, day face cream, face musk, face cleanser, face serum, face toner, face moisturiser	methylparaben, ethyl paraben, propylparaben, benzophenone-3, benzophenone-4	Click here for images
Lip care	Lip balm, lip conditioner, lip gloss, lip stick	benzophenone-3, methylparaben, propylparaben	Click here for images

General products

Image 1: Front label

Image 1: Back label

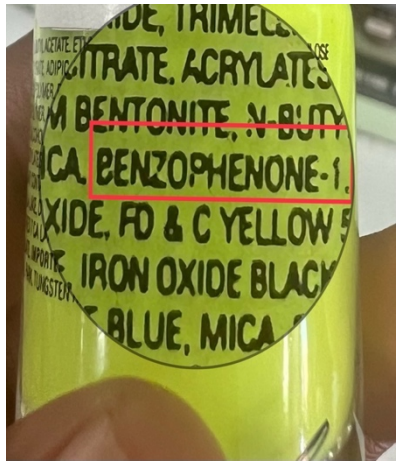
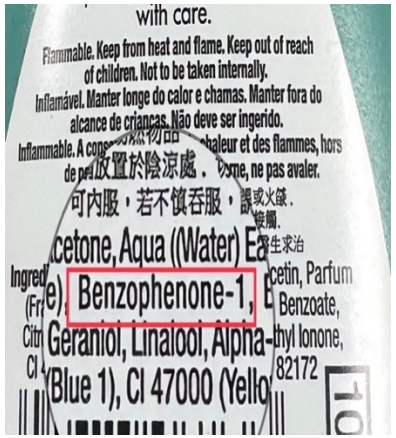


Image 2: Front label

Image 2: Back label



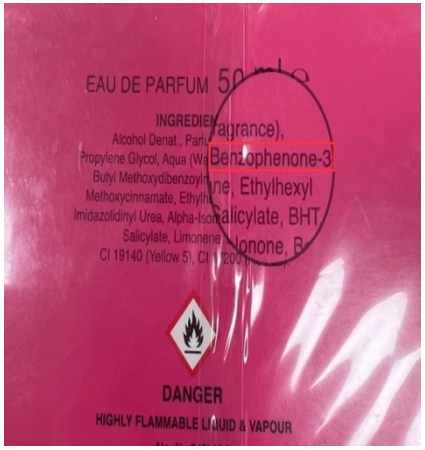
General products continued

Image 3: Front label

Image 3: Front label

Image 4: Front label

Image 4: Front label



General products continued

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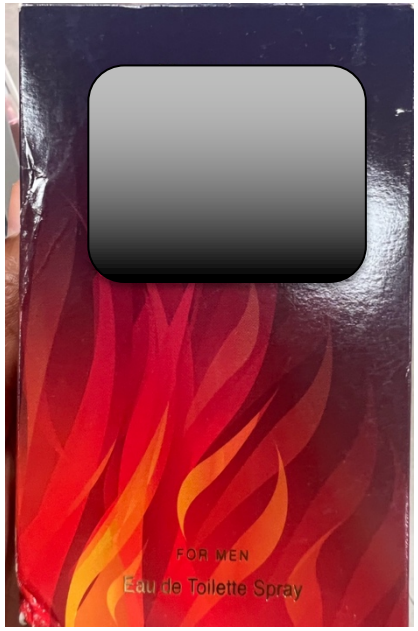

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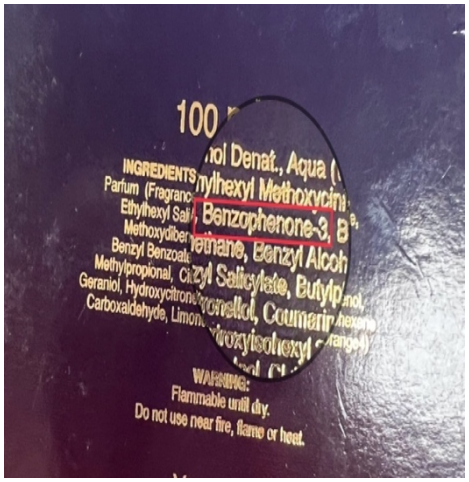

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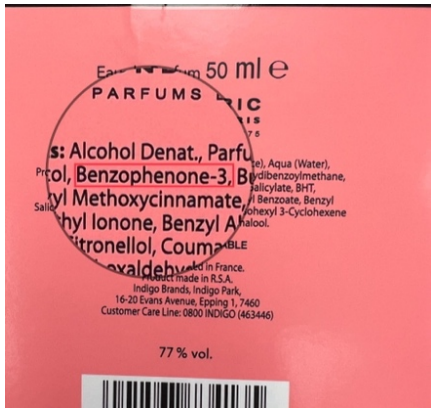
Image 6: Front label

General products continued

Image 7: Front label

Image 7: Front label



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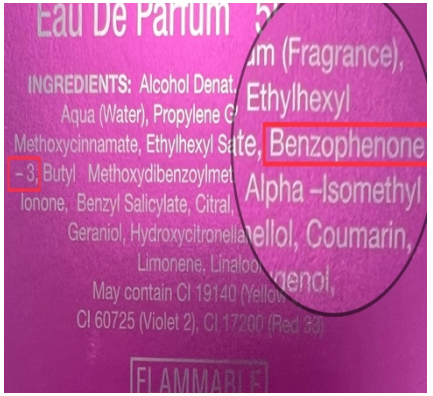


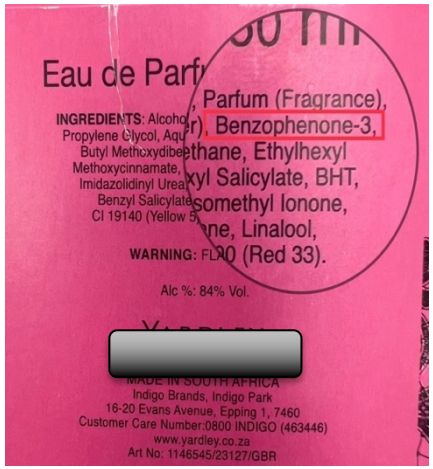
General products continued

Image 9: Front label

Image 9: Front label

Image 10: Front label

Image 10: Front label



General products continued

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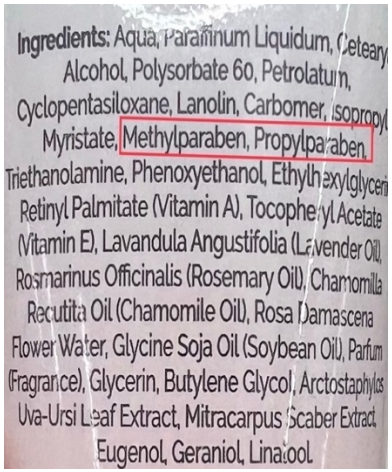
Image 11: Front label



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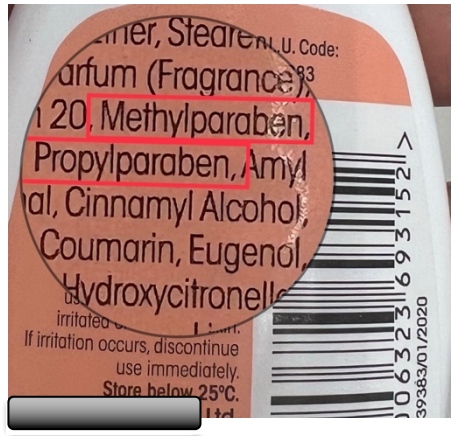

General products continued

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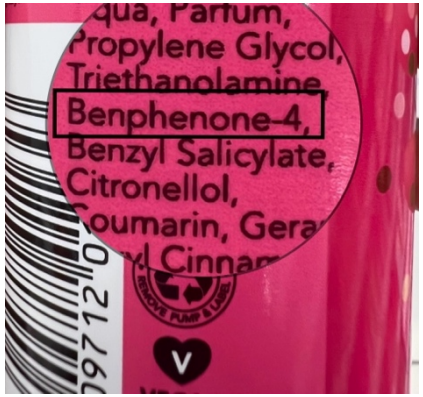

Makeup products

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Image 1: Back label

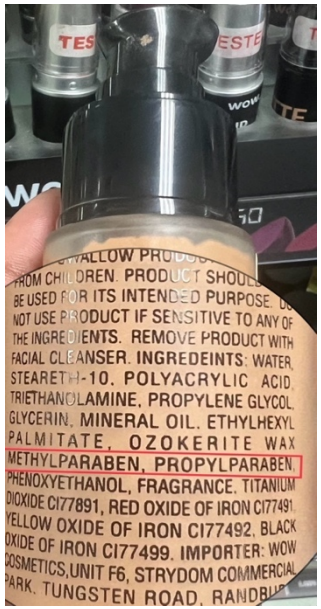

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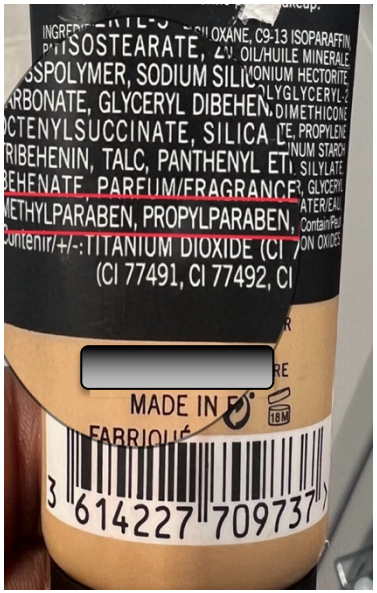
Image 2: Back label



Makeup products continued

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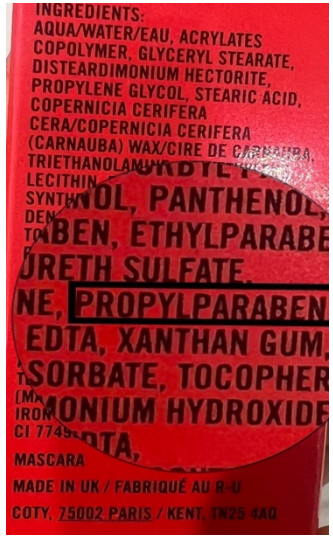
Image 3: Back label



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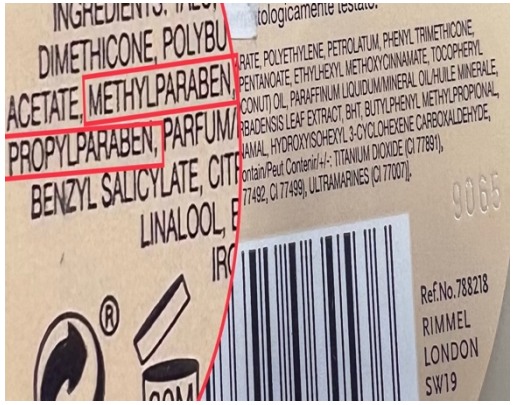

Makeup products continued

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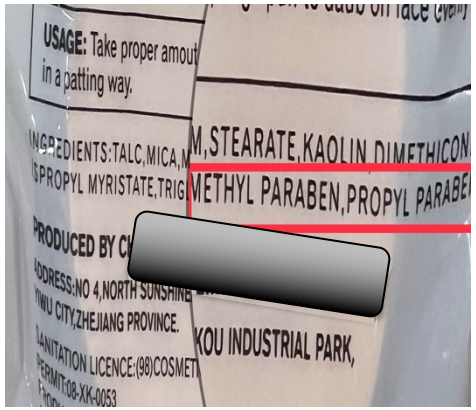
Image 5: Back label

Image 6: Front label

Image 6: Back label



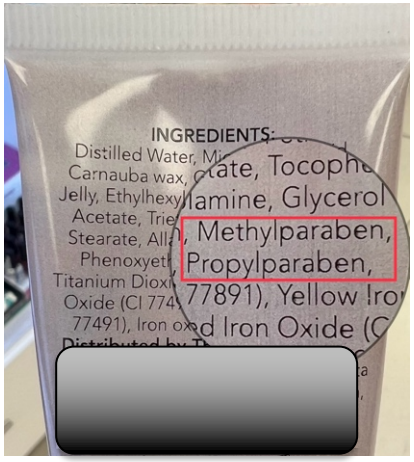
Makeup products continued

Image 7: Front label

Image 7: Back label

Image 8: Front label

Image 8: Back label



Makeup products continued

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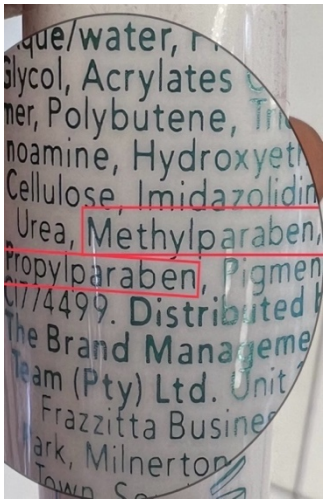
Image 9: Front label



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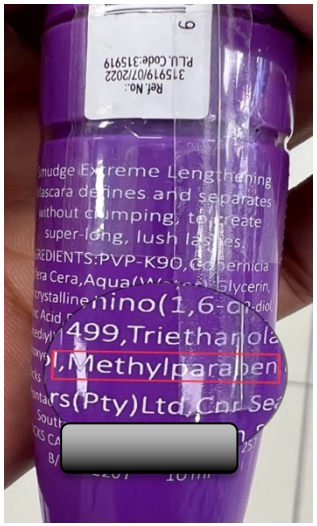

Makeup products continued

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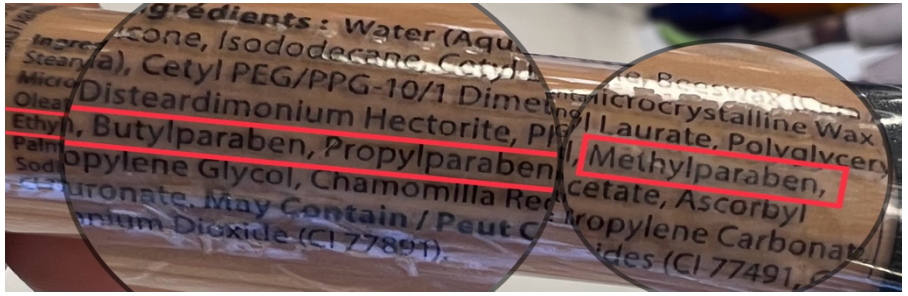
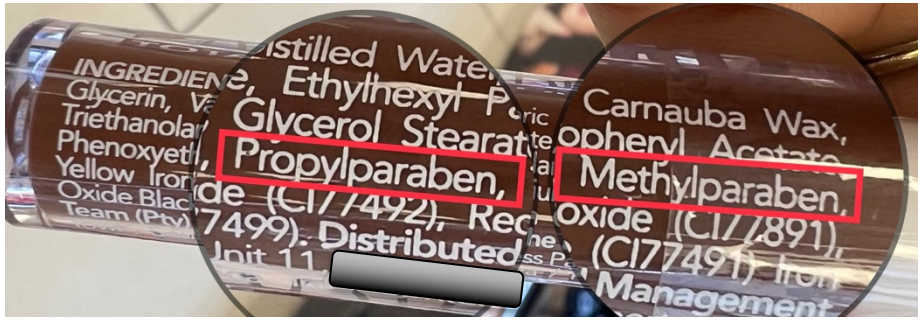
Image 11: Front label



Makeup products continued

Image 12: Front label

Image 12: Back label



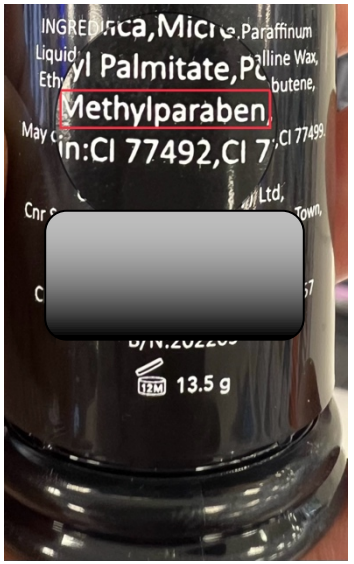
Makeup products continued

Image 13: Front label

Image 13: Back label

Image 14: Front label

Image 14: Back label



Bath and shower products

Image 1: Front label

Image 1: Front label

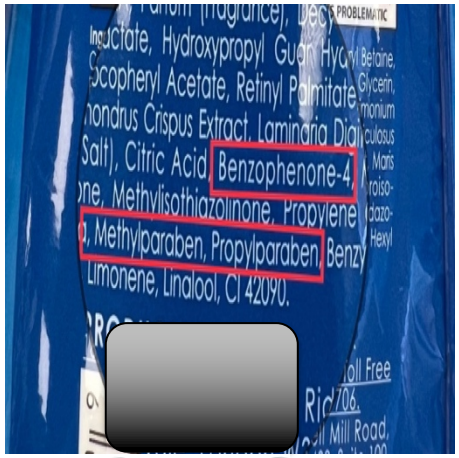
Image 2: Front label

Image 2: Front label

Bath and shower products continued

Image 3: Front label

Image 3: Front label



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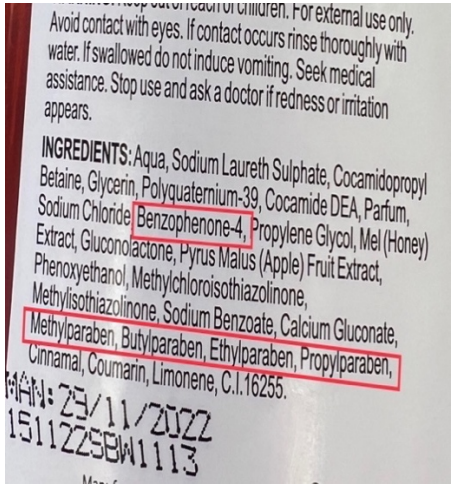
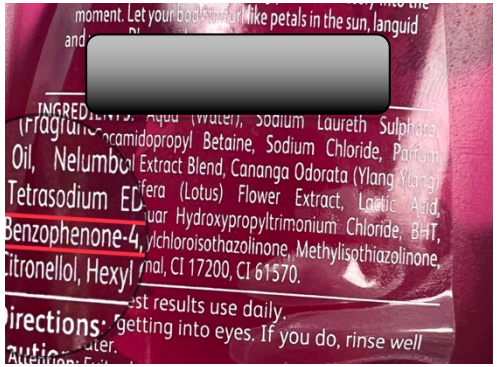
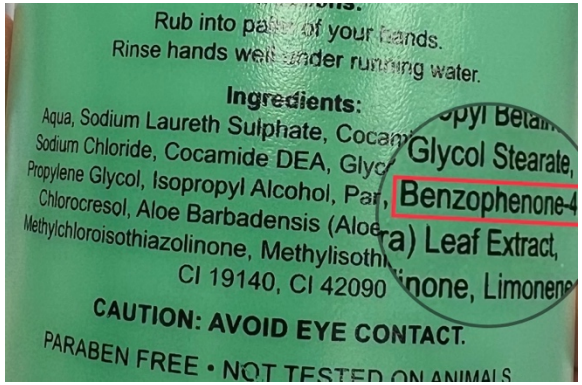


Bath and shower products continued

Image 5: Front label **Image 5: Back label** **Image 6: Front label** **Image 6: Back label**

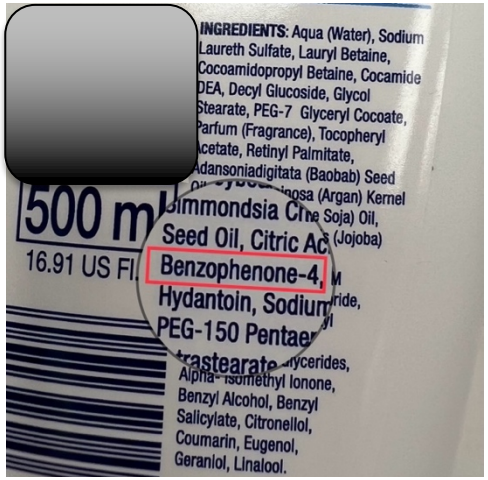




Bath and shower products continued

Image 7: Front label

Image 7: Back label



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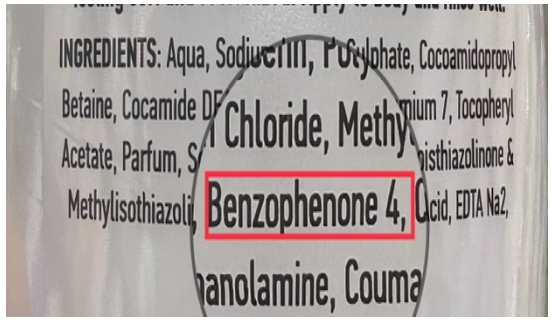


Bath and shower products continued

Image 9: Front label

Image 9: Back label

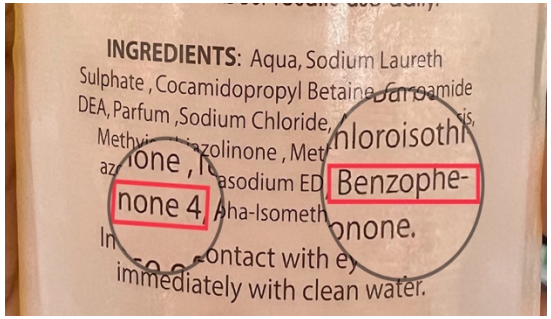


Image 10: Front label

Image 10: Back label

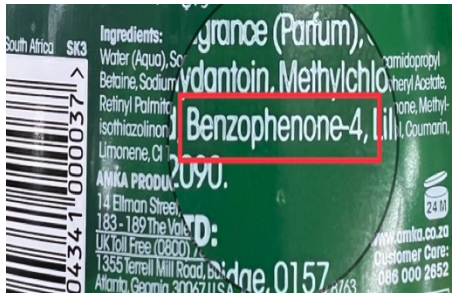
Bath and shower products continued

Image 11: Front label

Image 11: Back label

Image 12: Front label

Image 12: Back label



Bath and shower products continued

Image 13: Front label

Image 13: Back label

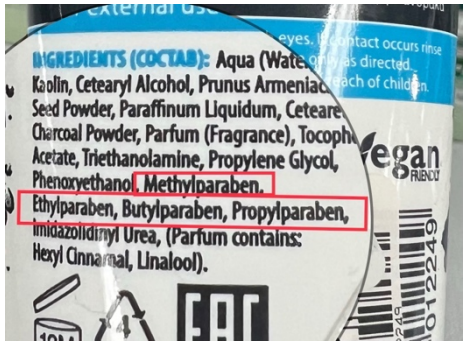


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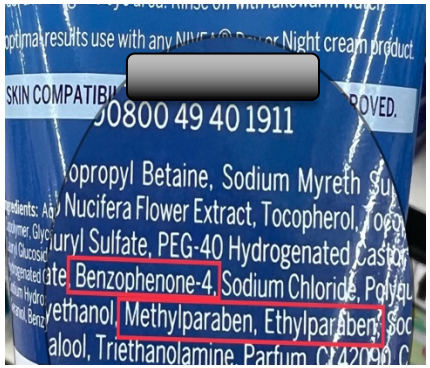
Image 14: Back label



Bath and shower products continued

Image15: Front label

Image 15: Back label

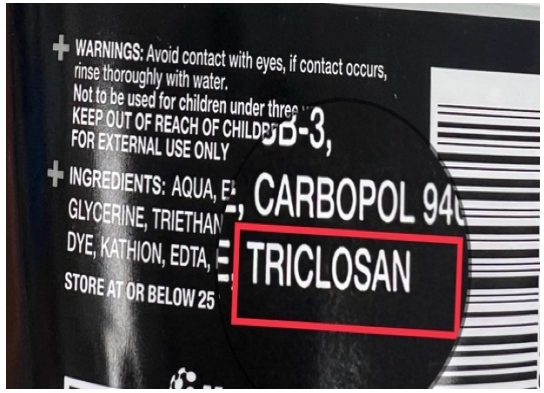
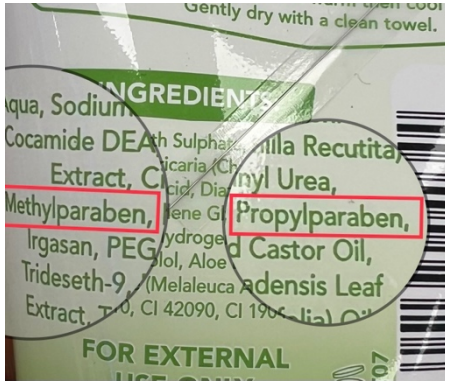


Image 16: Front label

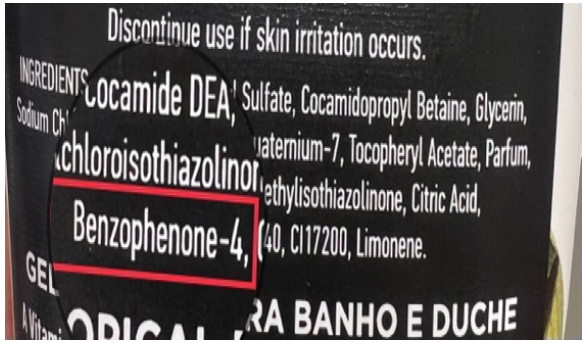
Image 16: Back label



Bath and shower products continued

Image 17: Front label

Image 17: Back label



Hair care products

Image1: Front label

Image 1: Back label

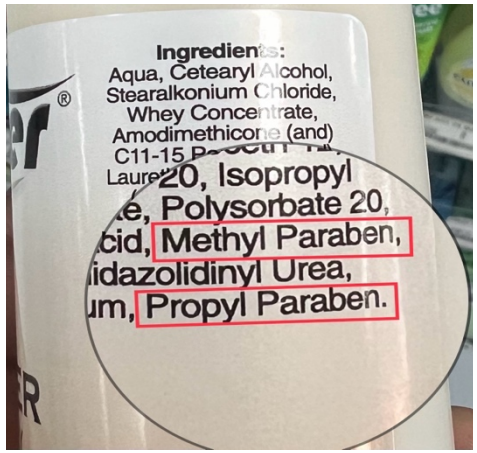
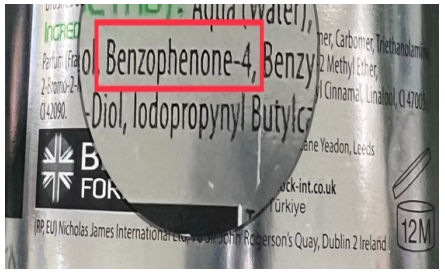


Image 2: Front label

Image 2: Back label



Hair care products continued

Image3: Front label

Image 3: Back label

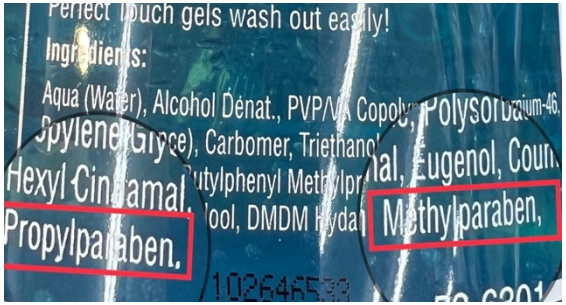
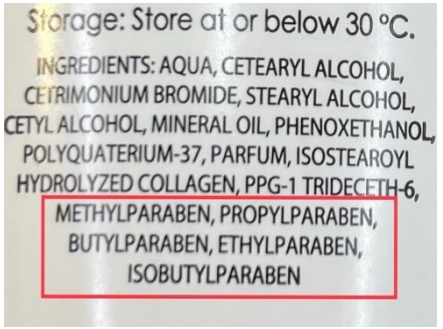


Image 4: Front label

Image 4: Back label



Hair care products continued

Image 5: Front label

Image 5: Back label

Image 6: Front label

Image 6: Back label

Hair care products continued

Image 7: Front label

Image 7: Back label

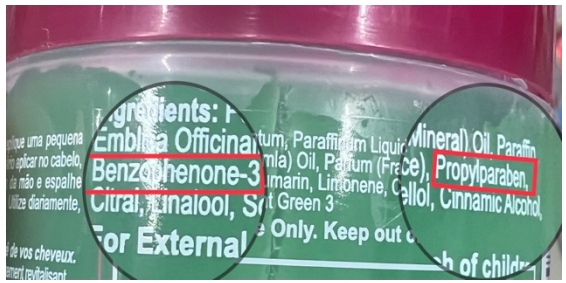
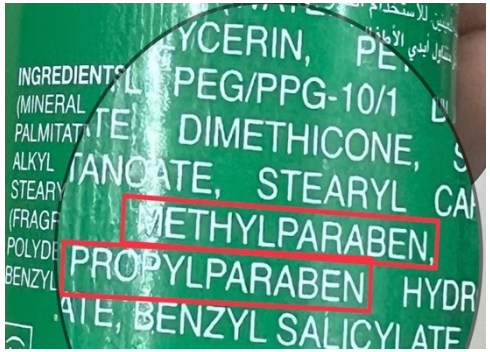


Image 8: Front label

Image 8: Back label



Hair care products continued

Image 9: Front label

Image 9: Back label

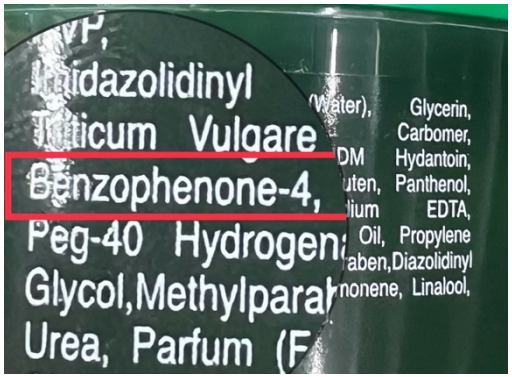
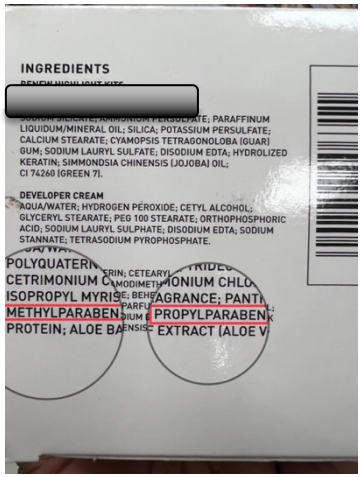


Image 10: Front label

Image 10: Back label



Hair care products continued

Image 11: Front label

Image 11: Back label

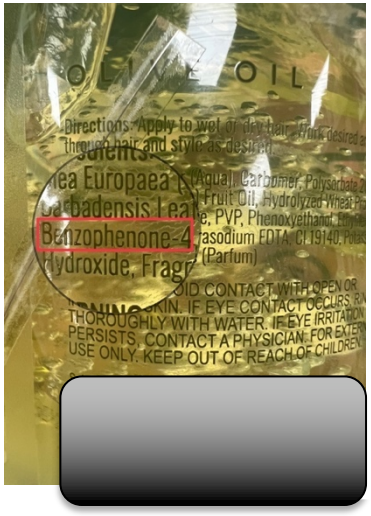
Image 12: Front label

Image 12: Back label

Hair care products continued

Image 13: Front label

Image 13: Back label



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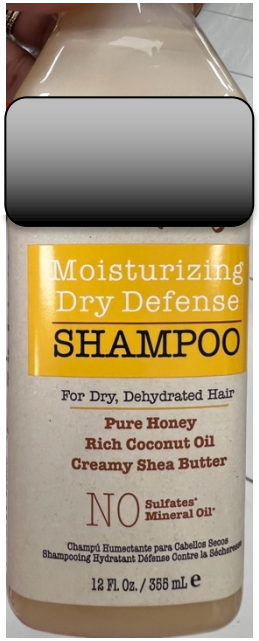

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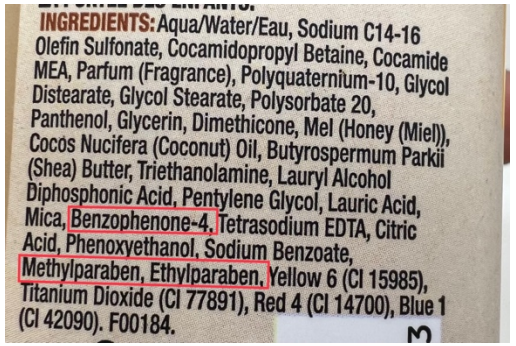
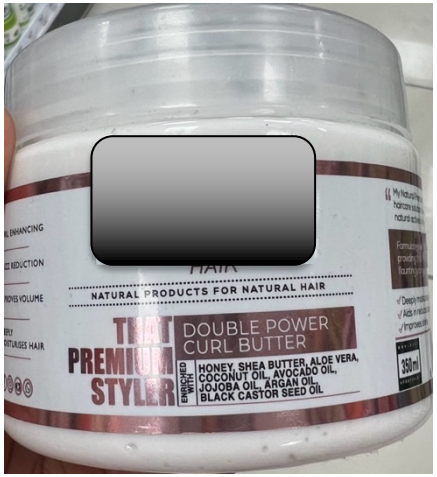


Hair care products continued

Image 15: Front label



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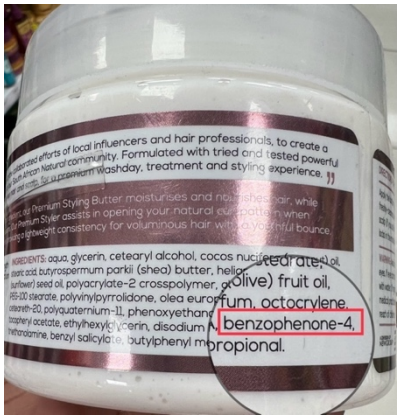
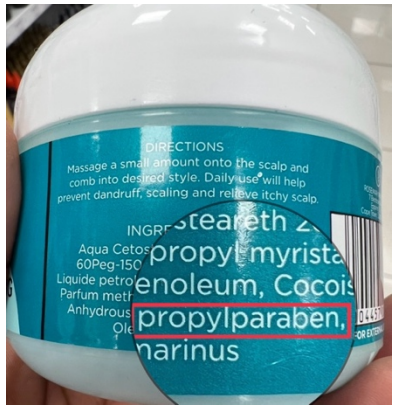


Image 16: Front label

Image 16: Back label



Hair care products continued

Image 17: Front label

Image 17: Back label

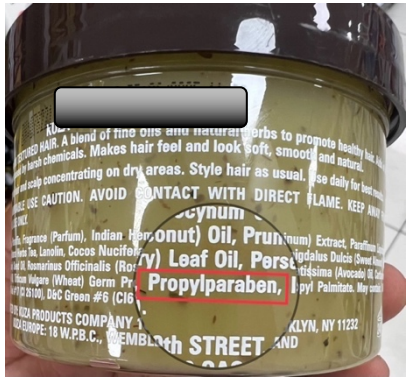


Image 18: Front label

Image 18: Back label

Hair care products continued

Image 19: Front label

Image 19: Back label

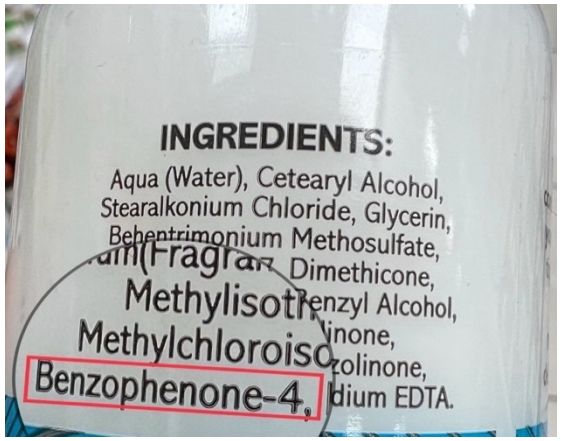


Image 20: Front label

Image 20: Back label

Hair care products continued

Image 21: Front label

Image 21: Back label

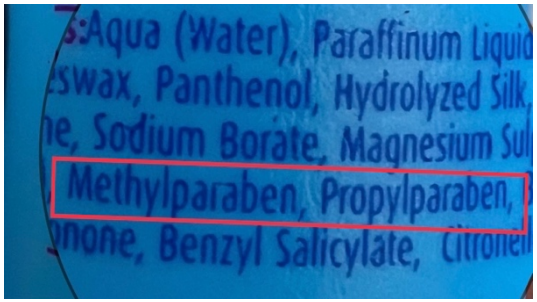
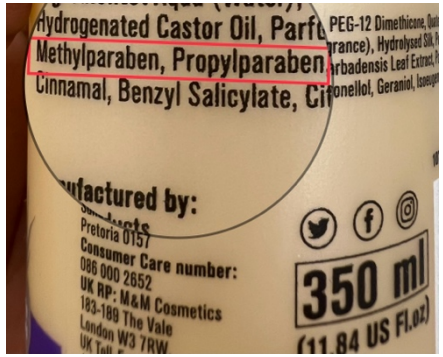


Image 22: Front label

Image 22: Back label



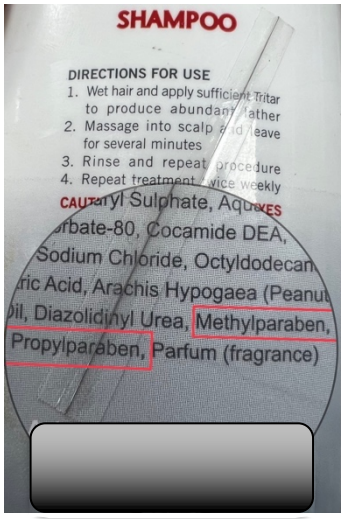
Hair care products continued

Image 23: Front label

Image 23: Back label

Image 24: Front label

Image 24: Back label



Hair care products continued

Image 25: Front label

Image 25: Back label

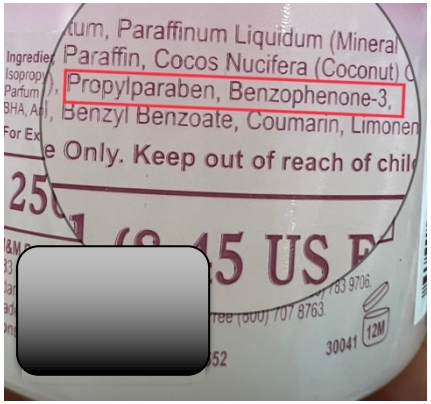


Image 26: Front label

Image 26: Back label

Hair care products continued

Image 27: Front label

Image 27: Back label

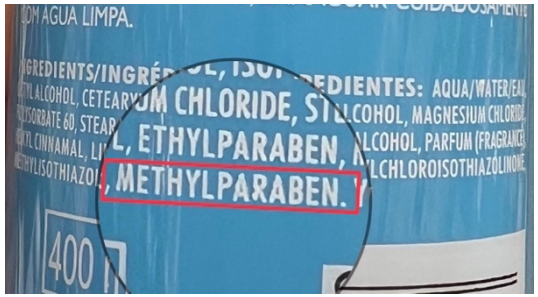
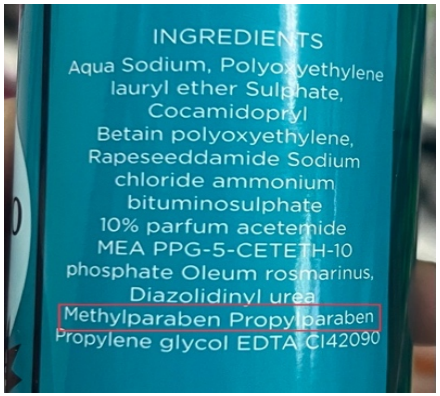


Image 28: Front label

Image 28: Back label



Hair care products continued

Image 29: Front label

Image 29: Back label

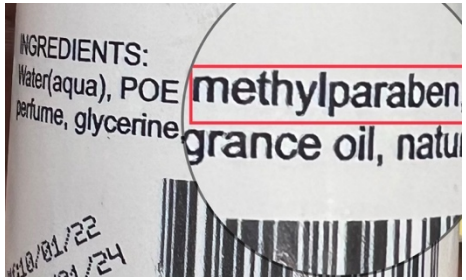
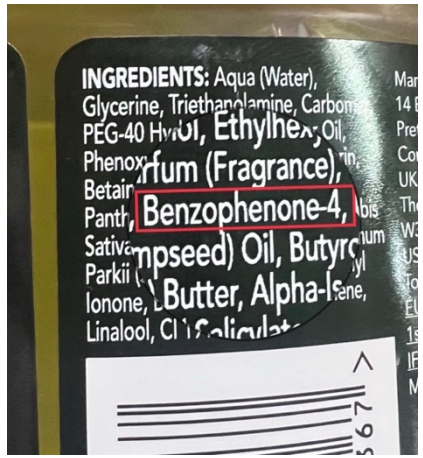


Image 30: Front label

Image 30: Back label



Hair care products continued

Image 31: Front label

Image 31: Back label

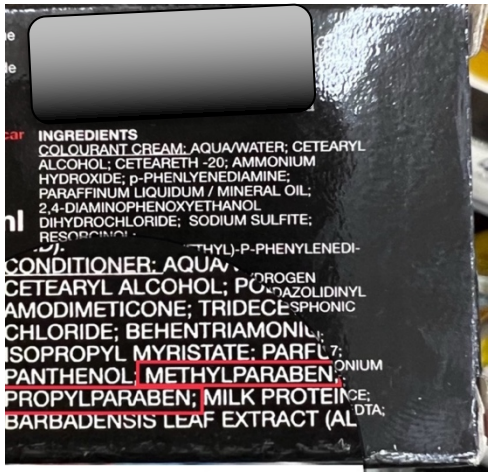


Image 32: Front label

Image 32: Back label

Skincare products

Image 1: Front label

Image 1: Back label

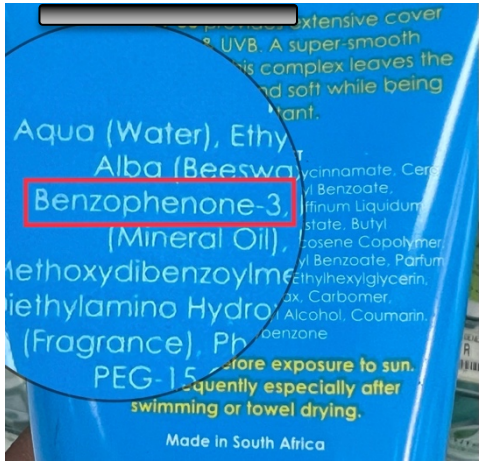
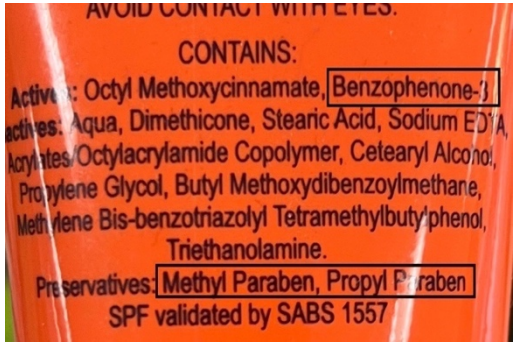


Image 2: Front label

Image 2: Back label



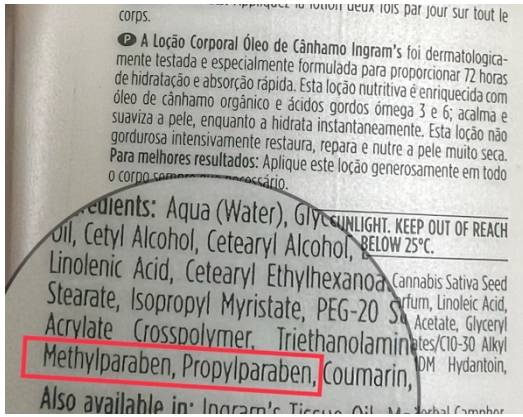
Skincare products continued

Image 3: Front label

Image 3: Back label

Image 4: Front label

Image 4: Back label



Skincare products continued

Image 5: Front label

Image 5: Back label

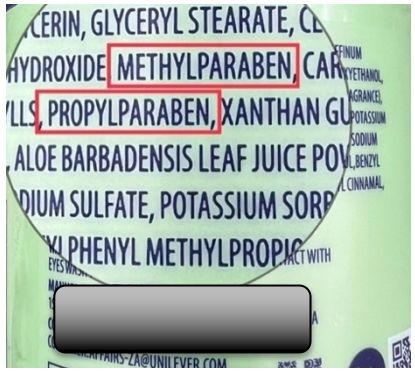
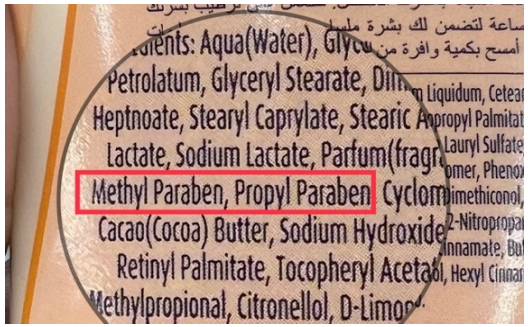


Image 6: Front label

Image 6: Back label



Skincare products continued

Image 7: Front label

Image 7: Back label

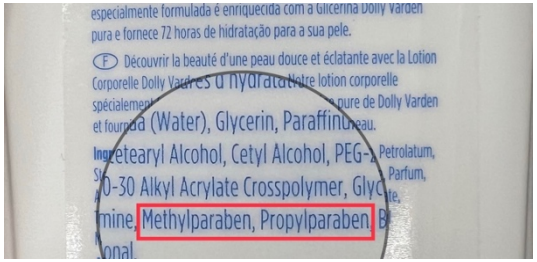
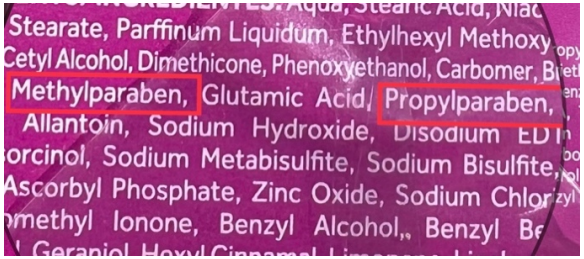


Image 8: Front label

Image 8: Back label



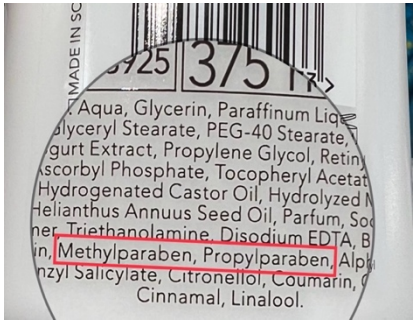
Skincare products continued

Image 9: Front label

Image 9: Back label

Image 10: Front label

Image 10: Back label



Skincare products continued

Image 11: Front label

Image 11: Back label

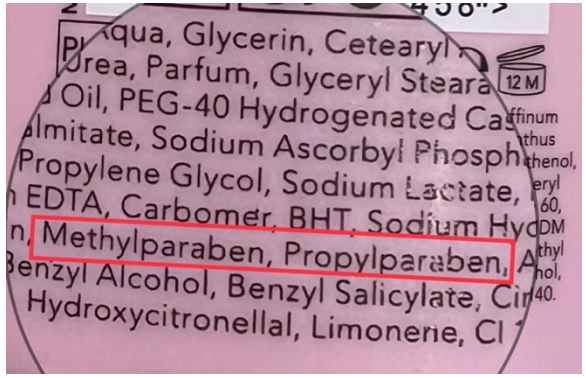
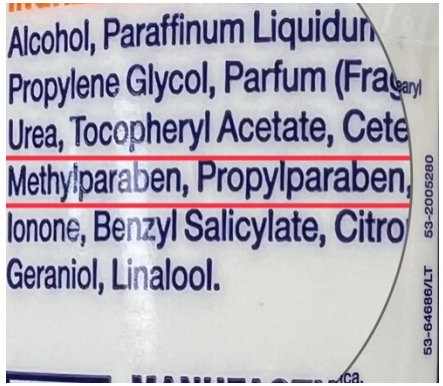


Image 12: Front label

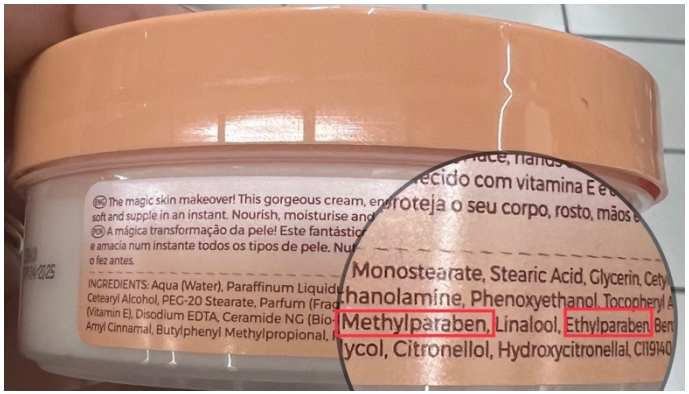
Image 12: Back label



Skincare products continued

Image 13: Front label

Image 13: Back label



Skincare products continued

Image 14: Front label

Image 14: Back label

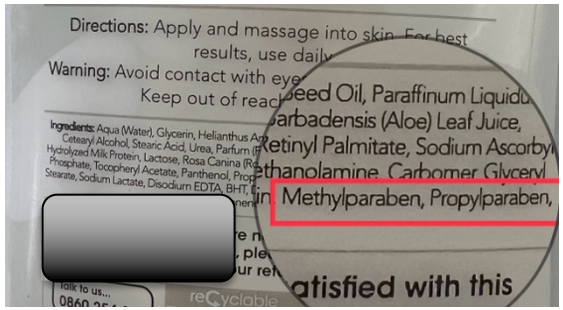
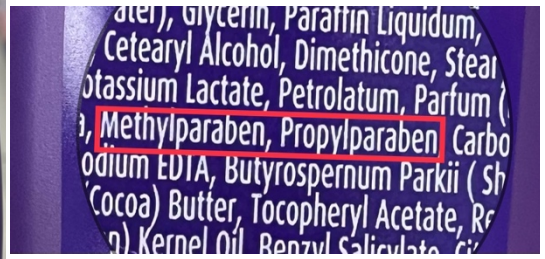


Image 15: Front label

Image 15: Back label



Skincare products continued

Image 16: Front label

Image 16: Back label

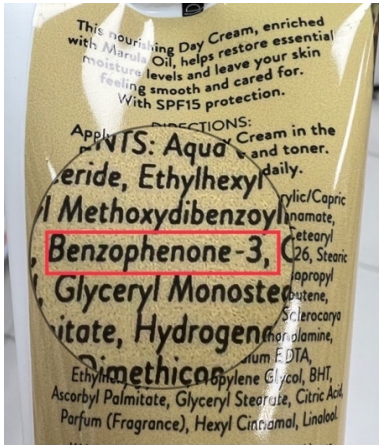
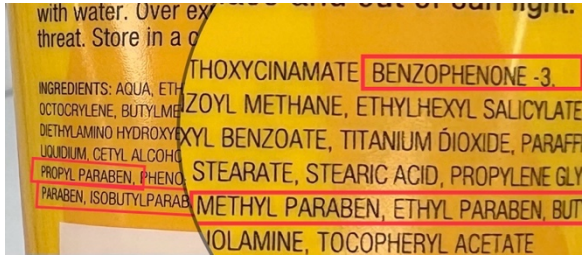


Image 17: Front label

Image 17: Back label



Skincare products continued

Image 18: Front label

Image 18: Back label

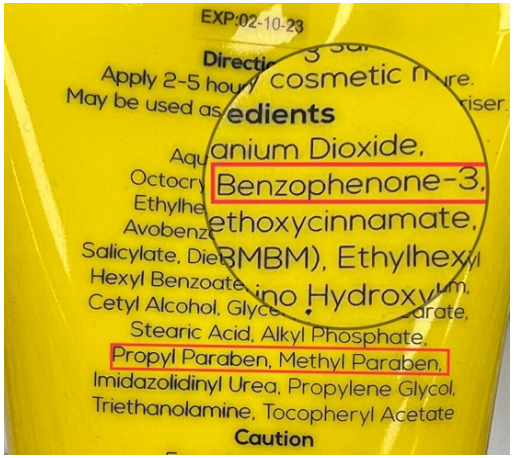
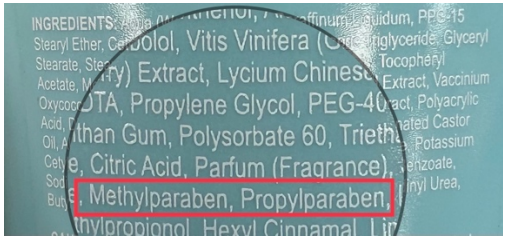


Image 19: Front label

Image 19: Back label



Skincare products continued

Image 20: Front label

Image 20: Back label

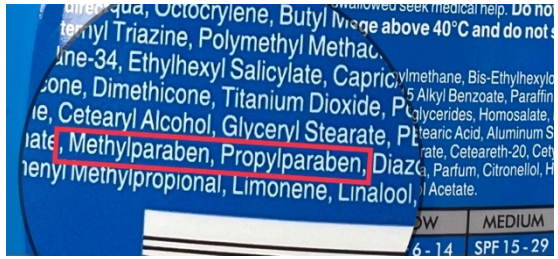
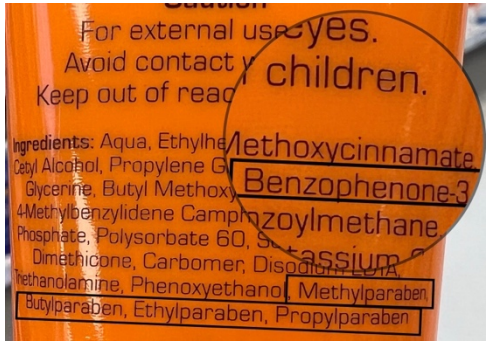


Image 21: Front label

Image 21: Back label



Skincare products continued

Image 22: Front label

Image 22: Back label

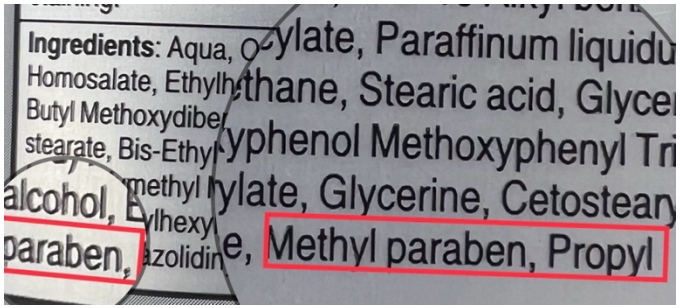


Image 23: Front label

Image 23: Back label

Skincare products continued

Image 24: Front label

Image 24: Back label

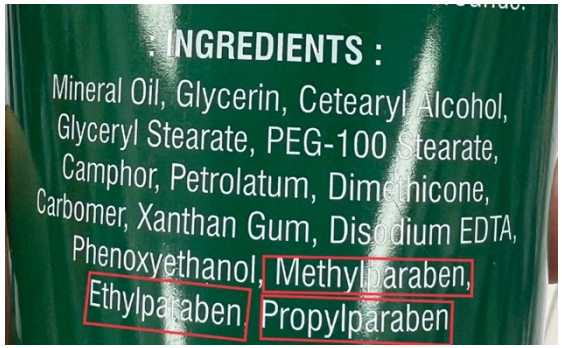
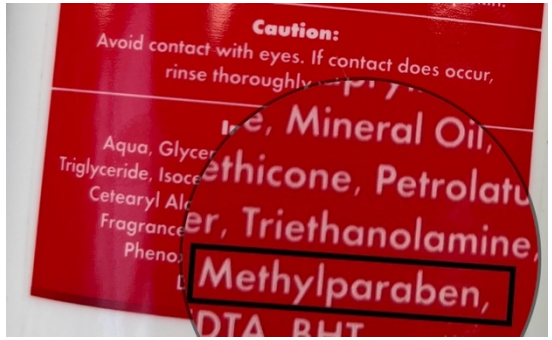


Image 25: Front label

Image 25: Back label



Skincare products continued

Image 26: Front label

Image 26: Back label

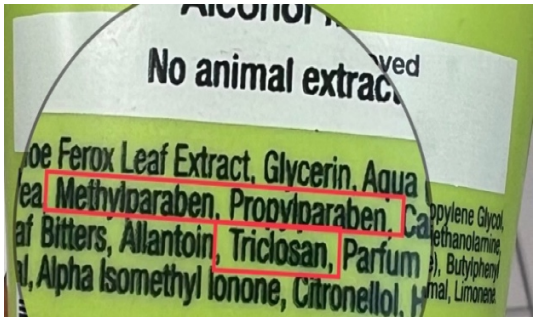
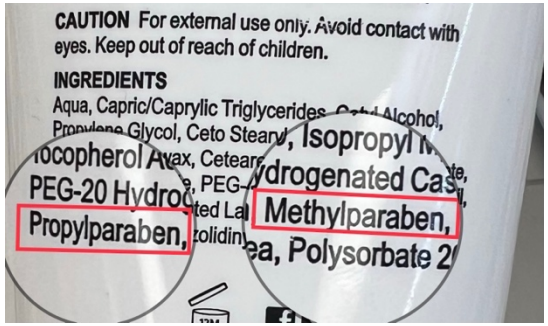


Image 27: Front label

Image 27: Back label



Skincare products continued

Image 28: Front label

Image 28: Back label

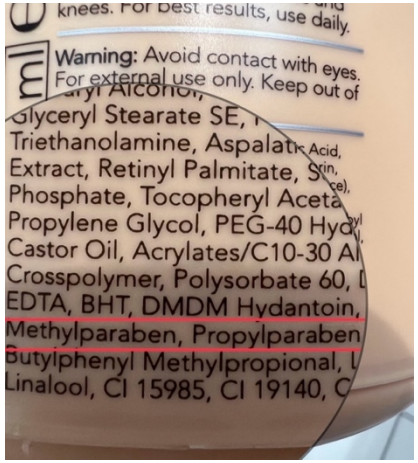


Image 29: Front label

Image 29: Back label

Facial products

Image 1: Front label

Image 1: Back label

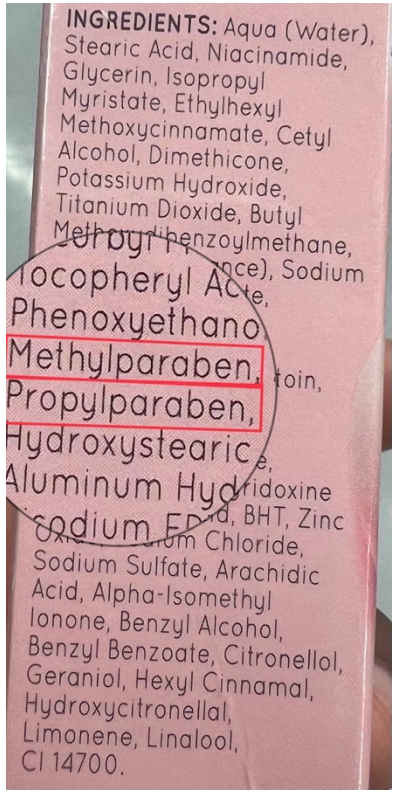
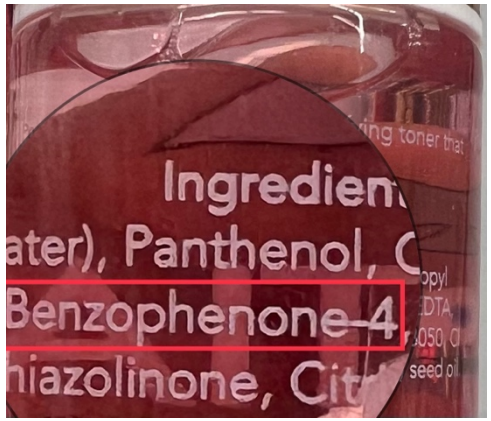


Image 2: Front label

Image 2: Back label



Facial products continued

Image 3: Front label

Image 3: Back label

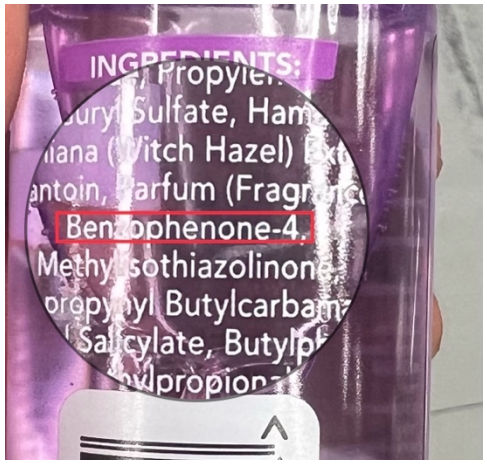
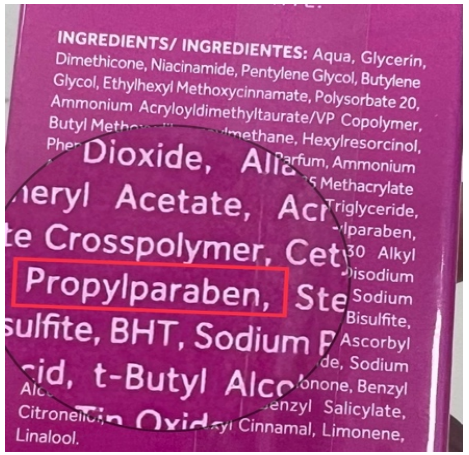


Image 4: Front label

Image 4: Back label



Facial products continued

Image 5: Front label

Image 5: Back label

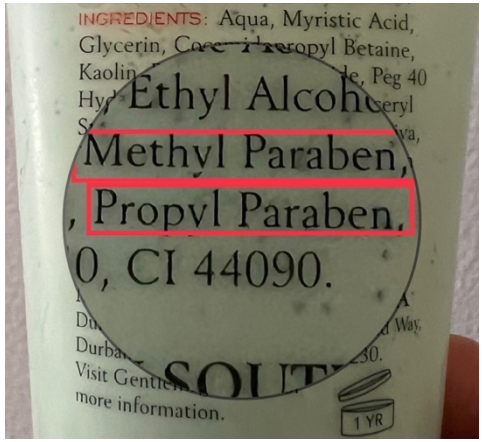


Image 6: Front label

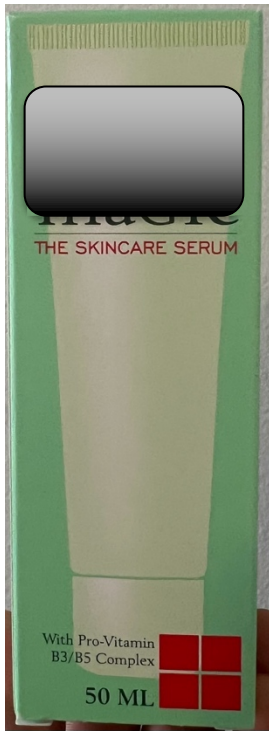
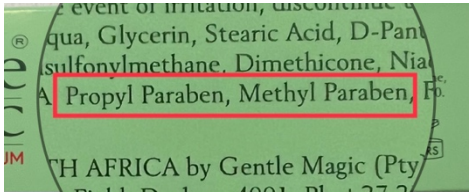


Image 6: Back label



Facial products continued

Image 7: Front label

Image 7: Back label

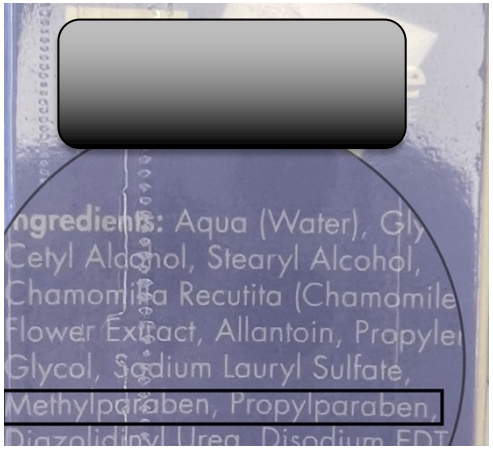
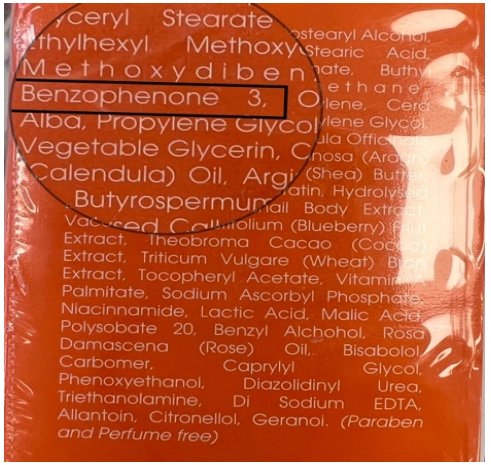


Image 8: Front label

Image 8: Back label



Facial products continued

Image 9: Front label

Image 9: Back label

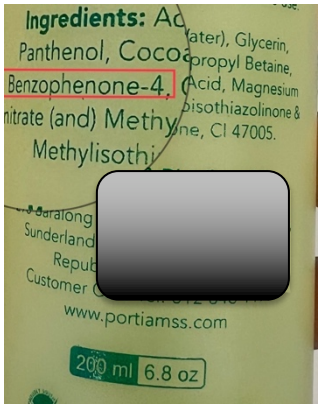
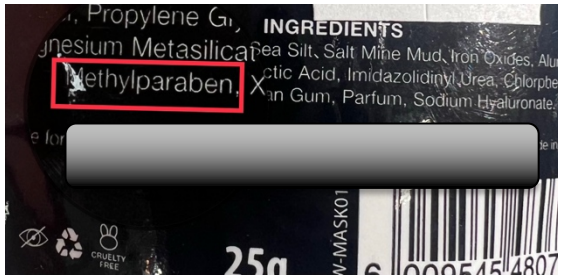


Image 10: Front label

Image 10: Back label



Facial products continued

Image 11: Front label

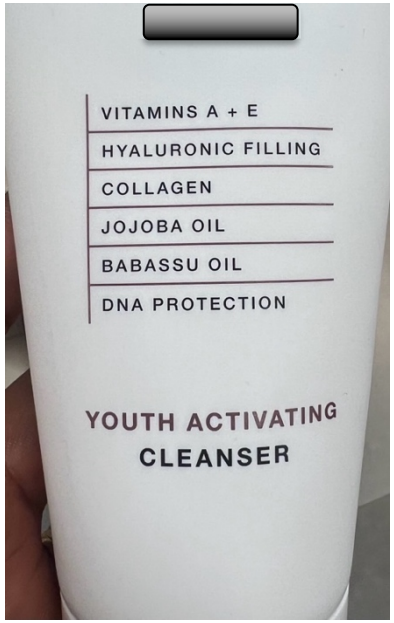
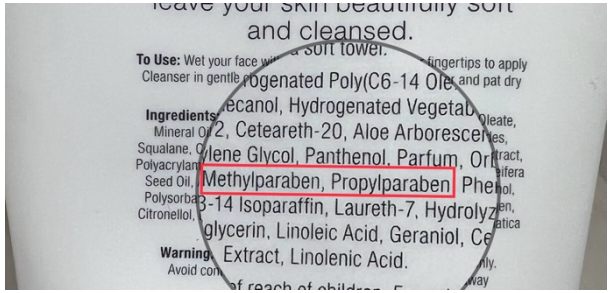


Image 11: Back label



Lip care products

Image 1: Front label

Image 1: Back label

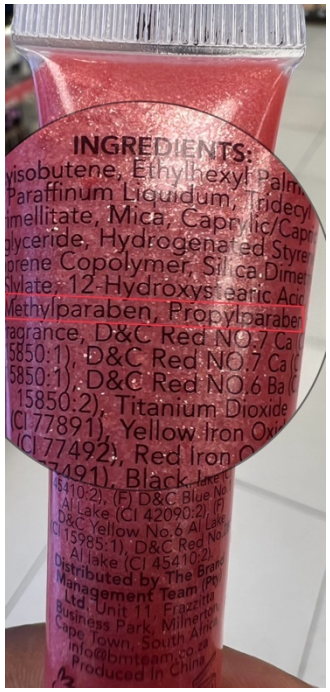
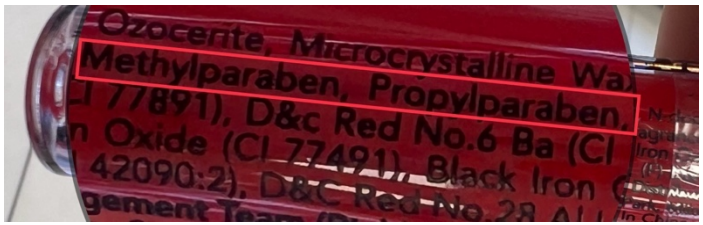


Image 2: Front label

Image 2: Back label



Lip care products continued

Image 3: Front label

Image 3: Back label

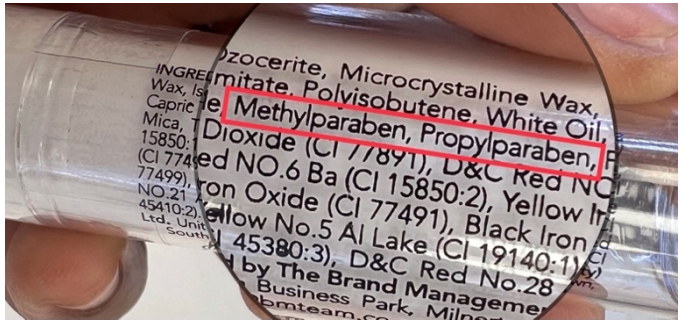


Image 4: Front label

Image 4: Back label

Lip care products continued

Image 5: Front label

Image 5: Back label

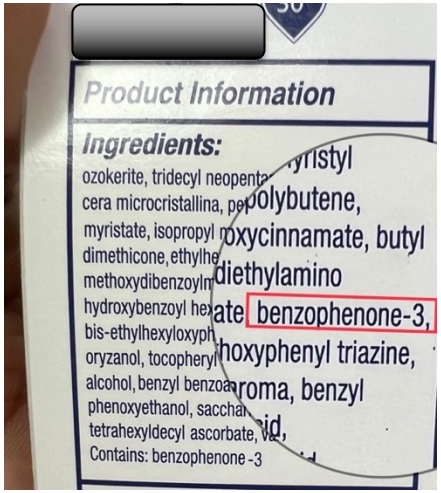
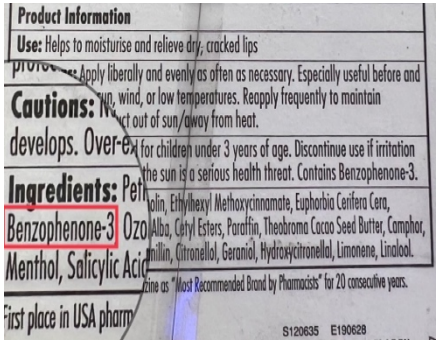


Image 6: Front label

Image 6: Back label



Lip care products continued

Image 7: Front label

Image 7: Back label

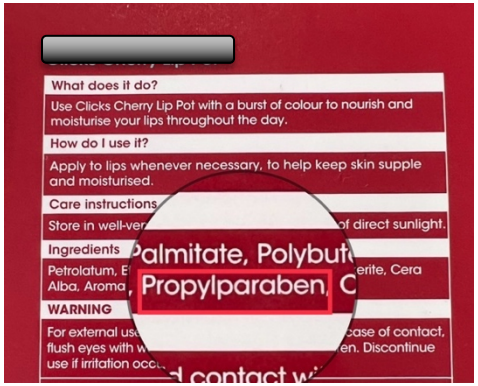
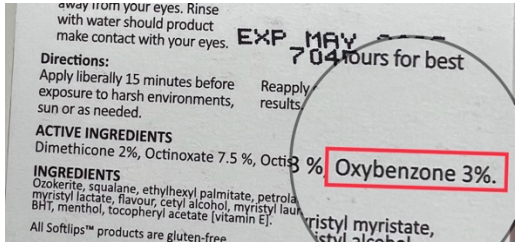


Image 8: Front label

Image 8: Back label



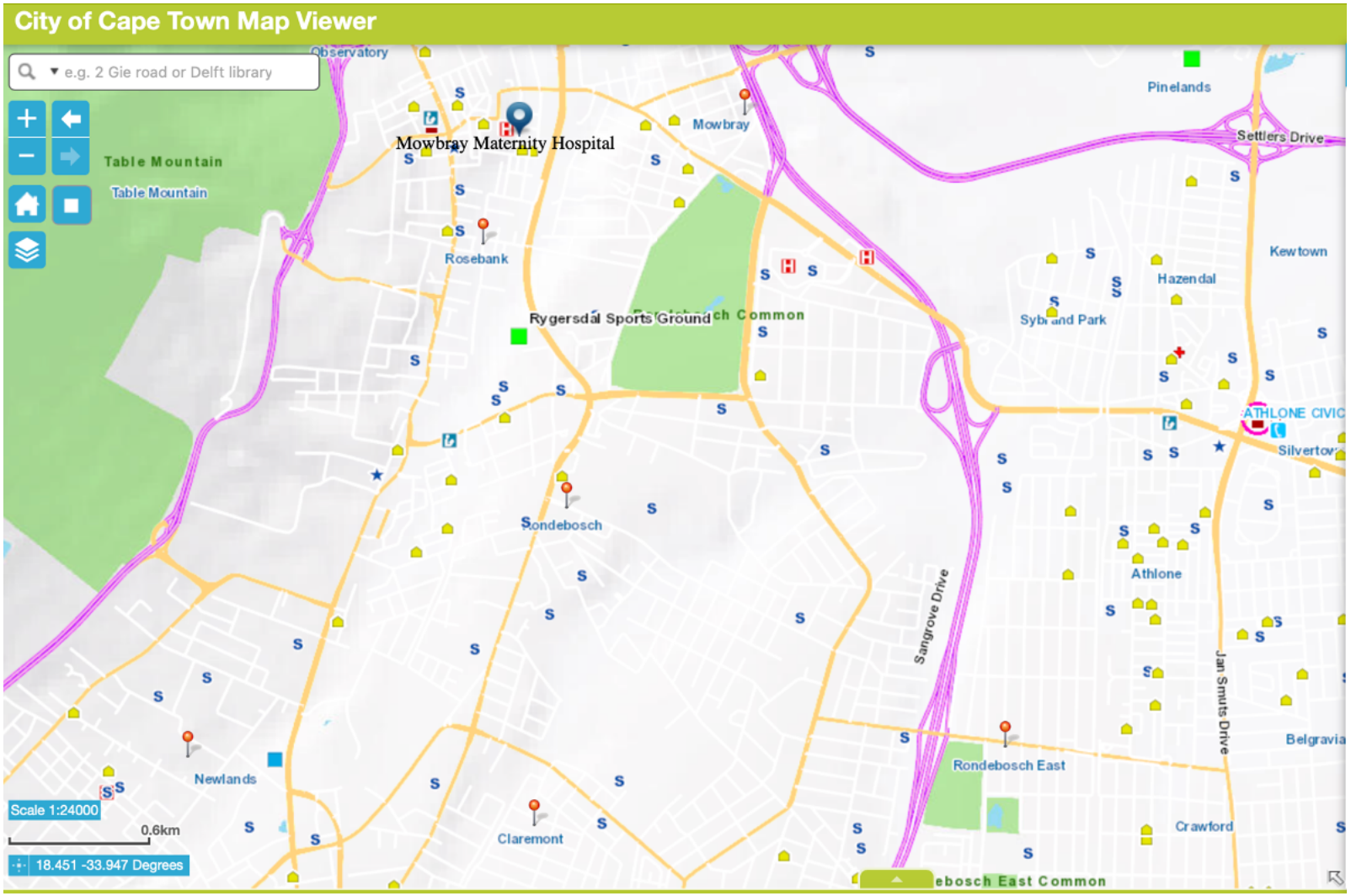


Fig.S1. Geographic distribution of participants' residential areas within the catchment area served by Mowbray Maternity Hospital

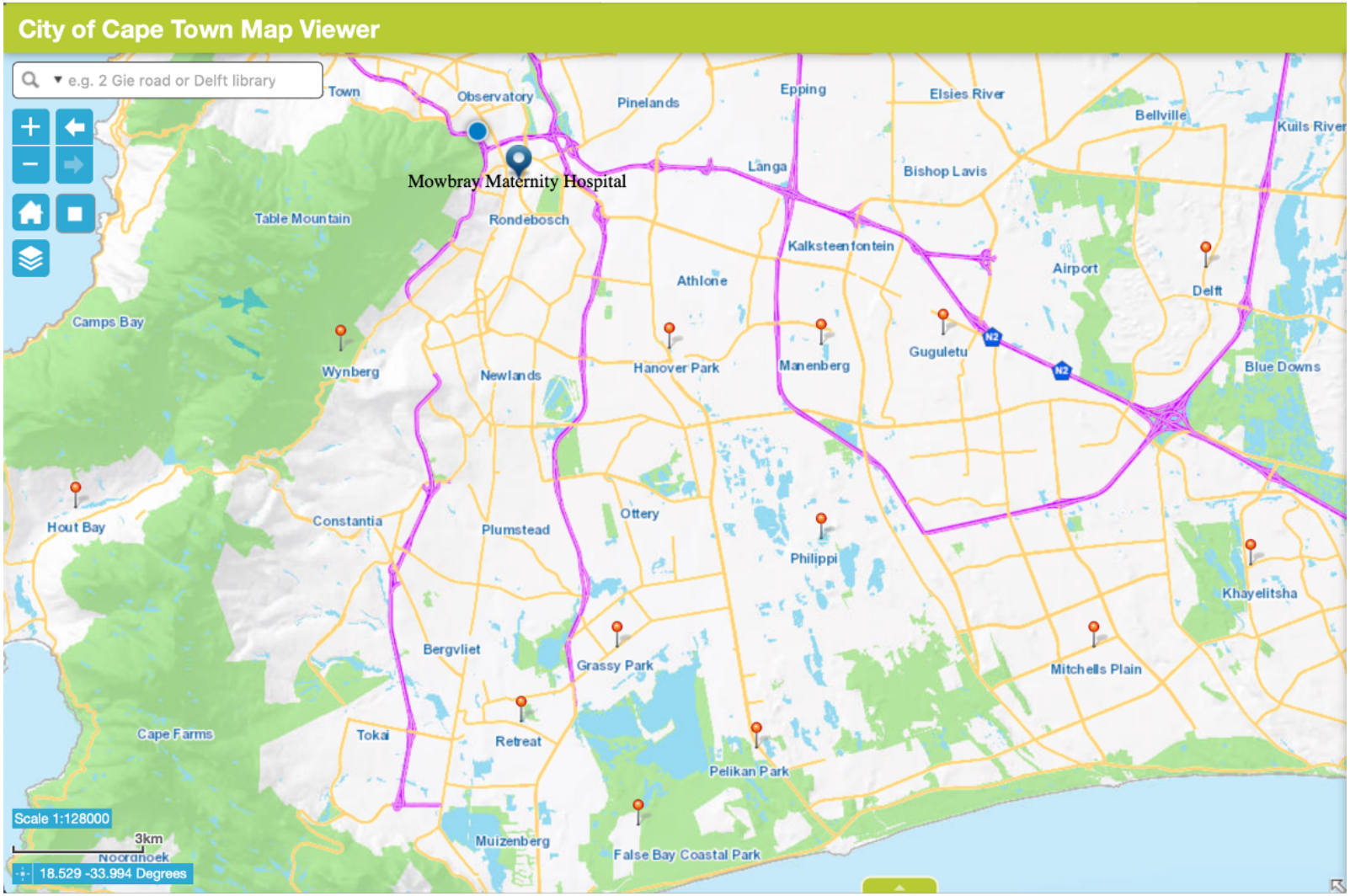


Fig.S2. Geographic distribution of participants' residential areas outside the immediate catchment area

NB. These maps were accessed via The City of Cape Town Map and Zoning Viewer, an online mapping tool. Participants' residential areas are indicated with a location symbol

PART C: APPENDICES

Appendix A Consent Form (English)

Student: Lissa Paul
Student number: PLXLIS002
University supervisor: Professor Andrea Rother
Place of Study: University of Cape Town

Research Topic: Harmful chemicals in hygiene and grooming products: what you know, feel, and understand about them.

My name is Lissa Paul, and I am a Master of Public Health student at the **University of Cape Town (UCT)**. As part of my studies, I am required to conduct a mini research. My research aims to see what pregnant women understand about toxic chemicals found in hygiene and beauty products and how these chemicals affect the health of the expecting mother and the unborn baby. As you are currently pregnant, I ask your permission to enrol you as a participant in this study. The survey will take you about **25-30 minutes** to complete. To thank you for completing the survey, you will receive a KFC lunch voucher. You will also be given an information sheet with tips on what to consider when choosing hygiene and grooming products.

In this study, **harmful chemicals** refer to ingredients added during the manufacturing of hygiene and beauty products that can harm the body's hormonal system.

In this study, **hygiene and beauty products** refer to products that are used daily to clean the body, hair, and mouth and enhance beauty. Examples include body lotions, deodorants, and shampoos.

This survey is confidential. Only the researcher and the supervisor will have access to your responses. **Your participation is voluntary.** You have the right to refuse to participate or stop participating at any time without facing any problems. For learning purposes, we value your honesty in answering the questions.

For any questions or comments about this study, you can contact the Principal Investigator or UCT ethics committee chairperson on the following contact details:

Prof. Andrea Rother
Division of Environmental Health
School of Public Health and Family Medicine
University of Cape Town
Anzio Road,
Observatory 7925
Phone number: (+27) 21 404 7661
Email: environmentalhealth@uct.ac.za
If you would like to contact the board of ethics with any queries or questions, please feel free to contact them on the following contact details:

Shuretta Thomas
Human Research Ethics Committee Administrator
Faculty of Health Sciences
University of Cape Town
E52, room 24, old main building
Groote Schuur Hospital
Observatory, Cape Town
South Africa
Phone number: (+27) 21 406 6338
Email: shuretta.thomas@uct.ac.za

I have read and understood all the information provided to me about the study and I agree to participate in this study.

YES	NO
☐	☐

Name of participant:(print in block letters) _____

Signature or cross (X): _____

Date: _____

Name of interviewer:(print in block letters) _____

Date: _____

Appendix B. Consent Form (IsiXhosa)

Umfundi: Lissa Paul
Inombolo yomfundi: PLXLIS002
Umphononongi weYunivesithi: Professor Andrea Rother
Indawo Yokufunda: Iyunivesithi yaseKapa

Umxholo woPhando: iikhemikhali eziyingozi kwizithambiso: ulwazi, izimo zengqondo, kunye neembono phakathi kwabasetyhini abakhulelweyo base Mzantsi Afrika

Igama lam ndinguLissa Paul kwaye ndingumfundi we-Master of Public Health **kwiDyunivesithi yaseKapa (UCT)**. Njengenxalenye yezifundo zam, kufuneka ndenze uphando oluncinci. Uphando lwam lujolise ekuboneni ukuba abafazi abakhulelweyo baqonda ntoni malunga neekhemikhali ezifumaneka kucoceko kunye neemveliso zobuhle kunye nokuba ezi khemikhali ziyichaphazela njani impilo kamama okhulelweyo kunye nosana olungekazalwa. Njengoko ukhulelwe ngoku, ndicela imvume yakho ukuba ubhalise njengomthathi-nxaxheba kolu phononongo. Uphando luya kukuthatha malunga nemizuzu **engama-25-30 yemizuzu** ukugqiba. Ukubulela ngoku gqibezela uphando, uya kufumana ivawutsha yesidlo sasemini sakwa-KFC. Uya kunikwa kwakhona iphepha lolwazi kunye neengcebiso malunga nento onokuyiqwalasela xa ukhetha iimveliso zococeko kunye nokuzilungisa.

Kolu phononongo, **amachiza** ibhekisa kwizithako ezongezwa ngexesha lokwenziwa kococeko kunye neemveliso zobuhle eziyingozi empilweni.

Kolu phononongo, **ucoceko kunye neemveliso zobuhle** zibhekisa kwiimveliso ezisetyenziswa mihla le ukucoca umzimba, iinwele, nomlomo kunye nokuphucula ubuhle. Imizekelo ibandakanya izithambiso zomzimba, izikhupha, kunye neshampu.

Olu phando luyimfihlo. Kuphela ngumphandi kunye nomphathi oya kuba nokufikelela kwiimpendulo zakho. **Ukuthatha kwakho inxaxheba kukuzithandela.** Unelungelo lokwala ukuthatha inxaxheba okanye uyeke ukuthatha inxaxheba nangaliphi na ixesha ngaphandle kokujongana neziphumo. Ngeenjongo zokufunda, siyakuxabisa ukunyaniseka kwakho ekuphenduleni imibuzo.

Ngayo nayiphi na imibuzo okanye amagqabantshintshi ngolu phononongo, ungaqhagamshelana noMphandi oyiNtloko okanye usihlalo wekomiti ye-UCT yokuziphatha kwezi nkcukacha zilandelayo:

Prof. Andrea Rother
ICandelo leMpilo yokuSingqongileyo
Isikolo sempilo yoluntu kunye neSapho soNyango
IYunivesithi yaseKapa
Anzio Road,
Observatory 7925
Inombolo yomnxeba: (+27) 21 404 7661
I-imeyile: environmentalhealth@uct.ac.za
Ukuba ungathanda ukuqhagamshelana nebhodi yeenkqubo zokuziphatha ngayo nayiphi na imibuzo okanye imibuzo, nceda uzive ukhululekile ukuqhagamshelana nabo kwezi nkcukacha zilandelayo zoqhagamshelwano:

Shuretta Thomas
Human Research Ethics Committee administrator
Faculty of Health Sciences
University of Cape Town
E52, igumbi24, isakhiwo esidala esiphambili
Isibhedlele saseGroote Schur
Observatory, Cape Town
South Africa
Inombolo yomnxeba: (+27) 21 406 6338
I-imeyile: shuretta.thomas@uct.ac.za

Ndilufundile kwaye ndaluqonda lonke ulwazi endilunikiweyo malunga nophononongo kwaye ndiyavuma ukuthatha inxaxheba kolu phononongo.

EWE ☐ HAYI ☐

Igama lomthathi-nxaxheba:(printa ngoonobumba bebhloko) _____

Umsayino okanye umnqamlezo (X): _____

Umhla: _____

Igama lodliwano-ndlebe:(printa ngoonobumba bebhloko) _____

Umhla:_____

Appendix C. Consent Form (Afrikaans)

Student: Lissa Paul
Studentenommer: PLXLIS002
Universiteit studieleier: Professor Andrea Rother
Plek van studie: **Universiteit van Kaapstad**

Navorsingsonderwerp - Skadelike chemikalieë in higiëne en versorgingsprodukte: kennis, houdings en persepsies onder swanger vroue in Suid-Afrika.

My naam is Lissa Paul en ek is 'n Meestersgraad in Openbare Gesondheid-student van die **Universiteit van Kaapstad (UCT).** As deel van my studies word daar van my verwag om navorsing te doen. My navorsing se doel is om te bepaal wat swanger vrouens verstaan oor giftige chemikalieë wat in higiëne- en skoonheidsprodukte voorkom en hoe hierdie chemikalieë die gesondheid van die verwagtende moeder en die ongebore baba kan beïnvloed. Aangesien jy tans swanger is, vra ek jou toestemming om jou as deelnemer aan hierdie studie in te skryf. Die opname sal jou ongeveer **25–30-minute** neem om te voltooi. Om jou te bedank vir die voltooiing van die opname, sal jy 'n KFC-middagete bewys ontvang. Jy sal ook 'n inligtingsblad kry met wenke oor wat om te oorweeg wanneer jy higiëne- en versorging produkte kies.

In hierdie studie verwys **chemikalieë** na bestanddele wat bygevoeg word tydens die vervaardiging van higiëne- en skoonheidsprodukte wat skadelik vir die gesondheid is.

In hierdie studie verwys **higiëne- en skoonheidsprodukte** wat daagliks gebruik word om die liggaam, hare en mond skoon te maak en skoonheid te verbeter. Voorbeelde sluit in lyfroom, desodorante en sjampoe.

Hierdie studie is anoniem. Slegs die navorser en die studieleier sal toegang tot jou antwoorde hê. Jou deelname is vrywillig. Jy het die reg om enige tyd te weier om deel te neem of op te hou om deel te neem sonder om enige gevolge. Vir leer doeleindes waardeer ons jou eerlikheid in die beantwoording van die vrae.

Vir enige vrae of kommentaar oor hierdie studie, kan jy die Hoof Ondersoeker of UK-etiek komitee voorsitter kontak by die volgende kontakbesonderhede:

Prof. Andrea Rother
Afdeling Omgewingsgesondheid
Skool vir Openbare Gesondheid en Huisartskunde
Universiteit van Kaapstad
Anzio Road,
Observatory 7925
Telefoon nommer: (+27) 21 404 7661
E-pos: environmentalhealth@uct.ac.za

Indien jy die etiese raad wil kontak met enige navrae of vrae, kontak hulle asseblief op die volgende kontakbesonderhede:

Shuretta Thomas
Menslike Navorsingsetiekkomitee administrateur
Fakulteit Gesondheidswetenskappe
Universiteit van Kaapstad
E52, room 24, ou hoofgebou
Groote Schur Hospitaal
Observatory, Cape Town
South Africa
Telefoon nommer: (+27) 21 406 6338
E-pos:shuretta.thomas@uct.ac.za

Ek het al die inligting wat aan my verskaf is oor die studie gelees en verstaan en ek stem in om aan hierdie studie deel te neem.

JA ☐ GEEN ☐

Naam van deelnemer:(druk in blokletters) _____

Handtekening of kruis (X) : _____

Datum: _____

Naam van onderhoudvoerder:(druk in blokletters) _____

Datum:_____

Appendix D. Questionnaire (English)

Student: Lissa Paul
Student number: PLXLIS002
University supervisor: Professor Hanna Andrea Rother
Place of study: University of Cape Town

Participant Code: ☐

Section A: Demographic information

1. What is your age?

   18- 25 years ☐

   26- 33 years ☐

   34- 41 years ☐

   42-49 years ☐

2. What is your home language?

   English ☐

   Afrikaans ☐

   Isi-Xhosa ☐

   Zulu ☐

   Other (please specify) _____

3. Where do you live?

Mowbray ☐	Rosebank ☐	Rondebosch ☐
Rondebosch East ☐	Newlands ☐	Claremont ☐
False Bay ☐	Retreat ☐	Gugulethu ☐
Hanover Park ☐		

Other (please specify) _____

4. What is your employment status?

Unemployed ☐

Full time employed ☐

Student ☐

Part-time employed ☐

Seasonally employed ☐

5. What is your overall monthly income, including all sources of income?

No income ☐

R1- R5599 ☐

R5600- R40 000 ☐

More than R40 000 ☐

6. What is the highest level of education you have completed?

No education ☐

Grade 1-8 ☐

Grade 9-11 ☐

Grade 12 (Matric) ☐

Certificate ☐

Bachelor's Degree/Postgraduate diploma ☐

Master's degree ☐

Doctoral Degree ☐

Postdoctoral ☐

7. How many children do you have?

0 ☐

1 ☐

2 ☐

3 ☐

>4 ☐

Section B: Practice questions

8. Which of the following hygiene and beauty products do you use?

General hygiene products

Bar soap	☐	Body Lotion or cream	☐
Shower gel	☐	Roll-on	☐
Toothpaste	☐	Deodorant	☐
Mouthwash	☐	Other (please specify) _____	

Facial products

Facial cleanser	☐	Facial scrub	☐
Day Face cream	☐	Facial mask	☐
Night face cream	☐	Sunblock/sunscreen.	☐
Facial toner	☐		

Other (please specify) _____

Hair care products

Shampoo	☐	Conditioner	☐
Hair mask	☐	Hair dye	☐
Hair moisturizer	☐	Hair food	☐

Other (please specify) _____

Make-up products

Makeup foundation	☐	Eye pencil	☐
Blush	☐	Eye shadow	☐
Mascara	☐	Lipstick	☐
Eyeliner	☐	Lip pencil	☐
Makeup remover	☐	Nail polish	☐
Nail polish remover	☐	Other (please specify) _____	

9. What do you use hygiene and beauty products for?_____
_____
_____

10. How often do you use hygiene and beauty products in a day?

Once a day ☐

Twice a day ☐

Three times a day ☐

> three times a day ☐

11. Where do you commonly buy most of your products?

Grocery stores ☐ Pharmacy ☐

Spaza shop ☐ Informal vendor ☐

Cosmetic shops ☐ Beauty saloons ☐

Online ☐

Other (please specify) _____

12. Why do you get them there?_____

_____

_____

13. What do you consider when deciding on which products to buy?

Price ☐ Brand I always buy ☐

Packaging ☐ Recommendations from friends and relatives ☐

Scent ☐ Brands I have seen advertised ☐

Well-known brand ☐ Recommended on social media ☐

Product Ingredients ☐ Convenience ☐

Special offer/ promotion ☐ Brands specific to my skin type ☐

Other (please specify) _____

Section C: Knowledge-based questions

14. Do you think some of the chemicals found in beauty and hygiene products can harm your health?

Yes ☐ No ☐ I don't know ☐

Could you explain your answer? _____
_____
_____

15. Which of the following diseases could be linked to harmful chemicals in cosmetics?

Cancer ☐ Blindness ☐

Headaches ☐ Diabetes ☐

Allergies ☐ Diarrhea ☐

16. Do you think women are more likely to be affected by chemicals in beauty and hygiene products compared to men?

Yes ☐ No ☐ I don't know ☐

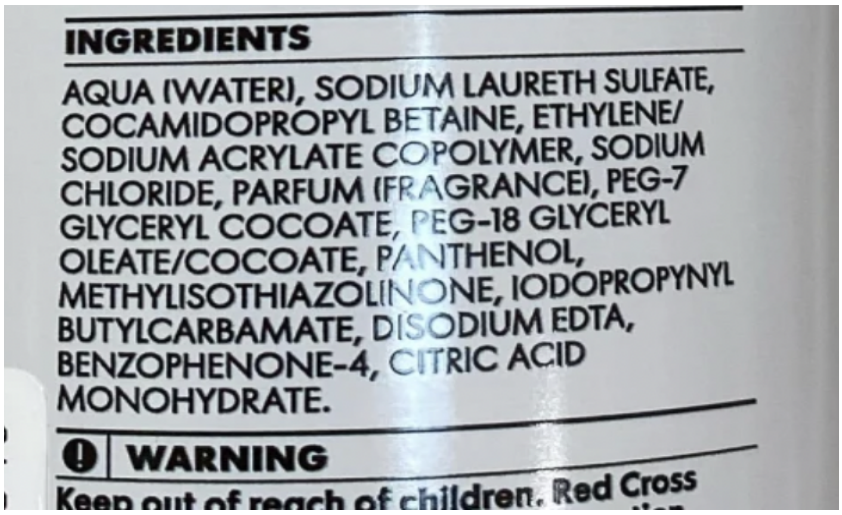
Could you explain your answer? _____
_____
_____

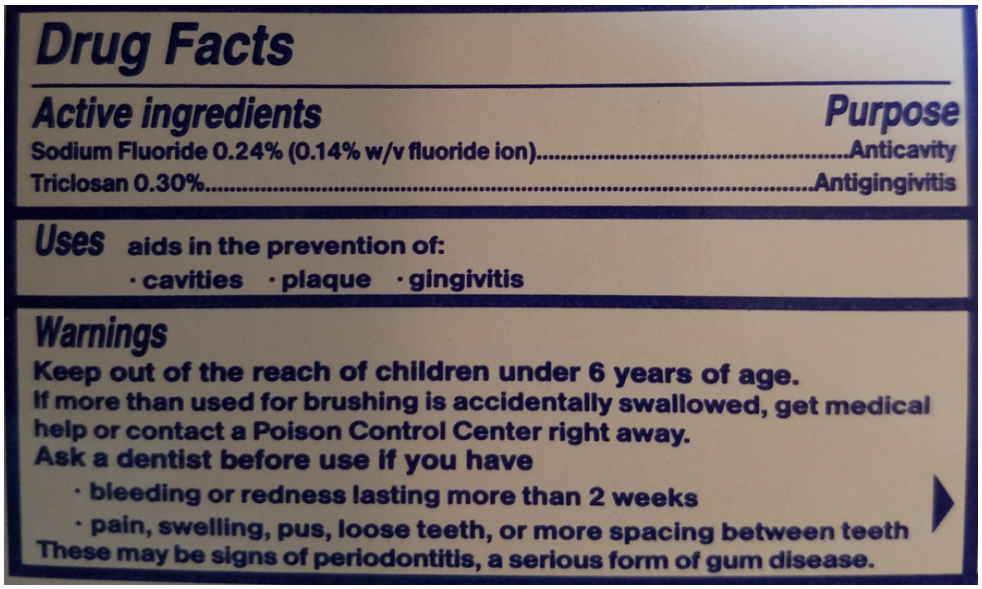
17. Do you think using beauty and hygiene products during pregnancy is safe?

Yes ☐ No ☐ I don't know ☐

18. For this question, use the images of common product labels provided. Which chemicals do you think can be harmful to your health?

İçindekiler: Aqua, Paraffinum Liquidum, Glycerin, Cetearyl Alcohol, Glyceryl Stearate, Glyceryl Stearate SE, Butyrospermum Parkii Butter, Prunus Amygdalus Dulcis Oil, Glyceryl Glucoside, Hydrogenated Coco-Glycerides, Sodium Cetearyl Sulfate, Dimethicone, Sodium Carbomer, Phenoxyethanol, Methylparaben, Linalool, Limonene, Geraniol, Benzyl Alcohol, Citronellol, Butylphenyl Methylpropional, Alpha-Isomethyl Ionone, Parfum.
Art. 88287
NIVEA Cilt Bakım Hattı: 0850 522 03 73
www.NIVEA.com.tr
250 ml


INGREDIENTS
AQUA (WATER), SODIUM LAURETH SULFATE, COCAMIDOPROPYL BETAINE, ETHYLENE/ SODIUM ACRYLATE COPOLYMER, SODIUM CHLORIDE, PARFUM (FRAGRANCE), PEG-7 GLYCERYL COCOATE, PEG-18 GLYCERYL OLEATE/COCOATE, PANTHENOL, METHYLISOTHIAZOLINONE, IODOPROPYNYL BUTYLCARBAMATE, DISODIUM EDTA, BENZOPHENONE-4, CITRIC ACID MONOHYDRATE.
WARNING
Keep out of reach of children. Red Cross


Drug Facts
Active ingredients
Purpose
Sodium Fluoride 0.24% (0.14% w/v fluoride ion)....Anticavity
Triclosan 0.30%....Antigingivitis
Uses aids in the prevention of:
· cavities · plaque · gingivitis
Warnings
Keep out of the reach of children under 6 years of age.
If more than used for brushing is accidentally swallowed, get medical help or contact a Poison Control Center right away.
Ask a dentist before use if you have
· bleeding or redness lasting more than 2 weeks
· pain, swelling, pus, loose teeth, or more spacing between teeth
These may be signs of periodontitis, a serious form of gum disease.

aqua (water)	☐	sodium Laureth sulfate	☐
paraffinum liquidum	☐	cocamidopropyl betaine	☐
glycerin	☐	sodium acrylate copolymer	☐
cetearyl Alcohol	☐	sodium chloride	☐
glyceryl Stearate	☐	panthenol	☐
butrospemum Parkii Butter.	☐	disodium EDTA	☐
prunus Amygdalus Dulcis Oil.	☐	benzophenone-4	☐
glycerol Glucoside	☐	citric acid monohydrate	☐
sodium Carbomer	☐	sodium fluoride	☐
phenoxyethanol	☐	triclosan	☐
methylparaben	☐	all chemicals	☐
linalool	☐	parfum	☐
benzyl alcohol	☐	I don't know	☐

19. Please explain your reason for choosing these chemical(s) _____

_____

_____

20. Do you think chemicals are listed in any particular order on the product label?

Yes ☐ No ☐ I don't know ☐

If yes, please explain. _____
_____
_____

21. Can chemicals in hygiene and beauty products enter your body?

Yes ☐ No ☐ I don't know ☐

If yes, are you able to explain how_____
_____
_____

22. Do you think chemicals in hygiene and beauty products can enter your body and then enter your unborn baby?

Yes ☐ No ☐ I don't know ☐

If yes, how? _____
_____
_____

23. Do you think chemicals in hygiene and beauty products can enter your body and be passed to the newborn baby through breast milk?

Yes ☐ No ☐ I don't know ☐

24. Do you think the effect of harmful chemicals in cosmetics can be passed down from your baby's generation to other generations?

Yes ☐ No ☐ I don't know ☐

Section D: Attitude questions

25. Before today, have you ever considered the chemicals that might be in your hygiene and beauty products?

Yes ☐ No ☐

26. Have you ever thought about the possible long-term health effects of chemicals on your unborn baby's health?

Yes ☐ No ☐

If yes, what are your thoughts? _____
_____
_____

27. What would encourage you to use different products to protect the health of your unborn baby?_____
_____
_____

28. Do you think it is important for you to know which hygiene and beauty products are safe to use during pregnancy?

Yes ☐ No ☐ I don't know ☐

Please explain your answer _____

29. In your own opinion, do you think all pregnant women should be provided with information about chemicals found in beauty and hygiene products?

Yes ☐ No ☐ I don't know. ☐

Explain your answer_____
_____
_____

30. Do you think beauty and hygiene products are tested for harmful chemicals in South Africa?

Yes ☐ No ☐ I don't know ☐

31. Do you think the government makes sure that no harmful chemicals are in the products you buy?

Yes ☐ No ☐ I don't know ☐

If yes, explain why _____

_____

_____

Section E: Perception questions

32. Do you think you are well informed about the effects of chemical ingredients found in hygiene and grooming products?

Yes ☐ No ☐ I don't know ☐

33. Which sources do you use to learn about cosmetic or hygiene products?

Television	☐	Radio	☐
Magazines	☐	Friends or family	☐
Internet/ social media	☐	Salespeople	☐
Dermatologist	☐	Healthcare professional	☐
Product label	☐	Momconnect	☐

Other (specify)_____

34. Does any of the information you learn include health and safety information?

Yes ☐ No ☐ I don't know ☐

If yes, give an example of the information you have learned._____

_____

_____

35. Would you be interested to learn more information about harmful chemical ingredients in beauty and hygiene?

Yes ☐ No ☐ (Skip question 36)

36. From which sources would like to access more information about harmful chemical ingredients in beauty and hygiene products?

Television	☐	Radio	☐
Magazines	☐	Friends or family	☐
Internet/ social media	☐	Salespeople	☐
Dermatologist	☐	Healthcare professional	☐
Product packaging	☐	Momconnect	☐

Other (specify)_____

Could you explain why you prefer this source(s) of information?_____

_____

_____

37. How often do you read information written on the back of hygiene and beauty products before buying the products?

Always ☐ Sometimes ☐ Never ☐

If never, why? _____
_____
_____

38. Do you think that companies that produce hygiene and beauty products make information about their products easy to understand?

Yes ☐ No ☐ I don't know ☐

39. Do you think that the information written on the back of beauty and hygiene products provides enough information to protect your health?

Yes ☐ No ☐ I don't know ☐

Please explain your answer _____
_____
_____
_____

40. Are there any comments or concerns you would like to add about harmful chemicals and beauty and hygiene products?_____
_____
_____
_____

THANK YOU FOR YOUR PARTICIPATION!

Appendix E. Questionnaire (IsiXhosa)

Umfundi: Lissa Paul
Inombolo yomfundi: PLXLIS002
Umphononongi weYunivesithi: Professor Hanna-Andrea Rother
Indawo yokufunda: IYunivesithi yaseKapa

Inombolo yomthathi-nxaxheba: ☐

Icandelo A: Ulwazi lwabantu

1. Mingaphi iminyaka yakho?

   18- 25 iminyaka ☐

   26- 33 iminyaka ☐

   34- 41 iminyaka ☐

   42-49 iminyaka ☐

2. Loluphi ulwimi lwakho lwasekhaya?

   IsiNgesi ☐

   Isibhulu ☐

   Isi-Xhosa ☐

   Isi Zulu ☐

   Okunye (nceda ucacise) _____

3. Uhlala phi?

Mowbray ☐	Rosebank ☐	Rondebosch ☐
Rondebosch East ☐	Newlands ☐	Claremont ☐
False Bay ☐	Retreat ☐	Gugulethu ☐
Hanover Park ☐		

Okunye (nceda ucacise) _____

4. Sithini isimo sakho sengqesho ?

Ukungaphangeli ☐

Uqeshwe ngokusisigxina ☐

Umfundi ☐

Umsebenzi wesingxungxo ☐

Ndiqeshwe ngamaxesha. ☐

5. Uthini umvuzo wakho wenyanga uwonke, kuquka yonke imithombo yomvuzo?

Akukho ngeniso ☐

R1- R5599 ☐

R5600- R40 000 ☐

More than R40 000 ☐

6. Leliphi inqanaba eliphezulu lemfundo oyigqibileyo ?

Akukho mfundo ☐

Ibakala 1-8 ☐

ibakala 9-11 ☐

Ibakala (Matric) ☐

Isatifikethi ☐

Isidanga sebhatshela / Idiploma yesidanga sokuqala ☐

Isidanga semasters ☐

Isidanga sobuGqirha ☐

Ngobugqirha ☐

7. Bangaphi abantwana onabo?

0 ☐

1 ☐

2 ☐

3 ☐

>4 ☐

Icandelo B: Ziqhelise imibuzo

8. Kwezi mveliso zilandelayo zempilo nobuhle, zeziphi ozisebenzisayo ?

Iimveliso zococeko ngokubanzi

Isitena sesephu ☐ Isithambiso somzimba ☐

Ijeli yeshawa ☐ Isithambiso samakhwapha ☐

Intlama yamazinyo ☐ Ideodorant ☐

Ukuhlamba imilomo ☐ Okunye (nceda ucacise) _____

Iimveliso zobuso

Isicoci sobuso ☐ Ukukhuhla ubuso ☐

Day Face cream ☐ Imaski yobuso ☐

Ikhilimu yobuso ebusuku ☐ Ikhusi elangeni ☐

Itoni yobuso ☐

Okunye (nceda ucacise) _____

iimveliso zeenwele

Isampu ☐ Isilungisi seenwele ☐

Imaski yeenwele ☐ Idayi yeenwele ☐

Amafutha weenwele ☐ Ukutya kweenwele ☐

Okunye (nceda ucacise) _____

Make-up iimveliso

Make-up isiseko	☐	Ipensile yamehlo	☐
I-blush	☐	isithunzi selihlo	☐
I-mascara	☐	I-lipstick	☐
I-eyeliner	☐	I-pensile yomlomo	☐
I-makeup remover	☐	Isipolishi mazipho	☐

Isixhobo sokususa ipolishi ☐ Okunye (nceda ucacise) _____

9. Usebenzisela ntoni ucoceko kunye neemveliso zobuhle?_____
_____
_____

10. Usebenzisa kangaphi ucoceko kunye neemveliso zobuhle ngosuku ?

Kanye ngosuku ☐

Kabini ngosuku ☐

Amaxesha amathathu ngosuku ☐

Amaxesha angaphaya kwaamathathu ngosuku ☐

11. Udla ngokuthenga phi uninzi lwemveliso zakho ?

Kwiivenkilw zokutya ☐ Ekhemesti ☐

Esiphaza ☐ Kumthengisi ongekho sikweni ☐

Kwiivenkile zezithambiso ☐ Kwisoluni zobuhle ☐

Kwi-intanethi ☐

Okunye (nceda ucacise) _____

12. Kutheni uzifumana apho?_____

_____

_____

13. Yintoni oyiqwalaselayo xa usenza isigqibo malunga nokuba zeziphi iimveliso ozithengayo?

Ixabiso ☐ Brand ndihlala ndithenga ☐

Ukupakishwa ☐ Amacebiso avela kubahlobo nakwizalamane ☐

Ivumba ☐ Iimpawu endizibonileyo zipapashwa ☐

Uphawu olwaziwayo ☐ Kucetyiswa kwimidiya yoluntu ☐

Izithako zeMveliso ☐ Uncedo ☐

Special offer/ promotion ☐ Iimpawu ezikhethekileyo kuhlobo lolusu lwam ☐

Okunye (nceda ucacise) _____

Icandelo C: Imibuzo yolwazi

14. Ucinga ukuba ezinye zeekhemikhali ezifumaneka kwiimveliso zobuhle kunye nococeko zingonakalisa impilo yakho?

Ewe ☐ Hayi ☐ Andazi ☐

Cacisa impendulo yakho?_____
_____
_____

15. Ucinga ukuba nayiphi na imichiza kwiimveliso zakho inokubangela nayiphi na kwezi zilandelayo (ngokukhawuleza)?

Umhlaza ☐ Ubumfama ☐

Intloko ebuhlungu ☐ Isifo seswekile ☐

Ukwaliwa ☐ Urhudo ☐

16. Ucinga ukuba abasetyhini banokuchaphazeleka ngakumbi ngamachiza kwimveliso yobuhle kunye nezempilo xa kuthelekiswa namadoda?

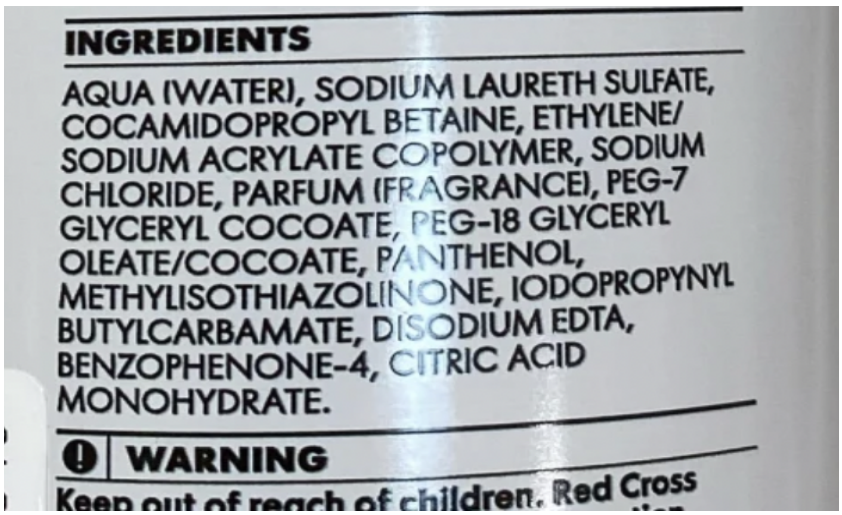
Ewe ☐ Hayi ☐ Andazi ☐

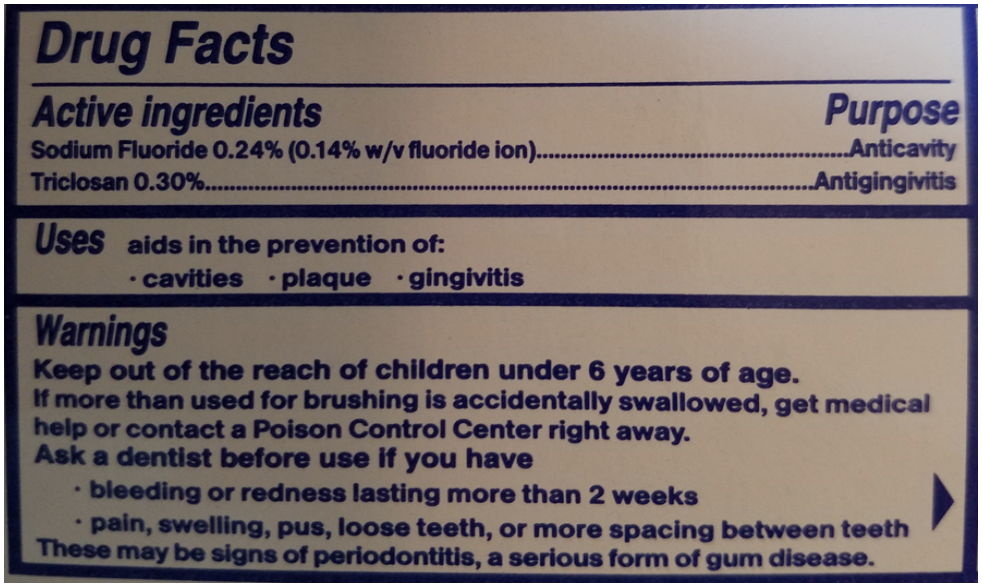
Cacisa impendulo yakho? _____
_____
_____

17. Ngaba ucinga ukusebenzisa imveliso yobuhle kunye nococeko ngexesha lokukhulelwa kukhuselekile?

Ewe ☐ Hayi ☐ Andazi ☐

18. Kulo mbuzo, sebenzisa imifanekiso yeelebhile zemveliso eqhelekileyo enikiweyo. Zeziphi iikhemikhali ocinga ukuba zinokuba yingozi kwimpilo yakho?





Drug Facts

Active ingredients — **Purpose**

Sodium Fluoride 0.24% (0.14% w/v fluoride ion) ..... Anticavity

Triclosan 0.30% ..... Antigingivitis

Uses aids in the prevention of:

- cavities
- plaque
- gingivitis

Warnings

Keep out of the reach of children under 6 years of age.

If more than used for brushing is accidentally swallowed, get medical help or contact a Poison Control Center right away.

Ask a dentist before use if you have

- bleeding or redness lasting more than 2 weeks
- pain, swelling, pus, loose teeth, or more spacing between teeth

These may be signs of periodontitis, a serious form of gum disease.

aqua (water)	☐	sodium Laureth sulfate	☐
paraffinum liquidum	☐	cocamidopropyl betaine	☐
glycerin	☐	sodium acrylate copolymer	☐
cetearyl Alcohol	☐	sodium chloride	☐
glyceryl Stearate	☐	panthenol	☐
butrospemum Parkii Butter	☐	disodium EDTA	☐
prunus Amygdalus Dulcis Oil	☐	benzophenone-4	☐
glycerol Glucoside	☐	citric acid monohydrate	☐
sodium Carbomer	☐	sodium fluoride	☐
phenoxyethanol	☐	triclosan	☐

methylparaben	☐	all chemicals	☐
linalool	☐	parfum	☐
benzyl alcohol	☐	andaz	☐

19. Nceda uchaze isizathu sakho sokukhetha ezi khemikhali _____
_____
_____
_____

20. Ucinga ukuba iikhemikhali zidweliswe ngendlela ethile kwileyibhile yemveliso?

Ewe ☐ Hayi ☐ Andazi ☐

Ukuba ewe, nceda ucacise _____
_____
_____

21. Ngaba iikhemikhali zococeko kunye neemveliso zobuhle zingangena emzimbeni wakho?

Ewe ☐ Hayi ☐ Andazi ☐

Ukuba ewe, cacisa ukuba zingena kanjani _____
_____
_____

22. Ucinga ukuba imichiza yezempilo kunye nemveliso yobuhle inokungena emzimbeni wakho kwaye ingene kusana lwakho olungekazalwa?

Ewe ☐ Hayi ☐ Andazi ☐

Ukuba kunjalo, njani? _____

_____

_____

23. Ucinga ukuba imichiza yococeko kunye nemveliso yobuhle inokungena emzimbeni wakho kwaye idluliselwe kusana olusandul 'ukuzalwa ngobisi lwebele?

Ewe ☐ Hayi ☐ Andazi ☐

24. Ngaba ucinga ukuba umphumo weekhemikhali ezinobungozi kwizithambiso unokugqithiselwa ukusuka kwisizukulwana somntwana wakho ukuya kwezinye izizukulwana?

Ewe ☐ Hayi ☐ Andazi ☐

Icandelo D: Imibuzo yesimo sengqondo

25. Ngaphambi kwanamhlanje, ngaba ukhe waqwalasela imichiza enokuba kucoceko lwakho kunye neemveliso zobuhle?

Ewe ☐ Hayi ☐

26. Ngaba ukhe wacinga malunga nemiphumo yempilo yexesha elide yeekhemikhali kwimpilo yomntwana wakho ongekazalwa?

Ewe ☐ Hayi ☐

Ukuba ewe, nceda ucacise _____

_____

_____

27. Yintoni enokukukhuthaza ukuba usebenzise iimveliso ezahlukeneyo ukukhusela impilo yosana lwakho olungekazalwa?

_____

_____

28. Ngaba ucinga ukuba kubalulekile kuwe ukwazi ukuba zeziphi iimveliso zococeko kunye nobuhle ezikhuselekileyo ukuba zisetyenziswe ngexesha lokukhulelwa?

Ewe ☐ Hayi ☐ Andazi ☐

Nceda ucacise impendulo yakho _____
_____
_____

29. Ngokoluvo lwakho, ucinga ukuba bonke abafazi abakhulelweyo kufuneka banikwe ulwazi malunga neekhemikhali ezifumaneka kwiimveliso zobuhle kunye nococeko?

Ewe ☐ Hayi ☐ Andazi ☐

Nceda ucacise impendulo yakho_____
_____
_____

30. Ucinga ukuba ubuhle kunye neemveliso zococeko zivavanyelwa imichiza eyingozi eMzantsi Afrika?

Ewe ☐ Hayi ☐ Andazi ☐

31. Ucinga ukuba urhulumente uyaqinisekisa ukuba akukho michiza iyingozi kwiimveliso ozithengayo?

Ewe ☐ Hayi ☐ Andazi ☐

Ukuba ewe, chaza ukuba kutheni_____
_____
_____

Icandelo E: Imibuzo yengqiqo

32. Ngaba ucinga ukuba unolwazi olufanelekileyo malunga nemiphumo yezithako zekhemikhali ezifumaneka kwimveliso yococeko kunye nokulungiswa?

Ewe ☐ Hayi ☐ Andaz ☐

33. Yeyiphi imithombo oyisebenzisayo ukufunda malunga nezithambiso okanye iimveliso zococeko?

Umabonakude	☐	Unomathotholo	☐
Iimagazini	☐	Abahlobo okanye usapho	☐
I-intanethi/ Imidiya yokuncokola	☐	Abathengisi	☐
Ugqirha wesikhumba	☐	Ingcali yezempilo	☐
Ileyibhile yemveliso	☐	Momconnect	☐

Okunye (nceda ucacise) _____

34. Ngaba naluphi na ulwazi olufundayo lubandakanya ulwazi lwezempilo nokhuseleko?

Ewe ☐ Hayi ☐ Andazi ☐

Ukuba ewe, nika umzekelo wolwazi olufundileyo_____
_____

35. Ngaba ungathanda ukufunda ulwazi oluthe kratya malunga nezithako zemichiza eyingozi kubuhle kunye nococeko?

Ewe ☐ Hayi ☐ (Tsiba umbuzo 36)

36. Kweyiphi imithombo engathanda ukufikelela kulwazi oluthe kratya malunga nezithako zekhemikhali eziyingozi kubuhle kunye neemveliso zococeko?

Umabonakude	☐	Unomathotholo	☐
Iimagazini	☐	Abahlobo okanye usapho	☐
I-intanethi/ Imidiya yokuncokola	☐	Abathengisi	☐
Ugqirha wesikhumba	☐	Ingcali yezempilo	☐
Ileyibhile yemveliso	☐	Momconnect	☐

Okunye (nceda ucacise) _____

Ngaba unokucacisa ukuba kutheni ukhetha lo mthombo wolwazi?

_____

_____

37. Ufunda kangaphi ulwazi olubhalwe ngasemva kwimveliso yococeko kunye nobuhle phambi kokuthenga iimveliso?

Rhoqo ☐ Ngamaxesha athile ☐ Zange ☐

Ukuba akunjalo, kutheni? _____

_____

_____

38. Ucinga ukuba iinkampani ezivelisa ucoceko kunye neemveliso zobuhle zenza ulwazi malunga neemveliso zabo lula ukuqonda?

Ewe ☐ Hayi ☐ Andazi ☐

39. Ngaba ucinga ukuba ulwazi olubhalwe ngasemva kweemveliso zobuhle kunye nococeko lunika ulwazi olwaneleyo ukukhusela impilo yakho?

Ewe ☐ Hayi ☐ Andazi ☐

Nceda ucacise impendulo yakho _____
_____
_____
_____

40. Ngaba kukho naziphi na izimvo okanye iinkxalabo ongathanda ukuzongeza malunga neekhemikhali ezinobungozi kunye nobuhle kunye neemveliso zococeko?_____
_____
_____
_____

ENKOSI NGENXAXHEBA YAKHO!

Appendix F. Questionnaire (Afrikaans)

Student: Lissa Paul
Studentenommer: PLXLIS002
Universiteit studieleier: Professor Hanna- Andrea Rother
Plek van studie: Universiteit van Kaapstad

Navorsing onderwerp: Skadelike chemikalieë in higiëne- en skoonheidsprodukte: kennis, houdings en persepsies onder swanger vroue in Suid-Afrika.

Deelnemer nommer: ☐

Afdeling A: Demografiese inligting

1. Wat is jou ouderdom?

   18- 25 jare ☐

   26- 33 jare ☐

   34- 41 jare ☐

   42-49 jare ☐

2. Wat is jou huistaal?

   Engels ☐

   Afrikaans ☐

   Xhosa ☐

   Zulu ☐

   Anders (spesifiseer asseblief) _____

3. Waar woon jy?

Mowbray	☐	Rosebank	☐	Rondebosch	☐
Rondebosch East	☐	Newlands	☐	Claremont	☐
False Bay	☐	Retreat	☐	Gugulethu	☐
Hanover Park	☐				

Anders (spesifiseer asseblief)_____

4. Wat is jou indiensneming status?

Werkloos ☐

Voltyds in diens ☐

Student ☐

Deeltyds in diens ☐

Seisoenale in diens ☐

5. Wat is jou algehele maandelikse inkomste, insluitend alle inkomstebronne?

Geen inkomste nie ☐

R1- R5599 ☐

R5600- R40 000 ☐

Meer as R40 000 ☐

6. Wat is die hoogste vlak van onderwys wat jy voltooi het?

Geen opvoeding nie ☐

Graad 1-8 ☐

Graad 9-11 ☐

Graad 12 (matriek) ☐

Sertifikaat ☐

Baccalaureus graad/ Nagraadse diploma ☐

Meesters graad ☐

Doktorsgraad ☐

Post doktorsgraad ☐

7. Hoeveel kinders het jy?

0 ☐

1 ☐

2 ☐

3 ☐

>4 ☐

Afdeling G: Oefenvrae

8.Watter van die volgende higiëne- en skoonheidsprodukte gebruik jy?

Algemene higiëne produkte

Seep	☐	Lyfroom/ Liggaamsroom	☐
Stortseep	☐	Roldeodorant	☐
Tandepasta	☐	Spuitdeodorant	☐
Mondspoel	☐	Anders (spesifiseer asseblief) _____	

Gesig produkte

Gesigsreiniger	☐	Gesigskrop	☐
Dagroom	☐	Gesigmasker	☐
Nagroom	☐	Sonskerm	☐

Gesigtoner (Facial toner) ☐

Anders (spesifiseer asseblief)_____

Haar produkte

Sjampoe	☐	Haaropknapper	☐
Haarmasker	☐	Haarkleur	☐
Haarbevogtiger	☐	Haarkos (hair food)	☐

Anders (spesifiseer asseblief)_____

Grimeringsprodukte

Onderlaag	☐	Oogpotlood	☐
Blosser	☐	Oogskaduwee	☐
Maskara	☐	Lipstiffie	☐
Oogomlyner	☐	Lippotlood	☐
Grimeringverwyderaar	☐	Naelpolitoer	☐
Naellakverwyderaar	☐	Anders (spesifiseer asseblief)_____	

9.Waarvoor gebruik jy higiëne- en skoonheidsprodukte?_____
_____
_____
_____

10.Hoe gereeld gebruik jy higiëne- en skoonheidsprodukte op 'n dag ?

Een keer per dag ☐

Twee keer per dag ☐

Drie keer per dag ☐

> Drie keer per dag ☐

11. Waar koop jy gewoonlik die meeste van jou produkte?

Kruidenierswinkel	☐	Apteek	☐
Spaza winkel	☐	Informele verkoper	☐
Kosmetiese winkels	☐	Skoonheidsalonne	☐

Anders (asseblief spesifiseer) _____

12. Hoekom koop jy hulle daar?_____

_____

_____

13. Wat neem jy in ag wanneer jy besluit watter produkte om te koop?

Prys	☐	Handelsmerk wat ek altyd koop	☐
Verpakking	☐	Voorstelle deur vriende en familie	☐
Geur	☐	Advertensies	☐
Bekende handelsmerk	☐	Op sosiale media aanbeveel	☐
Produkbestanddele	☐	Gerief	☐
Spesiale aanbod/promosie	☐	Handelsmerke spesifiek vir my vel tipe	☐

Anders (spesifiseer asseblief) _____

Afdeling C: Kennisvrae

14. Dink jy van die chemikalieë wat in skoonheids- en higiëne produkte voorkom, kan jou gesondheid benadeel?

Ja ☐ Nee ☐ Ek weet nie ☐

Kan jy jou antwoord verduidelik?_____
_____
_____

15. Dink jy enige chemikalieë in jou produkte kan enige van die volgende veroorsaak?

Kanker ☐ Blindheid ☐

Hoofpyne ☐ Suikersiekte ☐

Allergieë ☐ Diarree ☐

16.Dink jy vrouens is meer geneig om geraak te word deur chemikalieë in skoonheids- en higiëne produkte in vergelyking met mans ?

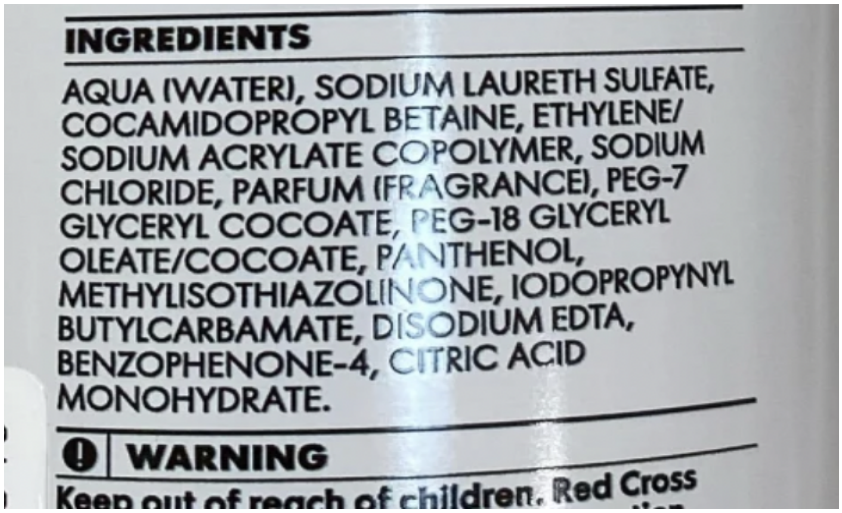
Ja ☐ Nee ☐ Ek weet nie ☐

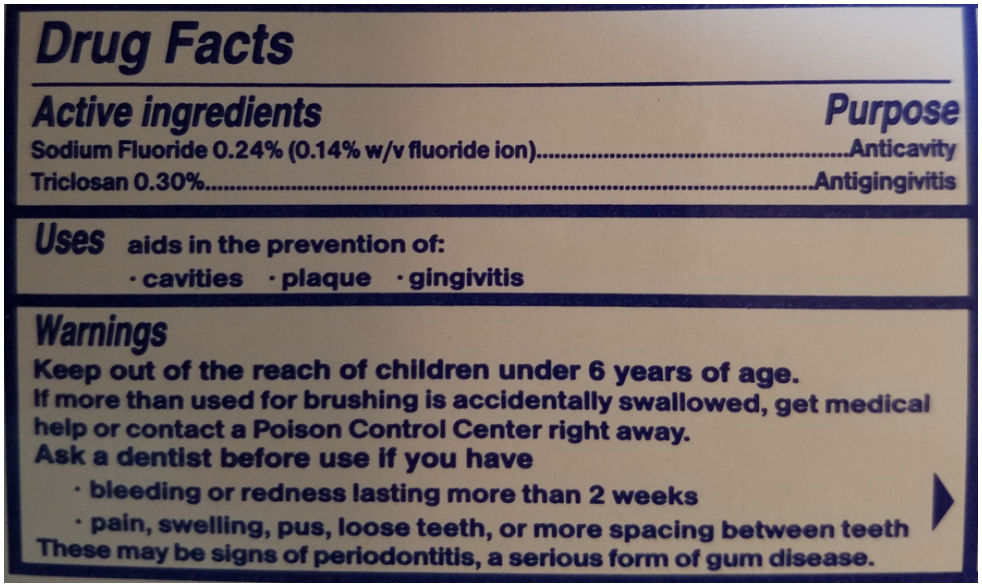
Indien ja, hoekom dink jy so? _____
_____
_____
_____

17.Dink jy die gebruik van skoonheids- en higiëne produkte tydens swangerskap is veilig?

Ja ☐ Nee ☐ Ek weet nie ☐

18. Vir hierdie vraag, gebruik die beelde van algemene produketikette wat verskaf word. Watter chemikalieë dink jy kan skade aanrig?





Drug Facts

Active ingredients — **Purpose**

Sodium Fluoride 0.24% (0.14% w/v fluoride ion) ..... Anticavity

Triclosan 0.30% ..... Antigingivitis

Uses aids in the prevention of:

- cavities
- plaque
- gingivitis

Warnings

Keep out of the reach of children under 6 years of age.

If more than used for brushing is accidentally swallowed, get medical help or contact a Poison Control Center right away.

Ask a dentist before use if you have

- bleeding or redness lasting more than 2 weeks
- pain, swelling, pus, loose teeth, or more spacing between teeth

These may be signs of periodontitis, a serious form of gum disease.

aqua (water)	☐	sodium Laureth sulfate	☐
paraffinum liquidum	☐	cocamidopropyl betaine	☐
glycerin	☐	sodium acrylate copolymer	☐
cetearyl alcohol	☐	sodium chloride	☐
glyceryl Stearate	☐	panthenol	☐
butrospemum Parkii Butter.	☐	disodium EDTA	☐
prunus Amygdalus Dulcis Oil	☐	benzophenone-4	☐
glycerol Glucoside	☐	citric acid monohydrate	☐
sodium Carbomer	☐	sodium fluoride	☐
phenoxyethanol	☐	triclosan	☐
methylparaben	☐	alle chemikalieë	☐

linalool ☐ Ek weet nie ☐

benzyl alcohol ☐

parfum ☐

19.Verduidelik asseblief die rede waarom jy hierdie chemikalieë gekies het

_____

_____

20.Dink jy chemikalieë word in enige spesifieke volgorde op die produketiket gelys?

Ja ☐ Nee ☐ Ek weet nie ☐

Indien wel, verduidelik asseblief _____

_____

_____

21.Kan chemikalieë in higiëne- en skoonheidsprodukte jou liggaam binnedring?

Ja ☐ Nee ☐ Ek weet nie ☐

Indien wel, kan jy verduidelik hoe?_____

_____

_____

22. Dink jy chemikalieë in higiëne- en skoonheidsprodukte kan jou liggaam binnedring en dan aan jou ongebore baba oorgedra word?

Ja ☐ Nee ☐ Ek weet nie ☐

Indien wel, kan jy verduidelik hoe? _____

_____

_____

_____

23. Dink jy chemikalieë in skoonheids- en higiëne produkte kan jou liggaam binnedring en deur borsmelk aan die baba oorgedra word?

Ja ☐ Nee ☐ Ek weet nie ☐

24. Dink jy die effek van skadelike chemikalieë in skoonheidsmiddels kan van jou baba se generasie na ander generasies oorgedra word?

Ja ☐ Nee ☐ Ek weet nie ☐

Afdeling D: Houdingsvrae

25. Voor vandag, het jy al ooit die chemikalieë oorweeg wat in jou higiëne- en skoonheidsprodukte kan wees?

Ja ☐ Nee ☐

26. Het jy al ooit gedink aan die moontlike langtermyn-gesondheidseffekte van chemikalieë op jou ongebore baba se gesondheid?

Ja ☐ Nee ☐

Indien wel, wat is jou gedagtes? _____

_____

_____

_____

27. Wat sal jou aanmoedig om verskillende produkte te gebruik om die gesondheid van jou ongebore baba te beskerm?_____

_____

_____

_____

28. Dink jy dit is vir jou belangrik om te weet watter produkte veilig is om te gebruik tydens swangerskap?

Ja ☐ Nee ☐ Ek weet nie ☐

Verduidelik asb jou antwoord _____
_____
_____
_____

29. Dink jy na jou eie mening alle swanger vroue moet voorsien word van inligting oor chemikalieë wat in skoonheids- en higiëne produkte voorkom?

Ja ☐ Nee ☐ Ek weet nie ☐

Verduidelik asb jou antwoord _____
_____
_____
_____

30. Dink jy skoonheids- en higiëne produkte word in Suid-Afrika vir skadelike chemikalieë getoets?

Ja ☐ Nee ☐ Ek weet nie ☐

31. Dink jy die regering maak seker dat geen skadelike chemikalieë in die produkte is wat jy koop nie?

Ja ☐ Nee ☐ Ek weet nie ☐

Indien wel, verduidelik hoekom _____
_____
_____
_____

32. Dink jy, jy is goed ingelig oor die uitwerking van chemiese bestanddele wat in higiëne- en versorgings produkte voorkom?

Ja ☐ Nee ☐ Ek weet nie ☐

33. Watter bronne gebruik jy om meer oor kosmetiese of higiëne produkte te leer?

Televisie	☐	Radio	☐
Tydskrif	☐	Vriende en familie	☐
Internet/ sosiale media	☐	Verkoopsmense	☐
Dermatoloog	☐	Gesondheidsorgwerker	☐
Produketiket	☐	Momconnect	☐

Ander (spesifiseer asseblief)_____

34. Sluit enige van die inligting wat jy leer gesondheids - en veiligheids inligting in?

Ja ☐ Nee ☐ Ek weet nie ☐

Indien wel, gee 'n voorbeeld van die inligting wat jy geleer het_____
_____
_____
_____

35. Sal jy belangstel om meer inligting oor skadelike chemiese bestanddele in skoonheid en higiëne te ontvang?

Ja ☐ Nee ☐ (gaan na vraag 37)

36. Uit watter bronne sal jy verkies om meer inligting oor skadelike chemiese bestanddele in skoonheids- en higiëneprodukte te kry?

Televisie	☐	Radio	☐
Tydskrif	☐	Vriende en familie	☐
Internet/ sosiale media	☐	Verkoopsmense	☐

Dermatoloog ☐ Gesondheidsorgwerker ☐

Produketiket ☐ Momconnect ☐

Ander (spesifiseer asseblief)_____

Kan jy verduidelik hoekom jy hierdie bron(ne) van inligting verkies?_____
_____
_____
_____

37. Hoe gereeld lees jy inligting wat op die agterkant van higiëne- en skoonheidsprodukte geskryf is voordat jy die produkte koop?

Altyd ☐ Soms ☐ Nooit nie ☐

Indien nooit, hoekom? _____
_____
_____
_____

38. Dink jy dat maatskappye wat higiëne- en skoonheidsprodukte vervaardig inligting oor hul produkte maklik verstaanbaar maak?

Ja ☐ Nee ☐ Ek weet nie ☐

Indien nie, hoekom dink jy so? _____
_____
_____
_____

39.. Voel jy dat die inligting wat op die agterkant van skoonheids- en higiëne produkte geskryf is genoeg inligting verskaf om jou gesondheid te beskerm?

Ja ☐ Nee ☐ Ek weet nie ☐

Verduidelik asseblief jou antwoord _____
_____

_____

_____

40. Is daar enige kommentaar of bekommernisse wat jy wil byvoeg oor skadelike chemikalieë en skoonheids- en higiëne produkte?_____

_____

_____

_____

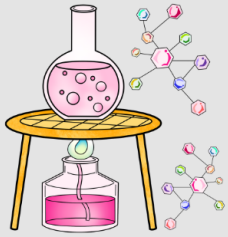
DANKIE VIR JOU DEELNAME!

Appendix G. Information sheet (English)

HARMFUL CHEMICALS IN BEAUTY AND HYGIENE PRODUCTS

FACT SHEET FOR PREGNANT WOMEN

DID YOU KNOW?



- SOAPS, BODY LOTIONS, DEODORANTS, SHAMPOOS, AND OTHER BEAUTY PRODUCTS ARE MADE WITH MANY CHEMICALS.
- CHEMICALS ARE ADDED TO MAKE THE PRODUCTS SMELL GOOD AND KEEP PRODUCTS FRESH AND GERM-FREE.
- NOT ALL CHEMICALS ARE HARMFUL. HOWEVER, SOME ARE NOT SAFE FOR YOU AND YOUR UNBORN BABY.

HOW DO HARMFUL CHEMICALS GET INTO YOUR BODY?

THROUGH:

- THE SKIN WHEN YOU BATH OR SHOWER WHILST USING PERFUMED PRODUCTS MADE WITH HARMFUL CHEMICALS.
- THE SKIN WHEN YOU APPLY BODY LOTION, CREAMS OR MAKEUP PRODUCTS.
- THE MOUTH WHEN YOU BRUSH YOUR TEETH OR APPLY LIPSTICK.
- THE NOSE WHEN YOU SPRAY DEODORANT OR HAIRSPRAY AND BREATHE IT IN.

THESE HARMFUL CHEMICALS ARE THEN PASSED ON TO YOUR UNBORN BABY

WHY SHOULD WE CARE ABOUT CHEMICALS IN BEAUTY AND HYGIENE PRODUCTS?

- BEING PREGNANT IS A SPECIAL TIME WHEN YOUR BODY IS CREATING NEW LIFE.
- THAT IS WHY MAKING HEALTHY CHOICES IS IMPORTANT
- WHEN YOU ARE PREGNANT, YOUR UNBORN CHILD GETS EVERYTHING IT NEEDS TO DEVELOP AND GROW FROM YOUR BLOOD.
- WHAT YOU PUT ON YOUR SKIN, HAIR AND MOUTH CAN BE TAKEN UP BY YOUR GROWING BABY TOO.

HARMFUL CHEMICALS CAN:

- AFFECT THE GROWTH OF YOUR UNBORN CHILD
- HARM THE DEVELOPMENT OF YOUR BABY'S BRAIN
- LEAD TO LIFELONG PROBLEMS SUCH AS OBESITY AND DIABETES.
- LEAD TO LEARNING DIFFICULTIES AND BEHAVIOURAL PROBLEMS SUCH AS BEING HYPERACTIVE OR AGGRESSIVE.
- INCREASE THE CHANCE OF PREMATURE DELIVERY, BIRTH DEFECTS, AND STILLBIRTH.

TIPS ON HOW TO REDUCE HARMFUL INGREDIENTS FROM YOUR BEAUTY ROUTINE!

- SIMPLIFY YOUR BEAUTY! USE ONLY A FEW HYGIENE AND BEAUTY PRODUCTS PER DAY.
- AVOID BUYING PERFUMED PRODUCTS! BEFORE BUYING PRODUCTS: CHECK THE LABELS AND TRY CHOOSE PRODUCTS LABELED *"FRAGRANCE-FREE"*.
- AVOID USING NAIL POLISH AND HAIR DYE DURING PREGNANCY. THESE PRODUCTS CONTAIN HARMFUL CHEMICALS!
- DURING CLINIC VISITS, DISCUSS WITH YOUR DOCTOR OR NURSE ABOUT THE SAFE USE OF HYGIENE AND BEAUTY PRODUCTS DURING PREGNANCY.
- ASKING QUESTIONS WILL HELP YOU TO LEARN!

FOR MORE INFORMATION ON HARMFUL CHEMICALS IN COSMETICS AND PREGNANCY VISIT
HTTPS://WWW.SAFECOSMETICS.ORG

THIS FACTSHEET WAS PRODUCED BY AN MPH STUDENT AT THE UNIVERSITY OF CAPE TOWN (ENVIRONMERNTAL HEALTH TRACK) AS PART OF AN MPH PROJECT.

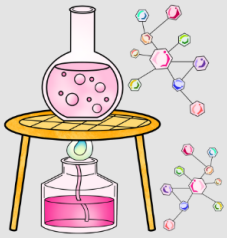
Division of Environmental Health | UCT

School of Public Health
Departement Openbare Gesondheid
Isikolo Sempilo Yoluntu
UNIVERSITY OF CAPE TOWN

Appendix H. Information Sheet (IsiXhosa)

IIKHEMIKHALI EZIYINGOZI KUCOCEKO KUNYE NEEMVELISO ZOBUHLE

UBUSAZI?



- IISEPHA, IZITHUNSI ZOMZIMBA, IZIQINISEKISO, ISHAMPOOS, NEZINYE IIMVELISO ZOBUHLE ZENZIWA NGEKHEMIKALI EZININZI.
- AYIZIZO ZONKE IIKHEMIKHALI EZIYINGOZI. NANGONA KUNJALO, EZINYE AYIKUKHUSELEKANGA KUWE NOMNTWANA WAKHO ONGEKAZALWA.

ZINGENA NJANI IIKHEMIKALI EMZIMBENI WAKHO?

NGO:

- ULUSU XA UHLAMBA OKANYE UHLAMBA NGEXESHA USEBENZISA IIMVELISO ZEZIQHOLO EZENZIWE NGEKHEMIKALI EZIYINGOZI.
- ULUSU XA UQABA ILOTION YOMZIMBA, IZINONGO OKANYE IIMVELISO ZOKUQABA UMZIMBA
- UMLOMO XA UHLAMBA AMAZINYO OKANYE FAKA ISIGCOBA MLOMO.
- NGEMPUMLO XA RHOGOLA ISINONGO MZIMBA OKANYE ISIQHOLO NWELE KWAYE UYIPHEFUMLA.

EZI ZINONGO ZIDLULELA KUSANA OLUNGEKA

IPHEPHA LENYANISO YABAFAZI ABAKHULELWEYO

KUTHENI SIFANELE SIKHATHALE IIKHEMIKALI EBUHLENI KUNYE IIMVELISO ZOCOCEKO?

- UKUKHULELWA LIXESHA ELIKHETHEKILEYO XA UMZIMBA WAKHO UDALA UBOMI OBUTSHA.
- YIYO LOO NTO UKWENZA UKHETHO OLUNEMPILO KUBALULEKILE.
- XA UKHULELWE, UMNTWANA WAKHO ONGEKAZALWA UFUMANA YONKE INTO EMFUNAYO UKUZE APHUHLISE FUTHI AKHULE EGAZINI LAKHO.
- INTO OYIQABA KULUSU LWAKHO, KWINWELE NOMLOMO USANA LWAKHO OLUNGEKA ZALWA LUNAKO UKUYIFUMANA.

IIKHEMIKHALI EZINOBUNGOZI ZINAKO UKU:

- KUCHAPHAZELE UKUKHULA KOMNTWANA WAKHO ONGEKAZALWA.
- KONAKALISA UPHUHLISO LOMNTWANA WAKHO.
- IKHOKELELA KWIINGXAKI ZEMPILO NJE NGOKUTYEBA NAKWISIFO SESWEKILE.
- IKHOKHELELA EKUBENI UMNTANA ABENDLONGONDLONGO, ABENAMANDLA NGOKUGQITHISILEYO.
- INYUSA IZINGA LOKUPHULUKANA NOMNTWANA, IZINGA LOKUBELEKA PHAMBI KWEXESHA, UKUPHAZAMISEKA KOMNTANA.

IINGCEBISO ZOKUNCIPHISA IZITHAKAZO EZINOKUBA YINGOZI KUWE!

- SEBENZISA IIMVELISO EZIMBALWA ZOCOCEKO NOBUHLE NGESUKU.
- KUPHEPHE UKUTHENGA IIMVELISO ZEZIQHOLO! PHAMBI KOKUTHENGA IIMVELISO: KHANGELA IILEBULA UZE UZAMA UKUKHETHA IIMVELISO EZILEYIBHILE “AKUKHO VUMBA”
- KUPHEPHE UKUSEBENZISA IPOLISHI YEZINZIPHO KUNYE NEDAYWE YEZINWELE NGEXESHA LOKUKHULELWA.
- NGEXESHA LOKUTYELELA KWIKLINIKI, XOXA NOGQIRHA OKANYE NOMONGIKAZI WAKHO NGOKUSETYENZISWA NGOKUKHUSELEKILEYO KOCOCEKO KUNYE NEEMVELISO ZOBUHLE NGEXESHA LOKUKHULELWA.
- UKUBUZA IMIBUZO KUYA KUNCEDA UFUNDE!

UKUZE UFUNDE OKUNGAKUMBI NGEKHEMIKALI EZENZAYO KWIZITHAMBISO NOKUKHULELWA, UNGATYELELA
HTTPS://WWW.SAFECOSMETICS.ORG

LE FACTSHEET IVELISWE NGUMFUNDI WE-MPH OVELA KWIYUNIVESITHI YASEKAPA. (ENVIRONMENTAL HEALTH TRACK) NJENGENGXALENYE YEPROJEKTHI YE-MPH.

EH Division of Environmental Health | UCT

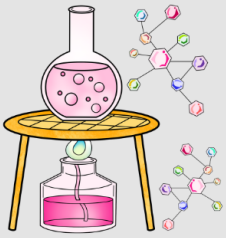
School of Public Health
Departement Openbare Gesondheid
Isikolo Sempilo Yoluntu
UNIVERSITY OF CAPE TOWN

Appendix I. Information Sheet (Afrikaans)

SKADELIKE CHEMIKALIEË IN SKOONHEID EN HIGIËNIESE PRODUKTE

FEITEBLAD VIR SWANGER VROUE

HET JY GEWEET?



- SEPE, LIGGAAMSROME, DEODORANTS, SJAMPOOS EN ANDER SKOONHEIDSPRODUKTE WORD MET VERSKEIE CHEMIKALIEË GEMAAK.
- CHEMIKALIEË WORD BYGEVOEG OM DIE PRODUKTE GOED TE LAAT RUIK ASOOK OM DIE PRODUKTE VARS EN KIEMVRY TE HOU.
- ALHOEWEL NIE ALLE CHEMIKALIEË IS SKADELIK NIE, IS SOMMIGE EGTER NIE VEILIG VIR JOU EN JOU ONGEBORE BABA NIE.

HOE KOM SKADELIKE CHEMIKALIEË IN JOU LIGGAAM IN ?

DEUR:

- DIE VEL WANNEER JY BAD OF STORT MET GEPARFUMEERDE PRODUKTE WAT SKADELIKE CHEMIKALIEË BEVAT.
- DIE VEL WANNEER JY LIGGAAMSROME, SKOONGEIDSPRODUKTE OF GREMERING AAN SIT.
- DIE MOND WANNEER JY JOU TANDE BORSEL OF LIPSTIFFIE AAN SIT.
- DIE NEUS WANNEER JY DEODORANT OF HAARSPROEI GEBRUIK EN DIE WALMS IN ASEM.

HIERDIE SKADELIKE CHEMIKALIEË WORD DAN OORGEDRA NA JOU ONGEBORE BABA.

WAAROM MOET ONS OMGEGEE OOR CHEMIKALIEË IN SKOONHEID EN HIGIËNIESE PRODUKTE?

- OM SWANGER TE WEES IS 'N SPESIALE TYD WANNEER JOU LIGGAAM NUWE LEWE SKEP.
- DAAROM IS DIT BELANGRIK OM GESONDE KEUSES TE MAAK.
- WANNEER JY SWANGER IS, KRY JOU ONGEBORE KIND ALLES WAT DIT BENODIG OM TE ONTWIKKEL EN GROEI VANAF JOU EIE BLOED.
- DIT WAT JY OP JOU VEL, HARE EN MOND SIT KAN OOK DEUR JOU GROEIENDE BABA OPGENEEM WORD.

SKADELIKE CHEMIKALIEË KAN:

- DIE GROEI VAN JOU ONGEBORE KIND BEÏNVLOED
- SKADE BRING TOT DIE ONTWIKKELING VAN JOU BABA SE BREIN
- LEI TOT LEWENSLANGE PROBLEME SOOS OORGEWIG EN DIABETES.
- LEI TOT LEERPROBLEME EN GEDRAGSPROBLEME SOOS
- HIEPERAKTIWITEIT OF AGRESSIE.
- DIE KANSE VAN VROEË GEBOORTE, GEBOORTEDEFEKE EN STILGEBOORTE VERHOOG.

WENKE OOR HOE OM SKADELIKE BESTANDDELE IN JOU SKOONHEIDSROETINE TE VERMINDER!

- VEREENVOUDIG JOU SKOONHEID! GEBRUIK SLEGS 'N PAAR HIGIËNIESE- EN SKOONHEIDSPRODUKTE PER DAG.
- VERMY OM GEPARFUMEERDE PRODUKTE TE KOOP! VOORDAT U PRODUKTE KOOP: KONTROLEER DIE ETIKET EN PROBEER PRODUKTE KIES GEMERK AS "REUKVRY".
- VERMY DIE GEBRUIK VAN NAELAK EN HAARKLEURSEL TYDENS SWANGERSKAP. HIERDIE PRODUKTE BEVAT SKADELIKE CHEMIKALIEË!
- TYDENS KLINIEKBESOEKE, GESELS MET JOU DOKTER OF VERPLEEGSTER OOR DIE VEILIGE GEBRUIK VAN HIGIËNIESE EN SKOONHEIDSPRODUKTE TYDENS SWANGERSKAP.
- OM VRAE TE VRA SAL JOU HELP OM TE LEER!

VIR MEER INLIGTING OOR SKADELIKE CHEMIKALIEË IN SKOONHEIDSPRODUKTE EN DIE EFFEK OP SWANGERSKAP BESOEK:

HTTPS://WWW.SAFECOSMETICS.ORG

HIERDIE FEITEBLAD IS GEMAAK DEUR 'N MPH-STUDENT VAN DIE UNIVERSITEIT VAN KAAPSTAD (OMGEWINGSGESONDHEID DEPARTEMENT) AS DEEL VAN 'N MPH-PROJEK.

Division of Environmental Health | UCT

School of Public Health
Departement Openbare Gesondheid
Isikolo Sempilo Yoluntu
UNIVERSITY OF CAPE TOWN

Appendix J. HREC Approval

UNIVERSITY OF CAPE TOWN
Faculty of Health Sciences
Human Research Ethics Committee

Room 45 E-52-E-Floor- Old Main Building
Groote Schuur Hospital
Observatory 7925
Telephone [021] 406 6492
Email: hrec-submissions@uct.ac.za
Website: www.health.uct.ac.za/home/human-research-ethics

13 July 2023

HREC REF: 229/2023

Prof H Rother
Division of Environmental Health
FHS
Email: Andrea.rother@uct.ac.za
Student: plxlis002@myuct.ac.za

Dear Prof Rother

PROJECT TITLE: ENDOCRINE DISRUPTING CHEMICALS IN PERSONAL CARE PRODUCTS: KNOWLEDGE, ATTITUDES, AND PERCEPTIONS AMONG PREGNANT WOMEN IN SOUTH AFRICA- (MASTER'S CANDIDATE-MRS LISSA PAUL)

Thank you for your response letter addressing the issues raised by the Faculty of Health Sciences Human Research Ethics Committee (HREC).

It is a pleasure to inform you that the HREC has **formally approved** the above-mentioned study.

Approval is granted for one year until the 30 July 2024.

Please submit a progress form, using the standardised Annual Report Form (FHS016) if the study continues beyond the approval period. Please submit a Standard Closure form if the study is completed within the approval period.
(Forms can be found on our website: www.health.uct.ac.za/fhs/research/humanethics/forms)

The HREC acknowledge that the student: Mrs Lissa Paul will also be involved in this study.

Please quote HREC REF 229/2023 in all your correspondence.

Please note that the ongoing ethical conduct of the study remains the responsibility of the principal investigator.

Please note that for all studies approved by the HREC, the principal investigator **must** obtain appropriate institutional approval, where necessary, before the research may occur.

Yours sincerely

PROFESSOR M BLOCKMAN
CHAIRPERSON, FACULTY OF HEALTH SCIENCES HUMAN RESEARCH ETHICS COMMITTEE

Federal Wide Assurance Number: FWA00001637. Institutional Review Board (IRB) number: IRB00001938 NHREC-registration number: REC-210208-007
This serves to confirm that the University of Cape Town Human Research Ethics Committee complies to the Ethics Standards for Clinical Research with a new drug in patients, based on the Medical Research Council (MRC-SA), Food and Drug Administration (FDA-USA), International Council for Harmonisation of

Appendix K. Institutional approval to collect data at MMH

Western Cape Government
FOR YOU

Department of Health
Dr. Chantal Stewart
Head of Clinical Unit:
Obstetrics
Mowbray Maternity Hospital
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Endocrine Disrupting Chemicals in personal care products: Knowledge, attitudes and perceptions among pregnant women in South Africa

Dear Ms Paul

You are granted permission to proceed with your research at Mowbray Maternity Hospital until 16 August 2024.

Please note the following:

a) Your research may not interfere with normal patient care.
b) Hospital staff may not be asked to assist with your research.
c) No additional costs to the hospital should be incurred.
d) **As there is only one records clerk, folder requests should be given two weeks in advance, and no pressure should be applied for a quick service. Only 50 folders per week may be requested at one time.**
e) No patient folders may be removed from the premises or be inaccessible.
f) Please provide the researcher with a copy of this letter as verification of approval.
g) Confidentiality must be maintained at all times.
h) Should you require additional research time beyond the stipulated expiry date, please apply for an extension.
i) On completion of your research, please forward any recommendations/findings that can be beneficial in terms of further action, development or policy review.
j) Please forward a copy of the publication or report on completion of the research.

Good luck with your project.
Yours sincerely

Dr Chantal Stewart
Chair
MMH Research Committee
17/8/2023

NB. Please note that if you wish to use the container, dates and times will have to be communicated beforehand.

Appendix L. Environmental Research Journal guidelines to authors

ENVIRONMENTAL RESEARCH

A Multidisciplinary Journal of Environmental Sciences and Engineering

ELSEVIER

AUTHOR INFORMATION PACK

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ISSN: 0013-9351

DESCRIPTION

Environmental Research is a multi-disciplinary journal publishing high quality and novel information about anthropogenic issues of global relevance and applicability in a wide range of environmental disciplines, and demonstrating environmental application in the real-world context. Coverage includes, but is not limited to, the following research topics and areas:Air, soil, water and biota chemical pollutants and healthAnalytical and bioanalytical chemistryBioconcentration, bioaccumulation and biomagnificationBiotransformation and environmental fateContaminant behaviour and environmental processesBiomarkersBiomonitoring and adverse/toxic health effectsChemical stressorsEcological chemistryEcotoxicologyEndocrine disruptionEnvironmental and occupational medicineEnvironmental biotechnologyEnvironmental chemistryEnvironmental epidemiologyEnvironmental functional materials for pollution controlEnvironmental risks assessment and managementEnvironmental toxicologyEnvironment-related "omics"Food web interactionsGlobal warming/Climate changeIndoor and outdoor air pollution controlMarine, freshwater and terrestrial ecosystemsPollution detection and monitoring Resource-Energy recovery during pollution controlRisks and public health Solid-Waste management Soil and site pollution remediationWaste treatment and disposalWastewater and sewage contaminantsWater pollution control and Water securityWildlife and biota**Please DO NOT ask the Editors-in-Chief for permission before submitting a manuscript. Kindly check the guidelines above to determine whether your manuscript is within the scope of the journal; if yes, please go ahead and submit it.**
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GUIDE FOR AUTHORS

Your Paper Your Way

We now differentiate between the requirements for new and revised submissions. You may choose to submit your manuscript as a single Word or PDF file to be used in the refereeing process. Only when your paper is at the revision stage, will you be requested to put your paper in to a 'correct format' for acceptance and provide the items required for the publication of your article.
To find out more, please visit the Preparation section below.

INTRODUCTION

Environmental Research is a multi-disciplinary journal publishing high quality and novel information about anthropogenic issues of global relevance and applicability in a wide range of environmental disciplines, and demonstrating environmental application in the real-world context. Coverage includes, but is not limited to, the following research topics and areas:Air, soil, water and biota chemical pollutants and healthAnalytical and bioanalytical chemistryBioconcentration, bioaccumulation and biomagnificationBiotransformation and environmental fateContaminant behaviour and environmental processesBiomarkersBiomonitoring and adverse/toxic health effectsChemical stressorsEcological chemistryEcotoxicologyEndocrine disruptionEnvironmental and occupational medicineEnvironmental biotechnologyEnvironmental chemistryEnvironmental epidemiologyEnvironmental functional materials for pollution controlEnvironmental risks assessment and managementEnvironmental toxicologyEnvironment-related 'omics'Food web interactionsGlobal warming/Climate changeIndoor and outdoor air pollution controlMarine, freshwater and terrestrial ecosystemsPollution detection and monitoring Resource-Energy recovery during pollution controlRisks and public healthSolid-Waste management Soil and site pollution remediationWaste treatment and disposalWastewater and sewage contaminantsWater pollution control and Water securityWildlife and biota

The focus of the journal generally excludes papers that report results of toxicology studies or industrial exposures, unless these papers have clear relevance to environmental topics. The journal does not generally consider reports of a specific site or source (such as an assessment of releases or environmental contamination) unless these reports present novel or generalizable information. Papers reporting on studies of human subjects must provide written assurance that the research was reviewed and approved by an appropriate institutional review board (or ethics committee) for the protection of human subjects. *Environmental Research*, in common with international practice in science, requires that all authors must, in denoting measures, utilize the metric system and SI derived units (e.g., degrees Centigrade rather than Fahrenheit; Click here.

Types of article

Research Papers that meet the Aims and Scope of the journal reporting original and previously unpublished work. The Editors generally encourage brevity for all Research Papers should preferably not exceed 7,500 words (excluding refs.)
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Short Communications are primarily intended to be compact versions of Research Papers, and must still report new and original research of high quality that meet the criteria of being of broad international interest, significant and novel. Therefore Short Communications are peer reviewed to the same high standards as Research Papers and are therefore not handled any more rapidly. Other matters of general interest to the community will be considered for occasional publication as a Short Communication; an example could be a short contribution that addresses one very specific technical issue. Short Communications should be no more than 4000 words in length and contain no more than 3 figures.
Letters to the Editor (LTEs) are only published extraordinarily and in relation with very special topics. They are passed to external review only after a previous contact with the Editor-in-Chief, who will decide rapidly on the potential interest of the LTE for the readers of the Journal. In certain circumstances authors may be invited to submit a **Reply** to an LTE.

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Reporting sex- and gender-based analyses

Reporting guidance

For research involving or pertaining to humans, animals or eukaryotic cells, investigators should integrate sex and gender-based analyses (SGBA) into their research design according to funder/ sponsor requirements and best practices within a field. Authors should address the sex and/or gender dimensions of their research in their article. In cases where they cannot, they should discuss this as a limitation to their research's generalizability. Importantly, authors should explicitly state what definitions of sex and/or gender they are applying to enhance the precision, rigor and reproducibility of their research and to avoid ambiguity or conflation of terms and the constructs to which they refer (see Definitions section below). Authors can refer to the Sex and Gender Equity in Research (SAGER) guidelines and the SAGER guidelines checklist. These offer systematic approaches to the use and editorial review of sex and gender information in study design, data analysis, outcome reporting and research interpretation - however, please note there is no single, universally agreed-upon set of guidelines for defining sex and gender.

Definitions

Sex generally refers to a set of biological attributes that are associated with physical and physiological features (e.g., chromosomal genotype, hormonal levels, internal and external anatomy). A binary sex categorization (male/female) is usually designated at birth ("sex assigned at birth"), most often based solely on the visible external anatomy of a newborn. Gender generally refers to socially constructed roles, behaviors, and identities of women, men and gender-diverse people that occur in a historical and cultural context and may vary across societies and over time. Gender influences how people view themselves and each other, how they behave and interact and how power is distributed in society. Sex and gender are often incorrectly portrayed as binary (female/male or woman/man) and unchanging whereas these constructs actually exist along a spectrum and include additional sex categorizations and gender identities such as people who are intersex/have differences of sex development (DSD) or identify as non-binary. Moreover, the terms "sex" and "gender" can be ambiguous—thus it is important for authors to define the manner in which they are used. In addition to this definition guidance and the SAGER guidelines, the resources on this page offer further insight around sex and gender in research studies.

Suggestion for Reviewers

Authors must suggest a minimum of 6 names of potential reviewers who should have no conflict of interests with their work or that of their co-authors, including not working at their institution. For each suggested reviewer, authors must include: Full name and title, professional affiliation, and professional email address (avoiding yahoo, hotmail, gmail, etc. addresses). Please make sure that the email addresses you provide us with are valid and up-to-date. Give also at least one reason why the author is recommending her/his name as possible reviewer.

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Cover Letter: Document (Word, WordPerfect, RTF, PDF, LaTex) containing your cover letter to the Editors. The following statement should be included in the letter to the editor: " All of the authors have read and approved the paper and it has not been published previously nor is it being considered by any other peer-reviewed journal."

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Manuscripts must be written in English. There are no submission fees or page charges. Manuscripts are accepted for review with the understanding that no substantial portion of the study has been published or is under consideration for publication elsewhere and that its submission for publication

has been approved by all of the authors and by the institution where the work was carried out; further, that any person cited as a source of personal communication has approved such a citation. Written authorization may be required at the Editor's discretion. All papers reporting on studies involving human subjects must include documentation that the study was reviewed and approved, prior to its conduct, by an appropriate institutional review board for human subjects research. No exceptions will be made to this requirement. Manuscripts that do not meet the general criteria or standards for publication in *Environmental Research* will be immediately returned to the authors without detailed review.

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PREPARATION

Queries

For questions about the editorial process (including the status of manuscripts under review) or for technical support on submissions, please visit our Support Center.

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References

There are no strict requirements on reference formatting at submission. References can be in any style or format as long as the style is consistent. Where applicable, author(s) name(s), journal title/ book title, chapter title/article title, year of publication, volume number/book chapter and the article number or pagination must be present. Use of DOI is highly encouraged. The reference style used by the journal will be applied to the accepted article by Elsevier at the proof stage. Note that missing data will be highlighted at proof stage for the author to correct.

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There are no strict formatting requirements but all manuscripts must contain the essential elements needed to convey your manuscript, for example Abstract, Keywords, Introduction, Materials and Methods, Results, Conclusions, Artwork and Tables with Captions.
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Divide the article into clearly defined sections.

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Please ensure the figures and the tables included in the single file are placed next to the relevant text in the manuscript, rather than at the bottom or the top of the file. The corresponding caption should be placed directly below the figure or table.

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This journal operates a single anonymized review process. All contributions will be initially assessed by the editor for suitability for the journal. Papers deemed suitable are then typically sent to a minimum of two independent expert reviewers to assess the scientific quality of the paper. The Editor is responsible for the final decision regarding acceptance or rejection of articles. The Editor's decision is final. Editors are not involved in decisions about papers which they have written themselves or have been written by family members or colleagues or which relate to products or services in which the editor has an

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Regardless of the file format of the original submission, at revision you must provide us with an editable file of the entire article. Keep the layout of the text as simple as possible. Most formatting codes will be removed and replaced on processing the article. The electronic text should be prepared in a way very similar to that of conventional manuscripts (see also the Guide to Publishing with Elsevier). See also the section on Electronic artwork.
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Article structure

For original full-length articles:
Introduction should be as concise as possible, without subheadings.

Materials and methods should be sufficiently detailed to enable the experiments to be reproduced.

Results and Discussion may be combined and may be organized into subheadings.

For commentaries and articles related to environmental policy, alternate formats will be accepted but should include an Introduction describing the problem in terms that a general reader will understand. All statements of fact need to be referenced and papers that make use of newly acquired data must include a Materials and methods section as well as a Results and Discussion section.

Subdivision - numbered sections
Divide your article into clearly defined and numbered sections. Subsections should be numbered 1.1 (then 1.1.1, 1.1.2, ...), 1.2, etc. (the abstract is not included in section numbering). Use this numbering also for internal cross-referencing: do not just refer to 'the text'. Any subsection may be given a brief heading. Each heading should appear on its own separate line.

Introduction
State the objectives of the work and provide an adequate background, avoiding a detailed literature survey or a summary of the results.

Material and methods
Provide sufficient details to allow the work to be reproduced by an independent researcher. Methods that are already published should be summarized, and indicated by a reference. If quoting directly from a previously published method, use quotation marks and also cite the source. Any modifications to existing methods should also be described.

Results
Results should be clear and concise.

Discussion
This should explore the significance of the results of the work, not repeat them. A combined Results and Discussion section is often appropriate. Avoid extensive citations and discussion of published literature.

Conclusions
The main conclusions of the study may be presented in a short Conclusions section, which may stand alone or form a subsection of a Discussion or Results and Discussion section.

Appendices
If there is more than one appendix, they should be identified as A, B, etc. Formulae and equations in appendices should be given separate numbering: Eq. (A.1), Eq. (A.2), etc.; in a subsequent appendix, Eq. (B.1) and so on. Similarly for tables and figures: Table A.1; Fig. A.1, etc.

Essential title page information

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Page 1 should contain the article title, the names and affiliations of all authors, and the name, telephone and fax numbers, e-mail address, and complete mailing address of the person to whom all correspondence should be sent.

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Materials and methods should be sufficiently detailed to enable the experiments to be reproduced or the study design to be understood fully.

Results and Discussion may be combined and may be organized into subheadings.

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Abstracts should be a maximum of 300 words in length.

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Although a graphical abstract is optional, its use is encouraged as it draws more attention to the online article. The graphical abstract should summarize the contents of the article in a concise, pictorial form designed to capture the attention of a wide readership. Graphical abstracts should be submitted as a separate file in the online submission system. Image size: Please provide an image with a minimum of 531 × 1328 pixels (h × w) or proportionally more. The image should be readable at a size of 5 × 13 cm using a regular screen resolution of 96 dpi. Preferred file types: TIFF, EPS, PDF or MS Office files. You can view Example Graphical Abstracts on our information site.

Keywords

Immediately after the abstract, provide a maximum of 6 keywords, using American spelling and avoiding general and plural terms and multiple concepts (avoid, for example, 'and', 'of'). Be sparing with abbreviations: only abbreviations firmly established in the field may be eligible. These keywords will be used for indexing purposes.

Abbreviations
Define abbreviations that are not standard in this field in a footnote to be placed on the first page of the article. Such abbreviations that are unavoidable in the abstract must be defined at their first mention there, as well as in the footnote. Ensure consistency of abbreviations throughout the article.

Abbreviations should follow the usage established by *Chemical Abstracts*. Please restrict the use of acronyms, especially non-standard ones, as much as possible.

Acknowledgements
Collate acknowledgements in a separate section at the end of the article before the references and do not, therefore, include them on the title page, as a footnote to the title or otherwise. List here those individuals who provided help during the research (e.g., providing language help, writing assistance or proof reading the article, etc.).

Acknowledgments should be brief and should precede the references. In agreement with the Commission on Publication Ethics, authors must submit full information on sources of funding and other support for their work that is presented in their paper.

Formatting of funding sources
List funding sources in this standard way to facilitate compliance to funder's requirements:

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