**Title:** Assessing the Impact of Endocrine-Disrupting Chemicals in Makeup Products on Female Reproductive Health: Exposure Levels and Regulatory Improvements

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## Introduction

Infertility remains a prevalent reproductive health issue for women in the United States. According to the World Health Organization (2024) infertility can be defined as “a disease of the male or female reproductive system defined by the failure to achieve a pregnancy after 12 months or more of regular unprotected sexual intercourse.” In the female reproductive system, this condition may be caused by factors such as tubal disorders, uterine disorders, ovarian disorders, or endocrine system disorders (Gore et al., 2015; Segal and Giudice, 2019). Lifestyle factors such as age, weight, substance use, and sexually transmitted diseases can also lower one’s ability to conceive (Cleveland Clinic, 2025).

Available research suggests that infertility is growing worldwide at alarming rates. Data from the Centers for Disease Control and Prevention (CDC) National Health Statistics Report, shows that 1 in 7 women, ages 15-49, have trouble getting pregnant or sustaining a pregnancy (Nugent & Chandra, 2024). The World Health Organization also indicates that approximately 17.5% of the adult population around the globe is infertile or has struggled with infertility. These rates are spread evenly across high, medium, and low-income countries, demonstrating the overall prevalence of infertility throughout all parts of the world (World Health Organization, 2023). Among the adult population, women are disproportionately impacted by infertility. A global study of disease burden, conducted in 2021, examined female infertility in women aged 15–49 years. This study found that the global prevalence of female infertility was 110.1 million, representing a 33.1% increase since 1990 (Wei et al., 2025).

The widespread nature of infertility among women in the United States has significant implications for the overall health and well-being of women and their families. Specifically, infertility has a high economic cost for families as the World Health Organization (2023) reports that fertility treatments in many countries are largely funded out of pocket, often resulting in devastating financial costs. Fertility treatments in the United States are not always covered by health insurance. The lack of mandated insurance coverage for fertility treatments leaves many families with extremely high medical expenses to pay while also conveying a social message that infertility is not a medical problem deserving of critical financial aid or medical attention (Insogna & Ginsburg, 2018). In addition to the general financial burden that patients must endure to follow through with their fertility care plans, the most significant number of medical centers for *in vitro* fertilization treatment are found in states with high median incomes and mandated insurance coverage of infertility treatment (American Society for Reproductive Medicine, 2021). The inconsistency in the geographical location of specialists often leaves certain communities, particularly racial or ethnic minorities and low-income communities, without access to credible physicians. This inconsistency also creates a patient population of mainly highly educated, white individuals (American Society for Reproductive Medicine, 2021).

As a result of struggles with infertility, women and their families can also experience significant mental health issues as a result. Infertility can cause psychological distress, emotional stress, and financial difficulties for both partners. Couples may feel emotions like anger, guilt, sadness, depression, anxiety, and loss of self-confidence and self-esteem (Simionescu et al., 2021). Additionally, due to the high cost and disparity in access to treatment, women experience emotions of hopelessness as they feel a lack of power over their bodies and access to care. The financial burden of medical treatments can result in additional stress on top of the anxiety that comes from undergoing fertility treatments. Even more, some cultures mark childbearing as necessary, so a lack of this capability can heighten familial and marital tensions, as well as induce judgment from society upon an individual (Sharma & Shrivastava, 2022).

Individuals within certain minority groups often face additional challenges when seeking fertility treatment. Researchers have found that individuals from some racial/ethnic minority communities, such as Hispanics, Asians, and African Americans, are more likely to be discouraged from seeking medical attention for infertility due to cultural stigmas, communication challenges, or prior negative experiences with the United States healthcare system (American Society for Reproductive Medicine, 2021). For example, it takes an African American woman on average 4.3 years to seek medical help after being unable to conceive naturally versus 3.3 years for a white woman to do the same (Insogna and Ginsburg, 2018), and they are "half as likely to be evaluated for infertility" (Weiss & Marsh, 2023).

Due to the wide range of factors influencing the increasing worldwide infertility rates and its associated consequences for women and their families, it is important to understand and address the possible causes of female infertility. As one of the primary factors contributing to higher infertility rates among women that is noted in existing empirical literature is the exposure to endocrine-disrupting chemicals, further research examining the nature, extent, and impact of exposure to endocrine-disrupting chemicals on womens' reproductive health is necessary.

## Purpose of the Current Study

Considering the prevalence and impact of infertility in women, it is important to better understand and address the factors causing infertility. As available research has established the connection between endocrine-disrupting chemicals and infertility among women and girls, the current study seeks to examine the presence of toxic endocrine-disrupting chemicals in makeup products commonly used by women and girls. Specifically, this research study will first document the connection between toxic chemicals in makeup products and potential fertility issues through a literature review, conduct secondary data analyses to examine the presence of endocrine-disrupting chemicals in selected makeup products using the EWG's Skin Deep database, and propose regulatory measures to better protect consumers. The specific research questions to be examined in the current study are outlined below.

Research Questions:

1. What is the extent of exposure to endocrine-disrupting chemicals in commonly used makeup products, and how might this exposure contribute to infertility in women and girls?
2. How can government regulatory measures be improved to mitigate against exposure to endocrine-disrupting chemicals through makeup products?

## Literature Review

### Endocrine-Disrupting Chemicals: The Hidden Threat to Female Reproductive Health

The greatest chemical threat to female reproductive health is endocrine-disrupting chemicals (Cleveland Clinic, 2024). The endocrine system consists of endocrine glands located in the brain, internal organs, and ovaries. These glands are responsible for the secretion of hormones which carry signals throughout the body via the bloodstream and are responsible for numerous biological functions such as reproduction, fertility, and normal growth. The human body relies on over fifty hormones to function properly. However, hormones also work in very small amounts, meaning even the smallest changes can induce large responses and cause noticeable changes or symptoms (Cleveland Clinic, 2024).

The endocrine system is made up of three tissue groups spanning the entire body. The first group is the endocrine glands (pineal gland, the pituitary gland, the thyroid glands, the parathyroid glands, and the adrenal glands) which are responsible for making and secreting hormones directly into the bloodstream. The endocrine system also contains special endocrine

system organs (the hypothalamus, pancreas, adipose tissue or body fat, ovaries, and testicles) whose function is to release hormones into the body. Lastly, this system also includes endocrine-related tissues (the digestive tract, the kidneys, the liver, the heart, and the placenta) which play a role in the secretion of hormones into the body but are not typically categorized as solely part of the endocrine system since they hold a more significant role within the body (Cleveland Clinic, 2024).

Endocrine-disrupting chemicals are defined as any toxins that can negatively affect the endocrine system and its ability to function properly (U.S. Department of Health and Human Services, 2024). These chemicals may enter the body through ingestion, inhalation, or absorption through the pores. Numerous disruptors are commonly found in everyday products including cosmetics, pharmaceuticals, and food packaging. Parabens, phthalates, bisphenol A, and various pesticides all can yield major impacts on the endocrine system (U.S. Department of Health and Human Services, 2024).

These disruptors can work to harm the body in multiple ways. They can mimic a hormone, block its reception, and cause the over or underproduction of hormones directly or indirectly. For instance, chemicals that mimic the hormone estrogen pose significant threats to reproductive health. Estrogen is responsible for regulating the menstrual cycle, and its levels increase at the start of puberty while decreasing at the beginning of menopause. Environmental chemicals that can imitate or altogether block estrogen may trigger adverse effects on the timing of a female's reproductive cycle, delaying menopause, speeding up puberty, or leading to irregular development of certain sex organs (Gunderson et al., 2006).

Such toxins pose a multitude of risks to the reproductive system, having a deteriorating effect on an individual's sexual health. For example, girls exposed to the common pesticide dichloro-diphenyl-trichloroethane (DDT), early in life may face an accelerated puberty rate (Endocrine Society, 2019). These results can continue to impact them as they age, leading to elongated menstrual cycles as well as the earlier onset of menopause (Endocrine Society, 2019). Another common endocrine-disrupting chemical encountered in everyday life is bisphenol A (BPA). This toxin is used in a variety of products, including drink containers, plastics, and dental sealants (Patel et al., 2015). BPA poses several threats to female reproductive health. In women undergoing fertility treatment, higher levels of BPA in their urine was positively correlated with decreased number of sacs that hold immature eggs in the ovaries (Patel et al., 2015). When the number of sacs that hold immature eggs in the ovaries are decreased, this lessens a woman's chances of getting pregnant (Utah Fertility Center, n.d.).

## Endocrine-Disrupting Chemicals in Makeup: Impact on Female Reproductive Health

Makeup products are considered to be cosmetics, and the Federal Food, Drug, and Cosmetic Act (FD&C Act) defines cosmetics as "articles intended to be rubbed, poured, sprinkled, or sprayed on, introduced into, or otherwise applied to the human body...for cleansing, beautifying, promoting attractiveness, or altering the appearance" ([FD&C Act, sec. 201(i)], U.S. Food and Drug Administration, n.d.). Cosmetic makeup products are commonly used by women and girls and may include items such as foundations, makeup powder, and lip products. In an article published by YouGov, a survey study of 1,000 women in the U.S., found that up to 74% of them reported wearing makeup (Orth, 2023). Available research has confirmed the presence of endocrine-disrupting chemicals in makeup products used frequently by women and girls. These include chemicals such as lead, parabens, phthalates, butylated compounds, titanium dioxide,

per and polyfluoroalkyl substances, and formaldehyde and formaldehyde releasers. An in-depth overview of the nature and impact of these endocrine-disrupting chemicals is included below.

**Lead**

This chemical element is used in many colored cosmetics and is a known neurotoxin that has been found to increase infertility in women (Campaign for Safe Cosmetics, 2022). Research shows that lead has a significant impact on women's reproductive health and women exposed to lead may encounter irregular menstrual cycles and hormone imbalances. Furthermore, lead can cross over the placenta of a pregnant woman, harming the brain of the fetus and increasing the likelihood of a miscarriage (Campaign for Safe Cosmetics, 2022). Additionally, pregnant women with lead in their blood can pass the toxin to their baby, since the toxin reaches both the placenta and breast milk. This not only leads to the chemical's presence in the baby's body but can also harm childhood development (Campaign for Safe Cosmetics, 2022).

**Parabens (such as propylparaben, isopropylparaben, butylparaben, isobutylparaben)**

Parabens are chemicals most commonly found in makeup products such as mascara, foundation, eye shadow, and eyeliner. Parabens are typically added to products to increase shelf life by stopping the growth of mold or other bacteria. The U.N Environment program has identified parabens as endocrine-disrupting chemicals. This is because these chemicals are known to harm the reproductive system since they can mimic estrogen. Exposure to parabens can lead to the disruption of hormones, negative impacts on reproductive organs, increased infertility, and negative effects on birth outcomes. Parabens are typically absorbed by the skin and excreted through the urine. Additionally, in their National Health and Nutrition Examinations Surveys, the CDC found that over 92% of the Americans tested had high levels of propylparaben in their bodies while 50% had high levels of butylparaben. These data points highlight the concerning rate of exposure to parabens among Americans which may increase the likelihood of experiencing negative health outcomes associated with exposure. Frequent use of products containing parabens can increase the levels of these chemicals in a person's body by extreme percentages. For example, one study found that young girls who wore makeup every day had twenty times the propylparaben levels in their urine than those using makeup infrequently or in smaller increments. Multiple studies have been conducted on the effects of butylparaben specifically. In one animal study examining butylparaben in rats, results demonstrated that it harms the female reproductive system (Stoiber, 2019).

**Phthalates (such as DEP, DBP, and DEHP)**

Phthalates are chemicals commonly found in color cosmetics such as blush, concealer, and eyeshadow as well as fragrances and nail products. These chemicals are typically used to enhance the product structure, increase shelf life, and help the spreadability of a product (Redox Medical Group, 2024). Phthalates, specifically DEP and DEHP, have been determined to lead to significant endocrine disruption by the European Commission (EU). These chemicals are considered reproductive toxins. One study on the effects of DEHP specifically revealed that higher levels of this chemical in urine were found in women who reported pregnancy loss during their time undergoing fertility treatment (Toft et al., 2012). Other studies on DEHP in urine have shown that this toxin is associated with fewer viable eggs and lower levels of fertilized eggs during *in vitro* fertilization treatment (Land et al., 2025). Additionally, the babies of pregnant women exposed to high levels of phthalates have shown birth defects in their genital areas (Campaign for Safe Cosmetics, 2022). These toxins can also reduce hormone levels within the body, affecting the proper growth and function of many reproductive organs (Campaign for Safe Cosmetics, 2022).

**Butylated compounds (butylated hydroxyanisole, or BHA, and butylated hydroxytoluene, or BHT)**

Butylated compounds are most commonly found in lip products and eye shadow products. These chemicals are typically used as preservatives, especially in formulations with high fat and oil content. Butylated compounds have been stated to have a strong correlation with endocrine disruption by the European Commission (Campaign for Safe Cosmetics, 2022). These toxins have also been linked with dysfunction of reproductive organs. For example, an animal study of rats exposed to butylated compounds found that experimental male and female rats experienced the underdevelopment of their reproductive organs (Jeong et al., 2005). Additionally, the experimental rats had significantly observed changes in their testosterone levels and the weight of their sex organs (Jeong et al., 2005). Another study conducted on female and male rats monitored their offspring for a 13-week period, reviewing the reproductive effects on the animals when they received certain doses of BHA. The results demonstrated that exposure to the toxin led to delayed sexual maturity as well as smaller sperm size and reduced motility (Pop et al., 2013).

Similarly, research has identified negative reproductive effects associated with exposure to BHT. For example, a study examining the BHT levels in the fluid surrounding cells in the ovarian follicle among 181 women between the ages of 20 and 44 found greater concentrations of BHT among women who had diminished ovarian reserve when compared to women without the condition (Hao et al., 2023). The findings from this study demonstrate that greater concentrations of BHT positively correlated with an increased risk of having diminished ovarian reserve (Hao et al., 2023). Diminished ovarian reserve refers to when a woman has fewer eggs in her ovaries than she should at her age. This condition can make it much more difficult for women to become pregnant (Cleveland Clinic, 2022).

**Titanium Dioxide**

This chemical is inhalable and is a white pigment that can be found in colored cosmetics. It is also found in many sunscreens as it is known for its ability to filter out harmful UV rays from the sun (Chemical Safety Facts, 2024). However, studies have shown that this chemical can negatively impact reproductive health. During one study conducted on mice, those exposed to titanium dioxide particles for an extended time had a large volume of the chemical in their ovaries. This indicates that titanium dioxide can impact the function of reproductive organs (Wang et al., 2024). In the female mice included in the study, those with long-term exposure to this chemical also had a reduced number of ovarian follicles and developed ovarian cysts, indicating that the titanium-dioxide harms the ovaries. Titanium dioxide has also been shown to increase infertility (Mingui et al., 2024). Another study using mice discovered that those who received oral solutions of titanium dioxide had lower numbers of pregnancy and birth rates. Their fertility was also negatively impacted, having less fertilization success and fewer viable embryos. The estrogen hormone levels in the contaminated mice were also reduced (Karimipour, 2018).

**Per and polyfluoroalkyl substances (PFAs)**

These chemicals are usually added to makeup products to condition or smooth skin as well as give the product itself a shiny consistency or texture (FDA, 2024). They are also water and oil-resistant, making them ideal for makeup used for an extended time (Guardian News and Media, 2023). Studies have shown that long-term exposure to such chemicals causes increased miscarriages in pregnant women. These toxins can also cause developmental delays in children, some of the negative effects being a low birth weight and accelerated puberty

(Environmental Protection Agency, 2024). Additionally, other studies have shown that women with higher levels of PFAs in their blood had a 40 percent lower chance of conceiving during the same year compared to women with limited exposure to the same toxins. The same women who interacted significantly more with PFAs had a 34 percent lower chance of live birth after a 12-month period (Guardian News and Media, 2023).

The Environmental Health Sciences Core Center at Mount Sinai also found that contact with PFAs may increase a woman's infertility rates by approximately 40%. This study on females in Singapore revealed that higher levels of these toxins in the bloodstream positively correlated with a lower likelihood of conception as well as live births (U.S. Department of Health and Human Services, 2023). Furthermore, epidemiological studies have found that some cases of polycystic ovarian syndrome can be linked to exposure to PFAs (Qu et al., 2024).

**Formaldehyde and formaldehyde releasers**

Formaldehyde has antimicrobial properties and is used as a preservative in numerous products for this reason. It is classified as a carcinogen and has been banned by the European Union. However, some makeup products still utilize formaldehyde variants or chemicals that release formaldehyde (Million Marker Staff, 2024). In humans, this toxin has been shown to decrease fertility and increase the occurrence of a miscarriage (California Department of Public Health 2023). Exposure to this chemical has also been linked to premature birth (Amiri et al., 2015). For example, in a study of 271 infants exposed to formaldehyde solutions at birth, both major and minor health defects increased. Additionally, other studies on formaldehyde's impact on women have reported that menstrual cycle irregularities occur with higher exposure to formaldehyde releasers (Mekdeci, 2020).

## Research Methodology

The main focus of the current study is to assess the presence of endocrine-disrupting chemicals in commonly used makeup products. As such, secondary data analysis will be conducted to determine the extent of endocrine-disrupting chemicals that are present in selected make-up items. The research approach is described in this section.

### Sample Selection

Two phases of the sample selection process were completed to determine the specific types and brands of makeup products to be assessed in this study. In phase one, a broad spectrum of commonly used makeup products that serve distinct functions and are applied to different areas of the face were selected. Specifically, selected makeup products include lip gloss - for the lips, mascara - for the eyes, and concealer - for various blemishes and imperfections on the skin. The diversity of these items allows for a comprehensive exploration of various makeup products in this study.

In phase two, the brands of makeup products to be assessed were selected. A total of six brands were selected across two categories (Category 1: affordable makeup and Category 2: luxury/high-end makeup) to ensure a diverse and representative sample of commonly used makeup brands. Specifically, three brands were selected from a list of affordable/drug-store makeup brands with prices ranging between $10 and $30 per item (Robin, 2024) while three brands were selected from a list of luxury/high-end makeup brands with prices ranging between $31 and $60 per item (Alvarez, 2024). The affordable brands selected include L'Oréal Paris,

Pacifica, and Revlon while the luxury brands selected include Anastasia Beverly Hills, Dior Beauty, and Benefit Cosmetics. In total 133 products were analyzed across the six brands under the categories of lip gloss, concealer, and mascara.

**Ingredient Analysis Process**

Secondary data collection and ingredient analysis was carried out using EWG's Skin Deep Database. For each type of makeup product, all selected brands were surveyed individually. An initial database search was run to display all products available in the database for the selected type and brand of makeup products. Once the database displayed all of the products available under that category for the certain brand, the ingredient lists on every single product's packaging were reviewed. This step-by-step process was done to identify any endocrine-disrupting chemical of concern, such as lead, parabens, phthalates, butylated compounds, titanium dioxide, per and polyfluoroalkyl substances, and formaldehyde-releasing ingredients. For makeup products with multiple skin tone shades available in the database (e.g., lip gloss and concealer), each shade of the makeup product was analyzed in case a certain pigment for a specific skin tone contained more endocrine-disrupting chemicals than a different color.

**Environmental Working Group (EWG) Skin Deep Database**

The EWG's Skin Deep Database was used to survey the ingredients within each product for all of the brands. Every product on its website gets a two-part score, the first part being from 1-10 based on an item's level of hazardous ingredients and the second part ranging from none to robust, referring to the information available on the components of that item. Then, to find the product's overall score, the individual ingredient hazards are compared to all of the other items within the database, and given a final score. The safest products are those that score low on the hazard scale and have a decent amount of information available about the ingredients in their formula. For example, a hazard rating of 1 would mean that the ingredients in the product are overall extremely safe and that there is a large range of data available on both the ingredients and the formula of the product itself. On the other hand, a hazard rating of 10 would indicate that the product is of an incredibly high hazard and that almost all of its ingredients are super unsafe. This score could also signify a lack of data on information about the formula with this absence of knowledge about the product contributing to its hazardness. For every product, the database lists every identified component. It also marks whether the overall item is a low, moderate, or severe threat to reproductive health and whether certain chemicals are endocrine-disrupting. (Environmental Working Group, 2025).

## Results

The current study examined the presence of endocrine-disrupting chemicals in commonly used makeup products. Specifically, 133 make-up products across six brands were examined. These included 47 products across three affordable brands and 86 products across three high-end brands. The affordable brands were 1) L'Oreal Paris, 2) Pacifica Beauty, and 3) Revlon while the higher end brands were 1) Anastasia Beverly Hills, 2) Dior Beauty, and 3) Benefit Cosmetics.

The total number of products examined for each brand was based on the available product information on the EWG database. The numerical breakdown of products examined per brand is as follows: 41 for Revlon, 29 for Benefit Cosmetics, 23 for L'Oreal Paris, 22 for Pacifica Beauty, 14 for Anastasia Beverly Hills, and 4 for Dior Beauty.

Three types of facial make-up products were analyzed for each brand. These included lip gloss, concealer and mascara. A total of 32 lip glosses, 34 concealers and 67 mascaras were examined. All products were examined for traces of the following endocrine-disrupting chemicals: phthalates, parabens, formaldehyde-releasing preservatives, lead, butylated compounds, per/polyfluoroalkyl substances, and titanium dioxide. See **Table 1** below for a summary of harmful ingredient presence and EWG safety ratings in selected cosmetic products by brand and product type.

**Table 1.** Toxic Ingredient Prevalence and Safety Ratings in Cosmetic Products

| Total Number of Products | Brand | Product Type | Phthalates | Parabens | Formaldehyde-Releasing Preservatives | Lead | Butylated Compounds | Per and Polyfluoroalkyl Substances | Titanium Dioxide | EWG Safety Rating |
|---|---|---|---|---|---|---|---|---|---|---|
| 133 | N/A | N/A | 2 | 14 | 20 | 2 | 78 | 0 | 79 | 3.53 |
| 47 | High-end | Mascara, Lip gloss, Concealer | 0 | 4 | 7 | 0 | 39 | 0 | 36 | 3.62 |
| 86 | Affordable | Mascara, Lip gloss, Concealer | 2 | 10 | 13 | 2 | 39 | 0 | 43 | 3.48 |
| 67 | N/A | Mascara | 0 | 10 | 6 | 2 | 46 | 0 | 20 | 3.16 |
| 34 | N/A | Concealer | 0 | 1 | 4 | 0 | 22 | 0 | 30 | 3.59 |
| 32 | N/A | Lip Gloss | 2 | 3 | 10 | 0 | 10 | 0 | 29 | 4.49 |
| 23 | L'Oreal Paris | Mascara, Lip gloss, Concealer | 2 | 1 | 13 | 0 | 11 | 0 | 20 | 5.00 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 22 | Pacifica Beauty | Mascara, Lip gloss, Concealer | 0 | 0 | 0 | 2 | 3 | 0 | 10 | 2.50 |
| 41 | Revlon | Mascara, Lip gloss, Concealer | 0 | 9 | 0 | 0 | 25 | 0 | 13 | 3.15 |
| 14 | Anastasia Beverly Hills | Mascara, Lip gloss, Concealer | 0 | 3 | 1 | 0 | 5 | 0 | 9 | 3.50 |
| 4 | Dior Beauty | Mascara, Lip gloss, Concealer | 0 | 0 | 2 | 0 | 0 | 0 | 2 | 2.75 |
| 29 | Benefit Cosmetics | Mascara, Lip gloss, Concealer | 0 | 1 | 4 | 0 | 34 | 0 | 25 | 3.79 |

**Prevalence of Endocrine-Disrupting Chemicals across all Products**

**Per- and polyfluoroalkyl substances, Phthalates and Lead:** None of the 133 make-up products assessed contained per- and polyfluoroalkyl substances (PFAS). Additionally, phthalates and lead were among the least prevalent endocrine-disrupting chemicals, each appearing in only 2 products. Phthalates were found in two lip gloss products from L'Oreal Paris while Lead was found in two mascara products from Pacifica Beauty.

**Parabens:** A total of 14 products (4 high end and 10 affordable products) contained parabens across all 6 brands. 10 of the products were mascara, 3 were lip glosses, and 1 was a concealer. By brand, 9 Revlon products, 3 Anastasia Beverly Hills, 1 Benefit Cosmetics, and 1 L'Oreal Paris product were found to contain parabens.

**Formaldehyde-Releasing Preservatives:** A total of 20 makeup products contained formaldehyde releasing preservatives or traces to formaldehydes, with 7 from high-end brands and 13 from affordable brands. The chemical was found in 10 lip glosses, 6 mascaras and 4 concealers. By brand, 13 L'Oreal Paris products, 4 Benefit Cosmetics, 2 Dior Beauty, and 1 Anastasia Beverly Hills product.

**Butylated Compounds:** A total of 78 makeup products contained butylated compounds, evenly distributed between high-end (39 products) and affordable (39 products) brands. These compounds were most frequently found in 46 mascaras, followed by 22 concealers and 10 lip glosses. By brand, 34 Benefit Cosmetics products, 25 Revlon, 11 L'Oreal Paris, 5 Anastasia Beverly Hills, and 3 Pacifica Beauty products contained butylated compounds.

**Titanium Dioxide:** A total of 79 makeup products contained Titanium dioxide, with 36 from high-end brands and 43 from affordable brands. The chemical was found in 20 mascaras, 30 concealers, and 29 lip glosses. By brand, 25 Benefit Cosmetics products, 20 L'Oreal Paris, 13 Revlon, 10 Pacifica Beauty, 9 Anastasia Beverly Hills, and 2 Dior Beauty products contained titanium dioxide.

**Overview based on EWG Safety Rating**

The average EWG safety rating across all 133 makeup products was 3.53 indicating that, on average, the products were considered moderately hazardous. According to EWG's scale (where 1–2 signifies low hazard; 3–6 moderate hazard; and 7–10 high hazard), this score suggests a moderate level of concern regarding the health risks associated with the ingredients. Additionally, the rating reflects a modest volume of available research and information on the products' ingredients and formulations.

The average EWG safety rating for the 47 high-end products was 3.62, while the average rating for the 86 affordable products was 3.48, despite both categories containing similar levels of butylated compounds and titanium dioxide. Furthermore, high-end products had no phthalates or lead, when compared to affordable products, which included 2 products with phthalates and 2 with lead.

The EWG safety ratings were also analyzed by product type revealing that lip glosses had the highest (worst) average rating at 4.49, followed by concealers at 3.59 and mascaras at 3.16. This finding indicates that lip glosses posed the greatest potential toxicity concern among the three product types. Supporting this, 10 out of the 32 lip glosses contain formaldehyde-releasing preservatives. While concealers had a slightly lower average safety rating than lip glosses, they contained the highest levels of titanium dioxide, with 30 out of 34 products including the compound, likely due to its common use as a pigment or sunscreen agent. These findings suggest that both lip glosses and concealers may carry higher ingredient-related health risks compared to mascaras, which had the lowest average EWG safety rating.

The EWG safety ratings were also analyzed by brand, revealing that Pacifica Beauty had the lowest (best) EWG rating of 2.50, indicating the cleanest product formulation profile. Pacifica Beauty products had no parabens, phthalates, or formaldehyde-releasing preservatives, aligning with its marketed image as a "clean beauty" brand (Pacifica Beauty, LLC). In contrast, L'Oreal Paris had the highest (worst) EWG rating of 5.00, with the highest levels of phthalates and formaldehyde-releasing preservatives when compared to other make-up brands.

Benefit Cosmetics, Anastasia Beverly Hills, and Revlon showed moderate ingredient risk, with EWG safety ratings of 3.79 , 3.50, and 3.15, respectively. However, Revlon had no formaldehyde-releasing preservatives, Anastasia Beverly Hills had relatively low numbers of parabens, formaldehyde-releasers, and butylated compounds as well as no parabens or traces of lead, while Benefit had a relatively high number of butylated compounds (n = 34).

Dior Beauty, while being a high-end brand, had a relatively low product count of 4, making its broader safety conclusions limited. Its EWG rating of 2.75 was relatively low, and none of its products contain parabens or lead.

## Discussion

Six of the seven endocrine-disruptive chemicals assessed in this study were identified across 133 facial make-up products. These included phthalates, parabens, formaldehyde releasing preservatives, titanium dioxide, butylated compounds, and lead.

Both formaldehyde-releasing preservatives, products with traces of formaldehyde, and lead pose serious negative health effects. Formaldehyde-releasers can lead to a decrease in fertility as well as increase both likelihood of a miscarriage (California Department of Public Health, 2023) and premature birth (Amiri et al., 2015). Lead can engender a variety of issues, such as irregular menstrual cycles, hormone imbalances, and its presence in a woman's blood can cross the placenta, creating later developmental challenges for her baby (Campaign for Safe Cosmetics, 2022).

One of the most prevalent chemical groups were butylated compounds. However, the only two types encountered in the surveyed products were butylene glycol and butylated hydroxytoluene (BHT). More products contained butylene glycol than BHT which is a positive, as BHT is much more of a reproductive concern than butylene glycol. Butylene glycol is an organic alcohol, often used in cosmetics to soften and moisturize the skin as well as enhance product structure and texture (Tee-Melegrito, 2023). Butylated compounds have been stated to have a strong correlation with endocrine disruption by the European Commission (Campaign for Safe Cosmetics, 2022). These high quantities of BHT are concerning, especially when several brands incorporate the chemical into their products, meaning that it is being absorbed by a range of buyers. Not only does this put consumers at risk for harmful consequences on their reproductive organs, but frequent use of such cosmetics could lead to a higher risk of diminished quantity of healthy, immature eggs within a woman's ovaries (Hao et al., 2023; National Cancer Institute, n.d.). Since numerous women and girls may begin makeup use at a young age, the potential accumulation of BHT in their bodies may result in extremely adverse consequences on their egg count by the time they are choosing to attempt to conceive (Hao et al., 2023).

Another concerning data point was the high number of products that contained titanium dioxide. Not only was this chemical prevalent, but its presence was split almost entirely evenly between affordable and high-end brands. This indicates that consumers of all socio-economic demographics and identities are potentially being exposed to the harmful effects of this chemical. Titanium dioxide was also found pretty evenly amongst the three types of makeup (in 29 lip gloss, 20 in mascara, and in 30 concealer). This finding also reinforces the idea that a large variety of consumers are exposed to this chemical. Due to the wide range of products and brands utilizing titanium dioxide, countless women are potentially at a higher risk of encountering problems within their ovaries, such as a reduced egg count and the development of ovarian cysts. Additionally, the accumulation of usage across time and also by using several types of makeup products may contribute to a lower fertilization rate when trying to conceive. While the literature review did not identify any human-specific research studies examining the impacts of titanium dioxide on the female reproductive system, there is plentiful evidence of its negative impacts on the reproductive health of mice and rats (Wang et al., 2024; Mingui et al., 2024; Karimipour, 2018). The high level presence of titanium dioxide in makeup products indicates the urgent need to conduct in-depth research on this chemical, not just in animal studies but in human studies as well.

In terms of the phthalates, parabens, formaldehyde releasers, and ingredients traced to lead, all of these chemicals were only found in more cost-friendly brands. This indicates that

consumers who most likely have a lower income are at an increased risk of exposure to fertility harming toxins. Thus, a clear socioeconomic disparity is evident amongst which women are more likely to come into contact with chemicals that hurt reproductive health. Furthermore, since the affordable brands contained more of these toxins, this is a more challenging barrier to overcome as women with a lower income have less flexibility when it comes to choosing different makeup brands, as brands with less toxins may be at a much higher price range.

It is important to note that the average safety ratings of affordable and higher-end cosmetic brands were similar, although the luxury brands had a slightly higher average rating. As previously noted, affordable brands were more likely to contain chemicals linked to reproductive harm. Despite the comparable safety ratings, the overall average rating across all products evaluated in this study indicates a moderate level of hazard. This suggests that many cosmetic products still pose potential health risks. Further research is needed to assess the extent of these risks based on the types and concentrations of endocrine-disrupting chemicals present.

## Recommendations

The second research question in the current study focuses on how government regulatory measures can be improved to mitigate exposure to endocrine-disrupting chemicals through makeup products. To this end, this section will provide recommendations for strengthening federal policies and regulatory guidelines that can be instrumental in protecting women and girls against increased exposure to endocrine-disrupting chemicals.

### Recommendations for regulatory changes and improvements

Currently, the US Food and Drug Administration (FDA) regulates cosmetics under the Federal Food, Drug, and Cosmetic (FD&C) Act. The FDA primarily relies on post-market monitoring to ensure consumer safety and does not require approval for cosmetics before they are introduced to the market, except for certain color additives (U.S. Food and Drug Administration, n.d.). In contrast, the European Commission (EU) Cosmetics Regulation has very thorough and firm regulations on cosmetic products. This includes requirements for comprehensive safety assessments, ingredient bans and restrictions, and requirements for labeling and ingredient disclosures.

Specifically, manufacturers are required to complete a specific, thorough safety report on any product before introducing it to the market. Additionally, cosmetics are only able to be sold by designated ‘responsible people’, and there are firm regulations on whom the European Commission clears as a ‘responsible person,’ with distinct outlines delineating their obligations. These responsible people are required to notify the EU as soon as any adverse or serious consequences related to product use occur or are reported, and must share information collected by healthcare professionals and consumers with other European countries (European Commission, (n.d).).

Furthermore, The EU currently has bans and restrictions in place for more than 1,300 substances in cosmetic products. In contrast, the FDA has a significantly shorter list of restricted and banned substances, with less than 30 prohibited items (Wonnda, 2024). In fact, several endocrine-disrupting chemicals discussed in this study are completely banned in Europe but not in the United States. These include formaldehydes (and thus formaldehyde-releasers), lead (and therefore products that have traces to or contamination concerns with lead), parabens, and phthalates. While lead is heavily regulated by the FDA, it is still not banned as in Europe, which is why some products surveyed in this study contained ingredients that had contamination concerns with lead.

Considering the identified gaps in comprehensive safety assessments, ingredient bans and restrictions, and requirements for labeling and disclosing ingredients, there are several regulatory measures that can be implemented in the United States to mitigate the risk of consumers' exposure to endocrine-disrupting chemicals. First, the FDA should support research activities to identify the endocrine-disrupting chemicals used in cosmetics that can pose harm on the female reproductive system. Identified chemicals and toxins should be subsequently banned from inclusion as ingredients in cosmetic products. The list of restricted and banned ingredients identified by the EU Cosmetics Regulation can be adopted as a guide to inform the process of developing a more comprehensive list for the US.

Additionally, the FDA should strengthen the safety requirements and processes for cosmetic products to be FDA approved. This may include requiring brands to submit relevant evidence and testimony that no endocrine-disrupting chemicals are present in the formula of the product as part of the approval process. There should also be increased laboratory analyses and studies to ensure the safety and quality of products, and more stringent requirements before a product is allowed to be sold, as opposed to the limited restrictions currently placed on cosmetic brands (PlusChem, 2023). These requirements should ensure that the ingredients in the products themselves are endocrine and reproductive friendly, but also do not contain contamination or trace concerns, as seen through several of the products surveyed in this study. The FDA should also mandate manufacturers to clearly disclose any potential reproductive health risks of product ingredients on the label or ingredient list.

Finally, the FDA should partner with the European Union and take serious note on which ingredients the EU bans and why. The European Union already possesses extensive research on numerous endocrine-disrupting chemicals and has clear motives for why banning certain toxins is necessary. Thus, they are an extremely useful database for the United States to utilize, helping to promote reproductive wellbeing for citizens around the globe. The United States should question why it has not banned certain toxins that the EU has, leading to the investigation and faults within its regulatory measures.

**Recommendations for Cosmetic Product Manufacturers and Retailers**

While the FDA has a critical role to play in mitigating consumers' exposure to endocrine-disrupting chemicals, cosmetic product manufacturers and retailers can also be instrumental in this effort. Manufacturers should prioritize reproductive health safety by developing and testing cosmetic products to ensure they are safe for the reproductive system. This should include paying special attention to identifying and eliminating endocrine-disrupting chemicals, particularly those identified in the current study from cosmetic product formulations.

Cosmetic retailers (such as Sephora and Ulta Beauty) should only stock products that have been independently tested and verified as safe for the reproductive system. If the adoption of this recommendation is not immediately feasible, retailers should at a minimum clearly label which products meet these safety criteria. Furthermore, retailers should ensure that online and instore product listings clearly indicate any reproductive health risks associated with ingredients. The implementation of this recommendation empowers consumers to make informed decisions on makeup purchases and reinforces manufacturer and retailer accountability across the supply chain.

Finally, manufacturers and retailers should collaborate with brands, health experts, or advocacy groups to educate shoppers about endocrine-disrupting chemicals and other reproductive health concerns. This could include informational signage, online resources, or awareness campaigns geared toward younger consumers, parents, and the broader society.

This education is especially critical for informing younger consumers who may not yet consider the long-term impacts on reproductive health.

**Recommendations for Future Research**

Along with the need for more research to be done on endocrine-disrupting ingredients and the implementation of restrictions on such chemicals, studies must also be conducted on BHT and titanium dioxide specifically. These were the two most prevalent chemicals that appeared in the current survey, yet these were also the two that posed the greatest challenges to find human-specific studies on their impacts on reproductive health. However, there were numerous studies that thoroughly portrayed their adverse side effects in the reproductive health of animals. Thus, due to their great prevalence and clear negative consequences, more human studies must be conducted in order to illustrate a clear understanding of why these chemicals should be placed under severe restrictions and be banned from cosmetic products completely. These studies should take place in short-term and long-term circumstances in order to provide the greatest details on unique effects over an extended period of time and how these consequences may manifest themselves in older versus younger women, both of whom utilize makeup products frequently.

**Conclusion**

This study examined the links between toxic chemicals found in makeup products and fertility issues in women and girls while investigating the improvement of regulatory measures to mitigate these risks. Data was collected through the implementation of the Environmental Working Group database, focusing on lip gloss, mascara, and concealer from three affordable brands (L'Oreal Paris, Pacifica Beauty, and Revlon) and three luxury brands (Anastasia Beverly Hills, Dior Beauty, and Benefit Cosmetics). 6 out of the 7 chemicals that the products were surveyed for were present within the data. Titanium dioxide and butylated compounds occurred most frequently, revealing risks such as lower immature egg count and endocrine disruption for women. In order to minimize these effects, more stringent consumer protections should be put in place by regulatory bodies such as the FDA. Specifically, cosmetic production companies should be banned from utilizing known endocrine disrupting chemicals within their formulations, and cosmetic sellers should not allow for such products to be sold without alerting consumers of the risks that those products pose to their reproductive health. Lastly, more outreach should be conducted to ensure that makeup consumers, especially young girls, are aware of the threats that commonly used toxins pose on their health.

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## Appendices

Appendix A. Comprehensive list of products analyzed in the current study

| Product Name | Brand | Product Type | Phthalates | Parabens | Formaldehyde-Releasing Preservatives | Lead | Butylated Compounds | Per and Polyfluoroalkyl Substances | Titanium Dioxide | EWG Safety Rating |
|---|---|---|---|---|---|---|---|---|---|---|

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|---|---|---|---|---|---|---|---|---|---|---|
| L'Oreal Paris Infallible 8HR Pro Lip Gloss with Hydrating Finish (Shades 890 - Nightfall Rose and 885 Shell Pink) | L'Oreal Paris | Lip Gloss | Yes - Polyethylene Terephthalate | No | No | No | Yes - Butylene Glycol; Isobutyl Acrylate | No | Yes | 4 |
| L'Oreal Paris Infallible 8HR Pro Lip Gloss with Hydrating Finish, (Shades Petal, 125 - Bloom, 870 - Frosted, - 705 Sangria, and 115 - Blush) | L'Oreal Paris | Lip Gloss | Yes - Polyethylene Terephthalate | No | No | No | Yes - Isobutyl Acrylate; Butylene Glycol | No | Yes | 5 |
| L'oreal Paris Balm in Gloss Lip Color, (20 Celestial Blossom, 30 Pristine Pink, 60 Sophisticated Rose, 50 | L'Oreal Paris | Lip Gloss | No | No | Yes - Citronellol; Limonene | No | No | No | Yes | 6 |

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|---|---|---|---|---|---|---|---|---|---|---|
| Feathery Fleur, 40 Blissful Blush, 80 Sublime Magenta, 70 Angelic Daydream, 90 Rosy Utopia) | | | | | | | | | | |
| L'Oreal Paris Glow Paradise Lip Balm-in-Gloss with Pomegranate Extract, Blissful Blush | L'Oreal Paris | Lip Gloss | No | No | Yes - Citronellol; Limonene | No | No | No | Yes | 6 |
| L'Oreal Paris Glow Paradise Lip Gloss with Pomegranate Extract - (Feathery Fleur, Blissful Blush) | L'Oreal Paris | Lip Gloss | No | No | Yes - Citronellol; Limonene | No | No | No | Yes | 6 |
| L'Oreal Paris Lip Gloss with Pomegranate Extract, Sublime Magenta | L'Oreal Paris | Lip Gloss | No | No | Yes - Citronellol; Limonene | No | No | No | Yes | 6 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| L'oreal Paris Balm in Gloss Glossy Finish Lip Color, 120 Rose Harmony | L'oreal Paris | Lip Gloss | No | No | Yes - Citronellol; Limonene | No | No | No | Yes | 6 |
| L'Oreal Paris Glow Paradise Lip Gloss with Pomegranate Extract - Rosy Utopia | L'Oreal Paris | Lip Gloss | No | No | Yes - Citronellol; Limonene | No | No | No | Yes | 7 |
| L'Oreal Paris Infallible Plumping Lip Gloss - (600 Mirror, Mauve Glow) | L'oreal Paris | Lip Gloss | No | No | Yes - Citronellol; Limonene; Linalool | No | Yes - Isobutyl acrylate | No | Yes | 8 |
| L'oreal Paris Pro Gloss Plump Lip Gloss, 609 Lucid Glow | L'Oreal Paris | Lip Gloss | No | No | Yes - Citronellol; Limonene; Linalool | No | Yes - Isobutyl acrylate | No | Yes | 8 |

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|---|---|---|---|---|---|---|---|---|---|---|
| L'Oreal Paris Infallible Pro Gloss Plump Lip Gloss, Gleam, Creams | L'Oreal Paris | Lip Gloss | No | No | Yes - Citronellol; Limonene; Linalool | No | Yes - Isobutyl acrylate | No | Yes | 8 |
| L'Oreal Paris Paradise Big Deal Buildable Waterproof Mascara - (Black, Black Brown, Blackest Black) | L'Oreal Paris | Mascara | No | No | No | No | No | No | No | 2 |
| L'Oreal Paris Telescopic Original Intense Length Mascara, Black Noir 905 | L'Oreal Paris | Mascara | No | Yes - Methylparaben; Propylbarabem | No | No | Yes - BHT | No | No | 5 |
| L'oreal Paris True Match Eye Cream in a Concealer, - (Light Clair N3 4, Light C3 4, Medium N5 6, Dark C7 8, Dark N7 8, Fair C1 2, Deep | L'Oreal Paris | Concealer | No | No | No | No | No | No | Yes | 3 |

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|---|---|---|---|---|---|---|---|---|---|---|
| C9 10, Dark W7 8, Fair W1 2, Fair N1 2, Medium W5 6, Deep N9 10, Light W3 4) | | | | | | | | | | |
| L'oreal Paris True Match Radiant Serum Concealer, (N10, C2, W10.5, N6.5, C1, W9.5, N11, C4, N2, W7, N9, W3, C3, W5, N3, C10, W4, W1, W6, C8, N5, N1) | L'Oreal Paris | Concealer | No | No | No | No | Yes - Butylene Glycol | No | Yes | 3 |
| L'Oreal Paris Infallible Total Cover 220 Concealing & Contour Kit (2020 formulation) | L'Oreal Paris | Concealer | No | No | No | No | No | No | Yes | 3 |

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|---|---|---|---|---|---|---|---|---|---|---|
| L'Oreal Paris True Match Correcting Crayon Concealer, Green | L'Oreal Paris | Concealer | No | No | No | No | No | No | Yes | 3 |
| L'Oreal Paris True Match Super Blendable Crayon Concealer, Fair and Light Warm | L'Oreal Paris | Concealer | No | No | No | No | No | No | No | 3 |
| L'oreal Paris True Match Instantly Covers Dark Circles Eye Cream in a Concealer, Medium C5 6 | L'Oreal Paris | Concealer | No | No | No | No | No | No | Yes | 3 |
| L'Oreal Paris Infallible Waterproof Concealer - (345 Oatmeal, 330 Ivory) | L'Oreal Paris | Concealer | No | No | Yes - Linalool; Citronellol | No | Yes - Butylene Glycol | No | Yes | 5 |

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|---|---|---|---|---|---|---|---|---|---|---|
| L'Oreal Paris Waterproof Concealer - (375 Latte, 440 Truffle, 415 Honey, 400 Caramel) | L'Oreal Paris | Concealer | No | No | Yes - Linalool; Citronellol | No | Yes - Butylene Glycol | No | Yes | 5 |
| L'oréal Paris Light Full Wear More Than Concealer - (325 Eggshell, 330 Ivory, 365 Cashew) | L'Oreal Paris | Concealer | No | No | Yes - Linalool; Citronellol | No | Yes - Butylene Glycol | No | Yes | 5 |
| L'Oreal Paris Infallible Full Wear Full Coverage Waterproof Concealer - (340 Fawn, 325 Eggshell, 365 Cashew) | L'Oreal Paris | Concealer | No | No | Yes - Linalool; Citronellol | No | Yes - Butylene Glycol | No | Yes | 5 |
| Pacifica Highest Gloss Hemp Infused for Chronic Shine Lip Gloss Balm (2020 | Pacifica | Lip Gloss | No | No | No | No | No | No | No | 1 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| formulation) - (Strawberry Rose) | | | | | | | | | | |
| Pacifica Hemp Infused for Chronic Shine Lip Gloss Balm, Vanilla Orange (2020 formulation) | Pacifica | Lip gloss | No | No | No | No | No | No | Yes | 2 |
| Pacifica Cosmic Glow Lip Gloss, Magical Color | Pacifica | Lip gloss | No | No | No | No | No | No | Yes | 2 |
| Pacifica Enlightened Gloss Nourishing Mineral Lip Shine (2019 formulation) - (Nudist, Opal, Beach Kiss) | Pacifica | Lip gloss | No | No | No | No | No | No | Yes | 3 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Pacifica Vegan Collagen Lip Plumping Gloss - 0.22 fl oz | Pacifica | Lip gloss | No | No | No | No | No | No | Yes | 4 |
| Pacifica Crystal Punk Holographic Mineral Lip Gloss (2018 formulation) | Pacifica | Lip gloss | No | No | No | No | No | No | Yes | 4 |
| Pacifica Dream Big Lash Extending 7 in 1 Mascara | Pacifica | Mascara | No | No | No | No | No | No | No | 1 |
| Pacifica Natural Minerals Dreambig Lash Extending 7 in 1 Mascara, Black Magic (2019 formulation) | Pacifica | Mascara | No | No | No | No | No | No | No | 1 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Pacifica Stellar Gaze Length & Strength Mineral Vegan Mascara, Supernova | Pacifica | Mascara | No | No | No | Yes - Algae/Seaweed/Kelp Extract (species unspecified); Lead contamination concerns | No | No | No | 1 |
| Pacifica Natural Minerals Aquarian Gaze Water Resistant Long Lash Mineral Mascara, Deep (2019 formulation) | Pacifica | Mascara | No | No | No | No | Yes - Butylene Glycol | No | No | 2 |
| Pacifica Vegan Collagen Fluffy Lash Mascara, Black | Pacifica | Mascara | No | No | No | No | No | No | No | 2 |

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|---|---|---|---|---|---|---|---|---|---|---|
| Pacifica Stellar Gaze Length & Strength Mineral Mascara, Stardust (2018 formulation) | Pacifica | Mascara | No | No | No | Yes - Algae/Seaweed/Kelp Extract (species unspecified); Lead contamination concerns | No | No | No | 2 |
| Pacifica Aquarian Gaze Water Resistant Long Lash Mineral Mascara (2019 formulation) | Pacifica | Mascara | No | No | No | No | Yes - Butylene Glycol | No | No | 2 |
| Pacifica Ultrablack Highest Lash Chronic Volume Mascara You Are So Pretty (2020 formulation) | Pacifica | Mascara | No | No | No | No | No | No | No | 2 |

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|---|---|---|---|---|---|---|---|---|---|---|
| Pacifica Water Resistant Long Lash Mineral Mascara (2019 formulation) | Pacifica | Mascara | No | No | No | No | Yes - Butylene Glycol | No | No | 2 |
| Pacifica Activist Volume & Curl Mascara | Pacifica | Mascara | No | No | No | No | No | No | No | 2 |
| Pacifica Transcendent Concentrated Concealer (2019 formulation) | Pacifica | Concealer | No | No | No | No | No | No | No | 2 |
| Pacifica Liquid Cover Full Coverage Lasting Concealer, (2018 formulation) - (2 Nd , 12 Nm) | Pacifica | Concealer | No | No | No | No | No | No | Yes | 4 |

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|---|---|---|---|---|---|---|---|---|---|---|
| Pacifica Natural Minerals Liquid Cover Full Coverage Lasting Concealer (2018 formulation) - (17 Cl, 8 Wt, 5 Wt, 10 Nm, 20 Nf, 3 Wd) | Pacifica | Concealer | No | No | No | No | No | No | Yes | 4 |
| Pacifica Liquid Cover Concealer - (15WM Warm Medium) | Pacifica | Concealer | No | No | No | No | No | No | Yes | 4 |
| Pacifica Full Coverage Lasting Concealer Liquid Cover (2018 formulation) | Pacifica | Concealer | No | No | No | No | No | No | Yes | 4 |
| Pacifica Beauty Liquid Cover Full Coverage Lasting Concealer, (2018 formulation | Pacifica | Concealer | No | No | No | No | No | No | Yes | 4 |

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|---|---|---|---|---|---|---|---|---|---|---|
| ) - (18 WL - Warm Light) | | | | | | | | | | |
| Revlon Super Lustrous Lip Gloss - (200 Crystal Clear) | Revlon | Lip gloss | No | No | No | No | No | No | No | 3 |
| Revlon Super Lustrous Lip Gloss - (Snow Pink) | Revlon | Lip gloss | No | No | No | No | Yes - BHT | No | Yes | 4 |
| Revlon Super Lustrous Lip Gloss, (2019 formulation ) - (Sugar Violet 230, Blissed Out 2238407011, Desert Spice, 255 Sandstorm , Sky Pink) | Revlon | Lip gloss | No | No | No | No | Yes - BHT | No | Yes | 5 |

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|---|---|---|---|---|---|---|---|---|---|---|
| Revlon Super Lustrous Moisturizing High Shine Lip Gloss - (240 Fatal Apple) | Revlon | Lip gloss | No | No | No | No | Yes - BHT | No | Yes | 5 |
| Revlon Super Lustrous the Gloss Lip Gloss - (Taupe Luster, Plum Appeal) | Revlon | Lip gloss | No | No | No | No | Yes - BHT | No | Yes | 5 |
| Revlon Extend Lift Volumize Mascara - (701 Blackest Black) | Revlon | Mascara | No | No | No | No | Yes - Butylene Glycol | No | No | 2 |
| Revlon So Fierce! Big Bad Lash Mascara - (Blackest Black Waterproof 762) | Revlon | Mascara | No | No | No | No | No | No | No | 2 |

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|---|---|---|---|---|---|---|---|---|---|---|
| Revlon Sofierce! Mascara, (2019 formulation)- (Blackened Brown 703,) | Revlon | Mascara | No | No | No | No | Yes - Butylene Glycol | No | No | 2 |
| Revlon Colorstay Xtensionnaire Lengthening Mascara - (Black Brown 203) | Revlon | Mascara | No | No | No | No | No | No | No | 2 |
| Revlon ColorStay Xtensionnaire Lengthening Mascara, Lash Serum and Mascara In One | Revlon | Mascara | No | No | No | No | No | No | No | 2 |
| Revlon Extend Lift Volumized Mascara, (2019 formulation) - (702 Black Noir) | Revlon | Mascara | No | No | No | No | Yes - Butylene Glycol | No | No | 2 |

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|---|---|---|---|---|---|---|---|---|---|---|
| Revlon So Fierce! Big Bad Lash Mascara with Eyelash Tint - (762 Waterproof Blackest Black) | Revlon | Mascara | No | No | No | No | No | No | No | 2 |
| Revlon So Fierce! Eyes Wide Open Mascara, - (Waterproof Black 104) | Revlon | Mascara | No | No | No | No | No | No | No | 2 |
| Revlon ColorStay Xtensionnaire Mascara - (Black Waterproof 211) | Revlon | Mascara | No | No | No | No | No | No | No | 2 |
| Revlon Volumizing Mascara - (Blackest Black Waterproof 951) | Revlon | Mascara | No | No | No | No | No | No | No | 3 |

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|---|---|---|---|---|---|---|---|---|---|---|
| Revlon Mega Multiplier Mascara - (Blackened Brown 803, Plum Brown 804, Blackest Black 801, Black 802) | Revlon | Mascara | No | No | No | No | No | No | No | 3 |
| Revlon Ultimate All-in-One Mascara - (Blackest Black Waterproof) | Revlon | Mascara | No | Yes - Methylparaben; Ethylparaben | No | No | Yes - Butylene Glycol | No | No | 3 |
| Revlon So Fierce! Mascara - (Blackened Brown 703, Blackest Black 701, Black 702) | Revlon | Mascara | No | No | No | No | Yes - Butylene Glycol | No | No | 3 |
| Revlon Super Length Mascara - (Blackest Black Waterproof 151) | Revlon | Mascara | No | Yes - Methylparaben; Ethylparaben | No | No | No | No | No | 3 |

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|---|---|---|---|---|---|---|---|---|---|---|
| Revlon Mega Multiplier Mascara, (2019 formulation) - (802 Black) | Revlon | Mascara | No | No | No | No | No | No | Yes | 3 |
| Revlon Volumazing Mascara, (2018 formulation) - (901 Blackest Black) | Revlon | Mascara | No | No | No | No | No | No | No | 3 |
| Revlon ColorStay Xtensionnaire Lengthening Mascara, Lash Serum and Mascara In One | Revlon | Mascara | No | No | No | No | Yes - Butylene Glycol | No | No | 3 |
| Revlon Super Length Mascara - (Black 102, Blackened Brown 103, Blackest Black 101) | Revlon | Mascara | No | Yes - Methylparaben; Ethylparaben | No | No | Yes - Butylene Glycol | No | No | 4 |

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|---|---|---|---|---|---|---|---|---|---|---|
| Revlon Ultimate All-in-One Mascara - (Blackened Brown 503) | Revlon | Mascara | No | Yes - Methylparaben; Ethylparaben | No | No | No | No | No | 4 |
| Revlon So Fierce! Big Bad Lash Mascara - (Blackest Black 760, Black 761) | Revlon | Mascara | No | No | No | No | Yes - Butylene Glycol | No | No | 4 |
| Revlon Grow Luscious Bold Lacquer Length & Volume Mascara, (2019 formulation) - (003 Blackened Brown Burn Noirci, 001 Blackest Black) | Revlon | Mascara | No | Yes - Methylparaben; Ethylparaben | No | No | Yes - Butylene Glycol | No | No | 4 |
| Revlon Super Length Mascara, (2019 formulation) - (102 Black) | Revlon | Mascara | No | Yes - Methylparaben; Ethylparaben | No | No | Yes - Butylene Glycol | No | No | 4 |

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|---|---|---|---|---|---|---|---|---|---|---|
| Revlon Ultimate All-in-One Mascara - (Blackest Black, Black 502) | Revlon | Mascara | No | Yes - Methylparaben; Ethylparaben | No | No | Yes - Butylene Glycol | No | No | 4 |
| Revlon Dramatic Definition Mascara, (2019 formulation) - (201 Blackest Black, 202 Black) | Revlon | Mascara | No | No | No | No | No | No | Yes | 4 |
| Revlon So Fierce! Big Bad Lash Mascara with Eyelash Tint - (761 Black, 760 Blackest Black) | Revlon | Mascara | No | No | No | No | Yes - Butylene Glycol | No | No | 4 |
| Revlon So Fierce! Eyes Wide Open Mascara - (Blackest Black 101, 102 Black, Black Brown 103) | Revlon | Mascara | No | No | No | No | Yes - Butylene Glycol | No | No | 4 |

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|---|---|---|---|---|---|---|---|---|---|---|
| Revlon Grow Luscious, Bold Lacquer Length & Volume Mascara, (2019 formulation) - (002 Black) | Revlon | Mascara | No | Yes - Methylparaben; Ethylparaben | No | No | Yes - Butylene Glycol | No | No | 4 |
| Revlon Volume + Length Magnified Mascara - (Black 302) | Revlon | Mascara | No | Yes - Methylparaben; Ethylparaben | No | No | Yes - Butylene Glycol | No | No | 4 |
| Revlon ColorStay Skin Awaken 5-in-1 Concealer - (Truffle 078, Cool Ivory 003, Medium 040, Fair 005, Cinnamon 077, Vanilla 010, Universal Brightener 002, Deep 060, Medium Deep 050, Hazelnut | Revlon | Concealer | No | No | No | No | Yes - Butylene Glycol | No | Yes | 2 |

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|---|---|---|---|---|---|---|---|---|---|---|
| 075, Light Beige 025, Latte 055, Coffee 080, Universal Neutralizer 001, Honey 045, Caramel 076, Nutmeg 070, Light Medium 030, Light 015) | | | | | | | | | | |
| Revlon ColorStay Full Coverage Concealer - (Banana 001, Oat 028, Light Medium 030, Medium 040, Vanilla 010, Biscuit 027, Medium Deep 050, Café 065, Sand 022, Fair 005, Crème Brulee 025, Chestnut 055, Hazelnut | Revlon | Concealer | No | No | No | No | Yes - Butylene Glycol | No | Yes | 2 |

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|---|---|---|---|---|---|---|---|---|---|---|
| 075, Bisque 020, Deep 060, Espresso 080) | | | | | | | | | | |
| Revlon ColorStay Concealer Longwearing Full Coverage Color Correcting Makeup - (Fair, Light) | Revlon | Concealer | No | No | No | No | Yes - Butylene Glycol | No | Yes | 2 |
| Revlon PhotoReady Concealer - (Light Medium 003, Medium 004, Light 002, Deep 006, Medium Deep 005, Fair 001) | Revlon | Concealer | No | No | No | No | No | No | Yes | 3 |
| Revlon Photoready Candid Antioxidant Concealer, (2018 formulation) - (028 Oat, 010 Vanilla, 025 Creme Brulee,075 Hazelnut, | Revlon | Concealer | No | No | No | No | Yes - Butylene Glycol | No | Yes | 3 |

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|---|---|---|---|---|---|---|---|---|---|---|
| 055 Chestnut, 060 Deep, 001 Banana, 030 Light Medium, 065 Cafe, 070 Nutmeg) | | | | | | | | | | |
| Revlon ColorStay Skin Awaken Concealer - (045 Honey, 030 Light Medium, 015 Light, 040 Medium, 050 Medium Deep, 002 Universal Brightener, 076 Caramel, 003 Cool Ivory, 060 Deep, 070 Nutmeg, 010 Vanilla, 005 Fair, 077 Cinnamon, 025 Light Beige, 001 Universal Neutralizer, 080 Coffee, | Revlon | Concealer | No | No | No | No | Yes - Butylene Glycol | No | Yes | 3 |

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|---|---|---|---|---|---|---|---|---|---|---|
| 075 Hazelnut, 055 Latte, 078 Truffle) | | | | | | | | | | |
| Revlon PhotoReady Candid Antioxidant Concealer - (Chestnut 055, Bisque 020, Oat 028, Café 065) | Revlon | Concealer | No | No | No | No | Yes - Butylene Glycol | No | No | 3 |
| Revlon Photoready Candid Antioxidant Concealer, (2019 formulation) - (005 Fair) | Revlon | Concealer | No | No | No | No | Yes - Butylene Glycol | No | Yes | 3 |
| Anastasia Beverly Hills Cosmic Collection Lip Gloss - (Supernova) | Anastasia Beverly Hills | Lip gloss | No | No | No | No | Yes - BHT | No | Yes | 2 |
| Anastasia Beverly Hills Cosmic Collection Lip Gloss - (Aurora, Sun, | Anastasia Beverly Hills | Lip gloss | No | No | No | No | No | No | Yes | 2 |

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|---|---|---|---|---|---|---|---|---|---|---|
| Galaxy, Superclust er) | | | | | | | | | | |
| Anastasia Beverly Hills Lip Gloss - (Galaxy) | Anas tasia Beve rly Hills | Lip gloss | No | No | No | No | No | No | Yes | 2 |
| Anastasia Beverly Hills Lip Gloss - (Crystal) | Anas tasia Beve rly Hills | Lip gloss | No | No | Yes - Limonen e | No | No | No | No | 3 |
| Anastasia Beverly Hills Lip Gloss - (Honey Diamond Gloss, Cantaloup e, Peachy, Butterscotc h, Caramel, Peachy Nude, Dusty Rose, Cotton Candy, Goldy, Deep Taupe, Latte, Toffee | Anas tasia Beve rly Hills | Lip gloss | No | No | No | No | No | No | Yes | 3 |

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|---|---|---|---|---|---|---|---|---|---|---|
| Rose, Honey Kiss, Guava, Coral, Soft Pink, Sun Baked, Amber Sparkle, Pink Ginger) | | | | | | | | | | |
| Anastasia Beverly Hills Lip Gloss, (2019 formulation) - (Moon Jelly) | Anastasia Beverly Hills | Lip gloss | No | Yes - Propylparaben | No | No | No | No | Yes | 4 |
| Anastasia Beverly Hills Lip Gloss - (Tan Rose Abh10 19400) | Anastasia Beverly Hills | Lip gloss | No | No | No | No | No | No | Yes | 4 |
| Anastasia Beverly Hills Lip Gloss, (2019 formulation) - (Girly, Parfait, Maple, Rum, Grape Jelly) | Anastasia Beverly Hills | Lip gloss | No | Yes - Propylparaben | No | No | No | No | Yes | 5 |

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|---|---|---|---|---|---|---|---|---|---|---|
| Anastasia Beverly Hills Lip Gloss, (2019 formulation) - (Dusty Lilac, Dainty, Sepia, Toffee, Sunset Strip, Undressed, Carmel, Peony, Gilded, Tara, Butterscotch, Vintage, Metallic Rose, Vamp, Kristen, Warm Bronze, St.Tropez) | Anastasia Beverly Hills | Lip gloss | No | Yes - Propylparaben | No | No | No | No | Yes | 6 |
| Anastasia Beverly Hills Mini Lash Brag Mascara | Anastasia Beverly Hills | Mascara | No | No | No | No | Yes - Butylene Glycol | No | Yes | 3 |

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|---|---|---|---|---|---|---|---|---|---|---|
| Anastasia Beverly Hills Lash Brag Volumizing Mascara | Anastasia Beverly Hills | Mascara | No | No | No | No | Yes - Butylene Glycol | No | No | 3 |
| Anastasia Beverly Hills Lash Sculpt Lengthening & Volumizing Mascara | Anastasia Beverly Hills | Mascara | No | No | No | No | Yes - Butylene Glycol | No | No | 4 |
| Anastasia Beverly Hills Sculpt & Stun Mascara Duo Full Size Lash Sculpt Lengthening & Volumizing Mascara | Anastasia Beverly Hills | Mascara | No | No | No | No | Yes - Butylene Glycol | No | No | 4 |
| Anastasia Beverly Hills Magic Touch Concealer - (11, 17, 16, 2, 6, 10, 12, 13, 18, 5, 7, 8, 22, 19, 15, 24, 4, 9, 23, 25, 1, 3, 14, 20 | Anastasia Beverly Hills | Concealer | No | No | No | No | No | No | No | 4 |

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| , 21) | | | | | | | | | | |
| Dior Addict Lip Maximizer Plumping Gloss - (072 Celestial Purple) | Dior Beauty | Lip gloss | No | No | No | No | No | No | Yes | 4 |
| Dior Diorshow 24H Buildable Volume Mascara - (798 Brown) | Dior Beauty | Mascara | No | No | Yes - Limonene; Linalool; Citral; Citronellol | No | No | No | No | 2 |
| Christian Dior Diorshow Pump N Volume Mascara - (090 Black) | Dior Beauty | Mascara | No | No | Yes - Limonene; Linalool; Citral; Citronellol; | No | No | No | No | 2 |
| Dior Show 24h Buildable Volume Mascara 090 Black | Dior Beauty | Mascara | No | No | No | No | No | No | Yes | 3 |

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|---|---|---|---|---|---|---|---|---|---|---|
| Benefit Cosmetics Bangin' Lash Fest Mascara - Stocking Stuffer | Benefit Cosmetics | Mascara | No | No | No | No | Yes - Butylated Glycol | No | No | 1 |
| Benefit Cosmetics Benefit Badgal Bang! Volumizing Mini Mascara Black | Benefit Cosmetics | Mascara | No | No | Yes - Limonene; Linalool; Citral; Citronellol | No | No | No | No | 2 |
| Benefit Bad Gal Bang Waterproof Volumizing Mascara, Intense Pitch Black | Benefit Cosmetics | Mascara | No | No | No | No | No | No | No | 2 |
| Benefit BADgal BANG! Waterproof Mascara | Benefit Cosmetics | Mascara | No | No | No | No | Yes - Butylene Glycol | No | Yes | 3 |

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|---|---|---|---|---|---|---|---|---|---|---|
| Benefit They're Real! Mascara - (Jet Black, Beyond Brown, Beyond Blue) (2018 formulation) | Benefit Cosmetics | Mascara | No | No | No | No | Yes - Butylene Glycol; BHT | No | Yes | 4 |
| Benefit Bad Gal Bang! Bigger Badder Volumizing Mascara, Black | Benefit Cosmetics | Mascara | No | No | No | No | Yes - Butylene Glycol; BHT | No | Yes | 4 |
| Benefit Magnet Power Lifting & Lengthening Mascara Supercharged, Black | Benefit Cosmetics | Mascara | No | No | No | No | No | No | Yes | 4 |
| Benefit They're Real Magnet Mascara | Benefit Cosmetics | Mascara | No | No | No | No | No | No | Yes | 4 |

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|---|---|---|---|---|---|---|---|---|---|---|
| Benefit BADgal BANG! Volumizing Mascara - (Blue) | Benefit Cosmetics | Mascara | No | No | No | No | Yes - Butylene Glycol | No | Yes | 4 |
| Benefit Cosmetics BADgal BANG! Volumizing Mascara - (Black) | Benefit Cosmetics | Mascara | No | No | No | No | Yes - Butylene Glycol; BHT | No | Yes | 4 |
| Benefit Cosmetics They're Real! Magnet Extreme Lengthening Mascara - (Black) | Benefit Cosmetics | Mascara | No | No | No | No | No | No | Yes | 4 |
| Benefit Mascara Power Pair, Supercharged - (Black) | Benefit Cosmetics | Mascara | No | No | No | No | No | No | Yes | 4 |

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|---|---|---|---|---|---|---|---|---|---|---|
| Benefit Bangin' Deal Badgal Bang! Volumizing Mascara Full Size + Free Mini, Intense Pitch Black | Benefit Cosmetics | Mascara | No | No | No | No | Yes - Butylene Glycol; BHT | No | Yes | 4 |
| Benefit BADgal Bang! Volumizing Mascara (2018 formulation) | Benefit Cosmetics | Mascara | No | No | No | No | Yes - Butylene Glycol; BHT | No | Yes | 4 |
| Benefit They're Real! Beyond Mascara - (Black, Brown, Jet Black) | Benefit Cosmetics | Mascara | No | No | No | No | Yes - Butylene Glycol; BHT | No | Yes | 4 |
| Benefit BADgal Lash Mascara (2018 formulation) | Benefit Cosmetics | Mascara | No | No | No | No | Yes - Butylene Glycol | No | Yes | 4 |

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|---|---|---|---|---|---|---|---|---|---|---|
| Benefit Cosmetics Roller Lash Curling & Lifting Mascara - (Black) | Benefit Cosmetics | Mascara | No | No | No | No | Yes - Butylene Glycol | No | No | 4 |
| Benefit Cosmetics Roller Lash Curling & Lifting Mascara - (Black) | Benefit Cosmetics | Mascara | No | No | No | No | Yes - Butylene Glycol; BHT | No | Yes | 4 |
| Benefit They're Real! Beyond Mini Mascara | Benefit Cosmetics | Mascara | No | No | No | No | Yes - Butylene Glycol; BHT | No | Yes | 4 |
| Benefit Roller Lash Mascara, (2018 formulation) - (Brown, Black) | Benefit Cosmetics | Mascara | No | No | No | No | Yes - Butylene Glycol; BHT | No | Yes | 5 |

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|---|---|---|---|---|---|---|---|---|---|---|
| Benefit Boi-ing Cakeless Concealer - (4.75 Dream Big, 6.4 Happy Feels, 9 On Point, 9.25 Pep Talk, 10 Right On, 15 Work It Dark Cool, 6 Fly High,Your Way, 13 Think Big, 2 Best Life, 2.5 Big Mood, 6.5 In Charge, 8 Keep On, 16 You Rule, 17 Your Way Deepest Dark Warm, 0.5 All Good, 3 Bring It, 4.25 Carry On, 4.5 Do You, 6.25 Good Vibes, 8.25 Loves It, 8.5 Mic Drop, 9.5 Power Up, 12 Shake It, 14 Whole Mood, 1 Amaze | Benefit Cosmetics | Concealer | No | No | No | No | Yes - Butylene Glycol | No | Yes | 3 |

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|---|---|---|---|---|---|---|---|---|---|---|
| 'Em, 4 Can't Stop, 5 Feel Good, 6.3 Got This, 7 Jump In, 11 Say Yes, 13 Think Big, 15 Work It, 8.5 Mic Drop Medium Tan Olive) | | | | | | | | | | |
| Benefit Cosmetics Boi-ing Cakeless Full Coverage Waterproof Liquid Concealer - (5 Feel Good, 7 Jump In, 10 Right On) | Benefit Cosmetics | Concealer | No | No | No | No | Yes - Butylene Glycol | No | Yes | 3 |
| Benefit Boi-ing Hydrating Concealer (2018 formulation) | Benefit Cosmetics | Concealer | No | No | No | No | Yes - Butylene Glycol; BHT | No | Yes | 4 |

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|---|---|---|---|---|---|---|---|---|---|---|
| Benefit Boi-ing Industrial Strength Concealer (2018 formulation) | Benefit Cosmetics | Concealer | No | No | No | No | Yes - BHT | No | Yes | 4 |
| Benefit Boi-ing Bright On Concealer- (Lychee, Peach, Walnut, Hazelnut, Nectarine, Cantaloupe, Ginger, Melon, Almond, Apricot, Nutmeg, Clove) | Benefit Cosmetics | Concealer | No | No | No | No | Yes - Butylene Glycol | No | Yes | 4 |
| Benefit Boi-ing Industrial Strength Concealer - (01 Light Cool, 03 Medium Neutral, 05 Tan Neutral, 01 Fair Neutral, 06 Deep Warm, 04 Medium Tan-warm) | Benefit Cosmetics | Concealer | No | No | No | No | Yes - BHT | No | Yes | 4 |

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|---|---|---|---|---|---|---|---|---|---|---|
| Benefit, Boi-ing Bright on Undereye Concealer | Benefit Cosmetics | Concealer | No | No | No | No | Yes - Butylene Glycol | No | Yes | 4 |
| Benefit Cosmetics Benefit Boi-ing Industrial Strength Concealer ( No. 1 Light) | Benefit Cosmetics | Concealer | No | No | No | No | Yes - BHT | No | Yes | 5 |
| Benefit Boi-ing Brightening Concealer (2018 formulation) | Benefit Cosmetics | Concealer | No | Yes - Propylparaben | No | No | Yes - BHT | No | Yes | 6 |