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DOI: 10.4103/pjog.pjog_8_23

# Exposure of reproductive-aged pregnant and nonpregnant women to common environmental pollutants and endocrine-disrupting chemicals: A cross-sectional survey at the University of the Philippines-Philippine General Hospital

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Submitted: 02-Mar-2023  
Accepted: 04-Apr-2023  
Published: 30-May-2023

#### Abstract:

**CONTEXT:** Exposure to environmental pollutants (EP) and Endocrine-disrupting chemicals (EDCs) is associated with several general negative health effects which compromise women's reproductive health, maternal, and neonatal outcomes. Unfortunately, many nonpregnant and pregnant women are unaware of their active exposure to these potentially slow-acting toxic substances, EPs, and EDCs. At any stage of life, and in the long-term minute exposures, there is no established safe level of exposure to these substances. Due to the potentially harmful effects on women in general, and to the pregnant and her unborn child in particular, it is important to establish the prevalence of their exposure.

**AIMS:** The aim of this study was to determine the magnitude (prevalence) of exposure among nonpregnant and pregnant women aged 18–49 years to common EPs/EDCs such as bisphenol A, pesticides, phthalates, and perfluorinated compounds among others.

**SETTINGS AND DESIGN:** This study was conducted at the Philippine General Hospital, University of the Philippines Manila.

**SUBJECTS AND METHODS:** The study participants were nonpregnant and pregnant women, with low-risk singleton pregnancy, and had a prenatal checkup and eventual delivery at the Philippine General Hospital. After consent, women were asked to answer a survey focused on their sociodemographics and frequency of exposure to EP- and EDC-containing items.

**STATISTICAL ANALYSIS USED:** Descriptive statistics were used to summarize the demographic and clinical characteristics of the patients. Null hypotheses were rejected at 0.05  $\alpha$ -level of significance. The computer software STATA 13.1 was used for data analysis.

**RESULTS:** One hundred and fifty-nine survey responses by women were analyzed. Possible EDC-containing household items (carpets, linoleum, upholstered, and stain-resistant furniture) are more prevalent in the homes of pregnant women compared to nonpregnant women. Pregnant women are also exposed to wallpapers compared to nonpregnant individuals. Nonpregnant women were 1.5 times more exposed to lotions. Unexposure to hand sanitizers is 1.3 times higher among pregnant individuals.

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**How to cite this article:** Llamas-Clark EF, Heralde III FM, Cagayan MS, Uy ME, Medina JR, Ubial PJ. Exposure of reproductive-aged pregnant and nonpregnant women to common environmental pollutants and endocrine-disrupting chemicals: A cross-sectional survey at the University of the Philippines-Philippine General Hospital. *Philipp J Obstet Gynecol* 2023;47:3-10.

**CONCLUSIONS:** There are differences in the prevalence of exposure to household EDC-containing items between pregnant and nonpregnant women, with pregnant women having a higher prevalence of exposure.

**Keywords:**

Endocrine-disrupting chemicals, environmental pollutants, pregnancy, women

## Introduction

Environmental pollutants (EPs) are materials present where people live and work that can have possible harmful health effects. Endocrine-disrupting chemicals (EDCs) are compounds that affect the typical endocrinological system functioning, which encompasses a person's metabolism, neurodevelopment, and regulation of other biological processes in the gastrointestinal and reproductive systems, among others.<sup>[1]</sup> Many of these EDCs and EPs have integrated into the physical and social environment due to human activities and are recognized as human health hazards not only in toxic quantities but also in small doses with continuous exposure.<sup>[2]</sup> EDCs interfere with regular bodily processes and are detrimental to general health over time. Some examples of EDCs are dioxins, polychlorinated biphenyls, brominated flame retardants, chlorinated insecticides, fluorinated substances, bisphenol A (BPA), parabens, phthalates, organic tin compounds, and methylmercury.<sup>[3]</sup>

Sociocultural factors such as low socioeconomic status, poor housing, and workplace conditions and standards also influence the length and intensity of exposure to these chemicals. Over time, the burden of chemical exposure can affect the quality of life and may also be passed from one generation to the next, compromising the population's health.

Women are considered most at risk, particularly while they are pregnant.<sup>[3]</sup> EDCs can affect the ability of women to reproduce, and affect the growth and development of the fetus, including the transfer of genes and biochemical substances from mother to child, and the future occurrence of disease. There has been an increasing interest to understand how environmental substances and chemicals classed as EPs/EDCs are increasingly contributing to low-dose exposures in our daily living which can also affect human reproduction and survival.

Exposures from well-known EDCs such as BPA, phthalates, agricultural pesticides, and derivatives from personal care products are widely used and occur frequently. Everyday household and workplace items contain EPs/EDCs such as the coating of food and drink cans, plastics, medical equipment parts, thermal receipts, and cosmetics among others.<sup>[4,5]</sup> Research on BPAs revealed that it affects not only rodent fetuses'

growth and development but also affects human reproductive function.<sup>[6]</sup> Direct contact and using goods and consuming food that has come into contact with BPA are the two most common ways that individuals are exposed.

Despite widespread knowledge and awareness of the rising EDCs in our ecological systems, clinical medicine has not kept up and local research on EDCs is scarce. Health research focuses on the development of diseases, but there is a growing need to understand the pervasive effects of EDCs by understanding the risk factors, the extent of exposure, and potential pathways and mechanisms of exposure. This study then can partly answer Philippine health research gaps locally regarding EDCs. Future government environmental, economic, and health policies and initiatives must consider and support the knowledge and research gap on the health effects of EDCs, particularly in women and their offspring.

## Objectives

The objective of this first component of the WATER-FEMAH study is to determine the prevalence of exposure among nonpregnant and pregnant women aged 18–49 years to common EPs/EDCs such as BPA, pesticides, phthalates, and perfluorinated compounds among women at the Philippine General Hospital.

## Subjects and Methods

Ethical policy and Institutional Review Board statement:

This project was approved by the University of the Philippines Manila Research Ethics Board (UPMREB 2019-0300-01).

The University of the Philippines-Philippine General Hospital, a national government, university-based, tertiary-level hospital, with a 1500 bed-capacity in Manila City served as this study's research site. A total of 174 reproductive-aged women participants from January 1, 2022, to August 31, 2022, availing of UP PGH OB GYN clinic consultations, through the telehealth and/or the face-to-face services and referrals from the Manila City health centers to the research supplementary site at the Department of Biochemistry and Molecular Biology, Salcedo Hall, University of the Philippines Manila, were recruited using simple random sampling using a random number generation software. From a list of nonpregnant and pregnant women, 20 women daily were recruited

matching the selected numbers to participate in the study. The pregnant women at any age of gestation who will deliver at the UP-PGH were recruited to join the study. Informed consent was secured from all participants. Exclusion criteria include maternal age of fewer than 19 years, active maternal comorbidities, and multiple gestation pregnancies. Maternal socioeconomic status, exposure to certain food, products, and items containing EPs and EDCs, and gynecologic and obstetric history were established through interviews during prenatal checkups or prior to admission. Neonatal outcomes were obtained through medical records.

Prior to the consultation, all eligible patients were classified as pregnant or nonpregnant using pregnancy tests and/or ultrasound. Exclusion criteria include age <19 years or more than 49 years of age. Information on maternal socioeconomic status and obstetric history was established through interviews during prenatal checkups or prior to admission. Their maternal and neonatal outcome indicators were obtained through the records.

The enrolled participants were surveyed using an administered questionnaire on sociodemographic data and their exposure through the consumption of certain food, use of personal care and hygiene products, and different household and workplace items that may contain EDCs such as BPA, phthalates, agricultural pesticides, and its derivatives. Relevant data from nonpregnant and pregnant participants including any postdelivery data were done. This sample size was utilized to estimate the prevalence of exposure to common EDCs among 18–49-year-old women with a 95% confidence level within the interval ( $90 \pm 5\%$ ). Thereafter, their blood and urine specimens were also collected for biochemical analyses.

### The exposure survey tool

A validated questionnaire from a previous study on EDC exposure of pregnant women to BPA-containing items was adapted for this study.<sup>[7]</sup> The survey inquired of the patients' (a) general information and sociodemographic data and (b) exposure to several products (food, industrial, and factory materials, personal care and hygiene products, cleaning and sanitation products, household items, agricultural materials, chemical substances, and its derivatives) through direct contact, use, or consumption. The adapted questionnaire was administered face-to-face by trained research staff.

### Statistical analyses

Descriptive statistics were employed in determining the mean ( $\pm$  standard deviation) for all continuous variables and percentage distribution in comparing the baseline characteristics of pregnant and nonpregnant

women. Prevalence ratios (PRs) were estimated using a binomial model with the log link function to compare the prevalence of levels of exposure between pregnant and nonpregnant women. Missing variables were neither replaced nor estimated. Null hypotheses were rejected at 0.05  $\alpha$ -level of significance. Data were managed in Microsoft Excel version 2019 and analyzed using Stata 16.0 (Stata Corp, College Station, TX, USA). The prevalence of different environmental/chemical substances and their duration and frequency of exposures in both pregnant and nonpregnant participants is the main outcome indicator for this study.

## Results

There were 174 eligible participants, and only 159 were included as others had incomplete responses or had no consent forms. The sociodemographic profile of women in each group is summarized in Table 1. Nonpregnant respondents ( $n = 67$ ) make up 42.14% of the respondents while pregnant respondents ( $n = 92$ ) make up 57.86%. Pregnant respondents have a significantly younger mean age of  $25.81 \pm 0.67$  years compared to nonpregnant respondents  $32.13 \pm 1.15$  ( $P < 0.001$ ). The largest proportion of pregnant respondents fall under the youngest age group of 18–23 years (42 out of 92, or 45.65%); notably, the number of pregnant respondents decreases as the age group category gets older. On the other hand, the population of nonpregnant respondents is similar in number across all age groups.

A significantly larger proportion of respondents residing in an urban setting were pregnant (89 out of 146, 60.96%). On the other hand, a significantly larger proportion of respondents residing in a rural setting were not pregnant (9 out of 11, 81.82%) ( $P = 0.006$ ).

A significant difference in the region of origin among the respondents was found ( $P = 0.035$ ). A larger portion of the entire respondent sample size originated from, National Capital Region (NCR), of which 47 or 36.72% were nonpregnant and 81 or 63.28% were pregnant.

A statistically significant difference in the proportion of respondents in terms of civil status was found ( $P = 0.021$ ). Among unmarried or single respondents, the number of pregnant women (73 of 115, 63.48%) was significantly higher than nonpregnant women (42 of 115, or 36.52%). Conversely, the number of married or previously married nonpregnant individuals (23 of 40, 56.41%) was significantly greater than pregnant individuals (17 of 40 or 43.59%).

No significant difference in the proportion of pregnant nonsmokers ( $n = 77$ ), pregnant smokers ( $n = 15$ ),

**Table 1: Demographic and socioeconomic profile of participants**

Characteristic	Nonpregnant (n=67), n (%)	Pregnant (n=92), n (%)	P-value ( $\alpha=0.05$ )
Age (years), mean±SD	32.134±1.145	25.815±0.668	<0.001
Age groups			
18–23	17	42	
24–29	10	24	
30–35	15	18	
36–42	12	7	
43–48	13	1	
Geographical designation	n=66	n=91	
City/urban	57 (39.04)	89 (60.96)	0.006
Rural and suburban	9 (81.82)	2 (18.18)	
Current region	n=66	n=91	
NCR	47	81	
Region 1	1	0	
CAR	1	0	
Region III	2	1	
Region IVA	8	3	
Region IVB	1	1	
Region V	1	2	
Region VI	1	1	
Region VIII	1	1	
Region XII	0	1	
Region XIII	3	0	
Years at current address (mean±SD)	23.048±1.799	19.299±1.139	0.0669
Nature of employment			
Professionals	1	2	
Clerical support workers	2	0	
Service and sales workers	10	5	
Elementary occupation	5	1	
Unemployed	50	85	
Household income (Php)			
<10,000	40 (36.70)	69 (63.50)	0.324
10,000–29,999	19 (47.50)	21 (52.50)	
30,000 and above	3 (60.00)	2 (40.00)	
Smoking			
Smoker	16 (51.61)	77 (61.60)	0.181
Nonsmoker	48 (38.40)	15 (48.39)	

SD: Standard deviation, NCR: National Capital Region, CDR: Caraga Administrative Region

nonpregnant smokers ( $n = 16$ ), and nonpregnant nonsmokers ( $n = 48$ ) ( $P = 0.181$ ) was found.

The proportion of pregnant women with <P10,000 household income was higher compared to pregnant women with >P10,000 household income. However, there was no statistically significant difference observed between the two groups ( $P = 0.324$ ).

Table 2 presents the availability of common household items in the participants' homes. Pregnant women had 1.3 times the prevalence of having carpet at their residence compared to nonpregnant women. Pregnant women had 1.1 times the prevalence of having vinyl

or linoleum flooring at their residences compared to nonpregnant women. Among nonpregnant women, there were 6 excess cases of having upholstered furniture per 100 compared to pregnant women in each period. Among pregnant women, there were 12 excess cases of having stain- or water-resistant furniture per 100 compared to nonpregnant women in each period. Pregnant women had 1.4 times the prevalence of having vinyl or plastic shower curtains at their residences compared to nonpregnant women.

Table 3 summarizes the time exposure of women to household items. Pregnant women had 1.4 times the prevalence of removing or installing wallpaper at their residence compared to nonpregnant women between 1 and 7 days. However, there is no statistically significant difference between the two groups according to "removing or installing carpets," "replenishing, or reupholstering tables, chairs, sofas, cabinets, bookshelves, and dressers," "purchasing or receiving new upholstered furniture," "removing or installing floorings at homes," and "sealing or grouting windows and showers" across varying periods of time.

Table 4 shows that the prevalence of vaginal wash use is 1.51 times higher among pregnant women compared to nonpregnant women ( $P = 0.015$ ). It also shows a higher prevalence of hand sanitizer use among pregnant women compared to nonpregnant individuals ( $P = 0.015$ ).

In contrast, the prevalence of the use of lotions among nonpregnant individuals is 1.4 times higher than nonpregnant individuals ( $P = 0.011$ ). Finally, Table 4 indicates exposure to a toothpaste brand. Pregnant women had 1.5 times the prevalence of having used a particular brand of toothpaste as compared to nonpregnant women more than thrice per day. However, there is no statistically significant difference between the two groups according to "once per day," "twice per day," and "thrice per day."

Table 5 shows the prevalence of exposure of pregnant individuals to nonpersonal use items such as thermal receipts and CDs/DVDs. This shows the exposure of women to thermal receipts. Pregnant women had 0.6 times the prevalence of having touched a thermal receipt as compared to nonpregnant women in the last 24 h. However, there is no statistically significant difference between the two groups according to "between 1 and 7 days ago" and "between 8 days and 1 month ago." In addition, it indicates the time exposure to CDs/DVDs. Pregnant women had 1.5 times the prevalence of having touched a CD or DVD as compared to nonpregnant women between 3 and 7 days. However, there is no statistically significant difference between the two groups according to "last 24 h" and "between 1 and 2 days ago."

**Table 2: Availability of common household items in respondents' residence**

Common household items	Number of respondents			Prevalence ratio	95% CI
	Nonpregnant (n <sub>1</sub> ), pregnant (n <sub>2</sub> ), total (n)	Exposed, n (%)	Unexposed, n (%)		
Carpet	67	56 (83.58)	11 (16.42)	1.324	0.680–2.580
	92	72 (78.26)	20 (21.74)		
	159	128 (80.50)	31 (19.50)		
Vinyl or linoleum flooring	67	48 (71.64)	19 (28.36)	1.111	0.682–1.809
	92	63 (68.48)	29 (31.52)		
	159	111 (69.81)	48 (30.19)		
Upholstered furniture	67	60 (89.55)	7 (10.45)	0.416	0.126–1.370
	92	88 (95.65)	4 (4.35)		
	159	148 (93.08)	11 (6.92)		
Stain- or water-resistant furniture	67	56 (83.58)	11 (16.42)	1.721	0.914–3.241
	92	66 (71.74)	26 (28.26)		
	159	122 (76.73)	37 (23.27)		
Vinyl/plastic shower curtain	67	56 (83.58)	11 (16.42)	1.390	0.718–2.690s
	92	71 (77.17)	21 (22.83)		
	159	127 (79.87)	32 (20.13)		

CI: Confidence interval

## Discussion

This study shows some significant differences in the sociodemographic characteristics and household and workplace items among the groups of pregnant and nonpregnant women. Nonpregnant women had higher mean age, and years of residency in their current home, with more adults and children, compared to pregnant women. Women's age was also significantly higher in nonpregnant women with the reproductive age group with a significantly higher mean age difference.

For this study, it was found that there were more pregnant respondents whose civil status was single at the time of the study compared to nonpregnant respondents. This could be an implication of a rising trend of unexpected pregnancies among the Filipino community in line with a 2015 study showing a notable proportion of unplanned and unwanted pregnancies among teenagers, unmarried, and urban-residing individuals.<sup>[8]</sup>

The geographical distribution and place of origin were significantly different between the two groups, favoring the NCR and the city urban area which is consistent with the research site's sampling area.

### Socioeconomic status in relation to endocrine-disrupting chemicals

In the Family Income and Expenditure Survey by the Philippine Statistics Authority (PSA), it was suggested that families with a household monthly income of <P12,030.00 fall below the poverty threshold and cannot sufficiently support basic food and nonfood commodities.<sup>[9]</sup> This entails that most pregnant individuals in this study fall under the poverty threshold set by the PSA. Pregnant individuals that fall under the poverty threshold may be at risk of poorer choices in terms of exposure to

EDC-containing items as socioeconomic status together with educational attainment are correlated with access to health awareness and therefore can influence product use and selection.<sup>[10]</sup> This is consistent with this study's observation on the prevalence of EDC-containing items among pregnant women's homes such as carpets, vinyl or linoleum flooring, upholstered furniture, water- or stain-resistant furniture, and plastic shower curtains compared to the homes of nonpregnant women.

### Exposure to environmental pollutants/EDCs to common household and workplace items

While sociodemographic variables such as age and civil status may affect exposure, the use of common household commodities can possibly be affected by the presence of these household items. These common household items customarily expose the participants in their residences. Although there was no statistically significant difference between the two groups according to the presence of carpets, vinyl or linoleum flooring, upholstered, and water-resistant furniture, there was an observation that pregnant women had 1.4 times of removing or installing wallpaper at their residence compared to nonpregnant women between 1 and 7 days, and 1.5 times the prevalence of having used a certain toothpaste brand as compared to nonpregnant women for more than thrice per day, while nonpregnant women had 1.7 times the prevalence of having touched a CD or DVD as compared to pregnant women in the last 24 h.

Although there were no statistically significant differences in sunscreen, and nail polish use between the two groups, pregnant women were 1.5 times more likely than nonpregnant women to use fragrance, cologne, or perfume (PR = 1.530, 95% confidence interval [CI]: 1.156–2.024). In other studies, fragrances and perfumes have been found to contain different forms of phthalates

**Table 3: Prevalence of exposure to common household items**

Particulars	Prevalence ratio	95% CI
Remove or install carpets		
Past 24 h	0.758	0.360–1.596
Between 1 and 7 days ago	0.856	0.453–1.618
Between 8 days and 1 month ago	1.043	0.708–1.534
Unexposed	1.099	0.792–1.524
Replenish or reupholster tables, chairs, sofas, cabinets, bookshelves, and dressers		
Past 24 h	0.853	0.496–1.468
Between 1 and 7 days ago	0.784	0.428–1.434
Between 8 days and 1 month ago	0.969	0.615–1.528
Unexposed	1.179	0.849–1.638
Remove or install vinyl or linoleum flooring		
Past 24 h	0.858	0.423–1.742
Between 1 and 7 days ago	0.986	0.613–1.588
Between 8 days and 1 month ago	1.245	0.913–1.697
Unexposed	0.902	0.682–1.194
Remove or install flooring including places other than your home		
Past 24 h	0.732	0.307–1.745
Between 1 and 7 days ago	1.248	0.765–2.037
Between 8 days and 1 month ago	0.955	0.617–1.480
Unexposed	1.036	0.737–1.456
Remove or install wallpaper		
Past 24 h	0.684	0.231–2.026
Between 1 and 7 days ago	1.419	1.008–1.997
Between 8 days and 1 month ago	0.973	0.661–1.433
Unexposed	0.942	0.697–1.273
Seal, caulk, or grout any windows or showers		
Past 24 h	0.567	0.181–1.777
Between 1 and 7 days ago	1.163	0.717–1.886
Between 8 days and 1 month ago	0.853	0.496–1.468
Unexposed	1.145	0.783–1.676
Purchase or receive new upholstered furniture		
Past 24 h	0.684	0.231–2.026
Between 1 and 7 days ago	1.248	0.765–2.037
Between 8 days and 1 month ago	0.796	0.471–1.344
Unexposed	1.145	0.783–1.676
Touched a thermal receipt	0.605	0.386–0.984

CI: Confidence interval

**Table 4: Prevalence of exposure of pregnant participants to personal use items**

Pregnant	Robust				
	Risk ratio	SE	Z	P>Z	95% CI
Lotion	1.412381	0.191226	2.55	0.011	1.083193–1.841612
Hand sanitizer	1.370949	0.178124	2.43	0.015	1.06274–1.768544
Vaginal wash	1.51495	0.25817	2.44	0.015	1.084779–2.115707
Toothpaste brand	1.529				1.053–2.220

CI: Confidence interval, SE: Standard error

that have varying degrees of genotoxicity.<sup>[11]</sup> As an EDC, phthalates have been linked to gynecological abnormalities such as infertility among women,<sup>[12]</sup> phthalate accumulation in urine as a consequence of varying lengths of work-related exposure,<sup>[13]</sup> and increased risk of developing breast cancer among others.<sup>[14]</sup>

In terms of the usage of raincoats, storing food in a plastic container, microwaving food in a plastic container, frequency of eating canned foods in a week, drinking soda in a week, receiving a dental sealant at a recent dental visit, or being exposed to paint or varnish, there were no statistically significant differences between pregnant and nonpregnant women. However, pregnant women were found to be 1.4 times more likely than nonpregnant women to have stored any drinking fluid in a transparent or translucent, reusable water plastic bottle in the previous 1–2 days (PR = 1.375, 95% CI: 1.015–1.861).

There are hundreds of compounds and chemical groups classified as EDCs actively used in manufacturing plastics that serve different functions such as colorants, flame retardants, solvents, UV stabilizers, and plasticizers such as BPA.<sup>[15]</sup> Exposure to said EDCs can happen at any point in a plastic product's life cycle, including production, consumer interaction, recycling, waste management, and disposal. This places exposed women at risk of having disrupted ovarian cell division, modified menstrual cycle, and irregular uterus development.<sup>[16]</sup> Another study on 174 female *in vitro* fertilization patients discovered that the likelihood of their cells growing into eggs decreased the higher the quantities of BPA in their urine samples.<sup>[17]</sup>

There were no statistically significant differences in the ownership of nonstick Teflon-coated pans or pots, nonstick rice cooker bowls, or nonstick e-grills between the two groups. While there is a significant difference observed, this suggests that both pregnant and nonpregnant women are equally exposed to nonstick Teflon-coated pans. Perfluorinated compounds, which are present in nonstick cookware and water-resistant clothing, have been discovered to impact the body's steroid hormones, including estrogen, testosterone, and cortisol, according to a study on sheep and cells developed in the laboratory in the Norwegian University of Life Sciences. With all these products in the market, alternative materials with no known risks to health may be considered in producing packaging products.

## Conclusions

Majority of human populations are exposed to mixtures of EPs and EDCs which can be challenging in distinguishing

**Table 5: Prevalence of exposure of pregnant participants to nonpersonal use items**

	Number of respondents Nonpregnant (n <sub>1</sub> ), pregnant (n <sub>2</sub> )	Prevalence ratio	95% CI
Touched a thermal receipt, n (%)			
In the last 24 h	14 (56.00), 11 (44.00)	0.605	0.386–0.948
Between 1 and 7 days ago	9 (60.00), 6 (40.00)	1.167	0.763–1.785
Between 8 days and 1 month ago	3 (50.00), 3 (50.00)	1.167	0.763–1.785
Unexposed	4 (66.67), 2 (33.33)	1.069	0.810–1.410
Touched a CD or DVD, n (%)			
In the last 24 h	3 (60.00), 2 (40.00)	1.024	0.493–2.126
Between 1 and 2 days ago	2 (50.00), 2 (50.00)	0.849	0.315–2.290
Between 3 and 7 days ago	7 (87.50), 1 (12.50)	1.534	1.137–2.069
Unexposed	76 (57.14)	0.810	0.575–1.139

CI: Confidence interval, CD: Compact Disc, DVD: Digital Video Disc

between the effects of one exposure to an EDC and another pollutant, when exposures are associated because of shared sources.<sup>[2]</sup> EDC exposure has been linked to both male and female reproductive abnormalities, as well as a wide range of illnesses such as obesity, diabetes, nonalcoholic fatty liver disease, neurodevelopmental disorders, allergy, asthma, autoimmune, and cancer.<sup>[1]</sup> In this study, we determined the prevalence of exposure of pregnant and nonpregnant women to common EP and EDCs in household and workplace items. It was found that pregnant and nonpregnant women consume and use common household and workplace environment commodities in their daily lives. However, pregnant women had a higher prevalence of exposure to common household items, hand sanitizers, vaginal wash, thermal receipts, and toothpaste brands while nonpregnant women had a higher prevalence of having touched or used CDs or DVDs and lotions.

### Recommendation

Due to limitations posed by the COVID-19 pandemic in the mobility and social interaction of people, the single hospital and supplemental site where participant recruitment took place would have some characteristic bias, making generalizations based on the results limited. Increasing the project sites in a less restrictive environment may pave the way to various perspectives. The questionnaire prepared for this study, despite being verified, might not be completely appropriate for its intended participants. Some questionnaire modifications can be done to be able to gather more specific data as needed.

This study may be used by researchers to promote awareness concerning the common household items that may contain EDCs and EPs and their possible effects on human health. Future research on alternative options to these common commodities can be done.

### Acknowledgments

We would like to thank the University of the Philippines Manila, the Research Grants Administration Office,

Manila City Health Departments, the Department of Obstetrics and Gynecology, and the Philippine General Hospital for the administrative assistance given to implement this project.

### Financial support and sponsorship

We would like to express our sincerest gratitude to the Department of Science and Technology - Philippine Council for Health Research and Development (DOST-PCHRD) for the financial support that they have provided for the success of this project.

### Conflicts of interest

There are no conflicts of interest.

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