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**Migraine Headaches and Fragranced Consumer Products:  
An International Population-Based Study**

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## **Migraine Headaches and Fragranced Consumer Products: An International Population-Based Study**

### **Abstract**

Fragranced consumer products, such as air fresheners and cleaning supplies, have been associated with health problems including migraine headaches. This study investigates the prevalence of migraines associated with exposure to fragranced products. Nationally representative population surveys (n=4,435) across four countries—the United States (US), Australia (AU), the United Kingdom (UK), and Sweden (SE)—found that, on average, 12.6% of adults report migraine headaches when exposed to fragranced products (15.7% US, 10.0% AU, 8.4% UK, 16.1% SE). Among those individuals, 43.2% report migraines from air fresheners or deodorizers, 15.0% from the scent of laundry products coming from a dryer vent, 39.9% from being in a room cleaned with scented products, 53.7% from being near someone wearing a fragranced product, and 45.7% from other types of fragranced products. Further, 30.6% of these individuals have lost workdays or lost a job, in the past year, due to fragranced product exposure in the workplace. Findings from this study indicate that migraine headaches can be associated with fragranced consumer products, and that reducing exposure could reduce adverse health and societal effects.

**Keywords:** migraine, headache, fragranced consumer products, fragrance

## Introduction

Fragranced consumer products are ubiquitous in modern life. A "fragranced consumer product" (or "fragranced product") is "a product that contains an added fragrance or that is largely comprised of fragrance" (Steinemann 2019a). Common products include air fresheners, deodorizers, cleaning supplies, laundry detergents, fabric softeners, hand sanitizers, essential oils, candles, soaps, and personal care products, out of hundreds of items.

A fragranced product typically emits dozens of volatile ingredients, including some classified as hazardous air pollutants (Steinemann 2015, Nematollahi et al. 2019). However, no law requires products to disclose all ingredients (Lunny et al. 2017; Steinemann 2009), and fewer than 10% of ingredients are typically listed on labels or safety data sheets (Steinemann 2015, Nematollahi et al. 2019).

Exposure to fragranced products has been associated with a range of adverse health effects. Prior international studies (US, AU, UK, SE) found that, on average, 32.2% of the general population (34.7%, 33.0%, 27.8%, 33.1%, respectively) report adverse health effects when exposed to fragranced products (Steinemann 2016, 2017, 2018a, 2018b). The most common types of health effects were respiratory problems (16.7%), mucosal symptoms (13.2%), migraine headaches (12.6%), skin problems (9.1%), asthma attacks (7.0%), and neurological problems (5.1%), among others (Steinemann 2019b).

Relatively few prior studies have investigated links between fragranced products and migraine headaches specifically. In the aforementioned studies (US, AU, UK, SE), a foundation for the present study, 12.6% of the general population, 22.6% of asthmatics, 42.9% of autistic adults, and 36.9% of chemically sensitive individuals, on average, report migraine headaches from fragranced products (Steinemann 2019b, Steinemann and Goodman 2019, Steinemann 2018c, Steinemann 2019c). In clinic-based studies of migraineurs, triggers included perfumes or colognes in 15.5% of 200 migraine patients in the southeastern US (Andress-Rothrock et al. 2010); and perfume in 53%, deodorizers in 14.5%, and air fresheners in 6% of 200 migraine patients in northeastern Brazil (Silva-Néto et al. 2014).

While other studies have examined reports of migraines from fragranced products, results are limited in comparability due to lack of specificity; for instance, migraines were not distinguished from headaches or other health problems (e.g., Steinemann and Caress 2009; Farrow et al. 2003); perfumes were not distinguished from odors generally (e.g., Kelman 2004); or some products were not distinguished as containing fragrance (e.g., Andress-Rothrock et al. 2010; Silva-Néto et al. 2014).

This present study investigates the prevalence of migraine headaches associated with exposure to fragranced products across four countries. In addition, it examines specific product exposures associated with migraines, additional types of health effects, and societal effects such as loss of access to public places, lost workdays and lost jobs. This study extends and deepens prior work by providing a more extensive and focused analysis of associations between exposures and migraines, and the health and societal effects on individuals who report migraines from fragranced products.

## Methods

Nationally representative cross-sectional population-based surveys (confidence limit=95%, margin of error=3%) were conducted of adults ages 18-65 in the US, AU, UK, and SE. Using

the same questionnaire in each country's native language, surveys were implemented in June 2016 (US, AU, UK) and June 2017 (SE). Survey participants (n=1,137; 1,098; 1,100; 1,100; respectively) were randomly selected from large web-based panels (over 5,000,000; 200,000; 900,000; 60,000 people, respectively), developed and held by Survey Sampling International (SSI). Survey response rates were 94%, 93%, 97%, 92% (respectively).

Survey questions investigated fragranced product exposures and contexts, health effects associated with exposures, societal effects, and demographic information. Survey methods are detailed in the Electronic Supplementary Material (ESM-Survey Methods) and Steinemann (2019b). Survey data and statistical analyses for each question and response, according to each of the four countries individually and collectively, are also detailed in the Electronic Supplementary Material (ESM-Survey Data).

## **Results and Discussion**

Across the four countries (n=4,435), 12.6% of adults, on average, report migraine headaches when exposed to one or more types of fragranced products (15.7% US, 10.0% AU, 8.4% UK, 16.1%, SE). Among these individuals, specific products and exposure contexts are as follows: 43.2% report a migraine from exposure to air fresheners or deodorizers, 15.0% from the scent of laundry products coming from a dryer vent; 39.9% from being in a room after it has been cleaned with scented products; 53.7% from being near someone who is wearing a fragranced product; and 45.7% from other types of fragranced products. (Table 1.)

Further, among these individuals reporting migraine from exposure to fragranced products, 38.3% are unable or reluctant to use the restrooms in a public place if it has an air freshener, deodorizer, or scented product; 49.9% enter a business and then want to leave as quickly as possible if they smell air fresheners or a fragranced product; 32.1% are unable or reluctant to wash their hands with soap in a public place if the soap is fragranced; and 47.3% have been prevented from going someplace because they would be exposed to a fragranced product that would make them sick. Notably, 30.6% of these individuals have lost workdays or lost a job, in the past year, due to illness from fragranced product exposure in the workplace. (Table 1.)

For individuals reporting migraines when exposed to fragranced products, additional types of health effects from exposure include the following: respiratory problems (50.9%), mucosal problems (41.4%), skin problems (30.8%), asthma attacks (26.6%), and neurological problems (22.5%), cognitive problems (21.2%), cardiovascular problems (16.4%), gastrointestinal problems (16.1%), musculoskeletal problems (12.7%), immune system problems (12.2%), and other (3.4%). (ESM-Survey Data.)

Demographic proportions of individuals reporting migraines from fragranced products are 33.1% male and 66.9% female, compared with the general population of 48.9% male and 51.1% female. Thus, the percentage of individuals reporting migraines from fragranced products has a female bias (+ 15.9%). Relative to gender and age, the highest bias (percentage greater than general population) is female 25–34 (+ 6.7%). (ESM-Survey Data.)

As study strengths, sample populations are statistically representative of age, gender, and region for the general population; respondents were randomly recruited from large survey panels developed to reflect population characteristics; and the survey used the same instrument with questions previously tested and published. As study limitations, the survey covered adults ages 18–65, which excluded other age groups; the survey obtained data on reports of migraines from exposures to fragranced products, but without data on prior diagnoses of migraines; and

the survey relied on self-reported data, which is nonetheless an accepted approach for survey research as well as for assessment of migraine.

Given results of this survey, and the relevant population affected in the four countries (USCB 2016, ABS 2016, ONS 2016, SCB2017), everyday fragranced products are estimated to trigger migraines in over 36.8 million people, with over 14 million people losing workdays or a job in the past year due to fragranced product exposure in the workplace. (See ESM-Survey Data.)

## **Conclusion**

This study provides important evidence that exposure to fragranced consumer products can be associated with migraine headaches and adverse societal effects. Given the prevalence and severity of effects, reducing exposure would appear to be an important way to reduce the individual and societal burden of migraine.

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Table 1: Migraine headaches (prevalence) associated with exposure to fragranced consumer products

	US	AU	UK	SE	Sum / Average %
General Population (n)	1137	1098	1100	1100	4435
Migraine headache from exposure to fragranced consumer products (n, %)	179 15.7%	110 10.0%	92 8.4%	177 16.1%	558 12.6%
<i>*Migraine headache from exposure to:</i>					
Air fresheners or deodorizers	45.8%	41.8%	43.5%	41.8%	43.2%
Fragranced laundry products from dryer vent	20.7%	12.7%	16.3%	10.2%	15.0%
Room cleaned with fragranced products	41.9%	34.5%	44.6%	38.4%	39.9%
Someone wearing a fragranced product	53.6%	49.1%	40.2%	71.8%	53.7%
Other type of fragranced product	54.7%	46.4%	35.9%	45.8%	45.7%
<i>*Societal effects:</i>					
Unable to use restrooms in public place because of air freshener, deodorizer, or scented product	47.5%	35.5%	42.4%	27.7%	38.3%
Want to leave a business quickly because of fragranced product	55.3%	48.2%	44.6%	51.4%	49.9%
Unable to wash hands in public place because of fragranced soap	43.0%	31.8%	35.9%	17.5%	32.1%
Prevented from going someplace because of fragranced product that would cause sickness	58.1%	45.5%	50.0%	35.6%	47.3%
Lost workdays or lost job, in past year, due to fragranced product exposure in workplace	40.2%	32.7%	31.5%	18.1%	30.6%
<i>* percentages relative to number of individuals reporting migraine from exposure to one or more types of fragranced consumer products</i>					

## Survey Methods

Following Eysenbach G, 2004, Improving the Quality of Web Surveys: The Checklist for Reporting Results of Internet E-Surveys (CHERRIES), Journal of Medical Internet Research, Jul-Sep; 6(3): e34.

<b>Checklist for Reporting Results of Internet E-Surveys (CHERRIES)</b>		
<b>Item Category</b>	<b>Checklist Item</b>	<b>Explanation</b>
<b>Design</b>	Describe survey design	Target population: national random samples of adults (ages 18-65) in each country, the United States (US), Australia (AU), United Kingdom (UK), and Sweden (SE) (n=1,137; n=1,097; n=1,100; n=1,100; respectively), representative of age, gender, and region in each country (confidence limit=95%, margin of error=3%). The survey drew upon participants from large web-based panels in each country (> 5,000,000; >200,000; >900,000; >60,000; respectively) held by Survey Sampling International (SSI). Participant recruitment followed a three-stage randomization process: first, participants are randomly selected from SSI panels and invited to take a survey; second, participants are combined with others into SSI's Dynamix sampling platform and respond to randomly selected profiling questions; and third, prospective participants are then randomly assigned to a survey. All responses were anonymous.
	<b>IRB (Institutional Review Board) approval and informed consent process</b>	
	IRB approval	Ethics approval was obtained by the University of Melbourne, School of Engineering Human Ethics Advisory Group, application 1646894, on May 9, 2016.
	Informed consent	Participants had already provided informed consent as part of the SSI web-based panel. For this survey, participants were given the following introduction: aims of the study; principal researcher name, affiliation, and contact information; human ethics approval; length of survey (less than 15 minutes to complete); assurance that participation is completely voluntary and that all data provided are confidential; assurance that participants can withdraw at any time; outputs of research (findings will be provided through journal articles and website, free of charge); university human ethics contact information; and a specific question to indicate consent: "If you would like to participate in this project, please click the next button to proceed ('Go To Survey')."
	Data protection	Selected survey software and servers were used to ensure data protection. No personal information was linked to the survey results. The dataset (without any identifying information) is kept on password protected computers.

## Development and pre-testing

Development and testing

The survey instrument was a 35-item questionnaire, developed and tested over a two-year period, including cognitive testing with 10 individuals and piloting with over 100 individuals, in each country, before full implementation in June 2016 (US, AU, UK) and June 2017 (SE). The survey was implemented in each country's native language. The survey invitation is an open invitation, rather than a direct invite, to the pool of panelists available at the time. The pool is filtered to achieve a representative sample through a set of initial questions for basic demographic characteristics. SSI uses multiple sources to achieve a sample blend that is characteristic of the population, and response quotas for specific variables (e.g., age, gender, and region) ensure proportions that are representative of the population. Closed survey (only SSI participants), general population, random sample nationally representative of demographics. The survey provider, SSI, provided an open invitation to potential participants. The survey targeted the general population rather than a specific cohort. An open invitation was issued to randomly selected members of the web-based panel. The survey was not advertised.

## Recruitment process and description of the sample having access to the questionnaire

Open survey versus closed survey

Contact mode

Advertising the survey

## Survey administration

Web/E-mail

The survey was web-based, with multiple choice and open format answers. All responses were anonymous, and collected through the online survey platform and stored on local password protected servers.

Context

Mandatory/voluntary

SSI is a survey research company and online panel provider. Voluntary. Prospective participants were randomly invited to the survey.

Incentives

Respondents were provided incentives for their participation by the panel provider, SSI, with points that can be redeemed for money or reward programs.

Time/Date

Data were collected within one week in June 2016 (US, AU, UK) and June 2017 (SE).

Randomization of items or questionnaires

To prevent biases in response, five sets of questions were randomized for their multiple-choice items.

Adaptive questioning

Eight questions were conditionally displayed based on responses to other items.

Number of Items

The survey contained 35 questions. Each page contained one question with multiple choice and open format response categories.

Number of screens (pages)

Overall, 36 to 44 pages were presented (including the introductory page), depending on responses to conditional items.

Completeness check

All questions were required to be completed. All questions provided non-response options such as "don't know/not sure" and "decline to answer." Only completed surveys were included for analysis.

Review step

Respondents were allowed one attempt per question, once they click "next" to review the next question; they are not allowed to go back to the previous questions or answers.

<p><b>Response rates</b></p>	<p>Unique site visitor</p> <p>Participation rate (Ratio of unique visitors who agreed to participate/unique first survey page visitors)</p> <p>Completion rate (Ratio of users who finished the survey/users who agreed to participate)</p>	<p>US, AU, UK, SE: Number of initial responses: 1201, 1183, 1139, 1197; Survey response rate: 95%, 93%, 97%, 92%; Number of drop outs: 46, 53, 18, 78; Number of screen outs: 18, 32, 21, 19; Number of completes: 1137, 1098, 1100, 1100; Panel size, over 5,000,000; over 200,000; over 900,000; over 60,000.</p> <p>Each respondent goes through stringent verification of identity upon signing up on SSI panel (including name, contact details, and IP). Once opt-in process is completed, each respondent is tagged with unique panel ID.</p> <p>SSI respondents are invited to survey through general population random selection. Unique clicks or visitors to the first page of the survey can be those who complete survey, drop out, or screen out.</p> <p>US 95% (1,201 initial, 46 drop out, 18 screen out, 1,137 complete).  AU 93% (1,183 initial, 53 drop out, 32 screen out, 1,098 complete).  UK 97% (1,139 initial, 18 drop out, 21 screen out, 1,100 complete).  SE 92% (1,197 initial; 78 drop outs; 19 screen out; 1,100 complete).</p>
<p><b>Preventing multiple entries from the same individual</b></p>	<p>IP check</p> <p>Registration</p>	<p>SSI programming software and sampling tool, Dynamix, controls the traffic and ensures unique entries. Using unique Panel ID and IP, each respondent can attempt the survey only once.</p> <p>This is a closed survey for SSI respondents only. Survey invite is mailed specifically to the e-mail address used upon joining survey and verified.</p>
<p><b>Analysis</b></p>	<p>Handling of incomplete questionnaires</p> <p>Questionnaires submitted with an atypical timestamp</p> <p>Statistical correction</p>	<p>Only completed questionnaires were included in the final dataset for analysis.</p> <p>Minimum survey completion time was 5 minutes; average was 10 minutes. A small number of respondents were omitted for completing the items too quickly.</p> <p>All demographic subgroups obtained statistically valid numbers to ensure a national representativeness.</p>

**Migraine Headaches and Fragranced Consumer Products: An International Population-Based Study**  
**Anne Steinemann and Neda Nematollahi**

**Table 1**

	USA	AUS	UK	Sweden	Sum/Ave
<b>Total general population</b>	1137 100.00%	1098 100.00%	1100 100.00%	1100 100.00%	4435
<b>Migraine from fragranced consumer products (n)</b>	179	110	92	177	558
<b>% relative to gen pop</b>	15.7%	10.0%	8.4%	16.1%	12.6%

**Table 2****Do you experience any health problems when exposed to air fresheners or deodorizers?****Base: All Respondents Reporting Migraine**

	USA	AUS	UK	Sweden	Sum/Ave
<b>Total</b>	179	110	92	177	
	100.00%	100.00%	100.00%	100.00%	100.0%
<b>Yes</b>	109	59	57	98	323
	60.90%	53.60%	62.00%	55.40%	58.0%
<b>No</b>	46	31	19	51	
	25.70%	28.20%	20.70%	28.80%	25.9%
<b>Don't know/not sure</b>	23	20	16	28	
	12.80%	18.20%	17.40%	15.80%	16.1%
<b>Decline to answer</b>	1	0	0	0	
	0.60%	-	-	-	0.6%

**Table 3****Which of the following health problems do you experience?**

Base: Respondents who experienced below health problems when exposed to air fresheners or deodorizers

	USA	AUS	UK	Sweden	Sum/Ave
<b>Total</b>	109	59	57	98	
	100.00%	100.00%	100.00%	100.00%	
<b>Migraine headaches</b>	82	46	40	74	242
	75.20%	78.00%	70.20%	75.50%	74.7%
<b>Migraine headaches</b> (% relative to individuals reporting migraine)	82	46	40	74	242
	45.8%	41.8%	43.5%	41.8%	43.2%
<b>Asthma attacks</b>	27	21	21	17	
	24.80%	35.60%	36.80%	17.30%	28.6%
<b>Neurological problems (e.g., dizziness, seizures, head pain, fainti</b>	26	14	8	24	
	23.90%	23.70%	14.00%	24.50%	21.5%
<b>Respiratory problems (e.g., difficulty breathing, coughing, shorttr</b>	55	26	18	53	
	50.50%	44.10%	31.60%	54.10%	45.1%
<b>Skin problems (e.g., rashes, hives, red skin, tingling skin, dermati</b>	37	17	17	19	
	33.90%	28.80%	29.80%	19.40%	28.0%
<b>Cognitive problems (e.g., difficulties thinking, concentrating, or r</b>	22	11	10	17	
	20.20%	18.60%	17.50%	17.30%	18.4%
<b>Mucosal symptoms (e.g., watery or red eyes, nasal congestion, s</b>	43	23	17	42	
	39.40%	39.00%	29.80%	42.90%	37.8%
<b>Immune system problems (e.g., swollen lymph glands, fever, fati</b>	15	10	4	5	
	13.80%	16.90%	7.00%	5.10%	10.7%
<b>Gastrointestinal problems (e.g., nausea, bloating, cramping, diar</b>	20	8	7	10	
	18.30%	13.60%	12.30%	10.20%	13.6%
<b>Cardiovascular problems (e.g., fast or irregular heartbeat, jitterir</b>	17	12	15	8	
	15.60%	20.30%	26.30%	8.20%	17.6%
<b>Musculoskeletal problems (e.g., muscle or joint pain, cramps, we</b>	17	10	7	4	
	15.60%	16.90%	12.30%	4.10%	12.2%
<b>Other</b>	2	0	0	2	
	1.80%	-	-	2.00%	

**Table 4****Do you experience any health problems from the scent of laundry products coming from a dryer vent?****Base: All Respondents Reporting Migraine**

	USA	AUS	UK	Sweden	Sum/Ave
<b>Total</b>	179	110	92	177	
	100.00%	100.00%	100.00%	100.00%	
<b>Yes</b>	73	32	34	29	
	40.80%	29.10%	37.00%	16.40%	30.8%
<b>No</b>	76	59	44	117	
	42.50%	53.60%	47.80%	66.10%	52.5%
<b>Don't know/not sure</b>	30	19	14	29	
	16.80%	17.30%	15.20%	16.40%	16.4%
<b>Decline to answer</b>	0	0	0	2	
	-	-	-	1.10%	
	179	110	92	177	558



**Table 5**

**Which of the following health problems do you experience?**

**Base: Respondents who experienced below health problems from the scent of laundry products coming from a dryer vent**

	USA	AUS	UK	Sweden	Sum/Ave
<b>Total</b>	73	32	34	29	
	100.00%	100.00%	100.00%	100.00%	
<b>Migraine headaches</b>	37	14	15	18	84
	50.70%	43.80%	44.10%	62.10%	50.2%
<b>Migraine headaches</b> (% relative to individuals reporting migraine)	37	14	15	18	84
	20.7%	12.7%	16.3%	10.2%	15.0%
<b>Asthma attacks</b>	15	8	17	8	
	20.50%	25.00%	50.00%	27.60%	30.8%
<b>Neurological problems (e.g., dizziness, seizures, head pain, fainti</b>	16	6	3	5	
	21.90%	18.80%	8.80%	17.20%	16.7%
<b>Respiratory problems (e.g., difficulty breathing, coughing, shorttr</b>	24	13	16	7	
	32.90%	40.60%	47.10%	24.10%	36.2%
<b>Skin problems (e.g., rashes, hives, red skin, tingling skin, dermati</b>	23	9	6	8	
	31.50%	28.10%	17.60%	27.60%	26.2%
<b>Cognitive problems (e.g., difficulties thinking, concentrating, or r</b>	12	6	8	5	
	16.40%	18.80%	23.50%	17.20%	19.0%
<b>Mucosal symptoms (e.g., watery or red eyes, nasal congestion, s</b>	27	9	8	6	
	37.00%	28.10%	23.50%	20.70%	27.3%
<b>Immune system problems (e.g., swollen lymph glands, fever, fati</b>	13	12	4	3	
	17.80%	37.50%	11.80%	10.30%	19.4%
<b>Gastrointestinal problems (e.g., nausea, bloating, cramping, diar</b>	17	6	4	3	
	23.30%	18.80%	11.80%	10.30%	16.1%
<b>Cardiovascular problems (e.g., fast or irregular heartbeat, jitterir</b>	10	8	5	5	
	13.70%	25.00%	14.70%	17.20%	17.7%
<b>Musculoskeletal problems (e.g., muscle or joint pain, cramps, we</b>	13	5	6	4	
	17.80%	15.60%	17.60%	13.80%	16.2%
<b>Other</b>	3	0	1	1	
	4.10%	-	2.90%	3.40%	3.5%

**Table 6****Do you experience any health problems from being in a room after it has been cleaned with scented products?****Base: All Respondents Reporting Migraine**

	USA	AUS	UK	Sweden	Sum/Ave
<b>Total</b>	179	110	92	177	
	100.00%	100.00%	100.00%	100.00%	
<b>Yes</b>	119	62	61	77	
	66.50%	56.40%	66.30%	43.50%	58.2%
<b>No</b>	51	40	21	71	
	28.50%	36.40%	22.80%	40.10%	32.0%
<b>Don't know/not sure</b>	9	8	9	29	
	5.00%	7.30%	9.80%	16.40%	9.6%
<b>Decline to answer</b>	0	0	1	0	
	-	-	1.10%	-	1.1%

**Table 7**

**Which of the following health problems do you experience?**

**Base: Respondents who experienced below health problems from being in a room after it has been cleaned with scented products**

	USA	AUS	UK	Sweden	Sum/Ave
<b>Total</b>	119	62	61	77	
	100.00%	100.00%	100.00%	100.00%	
<b>Migraine headaches</b>	75	38	41	68	222
	63.00%	61.30%	67.20%	88.30%	70.0%
<b>Migraine headaches</b> (% relative to individuals reporting migraine)	75	38	41	68	222
	41.9%	34.5%	44.6%	38.4%	39.9%
<b>Asthma attacks</b>	24	9	15	10	
	20.20%	14.50%	24.60%	13.00%	18.1%
<b>Neurological problems (e.g., dizziness, seizures, head pain, fainti</b>	34	9	8	14	
	28.60%	14.50%	13.10%	18.20%	18.6%
<b>Respiratory problems (e.g., difficulty breathing, coughing, shorttr</b>	57	22	21	39	
	47.90%	35.50%	34.40%	50.60%	42.1%
<b>Skin problems (e.g., rashes, hives, red skin, tingling skin, dermati</b>	23	14	15	8	
	19.30%	22.60%	24.60%	10.40%	19.2%
<b>Cognitive problems (e.g., difficulties thinking, concentrating, or r</b>	25	9	12	12	
	21.00%	14.50%	19.70%	15.60%	17.7%
<b>Mucosal symptoms (e.g., watery or red eyes, nasal congestion, s</b>	41	24	17	30	
	34.50%	38.70%	27.90%	39.00%	35.0%
<b>Immune system problems (e.g., swollen lymph glands, fever, fati</b>	16	10	4	3	
	13.40%	16.10%	6.60%	3.90%	10.0%
<b>Gastrointestinal problems (e.g., nausea, bloating, cramping, diar</b>	22	8	6	6	
	18.50%	12.90%	9.80%	7.80%	12.3%
<b>Cardiovascular problems (e.g., fast or irregular heartbeat, jitterir</b>	18	8	8	2	
	15.10%	12.90%	13.10%	2.60%	10.9%
<b>Musculoskeletal problems (e.g., muscle or joint pain, cramps, we</b>	16	7	6	3	
	13.40%	11.30%	9.80%	3.90%	9.6%
<b>Other</b>	1	0	2	1	
	0.80%	-	3.30%	1.30%	1.8%

**Table 8****Do you experience any health problems from being near someone who is wearing a fragranced product?****Base: All Respondents Reporting Migraine**

	USA	AUS	UK	Sweden	Sum/Ave
<b>Total</b>	179	110	92	177	
	100.00%	100.00%	100.00%	100.00%	
<b>Yes</b>	129	74	57	150	
	72.10%	67.30%	62.00%	84.70%	71.5%
<b>No</b>	40	29	28	15	
	22.30%	26.40%	30.40%	8.50%	21.9%
<b>Don't know/not sure</b>	10	7	7	12	
	5.60%	6.40%	7.60%	6.80%	6.6%
<b>Decline to answer</b>	0	0	0	0	
	-	-	-	-	

**Table 9**

**Which of the following health problems do you experience?**

**Base: Respondents who experienced below health problems from being near someone who is wearing a fragranced product**

	USA	AUS	UK	Sweden	Sum/Ave
<b>Total</b>	129	74	57	150	
	100.00%	100.00%	100.00%	100.00%	
<b>Migraine headaches</b>	96	54	37	127	314
	74.40%	73.00%	64.90%	84.70%	74.3%
<b>Migraine headaches</b> (% relative to individuals reporting migraine)	96	54	37	127	314
	53.6%	49.1%	40.2%	71.8%	53.7%
<b>Asthma attacks</b>	21	13	10	20	
	16.30%	17.60%	17.50%	13.30%	16.2%
<b>Neurological problems (e.g., dizziness, seizures, head pain, fainti</b>	25	13	8	21	
	19.40%	17.60%	14.00%	14.00%	16.3%
<b>Respiratory problems (e.g., difficulty breathing, coughing, shorttr</b>	56	25	9	82	
	43.40%	33.80%	15.80%	54.70%	36.9%
<b>Skin problems (e.g., rashes, hives, red skin, tingling skin, dermati</b>	23	9	10	12	
	17.80%	12.20%	17.50%	8.00%	13.9%
<b>Cognitive problems (e.g., difficulties thinking, concentrating, or r</b>	17	12	9	17	
	13.20%	16.20%	15.80%	11.30%	14.1%
<b>Mucosal symptoms (e.g., watery or red eyes, nasal congestion, s</b>	38	27	17	43	
	29.50%	36.50%	29.80%	28.70%	31.1%
<b>Immune system problems (e.g., swollen lymph glands, fever, fati</b>	11	7	4	4	
	8.50%	9.50%	7.00%	2.70%	6.9%
<b>Gastrointestinal problems (e.g., nausea, bloating, cramping, diar</b>	19	7	7	15	
	14.70%	9.50%	12.30%	10.00%	11.6%
<b>Cardiovascular problems (e.g., fast or irregular heartbeat, jitterir</b>	14	8	8	6	
	10.90%	10.80%	14.00%	4.00%	9.9%
<b>Musculoskeletal problems (e.g., muscle or joint pain, cramps, we</b>	9	7	10	4	
	7.00%	9.50%	17.50%	2.70%	9.2%
<b>Other</b>	3	0	0	3	
	2.30%	-	-	2.00%	2.2%

**Table 10****In general, do you experience any health problems from exposure to any type of fragranced product?****Base: All Respondents Reporting Migraine**

	USA	AUS	UK	Sweden	Sum/Ave
<b>Total</b>	179	110	92	177	
	100.00%	100.00%	100.00%	100.00%	
<b>Yes</b>	132	75	49	98	
	73.70%	68.20%	53.30%	55.40%	62.7%
<b>No</b>	33	29	33	50	
	18.40%	26.40%	35.90%	28.20%	27.2%
<b>Don't know/not sure</b>	14	6	10	28	
	7.80%	5.50%	10.90%	15.80%	10.0%
<b>Decline to answer</b>	0	0	0	1	
	-	-	-	0.60%	0.6%

**Table 11**

**Which of the following health problems do you experience?**

**Base: Respondents who experienced below health problems from exposure to any type of fragranced product**

	USA	AUS	UK	Sweden	Sum/Ave
<b>Total</b>	132	75	49	98	
	100.00%	100.00%	100.00%	100.00%	
<b>Migraine headaches</b>	98	51	33	81	263
	74.20%	68.00%	67.30%	82.70%	73.1%
<b>Migraine headaches</b> (% relative to individuals reporting migraine)	98	51	33	81	263
	54.7%	46.4%	35.9%	45.8%	45.7%
<b>Asthma attacks</b>	29	11	13	12	
	22.00%	14.70%	26.50%	12.20%	18.9%
<b>Neurological problems (e.g., dizziness, seizures, head pain, fainti</b>	32	10	8	14	
	24.20%	13.30%	16.30%	14.30%	17.0%
<b>Respiratory problems (e.g., difficulty breathing, coughing, shorttr</b>	61	31	15	55	
	46.20%	41.30%	30.60%	56.10%	43.6%
<b>Skin problems (e.g., rashes, hives, red skin, tingling skin, dermati</b>	36	17	9	10	
	27.30%	22.70%	18.40%	10.20%	19.7%
<b>Cognitive problems (e.g., difficulties thinking, concentrating, or r</b>	24	12	7	10	
	18.20%	16.00%	14.30%	10.20%	14.7%
<b>Mucosal symptoms (e.g., watery or red eyes, nasal congestion, s</b>	52	24	17	36	
	39.40%	32.00%	34.70%	36.70%	35.7%
<b>Immune system problems (e.g., swollen lymph glands, fever, fati</b>	19	4	6	1	
	14.40%	5.30%	12.20%	1.00%	8.2%
<b>Gastrointestinal problems (e.g., nausea, bloating, cramping, diar</b>	21	7	5	6	
	15.90%	9.30%	10.20%	6.10%	10.4%
<b>Cardiovascular problems (e.g., fast or irregular heartbeat, jitterir</b>	11	7	9	6	
	8.30%	9.30%	18.40%	6.10%	10.5%
<b>Musculoskeletal problems (e.g., muscle or joint pain, cramps, we</b>	12	6	7	3	
	9.10%	8.00%	14.30%	3.10%	8.6%
<b>Other</b>	1	0	1	3	
	0.80%	-	2.00%	3.10%	2.0%

**Table 12**

**People Who Answer "Yes" To One Or More Of These Questions: T2/T4/T6/T8/T10 (migraine from exposure to one or more fragranced products).**

**Base: All Respondents Reporting Migraine**

	USA	AUS	UK	Sweden	Sum/Ave
<b>Total</b>	179	110	92	177	
	100.00%	100.00%	100.00%	100.00%	100.0%
<b>Yes</b>	179	110	92	177	
	100.00%	100.00%	100.00%	100.00%	100.0%



**Table 13****People who answer "Yes" to each type of health problem under T2/T4/T6/T8/T10****Base: All Respondents Reporting Migraine**

	USA	AUS	UK	Sweden	Sum/Ave
<b>Total</b>	179	110	92	177	
	100.00%	100.00%	100.00%	100.00%	
<b>Migraine headaches</b>	179	110	92	177	558
	100.00%	100.00%	100.00%	100.00%	100.0%
<b>Asthma attacks</b>	44	34	30	32	140
	24.60%	30.90%	32.60%	18.10%	26.6%
<b>Neurological problems (e.g., dizziness, seizures, head pain, fainti</b>	52	22	19	36	129
	29.10%	20.00%	20.70%	20.30%	22.5%
<b>Respiratory problems (e.g., difficulty breathing, coughing, shortr</b>	97	56	36	105	294
	54.20%	50.90%	39.10%	59.30%	50.9%
<b>Skin problems (e.g., rashes, hives, red skin, tingling skin, dermati</b>	64	36	32	35	167
	35.80%	32.70%	34.80%	19.80%	30.8%
<b>Cognitive problems (e.g., difficulties thinking, concentrating, or r</b>	46	23	19	31	119
	25.70%	20.90%	20.70%	17.50%	21.2%
<b>Mucosal symptoms (e.g., watery or red eyes, nasal congestion, s</b>	87	44	35	69	235
	48.60%	40.00%	38.00%	39.00%	41.4%
<b>Immune system problems (e.g., swollen lymph glands, fever, fati</b>	32	15	10	11	68
	17.90%	13.60%	10.90%	6.20%	12.2%
<b>Gastrointestinal problems (e.g., nausea, bloating, cramping, diar</b>	37	16	16	21	90
	20.70%	14.50%	17.40%	11.90%	16.1%
<b>Cardiovascular problems (e.g., fast or irregular heartbeat, jitterir</b>	31	18	21	16	86
	17.30%	16.40%	22.80%	9.00%	16.4%
<b>Musculoskeletal problems (e.g., muscle or joint pain, cramps, we</b>	27	15	14	12	68
	15.10%	13.60%	15.20%	6.80%	12.7%
<b>Other</b>	6	0	3	6	15
	3.40%	-	3.30%	3.40%	3.4%

**Table 14****Have you ever been unable or reluctant to use the toilets in a public place, because of the presence of an air freshener, deodorizer, or scented product?****Base: All Respondents Reporting Migraine**

	USA	AUS	UK	Sweden	Sum/Ave
<b>Total</b>	179	110	92	177	
	100.00%	100.00%	100.00%	100.00%	
<b>Yes</b>	85	39	39	49	212
	47.5%	35.5%	42.4%	27.7%	38.3%
<b>No</b>	87	65	45	104	
	48.60%	59.10%	48.90%	58.80%	53.9%
<b>Neutral/not sure</b>	7	6	8	23	
	3.90%	5.50%	8.70%	13.00%	7.8%
<b>Decline to answer</b>	0	0	0	1	
	-	-	-	0.60%	

**Table 15****If you enter a business, and you smell air fresheners or some fragranced product, do you want to leave as quickly as possible?****Base: All Respondents Reporting Migraine**

	USA	AUS	UK	Sweden	Sum/Ave
<b>Total</b>	179	110	92	177	
	100.00%	100.00%	100.00%	100.00%	
<b>Yes</b>	99	53	41	91	284
	55.3%	48.2%	44.6%	51.4%	49.9%
<b>No</b>	53	43	31	51	
	29.60%	39.10%	33.70%	28.80%	32.8%
<b>Neutral/not sure</b>	27	14	20	35	
	15.10%	12.70%	21.70%	19.80%	17.3%
<b>Decline to answer</b>	0	0	0	0	
	-	-	-	-	

**Table 16****Have you ever been unable or reluctant to wash your hands with soap in a public place, because you know or suspect that the soap is fragranced?****Base: All Respondents Reporting Migraine**

	USA	AUS	UK	Sweden	Sum/Ave
<b>Total</b>	179	110	92	177	
	100.00%	100.00%	100.00%	100.00%	
<b>Yes</b>	77	35	33	31	176
	43.0%	31.8%	35.9%	17.5%	32.1%
<b>No</b>	89	68	47	131	
	49.70%	61.80%	51.10%	74.00%	59.2%
<b>Neutral/not sure</b>	12	7	12	13	
	6.70%	6.40%	13.00%	7.30%	8.4%
<b>Decline to answer</b>	1	0	0	2	
	0.60%	-	-	1.10%	0.9%

**Table 17****Have you ever been prevented from going to some place because you would be exposed to a fragrance product that would make you sick?****Base: All Respondents Reporting Migraine**

	USA	AUS	UK	Sweden	Sum/Ave
<b>Total</b>	179	110	92	177	
	100.00%	100.00%	100.00%	100.00%	
<b>Yes</b>	104	50	46	63	263
	58.1%	45.5%	50.0%	35.6%	47.3%
<b>No</b>	61	48	39	80	
	34.10%	43.60%	42.40%	45.20%	41.3%
<b>Don't know/not sure</b>	13	12	7	34	
	7.30%	10.90%	7.60%	19.20%	11.3%
<b>Decline to answer</b>	1	0	0	0	
	0.60%	-	-	-	0.6%

**Table 18****Has any exposure to fragranced products in your work environment caused you to become sick, lose work days, or lose a job?**

(time frame: in previous year from point of survey)

**Base: All Respondents Reporting Migraine**

	USA	AUS	UK	Sweden	Sum/Ave
<b>Total</b>	179	110	92	177	
	100.00%	100.00%	100.00%	100.00%	100.0%
<b>Yes</b>	72	36	29	32	169
	40.2%	32.7%	31.5%	18.1%	30.6%
<b>No</b>	95	68	55	125	
	53.10%	61.80%	59.80%	70.60%	61.3%
<b>Don't know/not sure</b>	12	6	8	20	
	6.70%	5.50%	8.70%	11.30%	8.1%
<b>Decline to answer</b>	0	0	0	0	
	-	-	-	-	

**Table 19**  
**Demographics - Migraine from Fragranced Products**

	migraine				
	USA	AUS	UK	Sweden	Sum/Ave
<b>Total</b>	179	110	92	177	
	100.00%	100.00%	100.00%	100.00%	
<b>Male/Female</b>					
<b>All Males</b>	62	34	37	47	
	34.60%	30.90%	40.20%	26.60%	33.1%
<b>All Females</b>	117	76	55	130	
	65.40%	69.10%	59.80%	73.40%	66.9%
<b>Gender vs Age</b>					
<b>Male 18-24</b>	5	5	5	5	
	2.80%	4.50%	5.40%	2.80%	3.88%
<b>Male 25-34</b>	20	13	14	14	
	11.20%	11.80%	15.20%	7.90%	11.53%
<b>Male 35-44</b>	22	7	9	13	
	12.30%	6.40%	9.80%	7.30%	8.95%
<b>Male 45-54</b>	11	6	7	9	
	6.10%	5.50%	7.60%	5.10%	6.08%
<b>Male 55-65</b>	4	3	2	6	
	2.20%	2.70%	2.20%	3.40%	2.63%
<b>Female 18-24</b>	10	13	9	12	
	5.60%	11.80%	9.80%	6.80%	8.50%
<b>Female 25-34</b>	33	17	17	36	
	18.40%	15.50%	18.50%	20.30%	18.18%
<b>Female 35-44</b>	34	22	15	30	
	19.00%	20.00%	16.30%	16.90%	18.05%
<b>Female 45-54</b>	28	16	9	33	
	15.60%	14.50%	9.80%	18.60%	14.63%
<b>Female 55-65</b>	12	8	5	19	
	6.70%	7.30%	5.40%	10.70%	7.53%

**Table 20**  
**Demographics - General Population**

	gen pop				
	USA	AUS	UK	Sweden	Sum/Ave
<b>Total</b>	1137	1098	1098	1100	
	100.00%	100.00%	100.00%	100.00%	
<b>Male/Female</b>					
<b>All Males</b>	525	543	543	556	
	46.20%	49.50%	49.50%	50.50%	48.9%
<b>All Females</b>	612	555	555	544	
	53.80%	50.50%	50.50%	49.50%	51.1%
<b>Gender vs Age</b>					
<b>Male 18-24</b>	47	70	70	89	
	4.10%	6.40%	6.40%	8.10%	6.25%
<b>Male 25-34</b>	130	109	109	110	
	11.40%	9.90%	9.90%	10.00%	10.30%
<b>Male 35-44</b>	136	119	119	134	
	12.00%	10.80%	10.80%	12.20%	11.45%
<b>Male 45-54</b>	108	126	126	113	
	9.50%	11.50%	11.50%	10.30%	10.70%
<b>Male 55-65</b>	104	119	119	110	
	9.10%	10.80%	10.80%	10.00%	10.18%
<b>Female 18-24</b>	78	86	86	68	
	6.90%	7.80%	7.80%	6.20%	7.18%
<b>Female 25-34</b>	135	130	130	116	
	11.90%	11.80%	11.80%	10.50%	11.50%
<b>Female 35-44</b>	155	137	137	112	
	13.60%	12.50%	12.50%	10.20%	12.20%
<b>Female 45-54</b>	144	115	115	133	
	12.70%	10.50%	10.50%	12.10%	11.45%
<b>Female 55-65</b>	100	87	87	115	
	8.80%	7.90%	7.90%	10.50%	8.78%



**Table 21****Population Affected**

	USA	AUS	UK	Sweden	Sum/Ave
population of adults (18-65) at time of survey	2.00E+08	1.45E+07	3.54E+07	5.99E+06	2.56E+08
migraines from fragranced products	15.7%	10.0%	8.4%	16.1%	12.6%
population affected from migraines	3.15E+07	1.45E+06	2.96E+06	9.64E+05	3.68E+07
lost workdays or job	40.2%	32.7%	31.5%	18.1%	30.6%
population affected by lost workdays or jobs	1.26E+07	4.75E+05	9.33E+05	1.75E+05	1.42E+07