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Chemical Sensitivity, Asthma, and Effects from Fragranced Consumer Products:

National Population Study in Sweden

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ABSTRACT

Common chemical products and pollutants—such as pesticides, solvents, new building materials, and fragranced consumer products—have been associated with adverse health and societal effects. For some, the effects can be severe and disabling. This national population study in Sweden examined the prevalence and effects of chemical sensitivity, a condition characterized by health problems from chemical pollutant exposures. In addition, it examined the prevalence of medically diagnosed multiple chemical sensitivities (MCS), and the co-occurrence of chemical sensitivity with asthma and asthma-like conditions, and with fragrance sensitivity (health problems from fragranced consumer products). Using a nationally representative sample, an online survey was conducted in July 2017 of adults in Sweden (n=1,100). This study found that, across the population, 18.5% report chemical sensitivity; 3.6% report medically diagnosed MCS; 23.2% are asthmatic, with diagnosed asthma (14.9%), an asthma-like condition (9.1%) or both; and 33.1% have fragrance sensitivity. Among the chemically sensitive, 49.0% are asthmatic and 86.8% are fragrance sensitive. Among asthmatics, 39.2% are chemically sensitive and 57.3% are fragrance sensitive. Health problems from fragranced products can be potentially disabling for 40.1% of the chemically sensitive and 36.3% of asthmatics. In addition, among the chemically sensitive, 24.0% have lost workdays or lost a job in the past year due to fragranced products in the workplace. Results indicate that chemical sensitivity is a widespread condition, affecting more than 1 million adults in Sweden, with fragrance sensitivity affecting nearly 2 million. Reducing chemical exposure to problematic sources, such as fragranced consumer products, is critical to reduce adverse health and societal effects.

1. Introduction

Common consumer products that emit volatile chemicals, such as those with a fragrance, can be a dominant contributor to both outdoor and indoor air pollutants (McDonald et al. 2018; Ott et al. 2007), as well as both acute and chronic health problems (Steinemann 2016). Chemical sensitivity is a condition characterized by adverse health effects from exposure to common petrochemical products and pollutants (Ziem and McTamney 1997; Caress and Steinemann 2004; Ashford and Miller 1998). Individuals with chemical sensitivity have been likened to human canaries, as they react more immediately and severely to air pollutants and at exceptionally low levels (Steinemann 2018b).

Products implicated in chemical sensitivity include pesticides, new carpet and paint, renovation materials, diesel exhaust, and fragranced consumer products (Ashford and Miller 1998). Health effects associated with exposure include headaches, dizziness, seizures, heart arrhythmia, gastrointestinal problems, breathing difficulties, and asthma attacks (Steinemann 2018a, 2018b).

While chemical sensitivity is a common and general term, the condition may also be diagnosed as multiple chemical sensitivities (MCS). Other terms include chemical intolerance or toxicant induced loss of tolerance (Ashford and Miller 1998; Miller and Prihoda 1999). Individuals may not receive a specific diagnosis but nonetheless manifest and report characteristics of the condition. Notwithstanding the lack of a single international definition and diagnosis, several previous studies have investigated the prevalence of chemical sensitivity.

In Sweden, a study of 1,387 adults in Skövde found a prevalence of 33% of self-reported general odour intolerance, or being bothered by strong or pungent odours such as perfume, cleaning agents or flower scents (Johansson et al. 2005). In this study, using the Chemical Sensitivity Scale for Sensory Hyperreactivity (CSS-SHR) (Nordin et al. 2004), chemical sensitivity was determined by a positive response to the question: "Are you bothered by strong odors? (e.g. perfume, cleaning agents or flower scents)." A survey of 7,402 women and 6,202 men in Skåne found 10.1% experienced "some annoyance" and 2.4 percent "much annoyance" from breathing air that smells of chemicals (Carlsson et al. 2005). A questionnaire-based study of teenagers aged 13-19 years in Skövde (n=401), using the CSS-SHR, found a prevalence of 15.6% for chemical sensitivity (Andersson et al. 2008). A survey of adults from Västerbotten (n=3,406) found 12.2% reported chemical intolerance to odorous pungent chemicals, such as perfumes and cleaning agents, and 3.3% were physician-diagnosed with chemical intolerance (Palmquist et al. 2014). A nationally representative population survey in Sweden (n=1,1100) found 33.1% of adults report adverse health effects when exposed to fragranced products such as air fresheners, cleaning supplies, and personal care products (Steinemann 2018c).

In other countries, recent national surveys in the United States (US) (Steinemann, 2018a) and Australia (AU) (Steinemann 2018b) found a prevalence of 25.9% US and 18.9% AU of self-reported chemical sensitivity and 12.8% US and 6.5% AU of medically diagnosed MCS. Prior US national prevalence studies, conducted in 2002-2003 and 2005-2006 (Caress and Steinemann 2005, 2009a), found respectively 11.1% and 11.6% self-reported chemical sensitivity and 2.5% and 3.9% medically diagnosed MCS. Thus, over the past decade in the US, MCS prevalence has increased over 300% and chemical sensitivity has increased over 200% (Steinemann 2018a). Chemical sensitivity was investigated in these

four studies using the following question (based on Kreutzer et al. 1999): "Compared to other people, do you consider yourself allergic or unusually sensitive to everyday chemicals like those in household cleaning products, paints, perfumes, detergents, insect spray and things like that?"

A survey of 7,245 adults in Japan (Azuma et al. 2015) estimated a prevalence of 7.5% of chemical intolerance. A study of 2,000 adults in Denmark (Skovbjerg et al. 2012) found a prevalence 8.2% of chemical intolerance. Chemical intolerance was investigated in these two studies using the Quick Environmental Exposure and Sensitivity Inventory (QEESI) criteria (Miller and Prihoda 1999).

The aims of this present study are the following: (1) to determine the prevalence of chemical sensitivity and medically diagnosed MCS in Sweden, (2) to investigate its co-occurrence with asthma or an asthma-like condition, and with fragrance sensitivity, and (3) to assess the effects of exposures to fragranced consumer products on health and societal access for chemically sensitivity and asthmatic individuals.

2. Methods

A national cross-sectional survey was conducted of the Swedish population using a sample representative of the general population according to age, gender, and region (n=1,100; confidence limit=95%, confidence interval=3%). Using randomized participation recruitment (SSI 2016), the survey drew upon a large web-based panel of adults ages 18-65 in Sweden (approximately 60,000 people) held by Survey Sampling International (SSI), a global survey research company and online panel provider.

The survey was conducted in the official national language of Swedish. The survey instrument was developed and tested over a three-year period, used in three other national studies (Steinemann 2016, 2017, 2018c), and piloted with 100 individuals in Sweden, before full implementation in Sweden in July 2017.

The survey was translated from English into Swedish by a professional linguist and native speaker based in Sweden, and proofread by another professional linguist and native speaker based in the UK. Survey translation and implementation were performed by SSI. The survey response rate was 92%, and all responses were anonymous. The research study received ethics approval from the University of Melbourne.

Details on the survey methodology, including the checklist for reporting results of internet e-surveys (Eysenbach 2004), are provided in Electronic Supplementary Material 1 (Survey Methodology). Full results of survey data and statistics are provided in Electronic Supplementary Material 2 (Survey Data). Results from effects of fragranced products on the general population of Sweden are provided in Steinemann (2018c), which this present study deepens and extends by investigating prevalence, co-occurrence, and health effects concerning sub-populations.

Descriptive statistics and cross-tabulations determined percentages according to each response and sub-population. Chi-squared analyses compared percentages to determine whether statistically significant differences exist. Prevalence odds ratios (PORs) measured the strength of associations to determine whether one sub-population is

proportionally more affected. All analyses were performed using a 95% confidence interval (CI).

To promote comparability and replicability, the survey employed questions from previous national studies of chemical sensitivity, MCS, asthma and asthma-like conditions, and fragrance sensitivity (Steinemann 2018a, 2018b; Caress and Steinemann 2005, 2009a 2009b), as follows.

For chemical sensitivity, the survey asked, "Compared to other people, do you consider yourself allergic or unusually sensitive to everyday chemicals like those in household cleaning products, paints, perfumes, detergents, insect spray and things like that?" For medically diagnosed MCS, the survey asked, "Has a doctor or health care professional ever told you that you have multiple chemical sensitivities?"

For asthma or asthma-like conditions, the survey asked, "Has a doctor or health care professional ever told you that you have asthma or an asthma-like condition?" If respondent answered yes, the survey then asked to specify whether "asthma" or an "asthma-like condition" or both. (The term "asthmatic" will be used herein to include individuals with either asthma or an asthma-like condition or both.)

For fragrance sensitivity, the survey asked about exposure to different types of fragranced consumer products and associated health effects. An individual was considered to characterize fragrance sensitivity if they reported one or more types of health problems from exposure to one or more types of fragranced consumer products or exposure contexts (Steinemann 2016).

A "fragranced consumer product" (or "fragranced product," for brevity) is a chemically formulated product with the addition of a fragrance or scent (Steinemann 2015). Fragranced product types were categorized as follows: air fresheners and deodorizers, personal care products, cleaning supplies, laundry products, household products, fragrance, and other. Exposure contexts were as follows: air fresheners or deodorizers used in public restrooms and other environments; scented laundry products coming from a dryer vent; being in a room after it was cleaned with scented cleaning products; being near someone wearing a fragranced product; and exposure to other types of fragranced consumer products.

Health effects were categorized as follows: migraine headaches; asthma attacks; neurological problems; respiratory problems; skin problems; cognitive problems; mucosal symptoms; immune system problems; gastrointestinal problems; cardiovascular problems; musculoskeletal problems; and other.

3. Results

Across the Swedish population,18.5% report chemical sensitivity, 3.6% medically diagnosed MCS, and 19.5% either or both. In addition, 23.2% are asthmatic, with diagnosed asthma (14.9%), an asthma-like condition (9.1%) or both; and 33.1% have fragrance sensitivity (Table 1.) Thus, nearly one-fifth of the population reports being chemically sensitive, and nearly one-sixth of those individuals are diagnosed with MCS.

Among the chemically sensitive individuals, 49.0% are asthmatic and 86.8% are fragrance sensitive. Among asthmatics, 39.2% are chemically sensitive and 57.3% are fragrance sensitive. (Table 1.) To compare with results from other countries, which used the same survey questions and criteria:

In the US (Steinemann 2016, 2018a, 2018d): 25.9% report chemical sensitivity, 12.8% medically diagnosed MCS, 26.8% are asthmatic, and 34.7% have fragrance sensitivity. Among the chemically sensitive, 59.2% are asthmatic and 81.0% are fragrance sensitive. Among asthmatics, 57.0% are chemically sensitive and 64.3% are fragrance sensitive.

In Australia (Steinemann 2017, 2018b, Steinemann et al. 2018): 18.9% report chemical sensitivity, 6.5% medically diagnosed MCS, 28.5% are asthmatic, and 33.0% have fragrance sensitivity. Among the chemically sensitive, 56.5% are asthmatic and 82.6% are fragrance sensitive. Among asthmatics, 37.4% are chemically sensitive and 55.6% are fragrance sensitive.

Even though the prevalence of chemically sensitive, asthmatic, and fragrance sensitive individuals is higher in the US, the co-occurrences of any two conditions are statistically similar across the three countries ($p>0.05$, Chi-square test).

For chemically sensitive individuals, fragranced product exposures that are associated with health problems include the following: air fresheners and deodorizers (60.3%), scented laundry products coming from a dryer vent (20.1%), being in a room recently cleaned with scented products (50.5%), being near someone wearing a fragranced product (69.1%), and other types of fragranced consumer products (57.4%). (Table 2.)

Most common adverse health effects associated with these exposures include respiratory problems (62.3%), migraine headaches (47.1%), mucosal symptoms (44.6%), and asthma attacks (24.5%), among others. (Table 3.)

Health problems from exposure to fragranced products can be so severe as to be disabling. To assess disability, the definition in the Swedish Disability Discrimination Act (DA 2008) was used as the basis of the question: "Orsakar några av dessa hälsoproblem några fysiska, psykiska eller begåvningsmässiga begränsningar av din funktionsförmåga?" (Do any of these health problems cause any physical, psychological or talented limitations on your functioning?) For 40.1% with chemical sensitivity and 36.3% of asthmatics, the health effects from fragranced product exposure were reported as potentially disabling.

Fragranced products also restrict access in society. For individuals with chemical sensitivity, 27.5% are unable or reluctant to use public restrooms that have an air freshener, deodorizer, or scented product; 20.6% are unable or reluctant to wash hands in a public place if the soap is fragranced; 56.9% enter a business but then leave as quickly as possible due to a fragranced product; and 41.7% have been prevented from going someplace because a fragranced product would make them sick. In addition, 24.0% of chemically sensitive have lost workdays or lost a job, in the past year, due to illness from fragranced product exposure in the workplace.

A strong majority of the Swedish population would prefer fragrance-free (rather than fragranced) workplaces, health care facilities, and health care professionals. Among the

general population, 50.7% would support a fragrance-free policy in the workplace (compared to 16.4% that would not), and 64.1% would prefer that health care facilities and health care professionals were fragrance-free (compared to 14.0% that would not). Among those with chemical sensitivity, 69.6% would support a fragrance-free policy in the workplace (compared to 7.8% that would not), and 84.3% would prefer that health care facilities and health care professionals were fragrance-free (compared to 6.4% that would not). (See Table 4 and Electronic Supplementary Material.)

Demographic proportions of chemical sensitivity are 32.4% male and 67.6% female, and diagnosed MCS are 60.0% male and 40.0% female, compared with the general population of 50.5% male and 49.5% female. Thus, chemical sensitivity has a female bias (+18.1%), and diagnosed MCS has a male bias (+0.5%). Relative to gender and age, the highest bias (percentage chemical sensitivity or MCS greater than general population) is Male 18-24 (+9.4%) for diagnosed MCS. (See Table 5.)

4. Discussion

This study found that chemical sensitivity is widespread in the Swedish population, affecting more than 1 million adults (SCB, 2018). Among chemically sensitive individuals, 49.0% are asthmatic and 86.8% are fragrance sensitive (compared with the non-chemically sensitive, 17.3% are asthmatic and 20.9% are fragrance sensitive). Among asthmatics, 39.2% are chemically sensitive and 57.3% have fragrance sensitivity (compared with non-asthmatics, 12.3% are chemically sensitive and 25.8% are fragrance sensitive).

Chemically sensitive individuals are proportionally more likely than the non-chemically sensitive to be asthmatic (POR 3.19; 95% CI 2.34-4.34) and fragrance sensitive (POR 13.26; 95% CI 8.67-20.25). Similarly, asthmatics are proportionally more likely than non-asthmatics to be chemically sensitive (POR 2.83; 95% CI 2.11-3.80) and fragrance sensitive (POR 2.71; 95% CI 2.05-3.58).

Perhaps not surprising is that chemically sensitive individuals are much more likely to be fragrance sensitive, since fragranced products are included in the key question to assess self-reported chemical sensitivity.

However, that asthmatics are more likely than non-asthmatics to be fragrance sensitive, and that more than half of asthmatics report adverse health effects from fragranced products, deserves attention. For instance, for more than one-fifth of asthmatics, exposure to a fragranced product is associated with an asthma attack. If the frequency of asthma attacks can be reduced simply by reducing or avoiding exposure, then this represents a straightforward and cost-effective form of prevention.

Also noteworthy is the percentage of chemically sensitive individuals (24.0%), representing more than a quarter of a million Swedish people, who have lost workdays or lost a job, in the past year, due to exposure to fragranced products in the workplace. This underscores the importance of fragrance-free policies for indoor environments, noting that even individuals who do not themselves report fragrance sensitivity would nonetheless support such policies.

This study adds to the growing body of evidence that volatile chemical products, such as those with a fragrance, can induce adverse health effects in the Swedish population, with vulnerable sub-populations more affected.

Study strengths include the following: (a) the sample population is statistically representative of age, gender, and region in Sweden; (b) the 1,100 respondents were randomly recruited from a large web-based panel, developed to reflect population characteristics; and (c) the survey replicated questions from national population studies in the US and AU (Steinemann 2018a, 2018b). Study limitations include the following: (a) only adults ages 18-65 were surveyed, which excludes data from other age groups; (b) the survey relied on self-reports, which is nonetheless a standard and widely accepted approach for epidemiological research (e.g., NIH 2011); and (c) chemical sensitivity lacks universal diagnostic criteria, although the survey employed questions from prior surveys to promote comparability.

5. Conclusion

Chemical sensitivity is a serious and potentially disabling health condition, related to exposure to common chemically formulated products, such as those with a fragrance. Reducing exposure to fragranced products is a straightforward and cost-effective way to help to reduce the frequency and severity of adverse health and societal effects.

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Table 1: Prevalence and Co-Occurrence of Chemical Sensitivity/MCS with Asthma/Asthma-Like Condition and Fragrance Sensitivity

	Gen Pop	**Chemical Sensitivity**	**MCS Diag**	**ChemSens/ MCS Diag**	**Asthmatic**	**Fragrance Sensitivity**
Total (N)	1100	204	40	214	255	364
(% relative to General Population)	100.0%	18.5%	3.6%	19.5%	23.2%	33.1%
	N % of column total	N % of column total	N % of column total	N % of column total	N % of column total	N % of column total
Chemical Sensitivity	204	204	30	204	100	177
	18.5%	100.0%	75.0%	95.3%	39.2%	48.6%
MCS Diagnosed	40	30	40	40	25	36
	3.6%	14.7%	100.0%	18.7%	9.8%	9.9%
MCS Diagnosed or Chemical Sensitivity (or both)	214	204	40	214	102	186
	19.5%	100.0%	100.0%	100.0%	40.0%	51.1%
Asthmatic (Asthma or Asthma-like Condition or both)	255	100	25	102	255	146
	23.2%	49.0%	62.5%	47.7%	100.0%	40.1%
Asthma Diagnosed	164	64	17	65	164	91
	14.9%	31.4%	42.5%	30.4%	64.3%	25.0%
Asthma-like Condition Diagnosed	100	39	9	40	100	59
	9.1%	19.1%	22.5%	18.7%	39.2%	16.2%
Fragrance Sensitivity	364	177	36	186	146	364
	33.1%	86.8%	90.0%	86.9%	57.3%	100.0%

Table 2: Exposures to fragranced consumer products and associated health problems

	Gen Pop	**Chemical Sensitivity**	**MCS Diag**	**ChemSens/ MCS Diag**	**Asthmatic**
	N % of column total	N % of column total	N % of column total	N % of column total	N % of column total
Total	1100	204	40	214	255
	100.0%	100.0%	100.0%	100.0%	100.0%
Fragrance Sensitive	364	177	36	186	146
	33.1%	86.8%	90.0%	86.9%	57.3%
Health problems from exposure to:					
Air fresheners or deodorizers	190	123	25	126	84
	17.3%	60.3%	62.5%	58.9%	32.9%
Scented laundry products from a dryer vent	62	41	14	43	32
	5.6%	20.1%	35.0%	20.1%	12.5%
Room cleaned with scented products	152	103	25	108	68
	13.8%	50.5%	62.5%	50.5%	26.7%
Someone wearing a fragranced product	259	141	29	146	112
	23.5%	69.1%	72.5%	68.2%	43.9%
Other type of fragranced consumer product	197	117	25	122	86
	17.9%	57.4%	62.5%	57.0%	33.7%

Table 3: Health problems (frequency and type) reported from exposure to fragranced consumer products

	Gen Pop	Chemical Sensitivity	MCS Diag	ChemSens/ MCS Diag	Asthmatic
Total (N)	1100	204	40	214	255
(% relative to General Population)	100.0%	18.5%	3.6%	19.5%	23.2%
	N	N	N	N	N
	% of column total	% of column total	% of column total	% of column total	% of column total
Total Fragrance Sensitive (N) (reporting one or more health problems)	364	177	36	186	146
(% relative to Sub-population)	33.1%	86.8%	90.0%	86.9%	57.3%
Type of health problem:					
* *Migraine headaches*	177	96	14	99	72
	16.1%	47.1%	35.0%	46.3%	28.2%
* *Asthma attacks*	61	50	11	51	57
	5.5%	24.5%	27.5%	23.8%	22.4%
* *Neurological problems* (e.g., dizziness, seizures,	55	42	5	43	21
head pain, fainting, loss of coordination)	5.0%	20.6%	12.5%	20.1%	8.2%
* *Respiratory problems* (e.g., difficulty breathing,	220	127	21	129	111
coughing, shortness of breath)	20.0%	62.3%	52.5%	60.3%	43.5%
* *Skin problems* (e.g., rashes, hives, red skin,	71	53	15	55	34
tingling skin, dermatitis)	6.5%	26.0%	37.5%	25.7%	13.3%
* *Cognitive problems* (e.g., difficulties thinking,	50	29	9	31	22
concentrating, or remembering)	4.5%	14.2%	22.5%	14.5%	8.6%
* *Mucosal symptoms* (e.g., watery or red eyes, nasal	149	91	18	93	74
congestion, sneezing)	13.5%	44.6%	45.0%	43.5%	29.0%
* *Immune system problems* (e.g., swollen lymph	16	14	8	15	8
glands, fever, fatigue)	1.5%	6.9%	20.0%	7.0%	3.1%
* *Gastrointestinal problems* (e.g., nausea, bloating,	39	25	10	27	19
cramping, diarrhea)	3.5%	12.3%	25.0%	12.6%	7.5%
* *Cardiovascular problems* (e.g., fast or irregular	23	17	7	19	14
heartbeat, jitteriness, chest discomfort)	2.1%	8.3%	17.5%	8.9%	5.5%
* *Musculoskeletal problems* (e.g., muscle or joint	17	13	7	14	9
pain, cramps, weakness)	1.5%	6.4%	17.5%	6.5%	3.5%
* *Other*	24	8	2	9	4
	2.2%	3.9%	5.0%	4.2%	1.6%

Table 4: Societal effects of fragranced consumer products

	Gen Pop	Chemical Sensitivity	MCS Diag	ChemSens/ MCS Diag	Asthmatic
	N % of column total	N % of column total	N % of column total	N % of column total	N % of column total
Total	1100	204	40	214	255
	100.0%	100.0%	100.0%	100.0%	100.0%
Fragrance Sensitive	364	177	36	186	146
	33.1%	86.8%	90.0%	86.9%	57.3%
Disabling health effects from fragranced consumer products	88	71	21	73	53
	24.2%	40.1%	58.3%	39.2%	36.3%
Unable or reluctant to use restrooms in public place because of air freshener, deodorizer, or scented product	132	56	15	59	51
	12.0%	27.5%	37.5%	27.6%	20.0%
Unable or reluctant to wash hands because of fragranced soap	74	42	16	46	30
	6.7%	20.6%	40.0%	21.5%	11.8%
Want to leave a business quickly because of fragranced product	199	116	21	119	74
	18.1%	56.9%	52.5%	55.6%	29.0%
Prevented from going someplace because of fragranced product	139	85	23	89	72
	12.6%	41.7%	57.5%	41.6%	28.2%
Lost workdays or job in past year due to fragranced product exposure in workplace	74	49	12	51	38
	6.7%	24.0%	30.0%	23.8%	14.9%
Supportive of fragrance-free policy in the workplace	558	142	25	147	141
	50.7%	69.6%	62.5%	68.7%	55.3%
Prefer fragrance-free health care facilities and professionals	705	172	30	175	183
	64.1%	84.3%	75.0%	81.8%	71.8%

Table 5: Demographic information

	Gen Pop	Chemical Sensitivity	MCS Diag	ChemSens/ MCS Diag	Asthmatic
	N % of column total	N % of column total	N % of column total	N % of column total	N % of column total
Total	1100	204	40	214	255
	100.0%	100.0%	100.0%	100.0%	100.0%
Male/Female					
All Males	556	66	24	75	105
	50.5%	32.4%	60.0%	35.0%	41.2%
All Females	544	138	16	139	150
	49.5%	67.6%	40.0%	65.0%	58.8%
Gender vs Age					
Male 18-24	89	11	7	15	14
	8.1%	5.4%	17.5%	7.0%	5.5%
Male 25-34	110	16	5	18	26
	10.0%	7.8%	12.5%	8.4%	10.2%
Male 35-44	134	14	6	15	24
	12.2%	6.9%	15.0%	7.0%	9.4%
Male 45-54	113	14	3	15	20
	10.3%	6.9%	7.5%	7.0%	7.8%
Male 55-65	110	11	3	12	21
	10.0%	5.4%	7.5%	5.6%	8.2%
Female 18-24	68	18	2	18	28
	6.2%	8.8%	5.0%	8.4%	11.0%
Female 25-34	116	25	3	26	24
	10.5%	12.3%	7.5%	12.1%	9.4%
Female 35-44	112	29	2	29	28
	10.2%	14.2%	5.0%	13.6%	11.0%
Female 45-54	133	37	5	37	38
	12.1%	18.1%	12.5%	17.3%	14.9%
Female 55-65	115	29	4	29	32
	10.5%	14.2%	10.0%	13.6%	12.5%

Survey Methodology

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.

Checklist for Reporting Results of Internet E-Surveys (CHERRIES)		
Item Category	***Checklist Item***	***Explanation***
Design		
	Describe survey design	Target population: national random sample of adults (ages 18-65) in Sweden, representative of age, gender, and region (n=1,100, confidence limit=95%, margin of error=3%). The survey drew upon participants from a large web-based panel (~60,000 participants) held by Survey Sampling International (SSI). Participant recruitment followed a randomized process (Dynamix). All responses were anonymous. Survey completion time was approximately ten minutes.
IRB (Institutional Review Board) approval and informed consent process		
	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, before full implementation in July 2017.
Recruitment process and description of the sample having access to the questionnaire		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.
	Open survey versus closed survey	Closed survey (only SSI participants), general population, random sample nationally representative of demographics. SSI uses 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 they are likely to take.
	Contact mode	The survey provider, SSI, provided an open invitation to potential participants. The survey targeted the general population rather than a specific cohort.
	Advertising the survey	An open invitation was issued to randomly selected members of the web-based panel. The survey was not advertised.
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	SSI is a survey research company and online panel provider.
	Mandatory/voluntary	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 July 2017.
	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.
Response rates		Survey completion rate: 92%. Number of initial responses: 1,197; number of drop outs: 78; number of screen outs: 19; number of completes: 1,100; Panel size: ~60,000.
	Unique site visitor	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.
	View rate (Ratio of unique survey visitors/unique site visitors)	not applicable
	Participation rate (Ratio of unique visitors who agreed to participate/unique first survey page visitors)	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.
	Completion rate (Ratio of users who finished the survey/users who agreed to participate)	Sweden 92% (1,197 initial; 78 drop outs; 19 screen out; 1,100 completes).
Preventing multiple entries from the same individual		
	Cookies used	not used
	IP check	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.
	Log file analysis	not used
	Registration	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.
Analysis		
	Handling of incomplete questionnaires	Only completed questionnaires were included in the final dataset for analysis.
	Questionnaires submitted with an atypical timestamp	Minimum survey completion time was 5 minutes; average was 10 minutes. A small number of respondents were omitted for completing the items too quickly.
	Statistical correction	All demographic subgroups obtained statistically valid numbers to ensure a national representativeness.

Table 1

Respondents (n, % of general population)

	GenPop	MCS	ChemSens	MCS / ChemSens	Asthmatic
Total	1100	40	204	214	255
	100.0%	3.6%	18.5%	19.5%	23.2%

Table 2

What is your gender?

	GenPop	MCS	ChemSens	MCS / ChemSens	Asthmatic
Total	1100	40	204	214	255
	100.00%	100.00%	100.00%	100.00%	100.00%
Male	556	24	66	75	105
	50.50%	60.00%	32.40%	35.00%	41.20%
Female	544	16	138	139	150
	49.50%	40.00%	67.60%	65.00%	58.80%
Other	-	-	-	-	-
	-	-	-	-	-

Table 3

What is your age?

	GenPop	MCS	ChemSens	MCS / ChemSens	Asthmatic
Total	1100	40	204	214	255
	100.00%	100.00%	100.00%	100.00%	100.00%
18-24 (21)	157	9	29	33	42
	14.30%	22.50%	14.20%	15.40%	16.50%
25-34 (29.5)	226	8	41	44	50
	20.50%	20.00%	20.10%	20.60%	19.60%
35-44 (39.5)	246	8	43	44	52
	22.40%	20.00%	21.10%	20.60%	20.40%
45-54 (49.5)	246	8	51	52	58
	22.40%	20.00%	25.00%	24.30%	22.70%
55-65 (60)	225	7	40	41	53
	20.50%	17.50%	19.60%	19.20%	20.80%

Table 4

SWEDEN Region.

	GenPop	MCS	ChemSens	MCS / ChemSens	Asthmatic
Total	1100	40	204	214	255
	100.00%	100.00%	100.00%	100.00%	100.00%
Blekinge län	11	-	1	1	2
	1.00%	-	0.50%	0.50%	0.80%
Dalarnas län	35	1	7	7	6
	3.20%	2.50%	3.40%	3.30%	2.40%
Gävleborgs län	34	1	8	8	5
	3.10%	2.50%	3.90%	3.70%	2.00%
Gotlands län	7	1	1	1	2
	0.60%	2.50%	0.50%	0.50%	0.80%
Hallands län	33	1	6	7	7
	3.00%	2.50%	2.90%	3.30%	2.70%
Jämtlands län	11	-	2	2	5
	1.00%	-	1.00%	0.90%	2.00%
Jönköpings län	34	2	9	9	7
	3.10%	5.00%	4.40%	4.20%	2.70%
Kalmar län	11	1	2	2	2
	1.00%	2.50%	1.00%	0.90%	0.80%
Kronobergs län	23	-	3	3	1
	2.10%	-	1.50%	1.40%	0.40%
Norrbottens län	33	1	6	6	7
	3.00%	2.50%	2.90%	2.80%	2.70%
Orebro län	33	1	9	9	8
	3.00%	2.50%	4.40%	4.20%	3.10%
Ostergötlands län	54	2	8	9	16
	4.90%	5.00%	3.90%	4.20%	6.30%
Skåne län	143	6	34	36	38
	13.00%	15.00%	16.70%	16.80%	14.90%
Södermanlands län	33	1	3	3	2
	3.00%	2.50%	1.50%	1.40%	0.80%
Stockholms län	253	7	45	47	65
	23.00%	17.50%	22.10%	22.00%	25.50%
Uppsalas län	44	1	10	11	11
	4.00%	2.50%	4.90%	5.10%	4.30%
Värmlands län	33	-	2	2	6
	3.00%	-	1.00%	0.90%	2.40%
Västerbottens län	33	2	6	6	7
	3.00%	5.00%	2.90%	2.80%	2.70%
Västernorrlands län	22	2	6	6	6
	2.00%	5.00%	2.90%	2.80%	2.40%
Västmanlands län	33	2	8	9	13
	3.00%	5.00%	3.90%	4.20%	5.10%
Västra Götalands län	187	8	28	30	39
	17.00%	20.00%	13.70%	14.00%	15.30%

Table 5

Q2. Do you experience any health problems when exposed to air fresheners or deodorizers?

	GenPop	MCS	ChemSens	MCS / ChemSens	Asthmatic
Total	1100	40	204	214	255
	100.00%	100.00%	100.00%	100.00%	100.00%
Yes	190	25	123	126	84
	17.30%	62.50%	60.30%	58.90%	32.90%
No	780	10	53	57	137
	70.90%	25.00%	26.00%	26.60%	53.70%
Don't know/not sure	123	5	28	31	34
	11.20%	12.50%	13.70%	14.50%	13.30%
Decline to answer	7	-	-	-	-
	0.60%	-	-	-	-

Table 6

BA. Which of the following health problems do you experience?

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

	GenPop	MCS	ChemSens	MCS / ChemSens	Asthmatic
Total	190	25	123	126	84
	100.00%	100.00%	100.00%	100.00%	100.00%
Migraine headaches	74	10	47	49	28
	38.90%	40.00%	38.20%	38.90%	33.30%
Asthma attacks	36	9	33	33	34
	18.90%	36.00%	26.80%	26.20%	40.50%
Neurological problems (e.g., dizziness, seizures,	32	4	25	26	13
head pain, fainting, loss of coordination)	16.80%	16.00%	20.30%	20.60%	15.50%
Respiratory problems (e.g., difficulty breathing,	105	14	75	76	58
coughing, shortness of breath)	55.30%	56.00%	61.00%	60.30%	69.00%
Skin problems (e.g., rashes, hives, red skin,	34	10	24	26	16
tingling skin, dermatitis)	17.90%	40.00%	19.50%	20.60%	19.00%
Cognitive problems (e.g., difficulties thinking,	21	2	19	19	11
concentrating, or remembering)	11.10%	8.00%	15.40%	15.10%	13.10%
Mucosal symptoms (e.g., watery or red eyes, nasal	75	11	56	57	36
congestion, sneezing)	39.50%	44.00%	45.50%	45.20%	42.90%
Immune system problems (e.g., swollen lymph	7	2	6	6	3
glands, fever, fatigue)	3.70%	8.00%	4.90%	4.80%	3.60%
Gastrointestinal problems (e.g., nausea, bloating,	14	3	10	10	8
cramping, diarrhea)	7.40%	12.00%	8.10%	7.90%	9.50%
Cardiovascular problems (e.g., fast or irregular	10	4	6	8	5
heartbeat, jitteriness, chest discomfort)	5.30%	16.00%	4.90%	6.30%	6.00%
Musculoskeletal problems (e.g., muscle or joint	5	1	3	3	1
pain, cramps, weakness)	2.60%	4.00%	2.40%	2.40%	1.20%
Other	11	2	6	7	-
	5.80%	8.00%	4.90%	5.60%	-
SUM	424	72	310	320	213
	223.20%	288.00%	252.00%	254.00%	253.60%

Table 7

Q3. Do you experience any health problems from the scent of laundry products coming from a dryer vent?

	GenPop	MCS	ChemSens	MCS / ChemSens	Asthmatic
Total	1100	40	204	214	255
	100.00%	100.00%	100.00%	100.00%	100.00%
Yes	62	14	41	43	32
	5.60%	35.00%	20.10%	20.10%	12.50%
No	934	17	129	133	184
	84.90%	42.50%	63.20%	62.10%	72.20%
Don't know/not sure	96	8	33	37	37
	8.70%	20.00%	16.20%	17.30%	14.50%
Decline to answer	8	1	1	1	2
	0.70%	2.50%	0.50%	0.50%	0.80%

Table 8

BA. 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

	GenPop	MCS	ChemSens	MCS / ChemSens	Asthmatic
Total	62	14	41	43	32
	100.00%	100.00%	100.00%	100.00%	100.00%
Migraine headaches	18	4	15	15	10
	29.00%	28.60%	36.60%	34.90%	31.30%
Asthma attacks	12	4	10	10	12
	19.40%	28.60%	24.40%	23.30%	37.50%
Neurological problems (e.g., dizziness, seizures,	6	2	5	5	4
head pain, fainting, loss of coordination)	9.70%	14.30%	12.20%	11.60%	12.50%
Respiratory problems (e.g., difficulty breathing,	19	4	13	13	12
coughing, shortness of breath)	30.60%	28.60%	31.70%	30.20%	37.50%
Skin problems (e.g., rashes, hives, red skin,	20	6	15	17	7
tingling skin, dermatitis)	32.30%	42.90%	36.60%	39.50%	21.90%
Cognitive problems (e.g., difficulties thinking,	7	4	7	7	6
concentrating, or remembering)	11.30%	28.60%	17.10%	16.30%	18.80%
Mucosal symptoms (e.g., watery or red eyes, nasal	17	3	10	10	13
congestion, sneezing)	27.40%	21.40%	24.40%	23.30%	40.60%
Immune system problems (e.g., swollen lymph	4	4	4	4	4
glands, fever, fatigue)	6.50%	28.60%	9.80%	9.30%	12.50%
Gastrointestinal problems (e.g., nausea, bloating,	3	2	3	3	3
cramping, diarrhea)	4.80%	14.30%	7.30%	7.00%	9.40%
Cardiovascular problems (e.g., fast or irregular	6	3	4	5	5
heartbeat, jitteriness, chest discomfort)	9.70%	21.40%	9.80%	11.60%	15.60%
Musculoskeletal problems (e.g., muscle or joint	5	3	4	5	3
pain, cramps, weakness)	8.10%	21.40%	9.80%	11.60%	9.40%
Other	5	-	2	2	1
	8.10%	-	4.90%	4.70%	3.10%
SUM	122	39	92	96	80
	196.80%	278.60%	224.40%	223.30%	250.00%

Table 9

Q4. Do you experience any health problems from being in a room after it has been cleaned with scented products?

	GenPop	MCS	ChemSens	MCS / ChemSens	Asthmatic
Total	1100	40	204	214	255
	100.00%	100.00%	100.00%	100.00%	100.00%
Yes	152	25	103	108	68
	13.80%	62.50%	50.50%	50.50%	26.70%
No	838	14	75	80	156
	76.20%	35.00%	36.80%	37.40%	61.20%
Don't know/not sure	106	1	26	26	31
	9.60%	2.50%	12.70%	12.10%	12.20%
Decline to answer	4	-	-	-	-
	0.40%	-	-	-	-

Table 10

BA. 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 scen

	GenPop	MCS	ChemSens	MCS / ChemSens	Asthmatic
Total	152	25	103	108	68
	100.00%	100.00%	100.00%	100.00%	100.00%
Migraine headaches	68	7	50	51	30
	44.70%	28.00%	48.50%	47.20%	44.10%
Asthma attacks	21	7	19	20	19
	13.80%	28.00%	18.40%	18.50%	27.90%
Neurological problems (e.g., dizziness, seizures,	17	3	15	15	7
head pain, fainting, loss of coordination)	11.20%	12.00%	14.60%	13.90%	10.30%
Respiratory problems (e.g., difficulty breathing,	81	12	63	65	41
coughing, shortness of breath)	53.30%	48.00%	61.20%	60.20%	60.30%
Skin problems (e.g., rashes, hives, red skin,	15	4	13	13	8
tingling skin, dermatitis)	9.90%	16.00%	12.60%	12.00%	11.80%
Cognitive problems (e.g., difficulties thinking,	18	4	12	13	9
concentrating, or remembering)	11.80%	16.00%	11.70%	12.00%	13.20%
Mucosal symptoms (e.g., watery or red eyes, nasal	65	12	52	53	28
congestion, sneezing)	42.80%	48.00%	50.50%	49.10%	41.20%
Immune system problems (e.g., swollen lymph	4	2	4	4	2
glands, fever, fatigue)	2.60%	8.00%	3.90%	3.70%	2.90%
Gastrointestinal problems (e.g., nausea, bloating,	11	4	7	7	6
cramping, diarrhea)	7.20%	16.00%	6.80%	6.50%	8.80%
Cardiovascular problems (e.g., fast or irregular	5	4	5	5	4
heartbeat, jitteriness, chest discomfort)	3.30%	16.00%	4.90%	4.60%	5.90%
Musculoskeletal problems (e.g., muscle or joint	3	2	3	3	2
pain, cramps, weakness)	2.00%	8.00%	2.90%	2.80%	2.90%
Other	4	-	2	2	1
	2.60%	-	1.90%	1.90%	1.50%
SUM	312	61	245	251	157
	205.30%	244.00%	237.90%	232.40%	230.90%

Table 11

Q5. Do you experience any health problems from being near someone who is wearing a fragranced product?

	GenPop	MCS	ChemSens	MCS / ChemSens	Asthmatic
Total	1100	40	204	214	255
	100.00%	100.00%	100.00%	100.00%	100.00%
Yes	259	29	141	146	112
	23.50%	72.50%	69.10%	68.20%	43.90%
No	723	9	45	48	117
	65.70%	22.50%	22.10%	22.40%	45.90%
Don't know/not sure	112	2	16	18	25
	10.20%	5.00%	7.80%	8.40%	9.80%
Decline to answer	6	-	2	2	1
	0.50%	-	1.00%	0.90%	0.40%

Table 12

BA. 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 p

	GenPop	MCS	ChemSens	MCS / ChemSens	Asthmatic
Total	259	29	141	146	112
	100.00%	100.00%	100.00%	100.00%	100.00%
Migraine headaches	127	8	69	70	50
	49.00%	27.60%	48.90%	47.90%	44.60%
Asthma attacks	36	7	29	30	34
	13.90%	24.10%	20.60%	20.50%	30.40%
Neurological problems (e.g., dizziness, seizures,	28	3	26	26	13
head pain, fainting, loss of coordination)	10.80%	10.30%	18.40%	17.80%	11.60%
Respiratory problems (e.g., difficulty breathing,	154	17	93	94	78
coughing, shortness of breath)	59.50%	58.60%	66.00%	64.40%	69.60%
Skin problems (e.g., rashes, hives, red skin,	18	6	17	18	9
tingling skin, dermatitis)	6.90%	20.70%	12.10%	12.30%	8.00%
Cognitive problems (e.g., difficulties thinking,	29	2	15	15	9
concentrating, or remembering)	11.20%	6.90%	10.60%	10.30%	8.00%
Mucosal symptoms (e.g., watery or red eyes, nasal	86	11	60	60	46
congestion, sneezing)	33.20%	37.90%	42.60%	41.10%	41.10%
Immune system problems (e.g., swollen lymph	5	2	4	5	1
glands, fever, fatigue)	1.90%	6.90%	2.80%	3.40%	0.90%
Gastrointestinal problems (e.g., nausea, bloating,	25	6	16	16	13
cramping, diarrhea)	9.70%	20.70%	11.30%	11.00%	11.60%
Cardiovascular problems (e.g., fast or irregular	8	1	8	8	4
heartbeat, jitteriness, chest discomfort)	3.10%	3.40%	5.70%	5.50%	3.60%
Musculoskeletal problems (e.g., muscle or joint	6	4	6	6	6
pain, cramps, weakness)	2.30%	13.80%	4.30%	4.10%	5.40%
Other	9	1	3	4	2
	3.50%	3.40%	2.10%	2.70%	1.80%
SUM	531	68	346	352	265
	205.00%	234.50%	245.40%	241.10%	236.60%

Table 13

Q6. In general, do you experience any health problems from exposure to any type of fragranced product?

	GenPop	MCS	ChemSens	MCS / ChemSens	Asthmatic
Total	1100	40	204	214	255
	100.00%	100.00%	100.00%	100.00%	100.00%
Yes	197	25	117	122	86
	17.90%	62.50%	57.40%	57.00%	33.70%
No	775	9	59	60	129
	70.50%	22.50%	28.90%	28.00%	50.60%
Don't know/not sure	123	6	28	32	40
	11.20%	15.00%	13.70%	15.00%	15.70%
Decline to answer	5	-	-	-	-
	0.50%	-	-	-	-

Table 14

BA. Which of the following health problems do you experience?

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

	GenPop	MCS	ChemSens	MCS / ChemSens	Asthmatic
Total	197	25	117	122	86
	100.00%	100.00%	100.00%	100.00%	100.00%
Migraine headaches	81	7	53	53	36
	41.10%	28.00%	45.30%	43.40%	41.90%
Asthma attacks	24	3	19	19	22
	12.20%	12.00%	16.20%	15.60%	25.60%
Neurological problems (e.g., dizziness, seizures,	23	1	19	19	9
head pain, fainting, loss of coordination)	11.70%	4.00%	16.20%	15.60%	10.50%
Respiratory problems (e.g., difficulty breathing,	109	12	72	74	59
coughing, shortness of breath)	55.30%	48.00%	61.50%	60.70%	68.60%
Skin problems (e.g., rashes, hives, red skin,	21	5	17	17	9
tingling skin, dermatitis)	10.70%	20.00%	14.50%	13.90%	10.50%
Cognitive problems (e.g., difficulties thinking,	16	4	12	13	8
concentrating, or remembering)	8.10%	16.00%	10.30%	10.70%	9.30%
Mucosal symptoms (e.g., watery or red eyes, nasal	77	8	50	50	37
congestion, sneezing)	39.10%	32.00%	42.70%	41.00%	43.00%
Immune system problems (e.g., swollen lymph	3	2	3	3	2
glands, fever, fatigue)	1.50%	8.00%	2.60%	2.50%	2.30%
Gastrointestinal problems (e.g., nausea, bloating,	17	4	9	11	6
cramping, diarrhea)	8.60%	16.00%	7.70%	9.00%	7.00%
Cardiovascular problems (e.g., fast or irregular	10	3	9	9	8
heartbeat, jitteriness, chest discomfort)	5.10%	12.00%	7.70%	7.40%	9.30%
Musculoskeletal problems (e.g., muscle or joint	4	2	3	3	3
pain, cramps, weakness)	2.00%	8.00%	2.60%	2.50%	3.50%
Other	6	-	3	3	2
	3.00%	-	2.60%	2.50%	2.30%
SUM	391	51	269	274	201
	198.50%	204.00%	229.90%	224.60%	233.70%

Table 15

People Who Answer "Yes" To One Or More Of These Questions: Q2/Q3/Q4/Q5/Q6 (fragrance sensitive group)

	GenPop	MCS	ChemSens	MCS / ChemSens	Asthmatic
Total	1100	40	204	214	255
	100.00%	100.00%	100.00%	100.00%	100.00%
Yes	364	36	177	186	146
	33.10%	90.00%	86.80%	86.90%	57.30%

Table 16

People who answer "Yes" to each type of health problem under BA for Q2/Q3/Q4/Q5/Q6 (fragrance sensitive group)

	GenPop	MCS	ChemSens	MCS / ChemSens	Asthmatic
Total	1100	40	204	214	255
	100.00%	100.00%	100.00%	100.00%	100.00%
Migraine headaches	177	14	96	99	72
	16.10%	35.00%	47.10%	46.30%	28.20%
Asthma attacks	61	11	50	51	57
	5.50%	27.50%	24.50%	23.80%	22.40%
Neurological problems (e.g., dizziness, seizures,	55	5	42	43	21
head pain, fainting, loss of coordination)	5.00%	12.50%	20.60%	20.10%	8.20%
Respiratory problems (e.g., difficulty breathing,	220	21	127	129	111
coughing, shortness of breath)	20.00%	52.50%	62.30%	60.30%	43.50%
Skin problems (e.g., rashes, hives, red skin,	71	15	53	55	34
tingling skin, dermatitis)	6.50%	37.50%	26.00%	25.70%	13.30%
Cognitive problems (e.g., difficulties thinking,	50	9	29	31	22
concentrating, or remembering)	4.50%	22.50%	14.20%	14.50%	8.60%
Mucosal symptoms (e.g., watery or red eyes, nasal	149	18	91	93	74
congestion, sneezing)	13.50%	45.00%	44.60%	43.50%	29.00%
Immune system problems (e.g., swollen lymph	16	8	14	15	8
glands, fever, fatigue)	1.50%	20.00%	6.90%	7.00%	3.10%
Gastrointestinal problems (e.g., nausea, bloating,	39	10	25	27	19
cramping, diarrhea)	3.50%	25.00%	12.30%	12.60%	7.50%
Cardiovascular problems (e.g., fast or irregular	23	7	17	19	14
heartbeat, jitteriness, chest discomfort)	2.10%	17.50%	8.30%	8.90%	5.50%
Musculoskeletal problems (e.g., muscle or joint	17	7	13	14	9
pain, cramps, weakness)	1.50%	17.50%	6.40%	6.50%	3.50%
Other	24	2	8	9	4
	2.20%	5.00%	3.90%	4.20%	1.60%

Table 17

Disability Question

Sweden: Do any of these health problems cause any physical, psychological or intellectual limitations on your functio

	GenPop	MCS	ChemSens	MCS / ChemSens	Asthmatic
Total	364	36	177	186	146
	100.00%	100.00%	100.00%	100.00%	100.00%
Yes	88	21	71	73	53
	24.20%	58.30%	40.10%	39.20%	36.30%
No	217	11	75	79	78
	59.60%	30.60%	42.40%	42.50%	53.40%
Don't know/not sure	58	4	31	34	15
	15.90%	11.10%	17.50%	18.30%	10.30%
Decline to answer	1	-	-	-	-
	0.30%	-	-	-	-

Table 18

Compared to other people, do you consider yourself allergic or unusually sensitive to everyday chemicals like those in household cleaning products, paints, perfumes, detergents, insect spray and things like that?

	GenPop	MCS	ChemSens	MCS / ChemSens	Asthmatic
Total	1100	40	204	214	255
	100.00%	100.00%	100.00%	100.00%	100.00%
	1100	40	204	214	255
(Percent of General Population)	100.0%	3.6%	18.5%	19.5%	23.2%
Yes	204	30	204	204	100
	18.50%	75.00%	100.00%	95.30%	39.20%
No	771	7	-	7	126
	70.10%	17.50%	-	0.033	49.40%
Don't know/not sure	119	3	-	3	29
	10.80%	7.50%	-	0.014	11.40%
Decline to answer	6	-	-	-	-
	0.50%	-	-	-	-

Table 19

Has a doctor or health care professional ever told you that you have multiple chemical sensitivities?

	GenPop	MCS	ChemSens	MCS / ChemSens	Asthmatic
Total	1100	40	204	214	255
	100.00%	100.00%	100.00%	100.00%	100.00%
	1100	40	204	214	255
(Percent of General Population)	100.0%	3.6%	18.5%	19.5%	23.2%
Yes	40	40	30	40	25
	3.60%	100.00%	14.70%	18.70%	9.80%
No	1006	-	152	152	206
	91.50%	-	74.50%	71.00%	80.80%
Don't know/not sure	49	-	22	22	24
	4.50%	-	10.80%	10.30%	9.40%
Decline to answer	5	-	-	-	-
	0.50%	-	-	-	-

Table 20

Has a doctor or health care professional ever told you that you have asthma or an asthma-like condition?

	GenPop	MCS	ChemSens	MCS / ChemSens	Asthmatic
Total	1100	40	204	214	255
	100.00%	100.00%	100.00%	100.00%	100.00%
Yes - asthma	164	17	64	65	164
	14.90%	42.50%	31.40%	30.40%	64.30%
Yes - asthma-like condition	100	9	39	40	100
	9.10%	22.50%	19.10%	18.70%	39.20%
Yes - Asthma or Asthma-like condition or Both	255	25	100	102	-
	23.20%	62.50%	49.00%	47.70%	-
No	804	14	96	103	-
	73.10%	35.00%	47.10%	48.10%	-
Don't know/not sure	36	1	8	9	-
	3.30%	2.50%	3.90%	4.20%	-
Decline to answer	5	-	-	-	-
	0.50%	-	-	-	-

Table 21

Have you ever been unable or reluctant to use the restrooms in a public place, because of the presence of an air fres

	GenPop	MCS	ChemSens	MCS / ChemSens	Asthmatic
Total	1100	40	204	214	255
	100.00%	100.00%	100.00%	100.00%	100.00%
Yes	132	15	56	59	51
	12.00%	37.50%	27.50%	27.60%	20.00%
No	880	16	121	124	183
	80.00%	40.00%	59.30%	57.90%	71.80%
Neutral/not sure	79	8	24	28	20
	7.20%	20.00%	11.80%	13.10%	7.80%
Decline to answer	9	1	3	3	1
	0.80%	2.50%	1.50%	1.40%	0.40%

Table 22

Have you ever been unable or reluctant to wash your hands with soap in a public place, because you know or suspect

	GenPop	MCS	ChemSens	MCS / ChemSens	Asthmatic
Total	1100	40	204	214	255
	100.00%	100.00%	100.00%	100.00%	100.00%
Yes	74	16	42	46	30
	6.70%	40.00%	20.60%	21.50%	11.80%
No	954	22	143	149	209
	86.70%	55.00%	70.10%	69.60%	82.00%
Neutral/not sure	66	2	17	17	16
	6.00%	5.00%	8.30%	7.90%	6.30%
Decline to answer	6	-	2	2	-
	0.50%	-	1.00%	0.90%	-

Table 23

If you enter a business, and you smell air fresheners or some fragranced product, do you want to leave as quickly as p

	GenPop	MCS	ChemSens	MCS / ChemSens	Asthmatic
Total	1100	40	204	214	255
	100.00%	100.00%	100.00%	100.00%	100.00%
Yes	199	21	116	119	74
	18.10%	52.50%	56.90%	55.60%	29.00%
No	751	13	50	55	139
	68.30%	32.50%	24.50%	25.70%	54.50%
Neutral/not sure	144	6	37	39	41
	13.10%	15.00%	18.10%	18.20%	16.10%
Decline to answer	6	-	1	1	1
	0.50%	-	0.50%	0.50%	0.40%

Table 24

Have you ever been prevented from going to some place because you would be exposed to a fragrance product that

	GenPop	MCS	ChemSens	MCS / ChemSens	Asthmatic
Total	1100	40	204	214	255
	100.00%	100.00%	100.00%	100.00%	100.00%
Yes	139	23	85	89	72
	12.60%	57.50%	41.70%	41.60%	28.20%
No	852	13	85	91	158
	77.50%	32.50%	41.70%	42.50%	62.00%
Don't know/not sure	103	4	33	33	25
	9.40%	10.00%	16.20%	15.40%	9.80%
Decline to answer	6	-	1	1	-
	0.50%	-	0.50%	0.50%	-

Table 25

Has any exposure to fragranced products in your work environment caused you to become sick, lose work days, or los

	GenPop	MCS	ChemSens	MCS / ChemSens	Asthmatic
Total	1100	40	204	214	255
	100.00%	100.00%	100.00%	100.00%	100.00%
Yes	74	12	49	51	38
	6.70%	30.00%	24.00%	23.80%	14.90%
No	952	23	136	143	194
	86.50%	57.50%	66.70%	66.80%	76.10%
Don't know/not sure	68	5	18	19	21
	6.20%	12.50%	8.80%	8.90%	8.20%
Decline to answer	6	-	1	1	2
	0.50%	-	0.50%	0.50%	0.80%

Table 26

Would you be supportive of a fragrance-free policy in the workplace?

	GenPop	MCS	ChemSens	MCS / ChemSens	Asthmatic
Total	1100	40	204	214	255
	100.00%	100.00%	100.00%	100.00%	100.00%
Yes	558	25	142	147	141
	50.70%	62.50%	69.60%	68.70%	55.30%
No	180	8	16	19	46
	16.40%	20.00%	7.80%	8.90%	18.00%
Neutral/not sure	353	6	45	46	66
	32.10%	15.00%	22.10%	21.50%	25.90%
Decline to answer	9	1	1	2	2
	0.80%	2.50%	0.50%	0.90%	0.80%

Table 27

Would you prefer that health care facilities and health care professionals be fragrance-free?

	GenPop	MCS	ChemSens	MCS / ChemSens	Asthmatic
Total	1100	40	204	214	255
	100.00%	100.00%	100.00%	100.00%	100.00%
Yes	705	30	172	175	183
	64.10%	75.00%	84.30%	81.80%	71.80%
No	154	6	13	18	29
	14.00%	15.00%	6.40%	8.40%	11.40%
Neutral/not sure	234	3	16	18	41
	21.30%	7.50%	7.80%	8.40%	16.10%
Decline to answer	7	1	3	3	2
	0.60%	2.50%	1.50%	1.40%	0.80%

Table 29

Demographics.

	GenPop	MCS	ChemSens	MCS / ChemSens	Asthmatic
Total	1100	40	204	214	255
	100.00%	100.00%	100.00%	100.00%	100.00%
Male/Female					
All Males	556	24	66	75	105
	50.50%	60.00%	32.40%	35.00%	41.20%
All Females	544	16	138	139	150
	49.50%	40.00%	67.60%	65.00%	58.80%
Gender vs Age					
Male 18-24	89	7	11	15	14
	8.10%	17.50%	5.40%	7.00%	5.50%
Male 25-34	110	5	16	18	26
	10.00%	12.50%	7.80%	8.40%	10.20%
Male 35-44	134	6	14	15	24
	12.20%	15.00%	6.90%	7.00%	9.40%
Male 45-54	113	3	14	15	20
	10.30%	7.50%	6.90%	7.00%	7.80%
Male 55-65	110	3	11	12	21
	10.00%	7.50%	5.40%	5.60%	8.20%
Female 18-24	68	2	18	18	28
	6.20%	5.00%	8.80%	8.40%	11.00%
Female 25-34	116	3	25	26	24
	10.50%	7.50%	12.30%	12.10%	9.40%
Female 35-44	112	2	29	29	28
	10.20%	5.00%	14.20%	13.60%	11.00%
Female 45-54	133	5	37	37	38
	12.10%	12.50%	18.10%	17.30%	14.90%
Female 55-65	115	4	29	29	32
	10.50%	10.00%	14.20%	13.60%	12.50%