



Short Communication

Prevalence and effects of multiple chemical sensitivities in Australia

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ABSTRACT

Multiple chemical sensitivities (MCS) is a medical condition associated with exposure to common chemical pollutants. The aims of this study are to assess the prevalence of MCS, its overlaps with asthma and fragrance sensitivity, and its health and societal effects in Australia. Data were collected in June 2016 using an on-line survey with a representative national sample ($N = 1098$) of adults (ages 18–65) in Australia. Results found that, across the country, 6.5% report medically diagnosed MCS, 18.9% report chemical sensitivity (being unusually sensitive to everyday chemicals and chemically formulated products), and 19.9% either or both. Among people with MCS, 74.6% also have diagnosed asthma or an asthma-like condition, and 91.5% have fragrance sensitivity, reporting health problems (such as migraine headaches) when exposed to fragranced consumer products (such as air fresheners and cleaning supplies). In addition, among people with MCS, 77.5% are prevented from access to places because of fragranced products, 52.1% lost workdays or a job in the past year due to fragranced product exposure in the workplace, and 55.4% report health effects considered potentially disabling. Results indicate that MCS is a widespread disease, affecting an estimated 1 million adult Australians, with chemical sensitivity affecting another 2 million. Reducing chemical exposure to problematic sources, such as fragranced consumer products, is critical to reduce adverse effects.

1. Introduction

People with multiple chemical sensitivities (MCS) experience adverse health effects from exposure to common chemical pollutants, often at low levels, from products such as pesticides, new carpet and paint, renovation materials, diesel exhaust, cleaning supplies, scented laundry products, air fresheners, and perfume (Ashford and Miller, 1998). Risks from exposure include a range of acute, chronic, and potentially disabling health effects, including headaches, dizziness, seizures, heart arrhythmia, gastrointestinal problems, breathing difficulties, and asthma attacks (Steinemann, 2018; Ashford and Miller, 1998). Prior studies found that people with MCS generally report a higher incidence of fragrance sensitivity (adverse health effects from exposure to fragranced consumer products) and of asthma (Steinemann, 2018; Caress and Steinemann, 2009b).

While multiple chemical sensitivities (or sensitivity) is arguably the most common term, the condition is also known as environmental illness (specific to chemical exposures), the petrochemical problem, or toxicant induced loss of tolerance (Ashford and Miller, 1998; Miller and Prihoda, 1999). Further, while progress has been made on elucidating mechanisms of disease and biomarkers (e.g., Genuis, 2010; De Luca et al., 2011; Belpomme et al., 2015), MCS still lacks a single

international case definition (MCS 1999, 1999; Ashford and Miller, 1998). People with MCS may not receive a distinct medical diagnosis, but nonetheless manifest the condition of chemical sensitivity.

A hallmark of MCS is that it is typically both initiated and triggered by chemical exposures. Sources commonly implicated in MCS (e.g., pesticides, solvents, new building materials, and fragranced consumer products) are documented sources of air pollutants (McDonald et al., 2018; Ott et al., 2007). People with MCS have been likened to human canaries: they react earlier and more severely to pollutants, and at levels far lower than the general population (Ashford and Miller, 1998).

Little is known about the prevalence of MCS in Australia. In one prior study, a population-based survey of 4009 adults in South Australia in 2001–2002 found a prevalence of 15.9% of self-reported chemical sensitivity and 1% medically diagnosed MCS (Fitzgerald, 2008). Chemical sensitivity was investigated with the questions: “Is your health seriously affected by exposure to any of the following (perfume, traffic pollution, household chemicals, workplace chemicals)?” and “Do you consider yourself especially sensitive to everyday chemicals found in household cleaning products, perfumes, insect sprays, new carpets, fresh paints, etc.?”

In other countries, a recent national study in the US (Steinemann, 2018) found a prevalence of 25.9% self-reported chemical sensitivity and 12.8% medically diagnosed MCS. Prior US national prevalence

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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, MCS prevalence has increased over 300% and chemical sensitivity over 200% in the US (Steinemann, 2018). Chemical sensitivity was investigated in these three national studies using the question: “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?” The fundamental question was developed by the California Department of Health Services and used in their survey of 4046 Californians (Kreutzer et al., 1999), and a modified version was also used in the survey of South Australians (Fitzgerald, 2008). Using the Quick Environmental Exposure and Sensitivity Inventory (QEESI) criteria (Miller and Prihoda, 1999), a survey of 7245 adults in Japan (Azuma et al., 2015) and 2000 adults in Denmark (Skovbjerg et al., 2012) estimated a prevalence of 7.5% and 8.2% respectively of chemical intolerance.

The aims of this present study are three-fold: (1) to determine the prevalence of medically diagnosed MCS and chemical sensitivity in Australia, (2) to investigate its co-occurrence with asthma or an asthma-like condition, and with fragrance sensitivity, and (3) to assess the impact of exposure to fragranced consumer products on health and quality of life for people with MCS. Results from this study point to ways to reduce adverse effects and promote public health.

2. Methods

To assess the national prevalence and effects of MCS, an on-line survey was conducted with a random sample of the Australian population, representative of age, gender, and region (N = 1098, 95% confidence level, 3% margin of error), drawn from a large national panel (over 200,000 people) held by Survey Sampling International. The survey instrument was developed and tested over a two-year period before full implementation in June 2016. Response rate was 93%, and all responses were anonymous. (For details, see “Survey Methods” and “Survey Data 2” as supplementary material.)

To promote comparability and consistency, the survey employed questions from previous national and large-scale regional MCS prevalence studies (Steinemann, 2018; Caress and Steinemann, 2004, 2005, 2009a; Fitzgerald, 2008; Kreutzer et al., 1999). For medically diagnosed MCS, the survey asked, “Has a doctor or health care professional ever told you that you have multiple chemical sensitivities?” 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 asthma, the survey asked, “Has a doctor or health care professional ever told you that you have asthma or an asthma-like condition?” and then further asked to specify whether asthma or an asthma-like condition. (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. An individual was considered to characterize fragrance sensitivity if they experienced one or more types of health problems from one or more types of fragranced products and 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. Specific 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; entering a business with the scent of fragranced products; fragranced soap used in public restrooms; and ability to access environments that used fragranced products. The survey also investigated effects of fragranced product exposure in the workplace, and preferences for fragrance-free environments and policies.

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. Data on fragranced product exposures and effects were derived from a survey of the general population (Steinemann, 2017), while the present study focuses specifically on effects on the sub-populations of individuals with MCS or chemical sensitivity. (See “Survey Data”)

3. Results

Across Australia, 6.5% report medically diagnosed MCS, 18.9% report chemical sensitivity, and 19.9% either or both.

For co-occurrence with asthma: 74.6% of people with MCS are asthmatic; that is, diagnosed with asthma (40.8%), an asthma-like condition (47.9%), or both. Also, 56.5% of people with chemical sensitivity are asthmatic; that is, diagnosed with asthma (32.9%), an asthma-like condition (28.5%), or both. (See Table 1.)

For co-occurrence with fragrance sensitivity: 91.5% of people with diagnosed MCS are also fragrance sensitive (Table 1), reporting one or more types of health problems, such as respiratory difficulties (56.3%) and migraine headaches (46.5%), when exposed to fragranced consumer products (see Table 2). Also, 82.6% of people with chemical sensitivity are also fragrance sensitive (Table 1), reporting one or more types of health problems when exposed to fragranced products (see Table 2).

Specific fragranced product exposures that trigger health problems for people with MCS include, but are not limited to, the following: air fresheners and deodorizers (67.6%), scented laundry products coming

Table 1
Prevalence and co-occurrence of MCS and chemical sensitivity with asthma and fragrance sensitivity.

	Gen pop	MCS diag	ChemSens	MCS/ ChemSens
Total (N)	1098	71	207	218
(% relative to general population)	100.0%	6.5%	18.9%	19.9%
	N	N	N	N
	% of column total	% of column total	% of column total	% of column total
MCS diagnosed	71	71	60	71
	6.5%	100.0%	29.0%	32.6%
Chemically sensitive	207	60	207	207
	18.9%	84.5%	100.0%	95.0%
MCS diagnosed or chemically sensitive or both	218	71	207	218
	19.9%	100.0%	100.0%	100.0%
Asthma diagnosed	176	29	68	70
	16.0%	40.8%	32.9%	32.1%
Asthma-like condition diagnosed	151	34	59	64
	13.8%	47.9%	28.5%	29.4%
Asthmatic (asthma or asthma-like condition or both)	313	53	117	123
	28.5%	74.6%	56.5%	56.4%
Fragrance sensitive	362	65	171	179
	33.0%	91.5%	82.6%	82.1%

Gen Pop = general population (including sub-populations of MCS and ChemSens).

MCS Diag = medically diagnosed with MCS.

ChemSens = self-reported chemical sensitivity.

MCS/ChemSens = medically diagnosed with MCS, or self-reported chemical sensitivity, or both.

Table 2
Health problems (frequency and type) from exposure to fragranced consumer products.

	Gen pop	MCS diag	ChemSens	MCS/ChemSens
Total (N)	1098	71	207	218
(% relative to General Population)	100.0%	6.5%	18.9%	19.9%
	(N)	(N)	(N)	(N)
	(% of column total)	(% of column total)	(% of column total)	(% of column total)
Fragrance sensitive	362	65	171	179
	33.0%	91.5%	82.6%	82.1%
Health problems from exposure to				
Air fresheners or deodorizers	180	48	106	110
	16.4%	67.6%	51.2%	50.5%
Scented laundry products from a dryer vent	67	35	48	52
	6.1%	49.3%	23.2%	23.9%
Room cleaned with scented products	168	51	115	119
	15.3%	71.8%	55.6%	54.6%
Someone wearing a fragranced product	213	47	115	117
	19.4%	66.2%	55.6%	53.7%
Any type of fragranced consumer product	223	56	132	136
	20.3%	78.9%	63.8%	62.4%
Type of health problem				
*Migraine headaches	110	33	64	68
	10.0%	46.5%	30.9%	31.2%
*Asthma attacks	83	28	52	54
	7.6%	39.4%	25.1%	24.8%
*Neurological problems (e.g., dizziness, seizures, head pain, fainting, loss of coordination)	49	19	32	34
	4.5%	26.8%	15.5%	15.6%
*Respiratory problems (e.g., difficulty breathing, coughing, shortness of breath)	183	40	98	102
	16.7%	56.3%	47.3%	46.8%
*Skin problems (e.g., rashes, hives, red skin, tingling skin, dermatitis)	104	36	67	71
	9.5%	50.7%	32.4%	32.6%
*Cognitive problems (e.g., difficulties thinking, concentrating, or remembering)	45	27	32	36
	4.1%	38.0%	15.5%	16.5%
*Mucosal symptoms (e.g., watery or red eyes, nasal congestion, sneezing)	154	34	87	90
	14.0%	47.9%	42.0%	41.3%
*Immune system problems (e.g., swollen lymph glands, fever, fatigue)	36	20	23	25
	3.3%	28.2%	11.1%	11.5%
*Gastrointestinal problems (e.g., nausea, bloating, cramping, diarrhea)	36	14	22	23
	3.3%	19.7%	10.6%	10.6%
*Cardiovascular problems (e.g., fast or irregular heartbeat, jitteriness, chest discomfort)	33	14	20	21
	3.0%	19.7%	9.7%	9.6%
*Musculoskeletal problems (e.g., muscle or joint pain, cramps, weakness)	29	15	17	19
	2.6%	21.1%	8.2%	8.7%
*Other	21	–	4	4
	1.9%	–	1.9%	1.8%

from a dryer vent (49.3%), being in a room recently cleaned with scented products (71.8%), being near someone wearing a fragranced product (66.2%), and other types of fragranced consumer products (78.9%) (see Table 2).

Importantly, for 55.4% of people with MCS, the severity of these health problems was potentially disabling according to the criterion of the Australian Disability Discrimination Act (DDA, 1992), as assessed by a positive response to the question: “Do any of these health problems mean a total or partial loss of bodily or mental functions, for you personally?” (See “Survey Data”)

Fragranced products also restrict access in society for people with MCS: 64.8% are unable or reluctant to use public restrooms that have an air freshener, deodorizer, or scented product; 57.7% are unable or reluctant to wash hands in a public place if the soap is fragranced; 64.8% enter a business but then leave as quickly as possible due to a fragranced product; and 77.5% have been prevented from going someplace because a fragranced product would make them sick.

Significantly, 52.1% of those with MCS lost workdays or a job in the past year due to illness from fragranced product exposure in the workplace, 77.5% would support a fragrance-free policy in the workplace, and 80.3% would prefer that health care facilities and professionals were fragrance-free.

Demographic proportions of diagnosed MCS are 47.9% male and 52.1% female, compared with the general population of 49.5% male

and 50.5% female. Thus, diagnosed MCS has a slight female bias (+1.6%). Relative to gender and age, the highest bias (percentage MCS greater than general population) is Male 25–34 (+8.4%).

4. Discussion

Results of this study indicate that MCS is widespread in the Australian population, affecting an estimated 1 million adults, with chemical sensitivity affecting another 2 million adults (ABS, 2016).

Among people diagnosed with MCS, 74.6% report being also diagnosed with asthma or an asthma-like condition. People with MCS are proportionally more likely to be asthmatic than people without MCS (prevalence odds ratio 8.7; 95% confidence interval 5.0–15.1).

In addition, among people diagnosed with MCS, 91.5% report fragrance sensitivity. People with MCS are proportionally more likely to be fragrance sensitive than people without MCS (prevalence odds ratio 26.6; 95% confidence interval 11.4–62.1).

Fragranced consumer products can trigger severe and potentially disabling health effects in a majority of people with MCS. Consequently, people with MCS are prevented from accessing restrooms, businesses, workplaces, and public places due to risks of adverse health effects from fragranced consumer products. A majority of people with MCS have lost workdays or a job, in the past year, due to exposure to fragranced products in the workplace.

In light of these results, a logical and prudent step would be to implement fragrance-free policies in workplaces and other environments, which could improve access for people with MCS and reduce potential health risks and liability. Even among the general population, most Australians would support fragrance-free workplaces, health care facilities, and health care professionals (Steinemann, 2017).

Study strengths include the following: (a) the sample population is statistically representative of age, gender, and region in Australia; (b) the 1098 respondents were randomly recruited from a large web-based panel, developed from multiple sources to reflect population characteristics; and (c) the survey used questions from a large national study in the US previously conducted and published (Steinemann, 2018). 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-reported data, although a standard and widely accepted approach for epidemiological research; (c) the cross-sectional design limits the investigation of temporal associations between exposures and effects; and (d) MCS and chemical sensitivity lack standard diagnostic criteria, although the survey replicated questions from prior large-scale studies to promote consistency and comparability.

5. Conclusion

MCS is a serious and potentially disabling health condition and is exacerbated by exposure to common chemically formulated products. Reducing exposure to problematic sources is critical for both primary and secondary prevention: to prevent more people from acquiring MCS, and to reduce the frequency and severity of adverse health and societal effects among an estimated 3 million Australians who already have chemical sensitivity or MCS.

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.pmedr.2018.03.007>.

Conflicts of interest

None.

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Supplementary Material - 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.

Checklist for Reporting Results of Internet E-Surveys (CHERRIES)		
<i>Item Category</i>	<i>Checklist Item</i>	<i>Explanation</i>
Design	Describe survey design	Target population: national random sample of adults (ages 18-65) in Australia, representative of age, gender, and region (n=1,098, confidence limit=95%, margin of error=3%). The survey drew upon participants from a large web-based panel (over 200,000 participants in Australia) 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 June 2016. This article reports results from the sub-populations of people with MCS and chemical sensitivity. Steinemann (2017) reports results from the general population.
Recruitment process and description of the sample having access to the questionnaire	Open survey versus closed survey	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. 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 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. Points for this survey have an estimated current value of \$1.50 AUD.
	Time/Date	Data were collected within one week in June 2016.

Response rates	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.
		Survey response rate: 93%. 1,183 initial responses; Number of drop outs: 53; Number of screen outs: 32; Number of completes: 1,098; Panel size, over 200,000. Panel response rate at time of survey implementation: 10.26%.
	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.
Preventing multiple entries from the same individual	Completion rate (Ratio of users who finished the survey/users who agreed to participate)	93% (1,183 initial, 53 drop out, 32 screen out, 1,098 complete).
	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
Questionnaires submitted with
an atypical timestamp

Statistical correction

Only completed questionnaires were included in the final dataset for analysis.

Minimum survey completion time was 5 minutes; average was 10 minutes. A small number of respondents were omitted for completing the items too quickly.

All demographic subgroups obtained statistically valid numbers to ensure a national representativeness.

Table 1

Australia
Base: All Respondents

	GenPop	MCS	ChemSens	MCS/ChemSens
Total	1098	71	207	218
	100.0%	6.5%	18.9%	19.9%

Table 2

What is your gender?

Base: All Respondents

	GenPop	MCS	ChemSens	MCS/ChemSens
Total	1098	71	207	218
	100.00%	100.00%	100.00%	100.00%
Male	543	34	73	79
	49.50%	47.90%	35.30%	36.20%
Female	555	37	134	139
	50.50%	52.10%	64.70%	63.80%
Other	-	-	-	-
	-	-	-	-

Table 3

What is your age?

Base: All Respondents

	GenPop	MCS	ChemSens	MCS/ChemSens
Total	1098	71	207	218
	100.00%	100.00%	100.00%	100.00%
18-24 (21)	156	11	24	28
	14.20%	15.50%	11.60%	12.80%
25-34 (29.5)	239	20	56	57
	21.80%	28.20%	27.10%	26.10%
35-44 (39.5)	256	14	46	49
	23.30%	19.70%	22.20%	22.50%
45-54 (49.5)	241	20	47	50
	21.90%	28.20%	22.70%	22.90%
55-65 (60)	206	6	34	34
	18.80%	8.50%	16.40%	15.60%

Table 4

AUSTRALIA Region
Base: All Respondents

	GenPop	MCS	ChemSens	MCS/ChemSens
Total	1098	71	207	218
	100.00%	100.00%	100.00%	100.00%
Australian Capital Territory	20	3	6	7
	1.80%	4.20%	2.90%	3.20%
New South Wales	360	30	66	70
	32.80%	42.30%	31.90%	32.10%
Northern Territory	7	-	1	1
	0.60%	-	0.50%	0.50%
Queensland	217	12	45	47
	19.80%	16.90%	21.70%	21.60%
South Australia	85	6	17	17
	7.70%	8.50%	8.20%	7.80%
Tasmania	25	2	4	5
	2.30%	2.80%	1.90%	2.30%
Victoria	278	15	49	52
	25.30%	21.10%	23.70%	23.90%
Western Australia	106	3	19	19
	9.70%	4.20%	9.20%	8.70%

Table 5

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

Base: All Respondents

	GenPop	MCS	ChemSens	MCS/ChemSens
Total	1098	71	207	218
	100.00%	100.00%	100.00%	100.00%
Yes	180	48	106	110
	16.40%	67.60%	51.20%	50.50%
No	760	17	61	65
	69.20%	23.90%	29.50%	29.80%
Don't know/not sure	157	6	40	43
	14.30%	8.50%	19.30%	19.70%
Decline to answer	1	-	-	-
	0.10%	-	-	-

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
Total	180	48	106	110
	100.00%	100.00%	100.00%	100.00%
Migraine headaches	46	16	28	31
	25.60%	33.30%	26.40%	28.20%
Asthma attacks	49	17	33	35
	27.20%	35.40%	31.10%	31.80%
Neurological problems (e.g., dizziness, seizures, head pain, fainting, loss of coordination)	24	9	16	17
	13.30%	18.80%	15.10%	15.50%
Respiratory problems (e.g., difficulty breathing, coughing, shortness of breath)	100	24	62	63
	55.60%	50.00%	58.50%	57.30%
Skin problems (e.g., rashes, hives, red skin, tingling skin, dermatitis)	53	22	42	44
	29.40%	45.80%	39.60%	40.00%
Cognitive problems (e.g., difficulties thinking, concentrating, or remembering)	21	11	15	16
	11.70%	22.90%	14.20%	14.50%
Mucosal symptoms (e.g., watery or red eyes, nasal congestion, sneezing)	68	18	47	48
	37.80%	37.50%	44.30%	43.60%
Immune system problems (e.g., swollen lymph glands, fever, fatigue)	20	11	13	14
	11.10%	22.90%	12.30%	12.70%
Gastrointestinal problems (e.g., nausea, bloating, cramping, diarrhea)	16	7	11	12
	8.90%	14.60%	10.40%	10.90%
Cardiovascular problems (e.g., fast or irregular heartbeat, jitteriness, chest discomfort)	21	11	12	13
	11.70%	22.90%	11.30%	11.80%
Musculoskeletal problems (e.g., muscle or joint pain, cramps, weakness)	18	8	11	12
	10.00%	16.70%	10.40%	10.90%
Other	6	-	-	-
	3.30%	-	-	-
SUM	442	154	290	305
	245.60%	320.80%	273.60%	277.30%

Table 7

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

Base: All Respondents

	GenPop	MCS	ChemSens	MCS/ChemSens
Total	1098	71	207	218
	100.00%	100.00%	100.00%	100.00%
Yes	67	35	48	52
	6.10%	49.30%	23.20%	23.90%
No	909	27	117	123
	82.80%	38.00%	56.50%	56.40%
Don't know/not sure	120	9	42	43
	10.90%	12.70%	20.30%	19.70%
Decline to answer	2	-	-	-
	0.20%	-	-	-

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 vent

	GenPop	MCS	ChemSens	MCS/ChemSens
Total	67	35	48	52
	100.00%	100.00%	100.00%	100.00%
Migraine headaches	14	7	11	12
	20.90%	20.00%	22.90%	23.10%
Asthma attacks	15	11	12	13
	22.40%	31.40%	25.00%	25.00%
Neurological problems (e.g., dizziness, seizures, head pain, fainting, loss of coordination)	8	6	6	7
	11.90%	17.10%	12.50%	13.50%
Respiratory problems (e.g., difficulty breathing, coughing, shortness of breath)	28	15	20	22
	41.80%	42.90%	41.70%	42.30%
Skin problems (e.g., rashes, hives, red skin, tingling skin, dermatitis)	23	14	16	19
	34.30%	40.00%	33.30%	36.50%
Cognitive problems (e.g., difficulties thinking, concentrating, or remembering)	11	8	9	10
	16.40%	22.90%	18.80%	19.20%
Mucosal symptoms (e.g., watery or red eyes, nasal congestion, sneezing)	17	10	15	16
	25.40%	28.60%	31.30%	30.80%
Immune system problems (e.g., swollen lymph glands, fever, fatigue)	20	13	15	16
	29.90%	37.10%	31.30%	30.80%
Gastrointestinal problems (e.g., nausea, bloating, cramping, diarrhea)	13	7	9	10
	19.40%	20.00%	18.80%	19.20%
Cardiovascular problems (e.g., fast or irregular heartbeat, jitteriness, chest discomfort)	15	10	12	13
	22.40%	28.60%	25.00%	25.00%
Musculoskeletal problems (e.g., muscle or joint pain, cramps, weakness)	10	7	7	8
	14.90%	20.00%	14.60%	15.40%
Other	2	-	-	-
	3.00%	-	-	-
SUM	176	108	132	146
	262.70%	308.60%	275.00%	280.80%

Table 9

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

Base: All Respondents

	GenPop	MCS	ChemSens	MCS/ChemSens
Total	1098	71	207	218
	100.00%	100.00%	100.00%	100.00%
Yes	168	51	115	119
	15.30%	71.80%	55.60%	54.60%
No	817	15	73	77
	74.40%	21.10%	35.30%	35.30%
Don't know/not sure	110	5	19	22
	10.00%	7.00%	9.20%	10.10%
Decline to answer	3	-	-	-
	0.30%	-	-	-

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 scented products

	GenPop	MCS	ChemSens	MCS/ChemSens
Total	168	51	115	119
	100.00%	100.00%	100.00%	100.00%
Migraine headaches	38	13	26	28
	22.60%	25.50%	22.60%	23.50%
Asthma attacks	27	13	23	24
	16.10%	25.50%	20.00%	20.20%
Neurological problems (e.g., dizziness, seizures, head pain, fainting, loss of coordination)	17	10	13	15
	10.10%	19.60%	11.30%	12.60%
Respiratory problems (e.g., difficulty breathing, coughing, shortness of breath)	82	27	58	61
	48.80%	52.90%	50.40%	51.30%
Skin problems (e.g., rashes, hives, red skin, tingling skin, dermatitis)	31	15	21	24
	18.50%	29.40%	18.30%	20.20%
Cognitive problems (e.g., difficulties thinking, concentrating, or remembering)	20	13	16	18
	11.90%	25.50%	13.90%	15.10%
Mucosal symptoms (e.g., watery or red eyes, nasal congestion, sneezing)	66	19	54	55
	39.30%	37.30%	47.00%	46.20%
Immune system problems (e.g., swollen lymph glands, fever, fatigue)	18	13	14	16
	10.70%	25.50%	12.20%	13.40%
Gastrointestinal problems (e.g., nausea, bloating, cramping, diarrhea)	16	10	13	14
	9.50%	19.60%	11.30%	11.80%
Cardiovascular problems (e.g., fast or irregular heartbeat, jitteriness, chest discomfort)	14	9	11	12
	8.30%	17.60%	9.60%	10.10%
Musculoskeletal problems (e.g., muscle or joint pain, cramps, weakness)	11	8	8	10
	6.50%	15.70%	7.00%	8.40%
Other	7	-	2	2
	4.20%	-	1.70%	1.70%
SUM	347	150	259	279
	206.50%	294.10%	225.20%	234.50%

Table 11

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

Base: All Respondents

	GenPop	MCS	ChemSens	MCS/ChemSens
Total	1098	71	207	218
	100.00%	100.00%	100.00%	100.00%
Yes	213	47	115	117
	19.40%	66.20%	55.60%	53.70%
No	793	18	70	76
	72.20%	25.40%	33.80%	34.90%
Don't know/not sure	90	5	22	24
	8.20%	7.00%	10.60%	11.00%
Decline to answer	2	1	-	1
	0.20%	1.40%	-	0.50%

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 product

	GenPop	MCS	ChemSens	MCS/ChemSens
Total	213	47	115	117
	100.00%	100.00%	100.00%	100.00%
Migraine headaches	54	14	32	33
	25.40%	29.80%	27.80%	28.20%
Asthma attacks	37	14	23	24
	17.40%	29.80%	20.00%	20.50%
Neurological problems (e.g., dizziness, seizures, head pain, fainting, loss of coordination)	26	9	19	19
	12.20%	19.10%	16.50%	16.20%
Respiratory problems (e.g., difficulty breathing, coughing, shortness of breath)	91	22	52	53
	42.70%	46.80%	45.20%	45.30%
Skin problems (e.g., rashes, hives, red skin, tingling skin, dermatitis)	19	10	13	13
	8.90%	21.30%	11.30%	11.10%
Cognitive problems (e.g., difficulties thinking, concentrating, or remembering)	17	10	13	14
	8.00%	21.30%	11.30%	12.00%
Mucosal symptoms (e.g., watery or red eyes, nasal congestion, sneezing)	87	17	52	53
	40.80%	36.20%	45.20%	45.30%
Immune system problems (e.g., swollen lymph glands, fever, fatigue)	14	10	11	11
	6.60%	21.30%	9.60%	9.40%
Gastrointestinal problems (e.g., nausea, bloating, cramping, diarrhea)	16	6	12	12
	7.50%	12.80%	10.40%	10.30%
Cardiovascular problems (e.g., fast or irregular heartbeat, jitteriness, chest discomfort)	13	6	10	10
	6.10%	12.80%	8.70%	8.50%
Musculoskeletal problems (e.g., muscle or joint pain, cramps, weakness)	13	10	11	11
	6.10%	21.30%	9.60%	9.40%
Other	9	-	2	2
	4.20%	-	1.70%	1.70%
SUM	396	128	250	255
	185.90%	272.30%	217.40%	217.90%

Table 13

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

Base: All Respondents

	GenPop	MCS	ChemSens	MCS/ChemSens
Total	1098	71	207	218
	100.00%	100.00%	100.00%	100.00%
Yes	223	56	132	136
	20.30%	78.90%	63.80%	62.40%
No	778	12	58	62
	70.90%	16.90%	28.00%	28.40%
Don't know/not sure	96	3	17	20
	8.70%	4.20%	8.20%	9.20%
Decline to answer	1	-	-	-
	0.10%	-	-	-

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
Total	223	56	132	136
	100.00%	100.00%	100.00%	100.00%
Migraine headaches	51	14	33	34
	22.90%	25.00%	25.00%	25.00%
Asthma attacks	40	13	29	30
	17.90%	23.20%	22.00%	22.10%
Neurological problems (e.g., dizziness, seizures, head pain, fainting, loss of coordination)	22	11	17	17
	9.90%	19.60%	12.90%	12.50%
Respiratory problems (e.g., difficulty breathing, coughing, shortness of breath)	110	28	71	71
	49.30%	50.00%	53.80%	52.20%
Skin problems (e.g., rashes, hives, red skin, tingling skin, dermatitis)	54	21	39	39
	24.20%	37.50%	29.50%	28.70%
Cognitive problems (e.g., difficulties thinking, concentrating, or remembering)	19	13	16	18
	8.50%	23.20%	12.10%	13.20%
Mucosal symptoms (e.g., watery or red eyes, nasal congestion, sneezing)	83	21	59	61
	37.20%	37.50%	44.70%	44.90%
Immune system problems (e.g., swollen lymph glands, fever, fatigue)	13	9	11	11
	5.80%	16.10%	8.30%	8.10%
Gastrointestinal problems (e.g., nausea, bloating, cramping, diarrhea)	14	6	10	10
	6.30%	10.70%	7.60%	7.40%
Cardiovascular problems (e.g., fast or irregular heartbeat, jitteriness, chest discomfort)	13	7	11	11
	5.80%	12.50%	8.30%	8.10%
Musculoskeletal problems (e.g., muscle or joint pain, cramps, weakness)	11	9	11	11
	4.90%	16.10%	8.30%	8.10%
Other	8	-	2	2
	3.60%	-	1.50%	1.50%
SUM	438	152	309	315
	196.40%	271.40%	234.10%	231.60%

Table 15

Q2/Q3/Q4/Q5/Q6. People Who Answer “Yes” To One Or More Of These Questions: Q2/Q3/Q4/Q5/Q6 (fragrance sensitive group).
Base: All Respondents

	GenPop	MCS	ChemSens	MCS/ChemSens
Total	1098	71	207	218
	100.00%	100.00%	100.00%	100.00%
Yes	362	65	171	179
	33.00%	91.50%	82.60%	82.10%

Table 16

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

Base: All Respondents

	GenPop	MCS	ChemSens	MCS/ChemSens
Total	1098	71	207	218
	100.00%	100.00%	100.00%	100.00%
Migraine headaches	110	33	64	68
	10.00%	46.50%	30.90%	31.20%
Asthma attacks	83	28	52	54
	7.60%	39.40%	25.10%	24.80%
Neurological problems (e.g., dizziness, seizures, head pain, fainting, loss of coordination)	49	19	32	34
	4.50%	26.80%	15.50%	15.60%
Respiratory problems (e.g., difficulty breathing, coughing, shortness of breath)	183	40	98	102
	16.70%	56.30%	47.30%	46.80%
Skin problems (e.g., rashes, hives, red skin, tingling skin, dermatitis)	104	36	67	71
	9.50%	50.70%	32.40%	32.60%
Cognitive problems (e.g., difficulties thinking, concentrating, or remembering)	45	27	32	36
	4.10%	38.00%	15.50%	16.50%
Mucosal symptoms (e.g., watery or red eyes, nasal congestion, sneezing)	154	34	87	90
	14.00%	47.90%	42.00%	41.30%
Immune system problems (e.g., swollen lymph glands, fever, fatigue)	36	20	23	25
	3.30%	28.20%	11.10%	11.50%
Gastrointestinal problems (e.g., nausea, bloating, cramping, diarrhea)	36	14	22	23
	3.30%	19.70%	10.60%	10.60%
Cardiovascular problems (e.g., fast or irregular heartbeat, jitteriness, chest discomfort)	33	14	20	21
	3.00%	19.70%	9.70%	9.60%
Musculoskeletal problems (e.g., muscle or joint pain, cramps, weakness)	29	15	17	19
	2.60%	21.10%	8.20%	8.70%
Other	21	-	4	4
	1.90%	-	1.90%	1.80%

Table 17

DDA: Do any of these health problems mean a total or partial loss of bodily or mental functions, for you personally?

	GenPop	MCS	ChemSens	MCS/ChemSens
Total	362	65	171	179
	100.00%	100.00%	100.00%	100.00%
Yes	62	36	47	49
	17.10%	55.40%	27.50%	27.40%
No	269	23	107	111
	74.30%	35.40%	62.60%	62.00%
Don't know/not sure	31	6	17	19
	8.60%	9.20%	9.90%	10.60%
Decline to answer	-	-	-	-
	-	-	-	-

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?

Base: All Respondents

	GenPop	MCS	ChemSens	MCS/ChemSens
Total	1098	71	207	218
(Percent of General Population)	100.0%	6.5%	18.9%	19.9%
Yes	207	60	207	207
	18.90%	84.50%	100.00%	95.00%
No	797	6	-	6
	72.60%	8.50%	-	2.80%
Don't know/not sure	93	5	-	5
	8.50%	7.00%	-	2.30%
Decline to answer	1	-	-	-
	0.10%	-	-	-

Table 19

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

Base: All Respondents

	GenPop	MCS	ChemSens	MCS/ChemSens
Total	1098	71	207	218
(Percent of General Population)	100.0%	6.5%	18.9%	19.9%
Yes	71	71	60	71
	6.50%	100.00%	29.00%	32.60%
No	986	-	134	134
	89.80%	-	64.70%	61.50%
Don't know/not sure	40	-	13	13
	3.60%	-	6.30%	6.00%
Decline to answer	1	-	-	-
	0.10%	-	-	-

Table 20

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

Base: All Respondents

	GenPop	MCS	ChemSens	MCS/ChemSens
Total	1098	71	207	218
	100.00%	100.00%	100.00%	100.00%
Yes - asthma	176	29	68	70
	16.00%	40.80%	32.90%	32.10%
Yes - asthma-like condition	151	34	59	64
	13.80%	47.90%	28.50%	29.40%
Yes - Asthma or Asthma-like condition or Both	313	53	117	123
	28.50%	74.60%	56.50%	56.40%
No	740	14	85	87
	67.40%	19.70%	41.10%	39.90%
Don't know/not sure	43	4	5	8
	3.90%	5.60%	2.40%	3.70%
Decline to answer	2	-	-	-
	0.20%	-	-	-

Table 21

Have you ever been unable or reluctant to use the restrooms in a public place, because of the presence of an air freshener, deodorizer, or scented product?

Base: All Respondents

	GenPop	MCS	ChemSens	MCS/ChemSens
Total	1098	71	207	218
	100.00%	100.00%	100.00%	100.00%
Yes	127	46	80	84
	11.60%	64.80%	38.60%	38.50%
No	920	22	118	123
	83.80%	31.00%	57.00%	56.40%
Neutral/not sure	49	3	9	11
	4.50%	4.20%	4.30%	5.00%
Decline to answer	2	-	-	-
	0.20%	-	-	-

Table 22

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

	GenPop	MCS	ChemSens	MCS/ChemSens
Total	1098	71	207	218
	100.00%	100.00%	100.00%	100.00%
Yes	113	41	65	70
	10.30%	57.70%	31.40%	32.10%
No	911	23	128	133
	83.00%	32.40%	61.80%	61.00%
Neutral/not sure	72	7	14	15
	6.60%	9.90%	6.80%	6.90%
Decline to answer	2	-	-	-
	0.20%	-	-	-

Table 23

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

	GenPop	MCS	ChemSens	MCS/ChemSens
Total	1098	71	207	218
	100.00%	100.00%	100.00%	100.00%
Yes	183	46	104	107
	16.70%	64.80%	50.20%	49.10%
No	773	20	72	79
	70.40%	28.20%	34.80%	36.20%
Neutral/not sure	141	5	31	32
	12.80%	7.00%	15.00%	14.70%
Decline to answer	1	-	-	-
	0.10%	-	-	-

Table 24

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

	GenPop	MCS	ChemSens	MCS/ChemSens
Total	1098	71	207	218
	100.00%	100.00%	100.00%	100.00%
Yes	165	55	98	103
	15.00%	77.50%	47.30%	47.20%
No	832	12	90	95
	75.80%	16.90%	43.50%	43.60%
Don't know/not sure	99	4	19	20
	9.00%	5.60%	9.20%	9.20%
Decline to answer	2	-	-	-
	0.20%	-	-	-

Table 25

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

Base: All Respondents

	GenPop	MCS	ChemSens	MCS/ChemSens
Total	1098	71	207	218
	100.00%	100.00%	100.00%	100.00%
Yes	85	37	59	61
	7.70%	52.10%	28.50%	28.00%
No	929	28	132	139
	84.60%	39.40%	63.80%	63.80%
Don't know/not sure	81	5	15	17
	7.40%	7.00%	7.20%	7.80%
Decline to answer	3	1	1	1
	0.30%	1.40%	0.50%	0.50%

Table 26

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

Base: All Respondents

	GenPop	MCS	ChemSens	MCS/ChemSens
Total	1098	71	207	218
	100.00%	100.00%	100.00%	100.00%
Yes	470	55	144	149
	42.80%	77.50%	69.60%	68.30%
No	244	12	18	23
	22.20%	16.90%	8.70%	10.60%
Neutral/not sure	381	4	45	46
	34.70%	5.60%	21.70%	21.10%
Decline to answer	3	-	-	-
	0.30%	-	-	-

Table 27

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

Base: All Respondents

	GenPop	MCS	ChemSens	MCS/ChemSens
Total	1098	71	207	218
	100.00%	100.00%	100.00%	100.00%
Yes	474	57	142	149
	43.20%	80.30%	68.60%	68.30%
No	277	9	27	30
	25.20%	12.70%	13.00%	13.80%
Neutral/not sure	342	5	37	38
	31.10%	7.00%	17.90%	17.40%
Decline to answer	5	-	1	1
	0.50%	-	0.50%	0.50%

Table 28

Demographics.

Base: All Respondents

	GenPop	MCS	ChemSens	MCS/ChemSens
Total	1098	71	207	218
	100.00%	100.00%	100.00%	100.00%
Male/Female				
All Males	543	34	73	79
	49.50%	47.90%	35.30%	36.20%
All Females	555	37	134	139
	50.50%	52.10%	64.70%	63.80%
Gender vs Age				
Male 18-24	70	5	8	10
	6.40%	7.00%	3.90%	4.60%
Male 25-34	109	13	27	28
	9.90%	18.30%	13.00%	12.80%
Male 35-44	119	7	12	15
	10.80%	9.90%	5.80%	6.90%
Male 45-54	126	7	17	17
	11.50%	9.90%	8.20%	7.80%
Male 55-65	119	2	9	9
	10.80%	2.80%	4.30%	4.10%
Female 18-24	86	6	16	18
	7.80%	8.50%	7.70%	8.30%
Female 25-34	130	7	29	29
	11.80%	9.90%	14.00%	13.30%
Female 35-44	137	7	34	34
	12.50%	9.90%	16.40%	15.60%
Female 45-54	115	13	30	33
	10.50%	18.30%	14.50%	15.10%
Female 55-65	87	4	25	25
	7.90%	5.60%	12.10%	11.50%