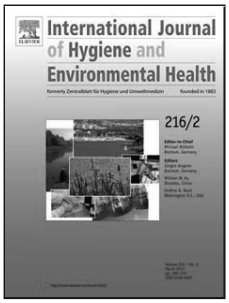

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Overlap in prevalence between various types of environmental intolerance

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RUNNING HEAD: Overlap in prevalence between various types of environmental intolerance

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Abstract

Environmental intolerance (EI) is characterized by attribution of several, multisystem symptoms to specific environmental exposures, such as exposure to odorous/pungent chemicals, certain buildings, electromagnetic fields (EMFs) and everyday sounds. The symptoms are medically unexplained, non-specific and the symptoms overlap between different types of EI. To approach the issue of underlying mechanisms the matter of overlap in prevalence between intolerances can provide valuable information. The aim of the study was to examine if the overlap between intolerance to odorous/pungent chemicals, certain buildings, EMFs and sounds is larger than the expected overlap if no association would exist between them. The study was using cross-sectional data from the Västerbotten Environmental Health Study in Sweden; a large questionnaire-based survey. 8520 adults (18-79 years) were randomly selected after stratification for age and sex, of whom 3406 (40%) participated. Individuals with the four types of intolerance were identified either through self-report, or by having been physician-diagnosed with a specific EI. The overlaps between the four EIs were greater than predictions based on coincidence for both self-reported and diagnosed cases (except for the overlap between diagnosed intolerance to sounds and EMFs). The results raise the question whether different types of EI share similar underlying mechanisms, or at least that the sufferers of EI share some predisposition to acquire the conditions.

Keywords: Prevalence, environmental intolerance, multiple chemical sensitivity, noise sensitivity, sick building syndrome, overlap.

Introduction

During the past decades a number of conditions, which collectively have become known as environmental intolerance (EI), have been puzzling psychologists and physicians. Persons with these conditions attribute several, multisystem symptoms to a specific environmental exposure such as exposure to odorous/pungent chemicals, certain buildings, electromagnetic fields (EMFs) or everyday sounds. Symptoms commonly reported include problems with cognition (e.g., attention and memory), general well-being (e.g., headaches, fatigue, nausea and dizziness), skin (e.g., skin irritation, redness, stinging and burning sensations), airway and mucosae (e.g., irritation/dryness of the mucous membrane, eye irritation, coughing, sneezing and nasal congestion) and coronary health (e.g., palpitation) (e.g. Andersson, M.J.E. et al., 2009; Hausteiner et al., 2007; Israeli and Pardo, 2011; Levallois, 2002).

The symptoms are medically unexplained, non-specific and the symptom overlap between different types of EI is extensive, even though some symptoms are more common in certain types (Henningsen and Priebe, 2003). In addition, the dose of the environmental exposure that the intolerant person responds to is often well below normally harmless levels and does not elicit any reaction in the non-intolerant population (Sorg, 1999). To complicate matters, there is no pathogen mechanism agreed upon explaining the etiology of the conditions, neither is there any agreed-upon method of diagnosis for any of them (e.g. Kipen and Fiedler, 2002; Labarge and McCaffrey, 2000; Rubin et al., 2010). Most studies have focused on each condition separately and the conditions have come to be known among the public as multiple

chemical sensitivity (MCS), sick building syndrome (SBS), electrosensitivity and noise sensitivity (NS).

MCS is described as an acquired condition displaying multi-organ symptoms provoked by very low doses of multiple, chemically diverse substances tolerated by most people (Bornschein et al., 2001). SBS is defined as a set of mucosal, skin and general symptoms that are related with residing or working in a particular building with certain environmental problems (Burge, 2004). Electrosensitivity is a condition in which sufferers experience diverse, non-specific symptoms when exposed to weak electromagnetic fields from sources such as computer equipment or mobile phones (Rubin et al., 2011). NS is described as a general hypersensitivity to normal environmental sounds of any frequency that are not threatening nor uncomfortably loud to a typical person (Baguley, 2003). In a workshop on MCS the term Idiopathic Environmental Intolerance was suggested for a number of conditions sharing similar symptomatology with MCS (IPCS/WHO, 1996). This was a precautionary measure to circumvent causal indications until the aetiology of the conditions are set. Similarly, in a workshop on electromagnetic field hypersensitivity the term "Idiopathic Environmental Intolerance (IEI) with attribution to EMF" was proposed to replace electrosensitivity (Hansson Mild et al., 2006). However, the different types of environmental intolerance can be separated according to the environmental source to which the sufferer attributes his/her symptoms. Consequently, the terms used here will be EI (attributed) to (odorous/pungent) chemicals, certain buildings, EMFs and sounds.

EIs have been reported to be associated with stress, increased attention to exposure, somatic sensations and awareness of modern health worries (Andersson L. et al., 2009; Bailer et al., 2008; Johansson, Nordin et al., 2010; Marmot et al., 2006; Persson et al., 2007; Stansfeld, 1992). Nordin et al. (2013) found that individuals scoring high on Weinstein´s Noise Sensitivity Scale (Weinstein, 1978) also scored high on the Perceived Stress Questionnaire (Levenstein et al., 1993) and the Chemical Sensitivity Scale (Nordin et al., 2003), raising the question of whether the relation between intolerance to chemicals and sounds reflects a general environmental sensitivity.

Due to the similarities between the different types of EI it seems plausible that they are associated in some way. If this is the case, the overlap between the conditions would be larger than by chance. Thus, the overlap between the conditions would be larger than the expected overlap if no association existed between them. A way to test this is to measure the overlap in prevalence, or more specifically co-prevalence, between the different conditions. Whereas prevalence studies for the different types of EI are rather common, co-prevalence studies between the conditions are rare and no study has investigated the co-prevalence between these four common types of EI. When studying overlaps in prevalence, it is possible to use two perspectives. One way is to measure the co-prevalence in a sample that could be generalized to a population; that is, to measure how common it is in the general population to suffer from two (or more) EIs. Another approach is to measure how prevalent other types of EI are in a subsample consisting of a specific EI. Using the first perspective, Levallois et al.

(2002) found the prevalence of the overlap between intolerance to odorous/pungent chemicals and intolerance to EMFs to be 2.0%, where the prevalence for intolerance to EMFs was 3.3% and to chemicals 24.4% in the same sample. Using the second perspective, of those reporting intolerance to EMFs 60.3% also reported intolerance to chemicals. Among individuals reporting intolerance to chemicals 8.4% also reported intolerance to EMFs. In a Swedish study (using the first perspective) the overlap between intolerance to chemicals (defined as a high annoyance from odors) and EMFs was 2.4%, whereas 4.1% reported intolerance to chemicals only (Carlsson et al., 2005). Intercorrelations ($r_s = 0.17$, $p < 0.01$) have been found between degree of intolerance to chemicals and sounds (Andersson et al., 2008). In another study, the prevalence of reporting disturbance from noise from neighbors, ventilation systems and traffic was at least twice as common in individuals with intolerance to EMFs compared to referents (Hillert et al., 2002). Different cultural contexts and media reporting may play a role in reporting EIs, hence comparing between countries may be difficult (Winters et al., 2003; Witthöft and Rubin, 2013).

The aim of the present study was to examine if the overlap between intolerance to odorous/pungent chemicals, certain buildings, EMFs and sounds is larger than the expected overlap if no association existed between them. Based on the assumption that the different types of EI actually are associated, the hypothesis was that the overlap in prevalence between the different types of EI is larger than by chance.

Methods

Population and procedure

The present study used cross-sectional data from the Västerbotten Environmental Health Study (VEHS); a large questionnaire-based survey with focus on various environmental hypersensitivities. The VEHS addresses diagnoses, symptomatology, annoyance and intolerance, psychological and physical/chemical risk factors, coping and social support. Västerbotten is a county in northern Sweden with approximately 260 000 inhabitants (about 195 000 between 18 and 79 years) and with an age and sex distribution similar to the general Swedish population (Figure 1).

[Figure 1 about here]

To obtain a representative sample of the population, 8600 adults (aged 18 to 79 years) from the county of Västerbotten were randomly selected from the population registry after stratification according to sex and six age strata: 18 to 29 years (n=1990; males=1035, females=955), 30 to 39 years (n=1377; males=717, females=660), 40 to 49 years (n=1452; males=741, females=711), 50 to 59 years (n=1467; males=746, females=721), 60 to 69 years (n=1395; males=702, females=693) and 70 to 79 years (n=919; males=426, females=493). Eighty persons were excluded from the sample because they were identified as unknown by the post office, resulting in a sample size of 8520 persons. The sample size was based on the lowest expected prevalence for a specific EI by sex, which was EI to EMFs for men (1.1%; Hillert et al., 2002). Precision was set to 0.55% (Naing et al., 2006) and with a

level of confidence of 95% the sample size was calculated according to Daniel (1999) to 1382 men. Since the sex distribution in Västerbotten was nearly equally distributed (50.3% men) in 2010 (Statistics Sweden) the number of women needed was rounded up to the same number as for men. With an expected response rate of 60% the sample size was estimated to 4607 participants. The present study is the first part of a longitudinal study, with expected accessibility of 90% and expected response rate of 60% at follow-up. Thus, the sample size was estimated to fully 8530 participants which was rounded up to 8600.

The questionnaire was sent by mail together with written information concerning confidentiality, intended use of the data and that participation was voluntary. A reminder was sent to non-responders after fully three weeks. An additional reminder and a new copy of the questionnaire were sent after another three weeks.

The present study was conducted between March and April 2010 (before the allergy season in the northern part of Sweden). It was approved by the Umeå Regional Ethics Board and conducted in accordance with the Declaration of Helsinki.

Questionnaire

Altogether, the VEHS questionnaire consisted of (i) demographic inquiries, (ii) an inventory on diagnosed cases of illness of relevance for EIs, (iii) questions on self-reported intolerance and symptoms attributed to environmental factors (odorous/pungent chemicals, certain buildings, sounds, EMFs), (iv) inquiries on affective and behavioral consequences of noise, odorous/pungent chemicals and

EMFs, (v) inventories on somatic symptoms and symptoms associated with EIs, (vi) sets of items for assessing personality traits (perceived stress, burnout syndrome, anxiety, depression, hopelessness and helplessness, modern health worries), (vii) questions concerning sleep, (viii) inquiries on certain environments and sources eliciting problems, and (ix) a section, only answered by those with self-reported EI containing questions on coping and social support. Sections (ii) and (iii) were used in the present study to classify participants as cases of a particular EI.

Data management

Filled in questionnaires were scanned and a database was created from the responses. A data-entry verification test was performed to check the accuracy of the scanning procedure. Each item of 35 (~1%) randomly selected filled in paper questionnaires were compared with the entries in the database, revealing an error rate of 0.11%, which was considered negligible. Several quality control checks (e.g. range checks and logical checks) were performed to test the accuracy of the data before analysis. Individuals with intolerance to chemicals, certain buildings, EMFs and sounds were identified either through answering 'Yes' to one (or several) of the questions in Table 1, resulting in being classified as self-reported cases of that specific EI. Diagnosed cases were identified as reporting to have been diagnosed by a physician to suffer from sensory hyperreactivity and/or hypersensitivity to odorous/pungent chemicals / multiple chemical sensitivity (classified as diagnosed EI to chemicals), hypersensitivity by residing in certain buildings / building related unhealthiness

(classified as diagnosed EI to certain buildings), hypersensitivity to switched on electrical devices / electrosensitivity (classified as diagnosed EI to EMFs), and hypersensitivity to sounds / noise (classified as diagnosed EI to sounds). Self-reported and diagnosed cases partially overlapped.

[Table 1 about here]

Data analysis

Statistical analyses were performed using IBM SPSS Statistics 19 (IBM Corporation; New York). Continuous demographic data were analyzed using independent samples t-tests, and chi square tests for categorical variables. Prevalence values for the four types of EI (with or without overlaps) were calculated as proportions expressed as percentages of the sample. The Wilson method was used to calculate 95% confidence intervals (Altman et al., 2000). Prevalences for the overlaps between the different types of EI were also calculated for the sample as well as subsamples of specific EI. Venn-diagrams were used to visualize overlaps in both the sample and in subsamples. Chi-square tests were performed to assess whether the overlaps between the different types of EI were greater than by chance. Yate´s (continuity) correction was used when at least one cell had an expected count less than 5.

Results

Of the 8520 randomly selected individuals, 3406 (40%) participated. The percentage of individuals who participated in each age and gender strata is presented in Figure 2.

[Figure 2 about here]

Mean age was 51.2 for responders and 42.7 for non-responders. The difference was significant ($t = 22.97$, $p < 0.001$). The response rate differed significantly between women and men ($\chi^2(1, 8520) = 69.1$, $p < 0.001$). Of the responders 55.7% were women. Characteristics of the responders are presented in Table 2.

[Table 2 about here]

Entire sample

Of the 3406 responders, 21.6% (n=736, 95% CI 20.3-23.0) reported to be intolerant to odorous/pungent chemicals, certain buildings, EMFs and/or sounds, referred to as "self-reported" cases. Of the responders, 6.3% (n=214, 95% CI 5.5-7.2) reported having been given at least one intolerance diagnosis by a physician, referred to as "diagnosed" cases. The diagnoses included MCS, SBS, electrosensitivity and NS. Of those with self-reported intolerance to chemicals, 22.2% had a physician-based diagnosis. Corresponding number for intolerance to certain buildings, EMFs and sounds were 17.6%, 15.4% and 21.1%, respectively.

The distribution of the number of persons with self-reported intolerances, and the number of persons reporting having been diagnosed with intolerances are shown in Figure 3 for each type of intolerance including overlaps.

[Figure 3 about here]

The co-prevalence between at least two EIs in the sample was 5.8% (n=197, 95% CI 5.1-6.6) and 1.4% (n=46, 95% CI 1.0-1.8) for self-reported and diagnosed intolerance, respectively. The co-prevalence between at least three EIs was 1.3% (n=44, 95% CI 1.0-1.7) and 0.3% (n=9, 95% CI 0.1-0.5) for self-reported and diagnosed EIs, respectively. The corresponding co-prevalences of subsamples of a specific EI are presented in Table 5. There were relationships between gender (where the observed numbers of females were larger than expected) and pairwise overlaps of the self-reported EIs, except for the overlap between EI to buildings and sounds (Table 3). A significant relationship between three types of self-reported EIs and gender was only found for the overlap between EI to chemicals, EMFs and sounds (Table 4).

[Tables 3-4 about here]

Subsamples

Figure 4 illustrates the prevalence of the other types of EI in subsamples of a specific EI. Table 5 presents percentages of overlap between the different EI subsamples and any one, two or three of the other EIs.

[Figure 4 about here]

[Table 5 about here]

Results from chi-square tests are presented in Tables 6 and 7 for self-reported and diagnosed EIs, respectively, which indicate that the observed overlaps in all cases (except for the overlap between diagnosed cases of intolerance to sounds and EMFs) were greater than expected.

[Table 6 and 7 about here]

Discussion

The overlaps between intolerance to odorous/pungent chemicals, certain buildings, EMFs and sounds, for both self-reported and diagnosed intolerance (except for the overlap between diagnosed intolerance to sounds and EMFs), were found to be greater than predictions based on coincidence. This was confirmed by chi-square tests. Elaborating the results, comparing the overlaps in the subsamples of a particular EI (Figure 4) and the overlaps in the entire sample (Figure 3), gives a picture of the extent of the association between different EIs. Actually, overlaps between two specific EIs (e.g. the overlap between intolerance to EMFs and sounds) were three to ten times higher in subsamples (e.g. individuals classified as intolerant to odorous/pungent chemicals) in comparison with the entire sample when identifying cases through self-report and nine to 36 times higher when using the diagnose

criteria. Overlaps between two unspecific, self-reported EIs (e.g. the co-prevalence between two or more EIs) were nearly two to five times higher in the subsamples of the four types of EI in comparison with the entire sample. Corresponding number for diagnosed EIs was six to 14 times. The subsamples consisting of persons reporting intolerance to certain buildings or EMFs showed greater overlaps than the subsamples of persons reporting intolerance to chemicals or sounds. Regarding intolerance to certain buildings the largest overlap was with intolerance to odorous/pungent chemicals. Potential causes of intolerance to certain buildings that have been suggested are poor ventilation, low humidity, biological pollutants (such as mold and dust), chemical pollutants (such as perfume and cleaning agents) and psychosocial factors (such as stress and social relations) (Israeli and Pardo, 2011). If chemical pollutants are somewhat involved in the etiology of intolerance to certain buildings it may explain the extensive overlap with intolerance to chemicals. Regarding intolerance to EMFs, provocation studies have shown that the EMF source per se does not seem to cause physiological symptoms and reactions (Rubin et al., 2011). These individuals may to a larger extent pay attention to environmental factors in general and react with stress responses, resulting in physiological symptoms that are attributed to factors in the environment. The larger overlap between EIs in women compared to men is not surprising considering that single forms of EI are typically reported to be more common in women than in men. However, the results evoke the question as to what extent gender per se explains the high overlap when controlling

for conditions that are known to be more common in women and also to be associated with EI (e.g. anxiety and worries). Future research may resolve this issue.

Regarding the prevalences of intolerance to odorous/pungent chemicals, certain buildings, EMFs and sounds, they were at least two to nearly six times higher in the self-reported environmental intolerant subsamples (e.g. the prevalence of intolerance to odorous/pungent chemicals among those reporting intolerance to certain buildings) and five to 21 times higher in the diagnosed EI subsamples than in the entire sample (compare Figures 3 and 4).

A strength of the present study is that both self-reported and diagnosed EIs are investigated and that both criteria confirm the hypothesis of an overlap between the different EIs being greater than by chance. Self-reports and diagnoses are commonly used criteria to identify cases of EIs where diagnoses can be seen as a more strict criterion than self-reports. However, not all individuals who reported having a specific EI diagnose fulfilled the self-report criterion. Actually 82% of the individuals reporting to have a MCS diagnose also considered themselves intolerant to odorous/pungent chemicals. Corresponding numbers for intolerance to certain buildings, EMFs and sounds were 63%, 93% and 73%. An explanation to the fact that not all diagnosed cases are self-report cases might be that persons who no longer experience symptoms from a particular environment may have been given an EI diagnose earlier in life during a period of poor health. If this is the case it may explain the lower overlap between diagnosed and self-reported cases of intolerance to certain buildings, since individuals reporting building related symptoms often leave

the building causing the problems, and even though long-lasting symptoms exist in this group, many improve after leaving the particular building (Edvardsson et al., 2008).

Since the response rate was low (40%) there is a risk of a selection bias which potentially affects the external validity. If there is a special topic of a survey, people with special interest in that topic are more prone to respond (Groves et al., 2006). Since the topic of the current questionnaire was environmental health it is likely that an overrepresentation exists of environmental intolerant persons or at least of individuals who are more conscious or concerned about these issues. If this is true the prevalence rates for the EIs may be too high. A complete non-responders analysis was not possible to perform due to ethical reasons, but a non-response bias probably exists since the responders and non-responders differed regarding age and sex. At least the sex difference would affect the prevalence values since EIs are more common in the female sex (Ellermeier et al., 2001; Johansson et al., 2005; Stenberg and Wall, 1995). There were more females responding to the questionnaire, which probably would result in increased prevalences. Even though the prevalences possibly are overestimated the overlaps between the different types of EIs are argued not to be affected so much since individuals with one environmental intolerance as well as individuals with several intolerances are motivated to answer the questionnaire.

Individuals with different EIs suffer from a number of symptoms which they attribute to particular environmental sources. The attribution of symptoms may be affected by cultural models, spread by for example mass media or personal

experience, explaining illness (Kirmayer and Sartorius, 2007). Hence, attribution of symptoms may vary depending on explanatory models available. However, if no known cause to the symptoms is available the individual's own explanation for the symptoms must be taken seriously. Attribution of symptoms may be affected by the focus of a study. For example, Brauer and Mikkelsen (2003) found that changing the information of a study influenced the attribution, but not the prevalence of symptoms. In the present study special concern was taken with this in mind where information was focusing on health in general rather than on environmentally-induced health issues.

All four types of EI studied are characterized by medically unexplained symptoms. The symptoms reported by persons suffering from the different EIs resemble each other, even though no uniform pattern can be found between the EIs. Nonetheless, no uniform pattern can be found between persons suffering from the same EI either. This unspecific symptoms pattern is characteristic for all four types of EI. The similarities between reported symptoms and their unspecific pattern, together with the overlap between the EIs presented in this study, indicate that we are possibly dealing with conditions that are similar to some extent. The medically unexplained symptoms characterizing EIs have been suggested as somatic stress disorders (Binder and Campbell, 2004). These disorders are characterized by physical symptoms resulting from physical and/or psychological stressors. The construct of somatic stress disorder does not separate the mind and body, but rather state that this separation is impossible. Stressors may either be environmental demands and/or psychological

demanding events. Hence, the stressor (the exposure) per se may be different for the various types of EI but the manifestation may be the same or very similar. In line with this, the result from the present study can be interpreted as the different types of EI, to some extent, share the same or similar underlying mechanism, or at least that the environmental intolerant persons share some predisposition to acquire the conditions. Hence, it seems plausible that sufferers from one EI eventually could develop an environmental hypersensitivity of a more general character. If this is the case future research should be focused on factors similar to the different EIs. It is important to address that these factors may stem from peripheral mechanisms, or from more central and complex mechanisms. In any case, the causes of EIs are complex and the environmental factors eliciting the condition seem to be innumerous.

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Figure Captions

Figure 1. Distribution of the population of Sweden (dark bars) and Västerbotten (light bars) for each age strata.

Figure 2. Response rate in each strata. The bars represent the proportion of women (dark) and men (light) in each age strata.

Figure 3. Distribution, n(%), of the different types of environmental intolerance in the sample.

Figure 4. Distribution, n(%), of three other environmental intolerances in subsamples of specific self-reported and diagnosed environmental intolerance. A square represents the whole subsample and regions within circles represent overlaps. All regions are proportional.

504 Table 1. Questions to assess self-reported intolerance to certain environmental factors.
505

Environmental intolerance	Question
Chemicals	Are you getting symptoms from odorous/pungent chemicals (not limited to certain buildings), such as perfumes and cleaning agents, in doses that you were not getting symptoms from before or that you believe most other people are not getting symptoms from?
Certain buildings	Are you getting symptoms from residing in certain buildings (non-specific building related symptoms) that you were not getting symptoms from before or that you believe most other people are not getting symptoms from?
EMFs	Are you getting symptoms from certain switched-on electrical devices that you believe most other people are not getting symptoms from?
Sounds	Do you have a hard time tolerating everyday sounds that you believe most other people can tolerate?

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Table 2. Characteristics, n(%), of the 3406 responders.

Age, years	
18-29	486 (14.3)
30-39	443 (13.0)
40-49	518 (15.2)
50-59	662 (19.4)
60-69	761 (22.3)
70-79	536 (15.7)
Sex	
Male	1508 (44.3)
Female	1898 (55.7)
Marital status	
Married/living with partner	2500 (73.4)
Unmarried	524 (15.4)
Divorced	215 (6.3)
Widow/widower	137 (4.0)
No answer	30 (0.9)
Education level	
Primary school	823 (24.2)
Upper secondary school	1137 (33.4)
Higher education/university	1405 (41.3)
No answer	41 (1.2)
Perceived health status	
Excellent	357 (10.5)
Very good	992 (29.1)
Good	1152 (33.8)
Fairly good	754 (22.1)
Poor	114 (3.3)
No answer	37 (1.1)

Chemicals + Buildings			Chemicals + EMFs			Buildings + Sounds		
Obs	Exp	χ^2	Obs	Exp	χ^2	Obs	Exp	χ^2
68	53.5	9.1**	25	16.7	9.5**	25	21.2	1.6^{NS}
28	42.5		5	13.3		13	16.8	

Table 3. Results from Chi-square tests and observed and expected number of women and men with two EIs.

Note. ** = $p < 0.01$. NS = non-significant.

	Chemicals + Buildings + EMFs				Chemicals + EMFs + Sounds			
	Obs	Exp	χ^2		Obs	Exp	χ^2	
	12	8.4	3.6^{NS}		11	6.7	6.3*	
	3	6.6			1	5.3		

Table 4. Results from Chi-square tests and observed and expected number of women and men with three EIs

Note. * = $p < 0.05$. NS = non-significant.

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538 Table 5. Overlap, % (95% CI), between subsamples of a specific environmental intolerance with one,
539 two or three of the other types of environmental intolerance.
540

Overlaps with	Type of intolerance							
	Chemicals		Certain buildings		EMFs		Sounds	
	Self-reported	Diagnosed	Self-reported	Diagnosed	Self-reported	Diagnosed	Self-reported	Diagnosed
At least one other type of EI	39.9 (35.3-44.6)	36.6 (28.3-45.8)	70.3 (62.9-76.7)	63.8 (49.5-76.0)	58.2 (48.0-67.8)	53.3 (30.1-75.2)	35.1 (30.1-40.6)	24.0 (16.5-33.4)
At least two other types of EIs	9.7 (7.2-12.9)	8.0 (4.3-14.6)	23.0 (17.3-30.0)	17.0 (8.9-30.1)	27.5 (19.4-37.4)	20.0 (7.0-45.2)	11.2 (8.2-15.2)	8.3 (4.3-15.6)
All other EIs	1.4 (0.7-3.1)	0.9 (0.2-4.9)	3.6 (1.7-7.7)	2.1 (0.4-11.1)	6.6 (3.1-13.6)	6.7 (1.2-29.8)	1.9 (0.9-4.1)	1.0 (0.2-5.7)

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545 Table 6. Results from Chi-square tests and observed and expected overlaps between the
546 different types of self-reported environmental intolerance.
547

Environmental Intolerance	Environmental Intolerance								
	Certain buildings			EMFs			Sounds		
	Observed	Expected	χ^2	Observed	Expected	χ^2	Observed	Expected	χ^2
Chemicals	96	19.5	359.2***	30	10.7	40.4***	85	37.7	74.7***
Certain buildings	—	—	—	26	4.3	117.6***	38	15.2	39.5***
EMFs	—	—	—	—	—	—	28	8.4	51.6***

Note. ***=p< 0.001

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550 Table 7. Results from Chi-square tests and observed and expected overlaps between the different types
551 of diagnosed environmental intolerance.
552

Environmental Intolerance	Environmental Intolerance								
	Certain buildings			EMFs			Sounds		
	Observed	Expected	χ^2	Observed	Expected	χ^2	Observed	Expected	χ^2
Chemicals	25	1.5	357.5***	6	0.5	52.8***	20	3.2	90.0***
Certain buildings	—	—	—	4	0.2	53.4***	10	1.3	52.6***
EMFs	—	—	—	—	—	—	2	0.4	2.8^{NS}

Note. *** = $p < 0.001$. NS = non-significant. Yate's continuity correction is used in calculating chi-square tests.

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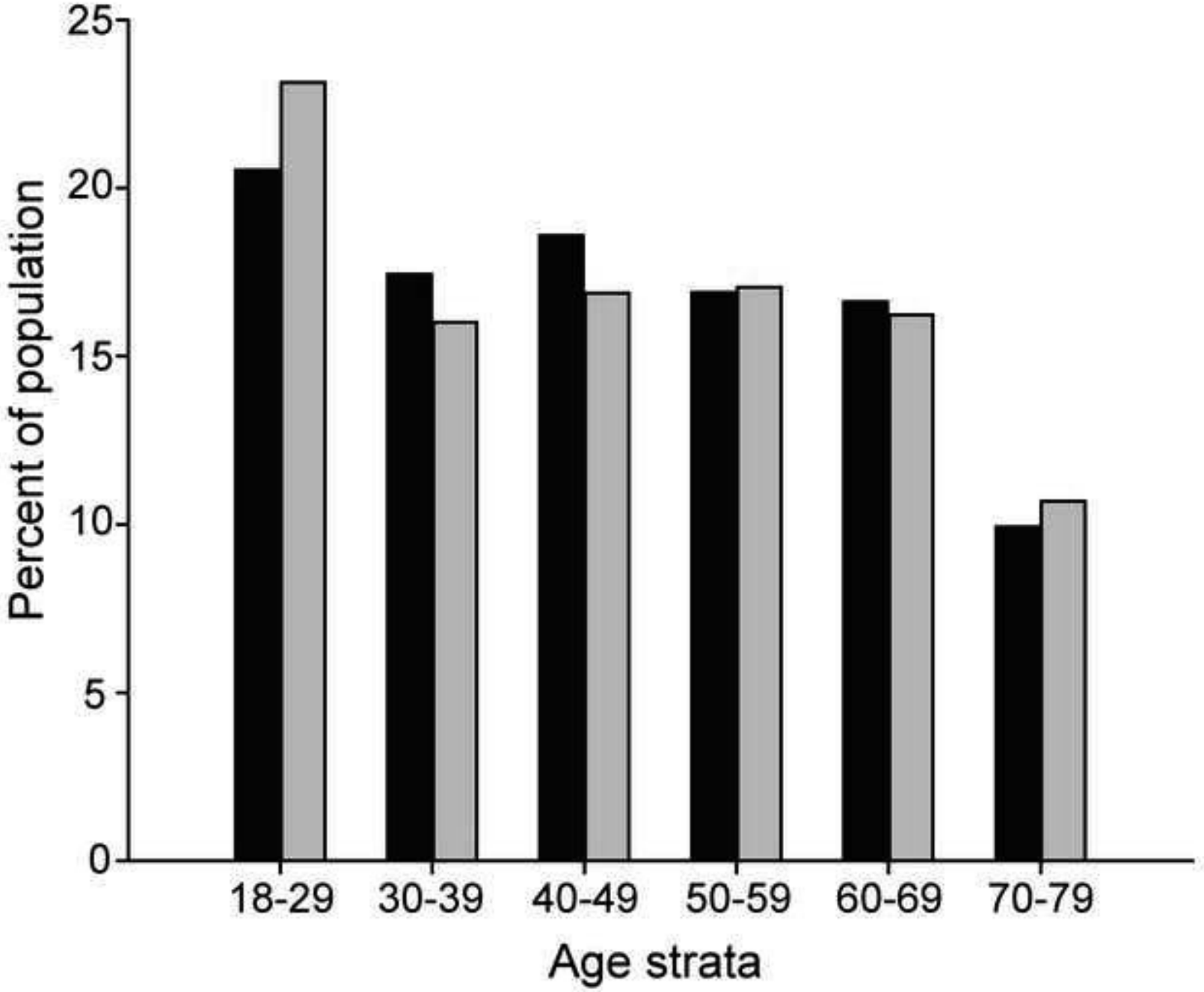
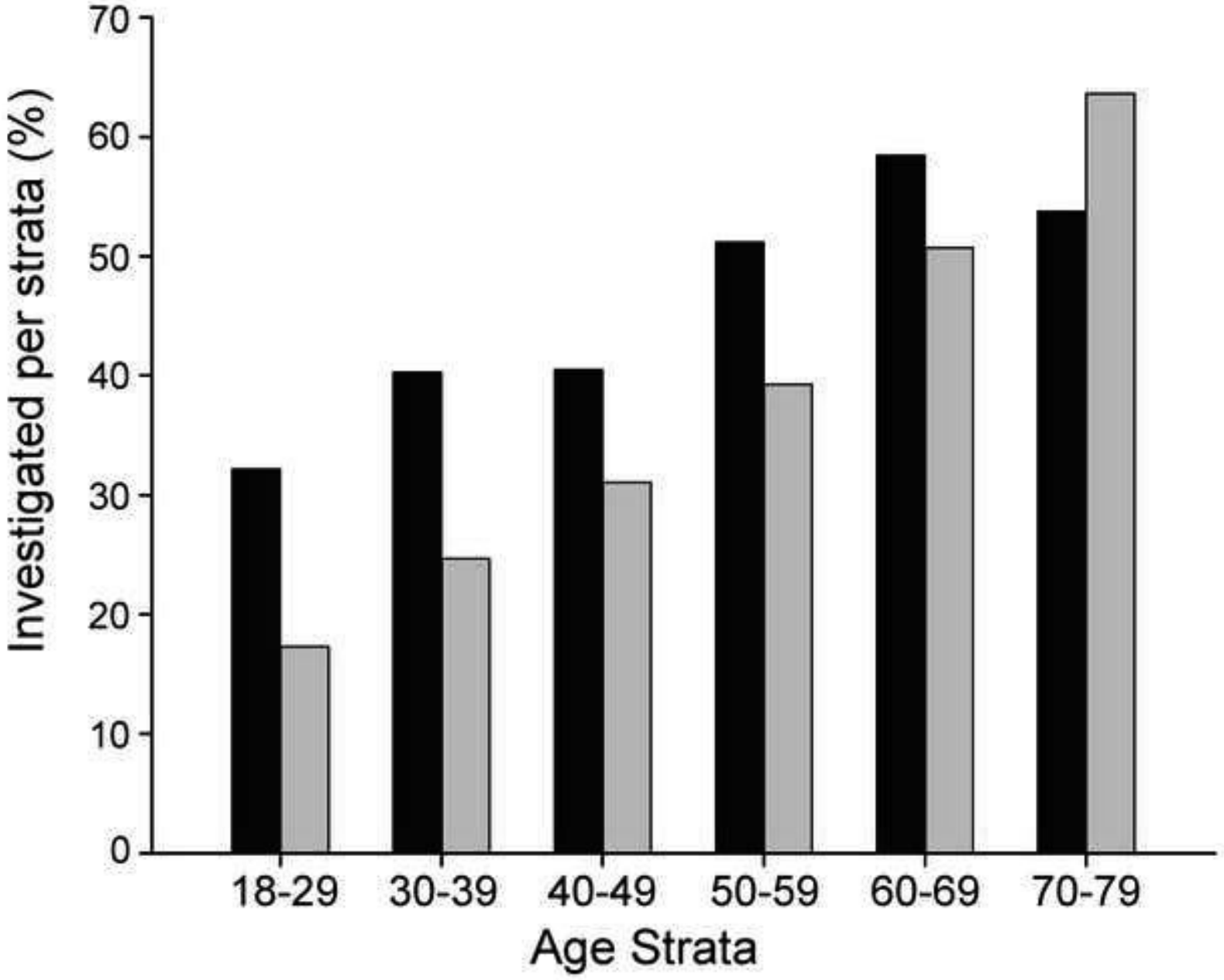
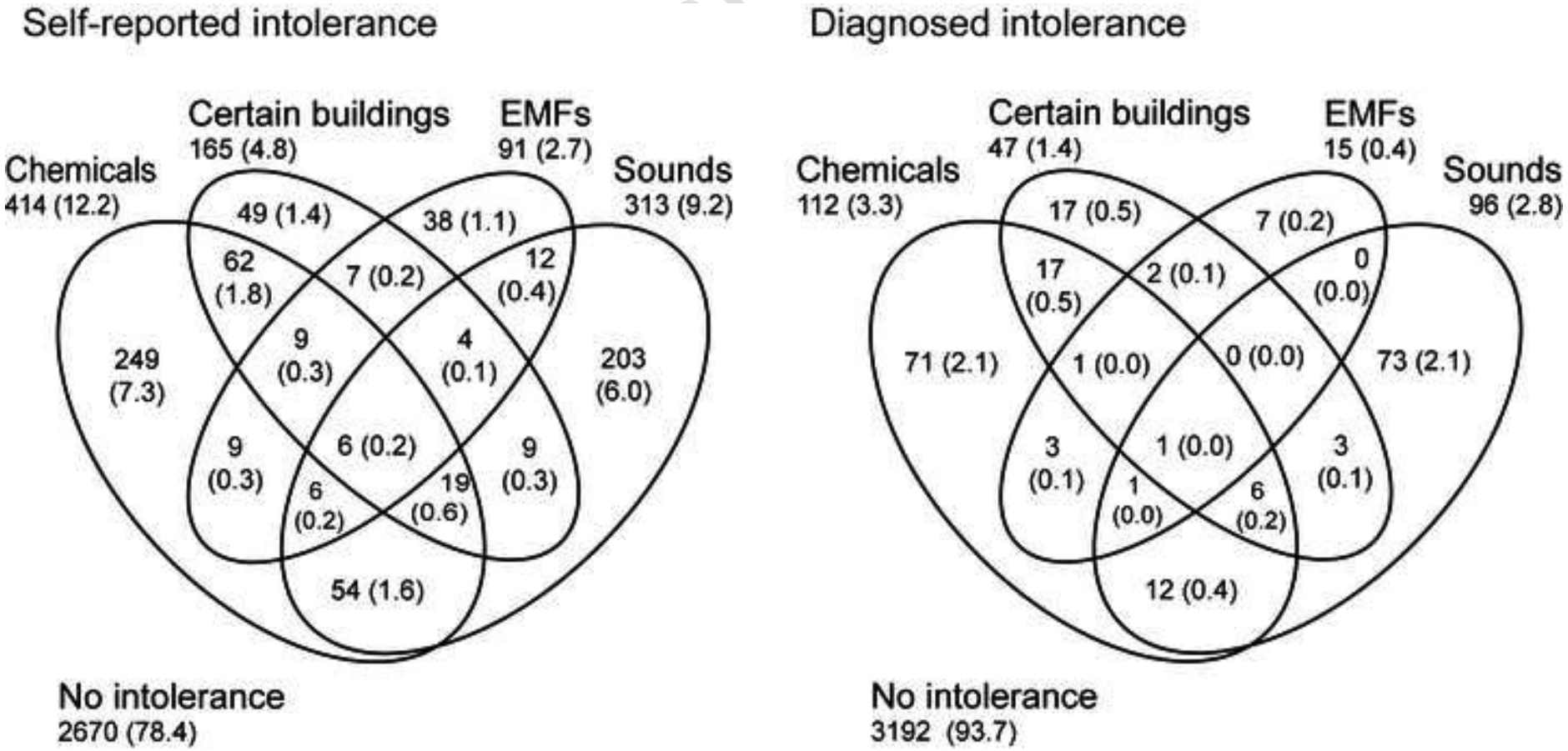
Figure


25
20
15
10
5
0
Percent of population
18-29
30-39
40-49
50-59
60-69
70-79
Age strata

Figure


Investigated per strata (%)
70
60
50
40
30
20
10
0
18-29
30-39
40-49
50-59
60-69
70-79
Age Strata

Figure


Self-reported intolerance
Certain buildings
165 (4.8)
EMFs
91 (2.7)
Chemicals
414 (12.2)
Sounds
313 (9.2)
49 (1.4)
38 (1.1)
62
(1.8)
7 (0.2)
12
(0.4)
249
(7.3)
9
(0.3)
4
(0.1)
203
(6.0)
9
(0.3)
6 (0.2)
9
(0.3)
6
(0.2)
19
(0.6)
54 (1.6)
No intolerance
2670 (78.4)
Diagnosed intolerance
Certain buildings
47 (1.4)
EMFs
15 (0.4)
Chemicals
112 (3.3)
Sounds
96 (2.8)
17 (0.5)
7 (0.2)
17
(0.5)
2 (0.1)
0
(0.0)
71 (2.1)
1 (0.0)
0 (0.0)
73 (2.1)
3
(0.1)
1 (0.0)
3
(0.1)
1
(0.0)
6
(0.2)
12 (0.4)
No intolerance
3192 (93.7)