

The distribution in specific IgE and the prevalence of allergic symptoms in 25–64-years old inhabitants of an eastern and a western German city – Results from Augsburg and Erfurt

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Abstract. *Background:* In an earlier study it has been found that allergic symptoms and sensitization in adults were more frequent in Hamburg (northern part of West Germany) compared to Erfurt (East Germany). The purpose of this study was to replicate these findings using data from Augsburg, a city from the southern part of West Germany. Furthermore the study population in this analysis was extended to higher age groups. *Methods:* The prevalence of respiratory symptoms, assessed by a self-administered questionnaire, was compared in a random sample of adults, 25–64 years of age, living in Augsburg ($n = 1572$) and Erfurt ($n = 1648$). From a subset ($n = 754$, resp. 1144) specific IgE to common aeroallergens were measured and atopic sensitization was defined as the presence of at least one positive specific IgE ($CAP > 0$). *Results:* The prevalence of allergic

rhinitis, wheezing, asthma and atopic sensitization was higher in Augsburg than in Erfurt (OR: 2.0; 1.3; 2.1; 1.7; all $p < 0.01$). For these differences no specific explanation could be found, i.e. the percentage of sensitized persons was equally increased in Augsburg for asthmatics, patients with hay fever or asymptomatic subjects. Furthermore, sensitization was equally increased for all common allergens. The differences were largest for the youngest age group, but also existed for higher ages. *Conclusions:* The increased prevalence of allergies observed in Hamburg, a northern city of West Germany, is also found in Augsburg, a southern city of West Germany, both compared to Erfurt in East Germany. This supports the finding that unspecific causes related to western lifestyle play an important role. Further research is needed to identify the causal influences.

Key words: Adults, Allergic respiratory symptoms, Atopic sensitization, East-west, Epidemiology, Specific IgE

Introduction

The European Community Respiratory Health Survey [1] (ECRHS), a multicenter survey among 20–44-year old adults in 48 centers in 22 countries showed wide regional variations in the prevalence of allergic respiratory symptoms [2] and also in the prevalence of atopic sensitization [3] between and within the countries. Germany was represented by one center located in West Germany (Hamburg) and one in East Germany (Erfurt), the former GDR. For the German centers significantly lower prevalences in Erfurt compared to Hamburg for nasal allergies (12% vs. 24%), asthma (0.7% vs. 2.4%) and allergic sensitization (34% vs. 40%) were reported [4].

Additionally, the International Study of Asthma and Allergies in Childhood (ISAAC) with 155 centers in 56 countries reported a worldwide variation in the prevalence of asthma and allergic rhinoconjunctivitis assessed by questionnaire [5]. The lowest prevalences were found in parts of eastern Europe, south and central Asia. Children living in the East German center Greifswald revealed a lower prevalence in al-

lergic rhinoconjunctivitis compared with children from the west German center in Münster.

The objective of the present analysis is (1) to test with an independent data set if the east-west differences between Erfurt and Hamburg (northern part of West Germany) can also be replicated analyzing data from Erfurt and Augsburg which is located in the southern part of West Germany, and (2) if the findings observed for the age group 20–44 years are also existing for older adults up to 64 years.

Materials and methods

Population and study design

The study population comprises the urban population of German nationals in Erfurt and Augsburg at the age of 25–64 years, both men and women. The city of Erfurt (former GDR) is located in the center of Germany and Augsburg in the south, 300 km south of Erfurt. The total population of the two cities

are similar, with about 210,000 inhabitants in Erfurt and 265,000 in Augsburg.

The study population in Augsburg is based on the survey population of the MONICA study Augsburg 1994/1995, which is a part of the WHO project for MONItoring of trends and determinants of CARDio-vascular disease as described elsewhere [6]. The study population is restricted to the inhabitants of the city of Augsburg and to those aged 25–64 years. In the city of Augsburg a total of 311 subjects was selected in each sex and 10-year age group from the population register of the city. The participants had to do a standardized interview, fill in a self-administered questionnaire, give a blood sample and undergo measurements of blood pressure and body composition [7]. Venous blood (10 ml) was taken for the determination of the immunologic parameters. The self-administered questionnaire of the screening questions about respiratory symptoms of the ECRHS [1] was completed in the center or at home. For the analyses reported here specific IgE (immunoglobulines E against common aeroallergens) have been determined in a subsample of 50% of the participants by the CAP-FEIA method, Pharmacia Diagnostics in Freiburg, Germany. The subsample was drawn as simple random sample from all participants of the study aged 25–65 years (using the SAS-Function RANUNI and selected those with probability lower than 0.5). The 50% subsample was necessary, because the specific IgE could not be measured in all blood samples by the same laboratory for organizational and financial reason.

The study population in Erfurt 1991/1992 is based on the stage II population of the ECRHS [1], where age classes were extended to 20–64 years. This study design intended two stages: screening questionnaire in the first and medical examination for a subsample in the second stage. For the first stage a random sample was drawn from the population registry of the city of Erfurt. To all of these selected subjects the standardized screening questionnaire was mailed. Details and results of the first stage are given in Refs. [4, 8]. The second stage consisted of a detailed questionnaire, blood drawing and determination of specific and total IgE, skin-prick testing, spirometric measurements, and Methacholine or bronchodilator inhalation tests. For the analysis presented here the population was restricted to 25–64-years old subjects.

Respiratory symptoms

In both study populations information on respiratory symptoms, attacks of asthma as well as the presence of allergic rhinitis were gathered by the identical self-administered questionnaire, after translation of the screening questionnaire of the ECRHS [1].

Specific IgE measurements and sensitization

In both studies blood processing was done under standardized conditions, given by the ECRHS protocol. From each participant 10 ml venous blood was taken and left to coagulate either 3–6 hours at room temperature or overnight in the refrigerator. The blood was centrifuged at 3000 rpm (maximum 4000) for 15 min, the serum separated and aliquoted into 2 ml micro-tubes (Sarstedt, Nürnberg, Germany). The aliquots from the participants under 45 years in Erfurt ($n = 618$) were stored at -20°C and sent on dry ice to the central laboratory at Pharmacia Diagnostics (Uppsala, Sweden) for analysis. All other aliquots ($n = 549$ from Erfurt and 782 from Augsburg) were stored at -80°C and sent to the laboratory of Pharmacia Diagnostics in Freiburg, Germany for analysis in July 1996.

Specific IgE against timothy grass, cat, cladosporium herbarium, birch and house dust mite (*Dermaphagoides pteronyssinus*) were measured by using the Pharmacia CAP-FEIA System (Pharmacia Diagnostics, Uppsala, Sweden). Assays for specific IgE were judged to be positive if they were in excess of 0.35 kU/L of the specific antibodies, the limit of detection. An atopic sensitization was present if at least one of the five specific IgE was positive ($\text{CAP} > 0$).

Quality control for specific IgE

For quality control purposes between the two laboratories frozen serum aliquots from 99 subjects, for which analyses in Uppsala were just done, were randomly selected. They were sent to Freiburg in July 1996 and the five above mentioned specific IgE were reanalyzed. The results are given in Table 1. Agreement in positive specific IgE levels were seen in at least 89% and in sensitization in 87%. As a measure of agreement κ was calculated [9]. For most purposes, values greater than 0.75 may be taken to represent excellent agreement beyond chance. Results of 'good' and nearly 'excellent agreement' were obtained for grass, birch, mite and overall atopic sensitization. The κ value for cat (0.42) can be commented on as 'fair to good'. 'Poor agreement' could only be found in the case of cladosporium, only 7 of 99 were identified positive in Uppsala and 2 in Freiburg, but no case were confirmed in both laboratories.

Statistical methods

To consider the different age structure of the populations to be compared age standardized prevalence rates were calculated by direct method in 10-year age groups. The weights were chosen according to the age distribution of the FRG population in May 1987. Prevalence rates are given with 95% confidence intervals (CI). To adjust for age and sex logistic regression models were used and the adjusted

Table 1. Laboratory comparison. Proportion (in %) of agreement/disagreement and coefficient κ with 95% CI for the 99 observations been analyzed in the laboratory Uppsala (U) and in Freiburg (F) of Pharmacia Diagnostics

Sensitization ^a	U ⁻ F ⁻ (%)	U ⁻ F ⁺ (%)	U ⁺ F ⁻ (%)	U ⁺ F ⁺ (%)	κ^b	95% CI
Total ^c	53	4	9	34	0.73	(0.6–0.9)
Grass	71	5	5	19	0.73	(0.6–0.9)
Birch	81	4	4	11	0.69	(0.5–0.9)
Cat	84	3	8	5	0.42	(0.1–0.7)
Mite	83	2	4	11	0.75	(0.6–0.9)
Cladosporium	91	2	7	0	–0.03	(–0.1–0.0)

^a Defined as positive if CAP > 0 (antibodies ≥ 0.35 kU/L).

^b '>0.75' excellent, '0.4–0.75' fair to good, '<0.4' poor agreement.

^c Positive if at least one of the five specific IgE was positive.

prevalence odds ratios (OR) with 95% CI are given. The calculations were done with the Statistical Analysis System, Release 6.09 and 6.12.

Results

Response

Table 2 gives an overview of the sample and the study population of the two cities to be compared. Whereas in self-reported questions on respiratory symptoms the study population in Erfurt showed a higher re-

sponse than in Augsburg, the response decreased for the main examination, so that data on sensitization are available for 1144 subjects in Erfurt and 754 for the 50% random sample in Augsburg. Availability of the parameters of interest, atopic sensitization and respiratory symptoms were similar.

Allergic respiratory symptoms

The prevalence of self-reported allergic rhinitis, wheezing and asthma attacks in the last 12 months for both populations is shown in Table 3. In Augsburg the prevalences are higher than in Erfurt. When stratifying by sex the differences between Augsburg and Erfurt have consistently remained, even though they were higher in women. In Figure 1(a) the prevalences of allergic rhinitis stratified by 10-year age groups are shown. While the youngest age groups differ in the prevalence of allergic rhinitis between Augsburg and Erfurt, the prevalence in the age group of 55–64 years in Augsburg approaches the level of allergic rhinitis in Erfurt.

Atopic sensitization

In Table 4 the prevalence of positive specific IgE values and atopic sensitization obtained in Augsburg and Erfurt are given. In Augsburg the prevalence of atopic sensitization with 36% was clearly higher than in Erfurt with 26%. Moreover, positive specific IgE values were more frequently counted in Augsburg than in Erfurt, with one exception cladosporium. Clear differences in the sensitization against house dust mite, cat and birch have been observed, but not for grass.

When separate analyses were done for men and women the differences between Augsburg and Erfurt have been preserved, but significant differences were only observed in men and for birch pollen in women. The OR for atopic sensitization amount to 2.1 (95% CI: 1.6–2.8) in men and 1.2 (95% CI: 0.9–1.6) in women regarding Augsburg vs. Erfurt. In both sexes the clearest difference can be seen in positive specific IgE against birch pollen.

Table 2. Study population, sample size, number of participants and response in Augsburg and Erfurt, aged 25–64 years. MONICA Survey 1994/1995 in Augsburg and ECRHS in Erfurt 1991/1992

	Augsburg	Erfurt
Sample size (n)	2488	2215 ^a
Netto sample (n)	2418	2068 ^a
Participants (n)	1707	1662 ^a
Response in %	70.6%	80.4% ^a
Questionnaire on respiratory diseases		
Non-missing answers (n) to allergic rhinitis, wheezing and asthma attacks	1572–1591	1648–1653 ^a
Blood drawing for IgE analysis	1551	1167 ^b
Response in %	64.1%	56.5% ^b
Non-missing specific IgE (n)	754 ^c	1144 ^b
Complete data on allergic diseases and sensitization (n)	698–706	1132–1140

The response was defined as the proportion of participants out of the netto sample, defined as sample size minus lost subjects.

^a First stage, mailed questionnaire.

^b Second stage with examination and blood drawing.

^c 50% random sample of 782 subjects.

Table 3. Age standardized prevalences (%) of respiratory diseases, assessed by self-administered questionnaire, with 95% CI and age adjusted prevalence OR for the participants in Augsburg vs. Erfurt, aged 25–64 years, by sex. Results from the MONICA Survey 1994/1995 in Augsburg and the ECRHS Study in Erfurt 1991/1992

	Augsburg			Erfurt			Augsburg vs. Erfurt	
	n	%	95% CI	n	%	95% CI	OR	95% CI
Allergic rhinitis ^a								
All	1574	16.9	(15.1–18.9)	1648	9.4	(8.1–11.0)	2.0	(1.6–2.4)
Men	771	15.0	(12.6–17.8)	794	9.5	(7.6–11.8)	1.6	(1.2–2.3)
Women	803	18.9	(16.3–21.8)	854	9.3	(7.5–11.5)	2.3	(1.7–3.0)
Wheezing ^b								
All	1591	14.4	(12.8–16.3)	1653	11.5	(10.0–13.1)	1.3	(1.1–1.7)
Men	772	15.2	(12.8–18.0)	796	12.1	(9.9–14.6)	1.3	(1.0–1.8)
Women	819	13.8	(11.5–16.4)	857	10.8	(8.9–13.2)	1.3	(1.0–1.8)
Asthma ^c								
All	1572	2.3	(1.6–3.2)	1653	1.1	(0.7–1.8)	2.1	(1.2–3.6)
Men	771	2.1	(1.2–3.4)	796	1.1	(0.6–2.2)	1.8	(0.8–4.2)
Women	801	2.6	(1.6–4.0)	857	1.1	(0.6–2.2)	2.2	(1.0–4.8)

^a Do you have any nasal allergies including hay fever?

^b Have you had wheezing or whistling in your chest at any time in the last 12 months?

^c Have you had an attack of asthma in the last 12 months?

While no difference between sex in Erfurt could be observed (28% vs. 25%), in Augsburg sensitization was more frequent in men (44%) than in women (28%). In Augsburg positive specific IgE values were more frequent in men than in women, by around 3–6%, and the IgE against allergen of house dust mite was around 12% higher in men than in women. In Erfurt the differences between the sexes were not consistent. The prevalence of sensitization against birch pollen, cat and cladosporium appeared to be slightly higher in women, and like in Augsburg, the greatest difference was observed for house dust mite (+5.9% for men).

In Figure 1(b) the prevalences of atopic sensitization, divided by indoor and outdoor allergens stratified by 10-year age groups are shown. In contrast to allergic rhinitis, where a decrease of the differences with increasing age was observed, the differences in sensitization, specially against indoor allergens (② + ③), consistently remained across older age groups.

The proportion of atopic sensitization among persons with reported respiratory symptoms are given in Table 5. Of the persons with allergic rhinitis 75% were sensitized against one of the tested aeroallergens in Augsburg, but only 64% in Erfurt, resulting in an OR of 1.7 (95% CI: 0.9–3.1). For wheezing the sensitization rate was clearly lower (38% in Augsburg, 30% in Erfurt, OR: 1.4, 95% CI: 0.8–2.5). However, the strongest difference between the cities is found for asthma, where 58% of the asthmatics have allergic asthma in Augsburg, but only 31% in Erfurt (OR: 3.2, 95% CI: 0.7–15.3). The differences among diseased persons were statistically not significant. The observed differences between Augsburg and Erfurt resulted from those in men

while the proportions in women were nearly identical (data not shown).

The proportions of persons with allergic rhinitis, wheezing and asthma attacks after stratifying by status of atopic sensitization are given in Table 6. The proportions of allergic rhinitis and asthma in the non-sensitized strata were significantly lower than in the sensitized strata and no difference between the areas were found. But in the sensitized strata differences in symptoms of rhinitis and asthma between Augsburg and Erfurt were observed. To study the relation of atopic sensitization to respiratory symptoms multiple logistic regression models were used and the results of two models with respiratory symptoms as outcome are given in Table 6. In the first model only sex, age groups and an indicator variable for the area (Augsburg vs. Erfurt) were entered and in the second model atopic sensitization was added. Sensitization was a strong predictor for allergic rhinitis (OR: 6.7) and a weaker predictor of asthma (OR: 1.9). Moreover, the region variable remained nearly unchanged suggesting that the differences in respiratory symptoms between Augsburg and Erfurt are not completely explained by sensitization.

Stratified analyses by sex did not change the findings. In allergic rhinitis the east-west effect was found significant in non-sensitized women with the consequence that the east-west effect was found greater in women, which is just known from Table 3.

Discussion

Allergic rhinitis, wheezing and asthma were more frequently reported in Augsburg than in Erfurt.

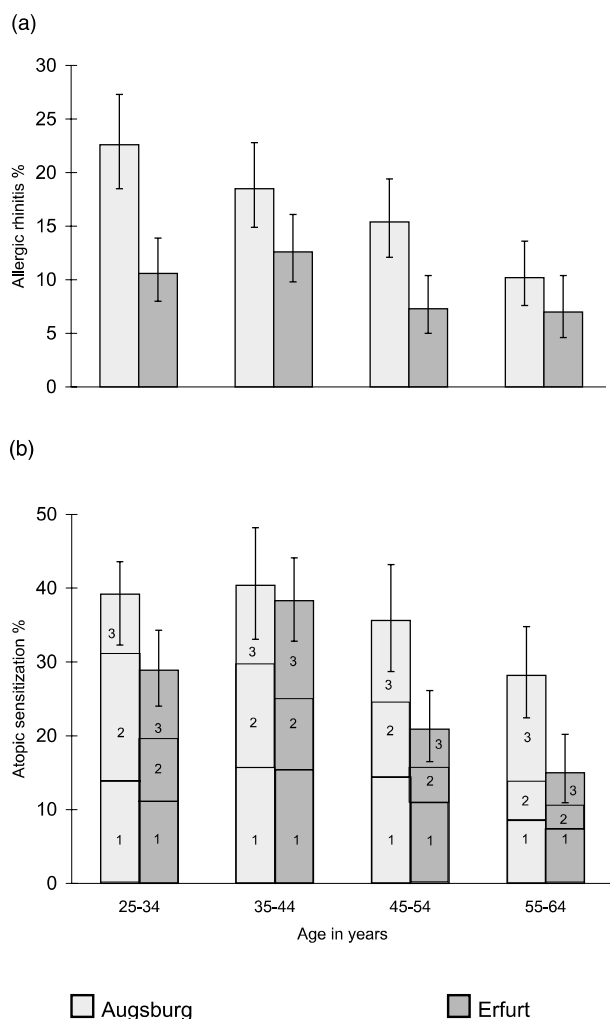


Figure 1. Prevalence (%) of allergic rhinitis (a), assessed by self-reported questionnaire, and of atopic sensitization (b), divided by sensitization against pollen alone ① indoor allergens alone ③ and both ② with 95% CI in 10-year age groups in Augsburg and Erfurt. Results from the subpopulation of the MONICA Survey 1994/1995 in Augsburg and the ECRHS Study in Erfurt 1991/1992.

Higher prevalences in atopic sensitization and sensitization against house dust mite, cat and birch were also observed in Augsburg, particularly in men.

The observed results from the comparison of two cross-sectional studies must be interpreted with some caution, because the study in Augsburg started 3 years later and the prevalences in Augsburg may be slightly overestimated. The east-west studies in 1994/1995 [10] showed no significant change within 3 years in self-reported allergies for the western subjects in Hamburg. Therefore there is no reason to assume that the situation in Augsburg has changed significantly in this period.

It was investigated whether a bias from non-response or selection of the subsamples exists. It is known [11] that lower response may overestimate prevalence of respiratory disease. A response bias in self-reported disorders could not be excluded. On the

other hand we could shown on the data in Erfurt that the prevalence in allergic rhinitis for example remained nearly unchanged (increased from 9.4 to 10.2%) when only the participants of the second stage ($n = 1144$) were analyzed, although the response decreased to 56%. Supposing a bias exist so that in Augsburg the prevalence in allergic rhinitis was overestimated by 1% the difference in comparison to Erfurt remained significantly different. No bias could be detected from the selection of the 50% random subsample in Augsburg. The prevalence of allergic rhinitis in the subsample ($n = 728$) was 15.9% in comparison to 16.9% for the whole city population.

Higher prevalences were found in Augsburg compared to Erfurt not only with respect to allergic rhinitis, wheezing and asthma, but also with respect to atopic sensitization. These results contribute to the east-west discussion. As shown in a review of German studies [12] the prevalence of physician-diagnosed allergic rhinitis was higher in western than in eastern Germany and the prevalence of asthma tended to be higher. Sensitization as measured by RAST or skin-prick tests was compared in few studies and was increased in western Germany in children [13, 14] and adults [4, 15]. Similar results were reported from a comparison between Sweden and Poland in school children [16] and between Sweden and Estonia in adults [17]. Lifestyle differences between the western and socialist countries are discussed [18, 19]. Possible explanations for the differences are factors such as increased exposure to allergen, less 'training' of immunologic defense by infectious diseases [20] and nutritional factors [21]. Trends in eastern Germany from 1992/1993 to 1995/1996 were studied and increased self-reported prevalence of allergic rhinitis in adults [10], physician diagnosed allergic diseases [22] and hay fever [23] in children were observed. The reported trends in sensitization differed, whereas the prevalence of atopic sensitization in children, as assessed by skin-prick test, increased [23], no change was observed in adults by using serum RAST test [22]. No difference between east and west were reported in skin test reactivity among children 5 years after unification [24].

While in Erfurt similar prevalences in men and women were observed, in Augsburg self-reported rhinitis was more frequent in women. Some other studies in adults agree with the results in Erfurt [4, 25, 26] and one with Augsburg [27]. On the other hand higher sensitization in men was found in Augsburg, which agree to [14, 25] and no sex differences in Erfurt except to mites. Sensitization against house dust mite was strongly elevated in men compared to women, a result that was also found by others [28–30].

Like in other studies [15, 25, 29, 31] allergic rhinitis decreases with age and the levels in west and east are similar in subjects over 55 years. Looking at the

Table 4. Age standardized prevalences (%) of atopic sensitization with 95% CI and age adjusted prevalence OR for the participants in Augsburg vs. Erfurt, aged 25–64 years, by sex. Results from the subpopulation of the MONICA Survey 1994/1995 in Augsburg and the ECRHS Study in Erfurt 1991/1992

Sensitization ^a	Augsburg (n = 379 men, 375 women)		Erfurt (n = 585 men, 559 women)		West vs. east	
	%	95% CI	%	95% CI	OR	95% CI
Total ^b						
All	36.2	(32.8–39.7)	26.1	(23.6–28.7)	1.7	(1.4–2.0)
Men	44.2	(39.2–49.4)	27.6	(24.1–31.5)	2.1	(1.6–2.8)
Women	28.3	(23.9–33.2)	24.5	(21.0–28.3)	1.2	(0.9–1.6)
Grass						
All	19.3	(16.6–22.3)	16.1	(14.1–18.4)	1.2	(1.0–1.6)
Men	22.4	(18.4–26.9)	17.1	(14.2–20.4)	1.4	(1.0–2.0)
Women	16.1	(12.6–20.3)	15.1	(12.3–18.4)	1.1	(0.7–1.5)
Birch						
All	16.1	(13.5–18.9)	7.4	(6.0–9.1)	2.4	(1.7–3.2)
Men	17.7	(14.1–22.0)	7.2	(5.3–9.7)	2.8	(1.8–4.2)
Women	14.5	(11.1–18.5)	7.7	(5.7–10.3)	2.0	(1.3–3.0)
Cat						
All	10.5	(8.5–12.9)	5.2	(4.0–6.6)	2.2	(1.5–3.1)
Men	12.5	(9.4–16.2)	4.6	(3.1–6.7)	3.0	(1.8–4.9)
Women	8.6	(6.1–12.0)	5.7	(4.0–8.1)	1.5	(0.9–2.5)
Mite						
All	15.8	(13.3–18.6)	10.7	(9.0–12.6)	1.7	(1.3–2.2)
Men	21.7	(17.8–26.1)	13.6	(11.0–16.7)	1.8	(1.3–2.6)
Women	10.1	(7.4–13.7)	7.7	(5.7–10.3)	1.3	(0.8–2.1)
Cladosporium						
All	1.8	(1.0–3.1)	2.6	(1.8–3.8)	0.65	(0.3–1.3)
Men	2.4	(1.2–4.6)	2.6	(1.5–4.3)	0.93	(0.4–2.2)
Women	1.1	(0.4–3.0)	2.7	(1.6–4.6)	0.38	(0.1–1.1)

^a Defined as positive if CAP > 0 (antibodies ≥ 0.35 kU/L).

^b Positive if at least one of the five specific IgE was positive.

Table 5. Proportion (%) of atopic sensitized persons (*m*) in subjects with self reported symptoms of allergic respiratory diseases (*n*) for the participants in Augsburg and Erfurt, aged 25–64 years. Results from the subpopulation of the MONICA Survey 1994/1995 in Augsburg and the ECRHS Study in Erfurt 1991/1992

	Augsburg			Erfurt			West vs. east	
	Diseased	Sensitized	Proportion	Diseased	Sensitized	Proportion		
	<i>n</i>	<i>m</i>	%	<i>n</i>	<i>m</i>	%	OR	95% CI
Allergic rhinitis ^a	111	83	75	114	73	64	1.7	(0.9–3.1)
Wheezing ^b	109	41	38	125	38	30	1.4	(0.8–2.5)
Asthma ^c	19	11	58	13	4	31	3.2	(0.7–15.3)
Asymptomatic ^d	500	142	28	913	202	22	1.5	(1.1–1.9)

^a Do you have any nasal allergies including hay fever?

^b Have you had wheezing or whistling in your chest at any time in the last 12 months?

^c Have you had an attack of asthma in the last 12 months?

^d Whether rhinitis, wheezing or asthma attacks.

atopic sensitization, above 35 years a stronger decrease with age was seen in eastern than in western subjects and significant east-west differences were observed in subjects aged 45–64 years. The studies

with an extended age range reported a strong decrease in the prevalence of skin test reactivity [32] with age up to 74 years and the only east-west comparison [14] in adults up to 69 years observed similar

Table 6. Proportion (%) of self-reported symptoms of allergic respiratory diseases, stratified by status of atopic sensitization with adjusted OR from different models for the participants in Augsburg vs. Erfurt, aged 25–64 years. Results from the subpopulation of the MONICA Survey 1994/1995 in Augsburg and the ECRHS Study in Erfurt 1991/1992

	Atopic sensitized persons			Non-atopic sensitized persons			All	
	Augsburg		Erfurt	Augsburg		Erfurt	Model 1 ^a	Model 2 ^b
	(n = 252–253)	(n = 298–301)	West vs. east ^a	(n = 446–454)	(n = 831–839)	West vs. east ^a	West vs. east	West vs. east
	%	%	OR (95% CI)	%	%	OR (95% CI)	OR (95% CI)	OR (95% CI)
Allergic rhinitis ^c	32.8	25.5	1.7 (1.2–2.5)	6.3	4.9	1.3 (0.8–2.1)	1.7 (1.3–2.3)	1.5 (1.1–2.0)
Wheezing ^d	16.3	12.6	1.2 (0.8–2.0)	15.0	10.4	1.5 (1.1–2.1)	1.4 (1.1–1.9)	1.2 (0.9–1.7)
Asthma ^e	4.4	1.3	3.2 (1.0–10.2)	1.8	1.1	1.7 (0.6–4.5)	2.3 (1.1–4.8)	2.2 (1.0–4.4)

^a Logistic regression models for the three outcome variables with a dummy variable for the effect west vs. east, adjusted for 10-year age groups and sex.

^b Logistic regression models for the three outcome variables with dummy variables for the effect west vs. east and the status of sensitization, adjusted for 10-year age groups and sex.

^c Do you have any nasal allergies including hay fever?

^d Have you had wheezing or whistling in your chest at any time in the last 12 months?

^e Have you had an attack of asthma in the last 12 months?

prevalences in adults over 45 years in East and West Germany, based on a serological test screening to common aeroallergens (SX1). However, the difference between Augsburg and Erfurt among those aged 55–64 years seems to follow by indoor allergens which might suggest that indoor allergens play locally in the city of Augsburg a strong role.

The association between atopic sensitization and allergic rhinitis seems similar in western and eastern Germans. The greatest proportion of sensitization with 75 and 64% were observed in subjects with allergic rhinitis, in comparison to 28 and 22% in asymptomatic subjects. Looking at the prevalences of allergic rhinitis in strata of sensitization status the association was seen too, rhinitis was reported by 33 and 26% of sensitized and by 6 and 5% of non-sensitized persons. Similar results for asthma and atopy assessed by prick tests in children were reported [12].

The prevalences of asthma and allergic rhinitis is influenced by sensitization in eastern and western subjects (Table 6) and the found OR are similar to those elsewhere reported for skin test reactivity among whites aged 25–75 years [33]. The proportion of sensitization was increased in the western population, in those with allergic rhinitis or asthma, and in asymptomatic subjects. But the difference in sensitization was not able to explain the differences in the prevalence of allergic respiratory symptoms between the west and the east, which is not in line to the findings in children [12]. Further data are needed to answer the question if the increased prevalence of reported symptoms in west is due to a heightened awareness regarding atopic diseases.

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