

Allergic rhinitis is often undiagnosed and untreated: results from a general population study of Danish adults

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Abstract

Introduction: A few earlier studies have indicated that allergic rhinitis (AR) is underdiagnosed and undertreated.

Objective: To assess awareness, diagnosis and treatment of AR in a general population of Danish adults.

Methods: Between October 2007 and June 2008, a total of 1277 consecutive participants in a Danish general population study of 18- to 69-year olds were skin-prick-tested and asked about respiratory symptoms. AR was defined as a combination of self-reported rhinitis symptoms and skin-prick test reactivity against inhalant allergens. Participants reporting rhinitis symptoms completed an additional questionnaire on medication for rhinitis symptoms.

Results: The prevalence of AR was 23.1%. A total of 43.6% ($n = 122/280$) of persons with AR had not received any treatment in the previous 12 months, and only 56.6% ($n = 163/288$) had been given a diagnosis of hay fever by a doctor. Both AR and lower airway symptoms indicating more severe AR were reported in 48.5% ($n = 143/295$). These persons were significantly more likely to having received treatment in previous 12 months and a diagnosis of hay fever.

Conclusion: Our results support that even in an affluent country like Denmark, AR is often undiagnosed and untreated. There appears to be a need for increased awareness of AR with regard to both diagnosis and treatment.

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Key words

allergic rhinitis – allergy – undiagnosed – undertreatment – prevalence

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Authorship and contributorship

Christian Grønhøj Larsen: drafting, revision and final approval of the article; Mette Gyldenløve: drafting, statistics, revision and final approval of the article; Allan Linneberg: PI of the Health2006 study, conceived the idea of the study, drafting, revision and final approval of the article.

Ethics

The study was approved by the local ethics committee (KA20060011). All participants gave their informed written consent before their inclusion in the study.

Conflict of interest

The authors have stated explicitly that there are no conflicts of interest in connection with this article.

Introduction

Allergic rhinitis (AR) is associated with many comorbidities, e.g. asthma, conjunctivitis, sinusitis and atopic eczema. Furthermore, AR is associated with lower quality of life, poorer job or school performance, and AR symptoms may interfere with sleep, intellectual functioning and recreational activities (1). For these reasons, proper diagnosis and correct treatment are important. In 2000, a questionnaire was sent to a general population sample of 14- to 44-year olds living

in Copenhagen (Denmark). From among the 5849 responders (54%), all persons who reported respiratory symptoms were invited to a clinical examination, and 1149 were examined. Out of these, 726 participants met the criteria of asthma and/or AR. Of these subjects, 571 suffered from AR, 233 (32%) were undiagnosed (unaware), 339 (59%) were untreated, and 244 (83%) with moderate-to-severe AR were undertreated according to GINA and ARIA guidelines (2).

The aim of the present study was to examine the extent of awareness, diagnosis and treatment of AR in

a general population of Danish adults examined in 2006–2008.

Materials and methods

We used data from a cross-sectional general population study, the Health2006. In brief, a random sample of 7931 18- to 69-year-old individuals living in 11 municipalities in the Western part of Copenhagen was invited to a health examination at the Research Centre for Prevention and Health. During 2006–2008, a total of 3471 persons participated in a health examination and filled out a comprehensive questionnaire on health, lifestyle and socio-economic factors. The Health2006 study has been described in more detail elsewhere (3). From 1 October 2007 to 12 June 2008, all consecutive participants in the Health2006 who reported at least one rhinitis symptom were eligible for the additional questionnaire on medication for nasal symptoms (Table 1).

We defined a patient as having rhinitis symptoms if answering 'yes' to one or more of the following questions: 'Have you, within the last 12 months, had an itchy or stuffy nose, or have you been sneezing in the summer season?', 'Have you, within the last 12 months, had an itchy or stuffy nose, or have you been sneezing in the winter season?', 'Have you, within the last 12 months, had an itchy or stuffy nose, or have you been sneezing following exposure to grass, trees, or flowers?', 'Have you, within the last 12 months, had an itchy or stuffy nose, or have you been sneezing following exposure to furry animals, e.g. horse, dog, cat, rabbit, guinea pig or hamster?' and 'Have you, within the last 12 months, had an itchy or stuffy nose, or have you been

sneezing following exposure to dust when cleaning rooms or making beds, or when in bed?'

All participants were skin-prick-tested by using the Soluprick skin-prick test (SPT) system (Soluprick, ALK, Hørsholm, Denmark). Reactions were read after 15 min by measuring the largest diameter of each wheel and its orthogonal, and dividing the number by two, thereby calculating the mean wheal diameter (MWD). An SPT was positive if the MWD to a specific allergen was 3 mm or greater after subtraction of the negative control MWD. We defined SPT reactivity to any allergen as a positive SPT to at least 1 of 10 inhalant allergens: birch pollen, grass pollen, sagebrush pollen, horse, dog, cat, *Dermatophagoides pteronyssinus* (dust mite), *Dermatophagoides farinae* (dust mite) and *Alternaria alternata* (mould). We defined AR as a minimum of one rhinitis symptom in combination with atopy. The term 'AR with lower airway symptoms' was used when a positive answer was given to at least one of the following three questions: (i) 'Within the last 12 months, have you experienced shortness of breath or trouble breathing following exposure to dust when cleaning rooms or making beds, or when in bed?'; (ii) 'Within the last 12 months, have you experienced shortness of breath or trouble breathing following exposure to furry animals, e.g. horse, dog, cat, rabbit, guinea pig or hamster?'; and (iii) 'Within the last 12 months, have you experienced shortness of breath or trouble breathing following exposure to grass, trees or flowers?'

The main questionnaire included the question: 'Has a doctor ever told you that you have hay fever?' In the following, participants answering 'yes' to this question are referred to as having 'self-reported doctor-diagnosed hay fever'.

Table 1. Wording of the additional questionnaire on medication for nasal symptoms

Wording of additional questionnaire
(A) Have you, <u>within the past 12 months</u> , taken any kind of medication for symptoms from your nose? ('yes', 'no')
(B) Have you taken spray/powder medicine for inhalation through the nose? If yes, was this medicine prescribed? ('yes', 'no') What type of medicine was it? (feel free to check more than one answer) ['adrenocortical hormones (steroids)', 'antihistamines', 'adrenergics (nasal spray like otrivin)', 'other']
(C) Have you, <u>within the past 12 months</u> , been given an injection in the muscle/skin for the symptoms of your nose? (adrenocortical hormone as storage) ('yes', 'no')
(D) Have you, <u>within the past 12 months</u> , taken medication (antihistamine/allergy pills) for the symptoms of your nose? ('yes', 'no') If yes, was this medication prescribed?
(E) Have you ever been treated with immunotherapy (allergy vaccination) for the symptoms of your nose? ('yes', 'no') If yes, which allergen were you treated with? (feel free to check more answers) ('grass', 'birch', 'house dust mite', 'cat', 'dog') Are you still being treated for this? ('yes', 'no') For how many years have you been receiving immunotherapy/allergy vaccination? ('6 months', '1 year', '2 years', '3 years', '4 years or more')
(F) Have you, <u>within the past 12 months</u> , been given medicine (eye drops) for the symptoms of your eyes? ('yes', 'no')

Table 2. Characteristics of the study population

	Total population, <i>n</i> = 1277	Patients with AR, <i>n</i> = 295	Patients without AR, <i>n</i> = 982
Age (years)	49.7 ± 13.2	45.3 ± 13.1	51.1 ± 13.0
Gender, men	44.3	49.8	42.7
BMI (kg/m ²)	26.1 ± 4.7	25.8 ± 4.5	26.1 ± 4.8
Daily smoking	20.8	15.3	22.5
Atopy*	30.3	100	9.4
AR	23.1	100	0
FEV ₁ , (L)	3.1 ± 0.8	3.4 ± 0.8	3.1 ± 0.8
FVC, (L)	4.0 ± 1.0	4.3 ± 1.0	3.9 ± 1.0
Education (years)	3.6 ± 2.6	3.6 ± 1.6	3.7 ± 2.9

*Atopy is defined by SPT reactivity to any inhalant allergen.

Categorical variables are presented in percentages. Continuous variables are presented in means ± standard deviations.

BMI, body mass index; AR, allergic rhinitis; FEV₁, forced expiratory volume in 1 s; FVC, forced vital capacity.

Statistical analysis

Statistical analyses were performed using IBM SPSS Statistics 19.0 (IBM SPSS, Chicago, IL, USA). Data are presented as absolute numbers and percentages, and the chi-squared test was used to compare categorical variables. *P* values <0.05 were considered statistically significant.

Results

The present analyses are based on 1277 consecutive participants examined from 1 October 2007 to 12 June 2008 (Table 2). A total of 723 participants (56.6%) reported at least one symptom of rhinitis and were therefore eligible for the additional questionnaire on medication for nasal symptoms. Median age was 45 years (range 20–72), and 49.8% of the participants were men.

We found that 23.1% (*n* = 295/1277) of participants had AR (both rhinitis symptoms and SPT reactivity), and out of these, 56.6% (*n* = 163/288) had been given a diagnosis of hay fever by a doctor. Further, 43.6% (*n* = 122/280) of individuals with AR had not received any treatment for rhinitis symptoms during the previous 12 months. Among participants having received treatment within last 12 months, a total of 63.5% (*n* = 99/156) had taken intranasal corticosteroids, 71.0% (*n* = 110/155) had antihistamine tablets, and 4.7% (*n* = 7/149) had been given a systemic corticoid injection within the last year. A total of 14.6% (*n* = 41/281) of the patients with AR reported to having ever received allergen specific immunotherapy (SIT). SIT had been given to 9.8% (*n* = 4/41) for 6 months, to

12.2% (*n* = 5/41) for 1 year, to 39.0% (*n* = 16/41) for 2 years, to 22.0% (*n* = 9/41) for 3 years, and to 12.2% (*n* = 5/41) for 4 years or more. Allergens included grass (*n* = 25), birch (*n* = 11), house dust mites (*n* = 12), cat (*n* = 8) and dog (*n* = 4).

A total of 48.5% (*n* = 143/295) of participants with AR also reported lower airway symptoms during the last 12 months. We defined these as more severe cases of AR. A total of 37.0% (*n* = 50/135) of severe cases had *not* received treatment in previous 12 months (Table 3).

AR severity defined by the presence of lower airway symptoms was significantly associated with both having received treatment within the last 12 months (Table 3) and a diagnosis of hay fever by a doctor (Table 4). Gender and age were not significantly associated with treatment or diagnosis. Interestingly, current smokers as compared with non-smokers were significantly less likely to having received treatment in last 12 months (Table 3).

Discussion

The aim of the present study was to evaluate the extent of diagnosis and treatment of AR in a general population of adults in Denmark. Defining AR as coexistence of allergic symptoms and a positive SPT to inhalant allergens, we found that AR was present in 23% of the study population. Of these, 43.4% were undiagnosed, and 43.6% had not received any treatment in the last 12 months despite reporting having had symptoms. Guidelines recommend that patients with moderate AR be offered intranasal corticosteroids and advice on allergen avoidance. Cases with AR and upper airway

Table 3. Determinants of having received treatment for nasal symptoms in the last 12 months among persons with allergic rhinitis (AR) ($n = 295$) in a general population of Danish adults

		Treated, % ($n = 158$)	Untreated, % ($n = 122$)	<i>P</i> value
Gender	Male	57.2 ($n = 79/138$)	42.8 ($n = 59/138$)	0.786
	Female	55.6 ($n = 79/142$)	44.4 ($n = 63/142$)	
Age (years)	18–35	56.9 ($n = 41/72$)	43.1 ($n = 31/72$)	0.340
	36–53	59.5 ($n = 88/148$)	40.5 ($n = 60/148$)	
	54–71	48.3 ($n = 29/60$)	51.7 ($n = 31/60$)	
AR severity	AR with lower airway symptoms	63.0 ($n = 85/135$)	37.0 ($n = 50/135$)	0.033
	AR without lower airway symptoms	50.3 ($n = 73/145$)	49.7 ($n = 72/145$)	
Current smoking	Yes	44.2 ($n = 23/52$)	55.8 ($n = 29/52$)	0.049
	No	59.2 ($n = 135/228$)	40.8 ($n = 93/228$)	

symptoms could be candidates for immunotherapy (4, 5). We found that 48.5% of participants had AR and reported lower airway symptoms, which we considered to be more severe cases of AR. A total of 37.0% of these participants with AR and lower airway symptoms had not received any treatment in the previous 12 months. Patients with AR are at high risk of asthma (6), why early detection and treatment of AR is important to reduce symptoms and prevent development of asthma.

Our results support one earlier Danish study performed in 2000 in a general population in Copenhagen in that AR is often not diagnosed. In that study, 32% of persons that were diagnosed with AR as part of the screening had not received a diagnosis of AR before the study, and 83% of persons with moderate-to-severe AR were untreated or only treated with antihistamines (2). Notably, Nolte *et al.* used the ARIA classification (7) to determine the moderate-to-severe cases. Those results were relatively consistent with international data from eight European countries showing that 1/3 of screen-detected cases of AR in the general population were undiagnosed (8).

We found that 43.4% of participants with AR had not been given a diagnosis of hay fever. This figure is

higher than that reported by Nolte *et al.* (32%) (2). This disparity probably reflects differences in the methods used between the two studies. However, both figures are surprisingly high.

It should be considered whether our study population is representative of the background population of Copenhagen. As previously reported, participants in the Health2006 study population were older and included more women as compared with the sample that were invited to the study. However, the prevalence of AR as defined by both symptoms and skin-prick test reactivity to inhalant allergens was found to be 22% in a previous study in the same background population performed in 1998 (9). This figure is quite similar to the figure observed in the present study. Copenhagen is an urbanised area and known to have a higher prevalence of AR as compared with more rural parts of Denmark (10). The few practising allergologists in Denmark are mainly placed in the Copenhagen area, which might influence the rate of undiagnosis. Thus, it may be speculated that the rate of undiagnosis may even be higher outside the Copenhagen area. However, there is no data on the rate of undiagnosis in other areas of Denmark outside Copenhagen. AR is a heterogeneous disease also including many mild cases that do

Table 4. Determinants of having received a diagnosis of hay fever by a doctor among persons with allergic rhinitis (AR) ($n = 295$) in a general population of Danish adults

		Diagnosed, % ($n = 163$)	Undiagnosed, % ($n = 125$)	<i>P</i> value
Gender	Male	53.1 ($n = 77/145$)	46.9 ($n = 68/145$)	0.228
	Female	60.1 ($n = 86/143$)	39.9 ($n = 57/143$)	
Age (years)	18–36	50.6 ($n = 39/77$)	49.4 ($n = 38/77$)	0.346
	37–55	57.0 ($n = 85/149$)	43.0 ($n = 64/149$)	
	56–71	62.9 ($n = 39/62$)	37.1 ($n = 23/62$)	
AR severity	AR with lower airway symptoms	64.5 ($n = 91/141$)	35.5 ($n = 50/141$)	0.008
	AR without lower airway symptoms	49.0 ($n = 72/147$)	51.0 ($n = 75/147$)	
Daily smoking	Yes	48.1 ($n = 26/54$)	51.9 ($n = 28/54$)	0.165
	No	58.5 ($n = 137/234$)	41.5 ($n = 97/234$)	

not necessarily need medication. This should be taken into account when evaluating the rate of treatment in our population. However, we believe that a proper diagnosis is relevant and at least AR patients that in addition report lower airways symptoms should be offered treatment.

We have previously reported that the prevalence of our definition of AR is quite similar to self-reported doctor-diagnosed hay fever (9). However, we did not use questions according to international consensus, which may limit generalisability of our results. We assumed that AR with lower airway symptoms is likely a more severe phenotype of AR, but we cannot be certain that this phenotype fulfils strict criteria for asthma. We used questions on AR symptoms that have been employed in our previous population-based studies since 1990 in order to be able to compare trends over time. These questions have previously been validated against immunoglobulin E sensitisation and found to be reasonably accurate (9, 11). Our questionnaire did not include questions on infectious rhinitis, and some misclassification of AR with infectious rhinitis cannot be excluded.

In Denmark, diagnosis and treatment of AR in adults are mainly provided by general practitioners. The observed high number of undiagnosed participants with AR suggests a need for increased attention on AR by Danish general practitioners. Furthermore, a substantial number of patients with AR, even among those who had experienced both upper and lower airways symptoms in the last 12 months, had not received any treatment during the last 12 months. There are several options for treatment of AR, e.g. antihistamines, nasal steroids and allergen-SIT that can effectively reduce symptoms and increase quality of life. Our data suggest that many patients with AR, even those with AR and lower airway symptoms, do not receive optimal treatment.

In conclusion, our results support that even in an affluent country like Denmark AR is often undiagnosed and untreated. There appears to be a need for increased awareness of AR with regard to both diagnosis and treatment.

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