

Prevalence of Possible Occupational Asthma in Hairdressers Working in Hair Salons for Women

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Key Words

Persulfate salts • Rhinitis • Dermatitis • Chronic bronchitis

Abstract

Background: The aim of this study was to determine the prevalence of possible occupational asthma (OA) in hairdressers. **Methods:** A telephone questionnaire (Q1) was administered to 1,334 individuals from a total of 1,875 hairdressers working in hair salons for women in Barcelona (response rate 71%) to identify those with respiratory symptoms. Multiple correspondence analysis showed 5 specific questions for assessing symptoms of asthma. Individuals who gave a positive response to 1 of these questions ($n = 251$) were given a second validated questionnaire (Q2) to identify those with suspected OA. OA was defined according to a classification tree based on the response to queries on nasal itching, daily symptoms throughout the week at work, nasal secretions, voice loss, wheezing, and sputum production as reported previously. Moreover, we calculated the prevalence of OA according to the conventional criteria of improvement and/or worsening of symptoms in relation to exposure at work and during off-work time on weekends and during vacations. **Results:** Asthma was present in 9.5%

of hairdressers. From Q2 data, 72 were classified as having possible OA, yielding a prevalence of OA from 5.4 (72/1,334) to 7.8% according to the classification tree previously described. A prevalence from 4.6 (62/1,334) to 6.7% was obtained using conventional criteria. Rhinitis or dermatitis (OR 7.80), as well as exacerbation of symptoms at work and persistence of symptoms on weekends (OR 2.99) were associated with the development of OA. **Conclusions:** Hairdressing employment can induce asthma. Episodes of rhinitis or dermatitis seem to be risk factors for the development of OA in this population.

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Introduction

Asthma, together with disease due to asbestos exposure, is the most common occupational lung disease in industrialized countries [1]. Occupational exposure is estimated to be responsible for 10–25% of all asthma cases

M.E. and X.M. contributed equally to the design and development of this study.

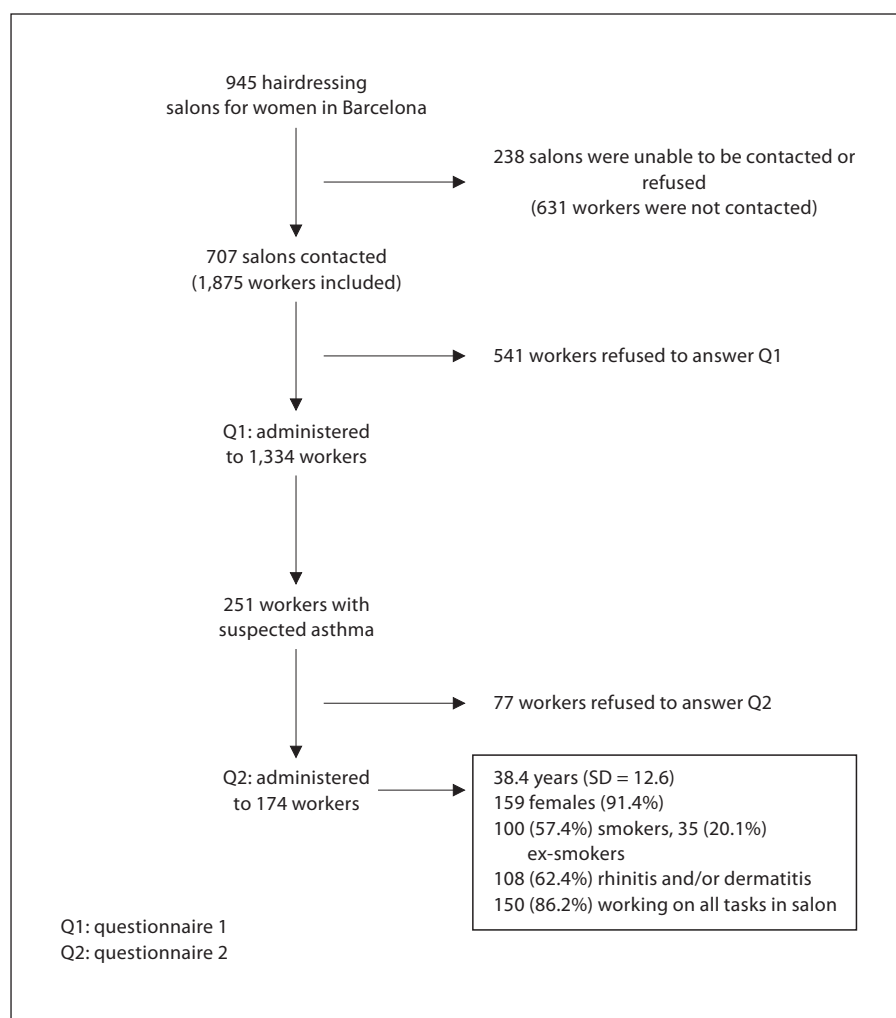


Fig. 1. Flow chart of the study population.

in adults [2], and numerous professions associated with causal agents and an increased risk for this condition have been identified [3]. According to several registries of voluntary notification, isocyanates are the most frequently implicated agents in the genesis of this entity although others such as flour, latex, and persulfate salts are gaining importance [4–7].

The first cases of occupational asthma (OA) due to persulfate salts were described in hairdressers [8] and persulfate production workers in the chemical industry [9] 35 years ago. To date, the incidence of this disease has shown discrepancies and differences between countries. Based on the English Registry of Surveillance of Work-Related and Occupational Respiratory Disease, Cullinan and Newman Taylor [10] reported that the estimated incidence of OA in hairdressers is around 81 cases per 1 million exposed persons per year, whereas Albin et al. [11]

found an incidence of 3.9 per 1,000 exposed persons per year in female hairdressers in Sweden. Other registries, such as the Canadian physician-based surveillance system [5], have recorded very few cases of OA due to persulfates, whereas in the Spanish [7] and French [6] registries persulfates are the second most frequent cause of OA in women.

Discrepancies as to the prevalence of this condition have also been observed. In a cross-sectional study of employees in a hairdressing salon, Blainey et al. [12] found that 4 of 23 subjects had OA caused by exposure to persulfate salts. In another cross-sectional study performed in 32 employees of a persulfate-producing chemical plant, Merget et al. [13] concluded that exposure to workplace concentrations of ammonium and sodium persulfate of about 1 mg/m³ were not associated with a risk of OA. Lastly, Leino et al. [14] conducted a study including 355

hairdressers aged 15–54 years. Among the 189 individuals reporting work-related skin and respiratory symptoms in a computer-aided telephone interview, 130 underwent physical examination, lung function testing, prick and patch testing, and nasal and lung challenge. The authors concluded that work-related skin and respiratory symptoms are common among hairdressers, but the reported prevalence of OA was only 0.8%.

Despite these discrepancies in the incidence and prevalence of OA in hairdressing professionals and the fact that the number of reported series on this subject is scant [12, 15–17], there is emerging evidence that OA may be an important work-related health problem in this population. Recent studies have shown that the prevalence of respiratory symptoms in hairdressers may range from 25 [18] to 45% [19]. Moreover, the incidence of bronchial hyperresponsiveness was reported to be higher in apprentice hairdressers than in the control population [20].

In this context, the aim of this study was to assess the prevalence of OA in a large population of hairdressers and to evaluate the associations between OA and various risk factors through the use of specific questionnaires adapted from the European Community Respiratory Health Survey (ECRHS) [21] and the items found to be most useful for identifying subjects with OA, as recently described by Vandenplas et al. [22].

Methods

Part 1

A cross-sectional study was conducted in the city of Barcelona (Spain). The project was approved by the hospital ethics committee for clinical research. Hairdressers working in hair salons for women were identified using a guide to Barcelona that provides free advertising for businesses and includes all of the salons operating in the city. A total of 945 hair salons for women were identified and 707 could be contacted, yielding a potential study population of 1,875 hairdressers. Errors in the contact information or refusal of the owners to contact employees excluded 238 salons, representing approximately 631 subjects (fig. 1).

Between July 2004 and July 2005, attempts were made to administer a short questionnaire (Q1) by telephone to all 1,875 eligible subjects. The participants were not informed about the main study hypothesis, i.e. the association between exposure to hairdressing products and asthma. The questionnaire included questions on symptoms extracted from the ECRHS survey [21] (Appendix 1). Telephone contact with the majority of participants was made from Tuesday to Thursday between 16:00 and 18:00 h.

Using multiple correspondence analysis (MCA) (see Statistical Analysis) we studied the association patterns (fig. 2) in the set of variables related to respiratory symptoms [(a), (f), (i), (j), (k), (l), and (m)] among the Q1 questions shown in Appendix 1. Asthma was defined based on an affirmative answer to at least 1 of 3 ques-

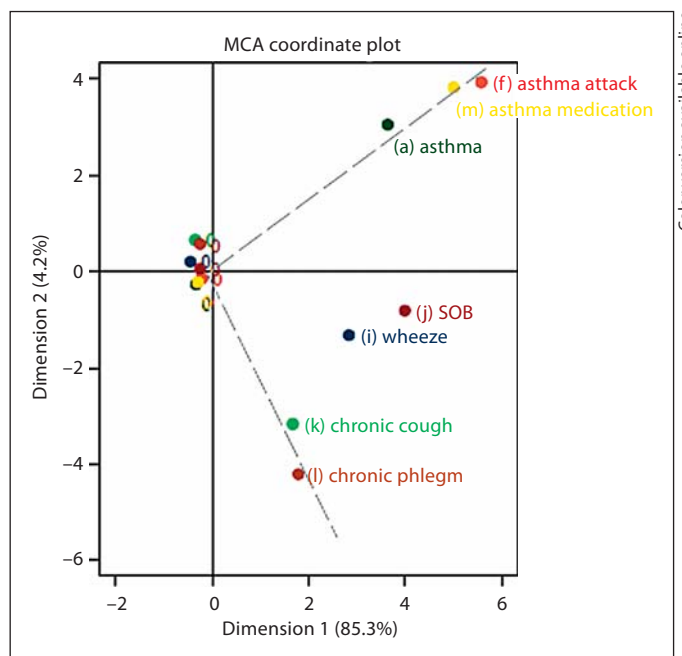


Fig. 2. MCA of Q1.

tions (a), (f), or (m). Chronic bronchitis was defined based on a positive answer to questions (k) and/or (l) and negative answers to all 3 asthma questions (a), (f), or (m). Rhinitis was established with a positive answer to questions (c) and/or (g), and dermatitis with a positive answer to questions (b) and/or (h).

Part 2

Between July 2005 and November 2006, attempts were made to administer a second questionnaire (Q2) via telephone contact with hairdressers who had answered positively to at least 1 of the following questions: (a), (f), (i), (j), or (m), based on the self-reported data collected in the first questionnaire (n = 251). According to the MCA, questions (a), (f), and (m) were closely related to asthma and questions (i) and (j) were possibly related to asthma. Q1 identified general (not necessarily work-related) symptoms, whereas Q2 was more specific, providing more detailed information on the symptoms and whether they were related to work. The items of information formulated and prospectively obtained from each participant are listed in Appendix 2. The questionnaire items were adapted to hairdressers from a list selected by Vandenplas et al. [22] as the most useful items for identifying subjects with possible OA and suggested for use in clinical assessment of this condition.

We defined possible OA according to a classification tree based on the response to questions regarding nasal itching, daily symptoms throughout the week at work, nasal secretions, voice loss, wheezing, and sputum, as previously reported by Vandenplas et al. [22]. Moreover, we calculated the prevalence of possible OA according to the conventional criteria of improvement and/or worsening of symptoms in relation to exposure at work and off work on weekends and during vacation periods.

Table 1. Prevalence of respiratory symptoms among the hairdresser population (n = 1,334)

		Prevalence		
		n	%	95% CI
(a)	Has a doctor ever told you that you have asthma?	109	8.2	6.8–9.8
(b)	Has a doctor ever told you that you have dermatitis?	147	11.0	9.4–12.8
(c)	Has a doctor ever told you that you have rhinitis?	143	10.7	9.1–12.5
(d)	Are you a smoker?	527	39.5	36.9–42.2
(e)	Are you an ex-smoker?	232	17.4	15.4–19.5
(f)	Have you had an asthma attack in the last 12 months?	47	3.5	2.6–4.7
(g)	Have you had allergic rhinitis in the last 12 months?	280	21.0	18.8–23.3
(h)	Have you had eczema or skin allergies in the last 12 months?	252	18.9	16.8–21.1
(i)	Have you had wheezing or whistling sounds in your chest in the last 12 months?	179	13.4	11.6–15.4
(j)	Have you had trouble breathing at night in the last 12 months?	77	5.8	4.6–7.2
(k)	Do you usually cough most days for at least 3 months a year?	228	17.1	15.1–19.2
(l)	Do you cough up phlegm during at least 3 months a year?	158	11.8	10.2–13.7
(m)	Have you taken any asthma medication in the last 12 months?	73	5.5	4.3–6.8

Statistical Analysis

MCA is a graphic tool used to assess the co-occurrence of categorical variables and summarize them into fewer variables [23]. In this case, it was applied to define asthma and chronic bronchitis by examining the association structures inherent to 8 respiratory symptoms based on the paired associations between them. MCA suggested the presence of 2 patterns. The first group of correlating variables included questions (a), (f), and/or (m), which were labeled *asthma*. The second group included questions (k) and (l), which were labeled *chronic bronchitis* (fig. 2). The 95% confidence intervals (CIs) for the prevalence of respiratory symptoms were calculated assuming a binomial distribution. A χ^2 test was used to assess associations in contingency tables. An unpaired t test was used to test differences in mean age between the 2 groups. The Kruskal-Wallis test was used to test whether the distribution of the duration of exposure at work and the interval between the onset of exposure and the onset of symptoms differed between the groups.

Univariate and multivariate associations of possible OA with subject characteristics and work-related variables were evaluated using logistic regression analysis, obtaining odds ratios (ORs), and using 95% CIs.

Results

Part 1

Among 1,875 eligible hairdressers, Q1 data were obtained for 1,334 subjects (response rate 71%) (fig. 1). The mean age (SD) of the responding individuals was 39.7 years (13.2); 1,207 (90.5%) were women; 527 (39.5%) were smokers, and 232 (17.4%) were ex-smokers.

The prevalence of any respiratory symptom in the study population on Q1 was 29%; 9.5% of the study sub-

jects had asthma and 6.2% chronic bronchitis. The frequency of each respiratory symptom reported is shown in table 1. Rhinitis was reported in 331 (23.5%) individuals and dermatitis in 304 (22.8%); 501 (37.6%) subjects had at least 1 of these conditions. Among the total, 944 individuals (70.8%) had no respiratory symptoms.

Individuals with asthma reported having rhinitis and/or dermatitis significantly more frequently than did subjects with chronic bronchitis or asymptomatic subjects. Asymptomatic subjects were older than those with asthma or chronic bronchitis (table 2). Smoking habits differed significantly across the various symptoms.

Part 2

Among a total of 251 subjects suspected of having asthma, data from the second questionnaire were obtained from 174 (69%) individuals (fig. 1). There were no differences in age, frequency of rhinitis or dermatitis, smoking habits, or sputum production between responders and nonresponders. The anthropometric and clinical characteristics of the 174 participants are shown in figure 1, and the prevalence of symptoms is shown in table 3.

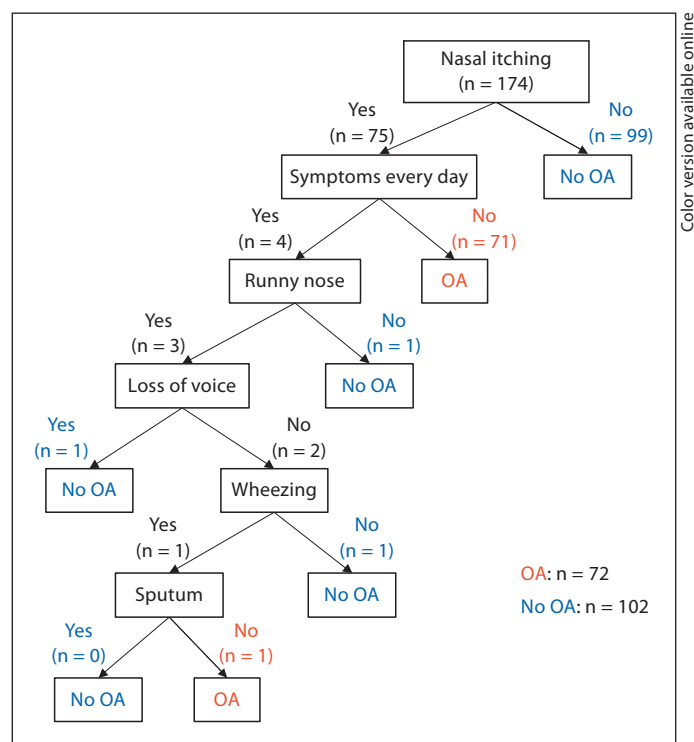
The classification tree showing the questionnaire items that best predicted the presence or absence of OA is illustrated in figure 3. The classification tree shows: (1) the total number of subjects at each bifurcation, (2) the key questionnaire item addressed at that point, and (3) the number of subjects with a yes (left side) or no (right side) answer. Based on the classification tree, 72 subjects were classified as having possible OA; hence, the prevalence of possible OA in hairdressers in the city of Barce-

Table 2. Characteristics of the population according to the presence of asthma or bronchitis or asymptomatic status (n = 1,334)

	Asthma (n = 127)	Bronchitis (n = 83)	Asymptomatic (n = 944)	p value		
				asthma vs. asymptomatic	bronchitis vs. asymptomatic	asthma vs. bronchitis
Age (mean $\pm$ SD), years	34.5 $\pm$ 12.7	33.8 $\pm$ 11.4	41.7 $\pm$ 13.2	<0.001	<0.001	0.730
Smokers, n (%)						
Smoker	54 (42.5)	60 (72.3)	311 (32.9)	0.011	<0.001	<0.001
Ex-smoker	28 (22.1)	5 (6.0)	165 (17.5)			
Never-smoker	45 (35.4)	18 (21.7)	468 (49.6)			
Rhinitis and/or dermatitis, n (%)	91 (71.7)	38 (45.8)	281 (29.8)	<0.001	0.003	<0.001

Table 3. Prevalence and 95% CI of symptoms among hairdressers with suspected asthma (n = 174)

	Prevalence		
	n	%	95% CI
Respiratory			
Cough	78	44.8	37.3–52.5
Expectoration	54	31.0	24.3–38.5
Chest tightness	68	39.1	31.8–46.8
Wheezing	97	55.7	48.0–63.3
Shortness of breath at rest	31	17.8	12.4–24.3
Shortness of breath during exercise	64	36.8	29.6–44.4
Voice loss	40	23.0	17.0–30.0
Nasal			
Obstruction	70	40.2	32.9–47.9
Secretions	74	42.5	35.1–50.2
Sneezing	94	54.0	46.3–61.6
Itching	75	43.1	35.6–50.8
Ocular			
Itching	52	29.9	23.2–37.3
Watering	44	25.3	19.0–32.4
Redness	34	19.5	13.9–26.2
Skin			
Rash	40	23.0	17.0–30.0
Eczema	41	23.6	17.5–30.6
Fever	36	20.7	14.9–27.5
Chills	29	16.7	11.5–23.1

**Fig. 3.** Classification tree of the presence or absence of OA for all subjects.

lona (72/1,334) was estimated to be 5.4% (95% CI 5.7–8.6) to 7.8% (95% CI 6.4–9.4) (the latter value was obtained by assuming that the percentage of OA was the same in responders and nonresponders to Q2).

Based on the conventional criteria of improvement and/or worsening of symptoms in relation to exposure at work and off work on weekends and during vacation periods, 62 subjects were classified as having possible OA;

hence, the prevalence of possible OA in hairdressers using these criteria (62/1,334) was estimated to be 4.6% (95% CI 4.2–7.1) to 6.7% (95% CI 5.8–8.9) (as described previously, the latter value was obtained by assuming that the percentage of OA was the same in responders and nonresponders to Q2).

Differences in the characteristics and work-related variables of individuals with and without possible OA ac-

Table 4. Association between OA and subject characteristics and work-related variables (n = 174)

	No OA	OA	p uni- variate	OR (95% CI)	Adjusted OR (95% CI)
Subjects, n	102	72			
Males, %	9.8	6.9	0.508	0.7 (0.2–2.1)	–
Mean age, years	38.7	38.1	0.729	1.0 (0.9–1.0)	–
Smokers, %			0.001		
Smoker	68.6	41.7		0.4 (0.2–0.9)	0.5 (0.2–1.2)
Ex-smoker	11.8	31.9		2.0 (0.8–5.2)	2.4 (0.8–7.0)
Never-smoker	19.6	26.4		1.0	1.0
Rhinitis and/or dermatitis (from Q1), %	46.1	85.9	<0.001	7.1 (3.3–15.5)	7.8 (3.3–18.3)
Median duration of exposure at work (OR per year), months	240	228	0.915	1.0 (0.9–1.0)	–
Median interval between the start of exposure and the onset of symptoms (OR per year), months	156	144	0.588	0.9 (0.9–1.0)	–
Performing all tasks in the salon, %	87.3	84.7	0.633	0.8 (0.3–1.9)	–
Symptoms before starting work, %	21.6	25.0	0.596	1.2 (0.6–2.5)	–
Symptoms at work and on weekends, %			0.008		
Do not worsen at work and do not improve on weekends	69.3	47.2		1.0	1.0
Worsen at work and do not improve on weekends	10.9	25.0		3.4 (1.4–7.9)	3.0 (1.1–7.9)
Worsen at work and improve on weekends	19.8	27.8		2.1 (0.9–4.3)	1.6 (0.7–3.7)
Symptoms improved while on vacation, %	31.4	52.8	0.005	2.4 (1.3–4.6)	–
Symptoms persisted after ending the work shift, %	33.3	40.3	0.348	1.3 (0.7–2.5)	–

– = Not included in final multivariate model because $p > 0.2$.

cording to the classification tree definition are shown in table 4. Being an ex-smoker increased the odds of having possible OA, although nonsignificantly, and individuals with rhinitis or dermatitis had a higher risk of developing OA (adjusted OR 7.8; 95% CI 3.3–18.3). The odds of having possible OA were 3 times greater (95% CI 1.1–7.9) among individuals with respiratory symptoms that worsened at work and did not improve on weekends than among those without symptoms. The percentage of persons who had symptoms before starting work at the salon was 21.6% in the group with no OA and 25.0% in the group with OA.

Discussion

The prevalence of possible OA in hairdressers in our setting ranged from 5.4 to 7.8% according to a previously described classification tree [22] or from 4.6 to 6.7% using conventional criteria. Rhinitis and/or dermatitis as well as presenting asthma symptoms that worsen at work and do not improve on the weekend were found to be risk factors for developing OA.

Following the administration of a preliminary general questionnaire, we found a 29% prevalence of respira-

tory symptoms and a 9.5% prevalence of asthma in hairdressers according to the MCA-based definition. Despite the fact that the study does not include a control group, the prevalence of asthma among hairdressers is somewhat higher than was expected in the population of Barcelona according to data from previous studies which estimated a rate of around 6% [24]. Similar findings were reported by Leino et al. [18] in a retrospective study performed in Finland between 1980 and 1995, with a 10.1% prevalence of asthma and a 5.6% prevalence of chronic bronchitis. In a random sample of 355 hairdressers, this same group reported a 53% prevalence of respiratory and/or cutaneous symptoms and a 4.5% calculated prevalence of asthma [14]. In a study based on a questionnaire sent to 100 hairdressers and 95 office workers, Hollund et al. [19] reported a 45% prevalence of respiratory symptoms suggesting asthma in the hairdresser group. This prevalence of respiratory symptoms did not differ from the rate in the control group but, after stratifying the sample by age, the prevalence was higher in hairdressers older than 40 years.

Despite evidence pointing to an excess of respiratory symptoms and, specifically, of asthma in hairdressers, few studies have attempted to determine the prevalence of OA in this population. The studies of Blainey et al. [12]

and Leino et al. [14], based on a clinical diagnosis of OA, reported a prevalence of 17.4 and 0.8%, respectively, whereas Akpınar-Elci et al. [25] found a prevalence of 14.6% in Turkish hairdressers in the only study to our knowledge in which epidemiological interrogation was used in the diagnosis. The authors considered hairdressers to have OA if 1 of several recurrent defining symptoms (nonproductive cough, dyspnea, chest tightness, or wheezing) was present within the overall working period and was work related. Among the 38 hairdressers studied, 25 (66%) with bronchial asthma were identified as having OA. Applying the same criteria, the present study established a prevalence of 4.6–6.7%. The difference may be due to the poor specificity of the questions used to define the diagnosis. Along this line, Malo et al. [26] found that improvement of symptoms on weekends and vacations, which are typical questions used to establish work-related symptoms, had sensitivities of 77 and 88% and specificities of 44 and 24%, respectively, for the diagnosis of OA. Thus, in the present study we used the algorithm recently proposed by Vandenplas et al. [22] to define OA which reported in the only study to date that analyzes the association between the defining symptoms and the presence or absence of the condition. Among 212 individuals included in the study, 72 were classified as having OA, 90 as having asthma but not OA, and 50 as having no asthma and no OA after specific inhalation challenge. Before the clinical study, all participants answered a questionnaire with the items most often used to assess patients with suspected OA. A prediction model based on the responses to questions about nasal itching, daily symptoms during the week at work, nasal secretions, voice loss, wheezing, and sputum production, correctly predicted the presence or absence of OA in 156 of 212 (74%) individuals according to the final diagnosis. Although the aim of that study was not to validate the questionnaire for use in research on OA, we decided to apply the diagnostic algorithm proposed by the authors since it appears to be the best approach to diagnose OA for epidemiological purposes available to date.

According to this classification tree, 72 hairdressers in our study were identified as having possible OA. Our qualification of the diagnosis as 'possible' OA refers to the fact that it is difficult to ensure that a patient has OA from questionnaire-derived information. In the interpretation of our findings, it should be borne in mind that the 72 patients classified as having OA were categorized as such from questionnaire data. A comparison between these individuals and the 102 classified as not having OA showed that worsening of symptoms at the workplace

and persistence of symptoms on the weekend were risk factors for OA in this population. One reason for this lack of improvement on the weekend is that nearly all of the hairdressers participating in the study worked on Saturdays; hence, they had only 1 day free from exposure. Moreover, it is known that when the diagnosis of this condition is delayed symptoms can be continuous during the day and night and may persist on weekends, during vacation time, and even months or years after leaving work [27]. Given that the median duration of exposure at work in the group of hairdressers with OA in the present study was 228 months and that the median interval between the start of exposure and the onset of symptoms was 144 months, it can be inferred that most of the participants had respiratory symptoms for some time before the questionnaire was administered, a fact that might contribute to the perpetuation of the symptoms.

One important point related to the analysis is that the diagnosis of OA likely encompasses true cases of OA and also possible cases of work-exacerbated asthma (WEA), a condition about which little is known [28]. In the present study, 18 hairdressers (25%) of the 72 identified as having possible OA reported having asthma symptoms before starting their work activity. These subjects were ultimately included in the prevalence calculation because having symptoms consistent with asthma does not necessarily imply that they had asthma before beginning work; according to some authors, some individuals with WEA may develop true OA as a consequence of new exposure to specific agents in the workplace [3, 29]. Of course, in the present study it is impossible to establish whether individuals who had respiratory symptoms prior to starting work activity were affected with WEA or OA, particularly taking into account that the most highly implicated agent in the genesis of OA in hairdressers is persulfate salts [30]. In fact, the possibility of developing OA in individuals with asthma prior to work exposure seems more feasible in cases where the mechanism implicated in the genesis of OA is immunological [31], and this is the mechanism proposed by some authors as being responsible for OA due to persulfate salts [15, 16]. One way to distinguish between OA and WEA could be SIC testing. In this sense, some authors have affirmed that work-related aggravation of asthma symptoms and a negative SIC would be the criteria to establish a diagnosis of WEA [31].

Sex, age, smoking habits, and atopy may be risk factors for the development of OA. In general, sex and age appear to be unimportant independent risk factors, although the prognosis may be poorer in older persons [32]. In the

present study, asymptomatic hairdressers were older than those with asthma or chronic bronchitis. A possible explanation for this finding may be the factor known as the healthy work effect, i.e. individuals who get a disease are more likely to leave the job and this results in a lower mean age of people who are ill. This concept is supported by the observations of Hollund et al. [33] and Leino et al. [34] who found that in a period of 4 and 15 years, respectively, 40 and 41.2% of female hairdressers left their profession because of asthma, chronic bronchitis, hand eczema, and musculoskeletal disorders.

In the present study, rhinitis and/or dermatitis were found to be risk factors for developing OA, suggesting that an immunologic mechanism may be implicated in the genesis of OA in hairdressers. Two recent studies performed in Spain [15] and Italy [16] support this idea but differ in whether the mechanism is IgE-dependent or not. In the Spanish study, 62% of patients had a positive skin prick test for persulfate salts, the main agent implicated in OA in hairdressers [30], and 75% had elevated total serum IgE levels. These alterations were not observed in the Italian study. Nevertheless, the fact that nasal itching and runny nose are included in the classification tree could indicate that rhinitis is automatically associated with the diagnosis of OA.

There are doubts as to whether smoking is a risk factor for developing OA. In the present study being an ex-smoker was a risk factor, whereas being a current smoker was a protective factor. This apparent paradox, which does not have a plausible biological explanation, has been reported in other diseases having an immunological cause such as bird fancier's lung [35], and it is attributed to a selection effect. Individuals who smoke and develop respiratory symptoms are significantly more likely to stop smoking than are those who have no symptoms. As would be expected, significant differences were seen in relation to smoking habits: persons with symptoms consistent with chronic bronchitis were more often smokers than those with symptoms of asthma or asymptomatic individuals.

There are several limitations to our study. The population included in the survey was restricted to beauty salons for women. Mixed salons and those for men were not investigated because the exposure to potential causal agents might be much lower. In Spain, it is mainly women who have their hair bleached and dyed. The fact that only salons for women were included means that the study population was also mainly comprised of women; nonetheless, we believe this fact did not have an impact on the results since it has not been shown that sex is a risk factor for OA [32]. Furthermore, we cannot

exclude the possibility of misclassification in the OA group since, as mentioned above, the sensitivity of the algorithm applied for this purpose was 74%. Lastly, because this was a cross-sectional workplace survey including only active workers, we were not able to control potential bias produced by the healthy work effect, i.e. the concept that sicker or more sensitive individuals may choose work environments in which exposure is low. Although selection aside from job exposure may contribute to protecting the individual health status, it remains a source of bias in epidemiology that could potentially lead to the false conclusion that jobs involving a higher exposure are safer [36].

In conclusion, the results of the present study demonstrate that the prevalence of possible OA in this population ranges from 5.4 to 7.8% or from 4.6 to 6.7%, depending on the method used. Nevertheless, it is difficult to establish how many of these patients have true OA and how many have WEA. Rhinitis and/or dermatitis, exacerbation of symptoms at the workplace, and persistent symptoms on weekends appeared to be clear risk factors for developing OA.

Acknowledgements

The authors express their gratitude to Dr. Jean Luc Malo for reviewing the manuscript. This project was supported by the FIS PI05100 (Instituto de Salud Carlos III), the Sociedad Española de Patología Respiratoria (SEPAR), the Fundació Catalana de Pneumologia (FUCAP), and the Societat Catalana de Pneumologia (SOCAP).

Appendix 1

Content of Questionnaire 1

-
- (a) Has a doctor ever told you that you have asthma?
 - (b) Has a doctor ever told you that you have dermatitis?
 - (c) Has a doctor ever told you that you have rhinitis?
 - (d) Are you a smoker?
 - (e) Are you an ex-smoker?
 - (f) Have you had an asthma attack in the last 12 months?
 - (g) Have you had allergic rhinitis in the last 12 months?
 - (h) Have you had eczema or skin allergies in the last 12 months?
 - (i) Have you had wheezing or whistling sounds in your chest apart from colds in the last 12 months?
 - (j) Have you had trouble breathing at night in the last 12 months?
 - (k) Do you usually cough most days for at least three months of the year?
 - (l) Do you cough up phlegm during at least three months a year?
 - (m) Have you taken any asthma medication in the last 12 months?
-

Appendix 2

Content of Questionnaire 2

-
1. Occupational data
 - Duration of work
 - Type of work in the salon
 - Work shift
 - Products causing symptoms
 - Previous jobs
 2. Nature of symptoms
 - 2.1. Respiratory
 - Cough
 - Sputum
 - Chest tightness
 - Wheezing
 - Shortness of breath at rest
 - Shortness of breath during exercise
 - Loss of voice
 - 2.2. Rhinitis
 - Nasal obstruction
 - Rhinorrhea
 - Sneezing
 - Itching of the nose or throat
 - 2.3. Conjunctival
 - Itching of the eyes
 - Watery eyes
 - Conjunctivitis
 - 2.4. Skin
 - Hives/reddening of the skin
 - Eczema (hands)
 3. Timing of symptoms in relation to work
 - Interval between the start of exposure at work and the onset of symptoms
 - Interval between the onset of symptoms and the current questionnaire
 - Interval between the last occupational exposure and the current questionnaire
 4. Relationship between work and respiratory symptoms
 - 4.1. Status of respiratory symptoms on working days as compared to days away from work
 - Better, worse, or the same
 - If better or worse:
 1. Every day
 2. Progressively over the course of the week
 3. As a function of working conditions; if yes,
 - During physical exertion
 - During exposure to mist or hot or cold temperature
 - During exposure to dust, fumes, or gas
 - 4.2. Possibility of identifying a process or a product that is responsible for respiratory symptoms
 - Yes, No
 - If yes, identify the process or product.
 - If yes, is this exposure regular or intermittent?
 - 4.3. Status of respiratory symptoms on weekends
 - They disappear
 - They improve
 - No change
 - 4.4. Status of respiratory symptoms on vacations (more than one week)
 - They disappear
 - They improve
 - No change
 - If they disappear or improve, after how many days does this occur?
 - 4.5. Timing of respiratory symptoms in relation to work
 - Interval between starting work and the onset of symptoms
 - Persistence or reappearance of symptoms upon returning home
 - Onset of symptoms only upon returning home
 - Change of timing of symptoms over time
 5. Relationship between work and nasal, conjunctival, or skin-related symptoms
 - 5.1. Status of the symptoms on working days as compared to days away from work
 - Better, worse, the same
 - If better or worse:
 1. Every day
 2. Progressively over the course of the week
 3. As a function of working conditions; if yes,
 - During physical exertion
 - During exposure to mist, hot or cold temperature
 - During exposure to dust, fumes, gas
 6. Other information
 - 6.1. Smoking habits: smoker, never-smoker, or ex-smoker; number of pack-years
 - 6.2. Presence of chronic bronchitis
 - 6.3. Asthma that causes symptoms before the start of work
 - 6.4. Respiratory drugs at the time of the investigation
 - 6.5. Symptoms suggesting hypersensitivity pneumonitis
 - 6.6. Symptoms suggesting gastroesophageal reflux
 - 6.7. Symptoms suggesting vocal cord dysfunction
 - 6.8. Symptoms of postnasal rhinorrhea
 - 6.9. Anxiety
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