Turk Thorac J 2019; 20(4): 241-7 DOI: 10.5152/TurkThoracJ.2018.18123

Original Article

Work-Related Symptoms of Patients with Asthma: A Multicenter Study

Dilşad Mungan[1], İpek Özmen[2], Fatma Evyapan[3], Füsun Topçu[4], Metin Akgün[5], Peri Arbak[6], Yılmaz Bülbül[7]

[1]Department of Chest Diseases, Division of Allergy and Immunology, Ankara University School of Medicine, Ankara, Turkey
[2]Clinic of Chest Diseases, Health Sciences University Süreyyapaşa Chest Diseases and Thoracic Surgery Research and Training Hospital, İstanbul, Turkey
[3]Department of Chest Diseases, Pamukkale University School of Medicine, Denizli, Turkey
[4]Department of Chest Diseases, Dicle University School of Medicine, Diyarbakır, Turkey
[5]Department of Chest Diseases, Atatürk University School of Medicine, Erzurum, Turkey
[6]Department of Chest Diseases, Düzce University School of Medicine, Düzce, Turkey
[7]Department of Chest Diseases, Karadeniz Technical University School of Medicine, Trabzon, Turkey

Cite this article as: Mungan D, Özmen İ, Evyapan F, et al. Work-related symptoms of patients with asthma: A multicenter study. Turk Thorac J 2019; 20(4): 241-7.

Abstract

OBJECTIVES: It is considered that occupational exposure accounts for up to 25% of all cases of adult asthma. We need detailed individual-level data regarding the relationship between asthma, occupation, and work-related symptoms in Turkey to inform policies on workplace safety. This study aimed to investigate the association between asthma symptoms, occupation type, and workplace exposure in patients with asthma.

MATERIALS AND METHODS: In this cross-sectional multicenter study, adult patients with asthma were investigated by a questionnaire in terms of relationship between asthma symptoms and workplace exposure. The study population was adult patients who had been diagnosed with asthma for at least six months prior to study and who were under follow-up in Ankara, İstanbul, Erzurum, Düzce, Trabzon, Denizli, and Diyarbakır.

RESULTS: The mean age of the 345 cases (188 females) was 41±13 years. The majority of the patients (36.8%) were "housewives"; other common occupations were office workers (6.7%), textile workers (4%), students (3.8%), hospital staff (3.5%), and cleaners (2.9%). Thirty-five percent of patients described worsening of asthma during working periods. Among patients with a history of increased symptoms in workplace, 100 (83%) developed asthma after starting work, while 20 patients (17%) had pre-existing asthma. Half of the patients described workplace exposure to dust, fume, and gases. Exposure to cleaning supplies at home was present in 43% of the subjects. Of all housewives, 12% (n=15) described an increase in their asthma symptoms during housework. The frequency of bleach or hydrochloric acid use alone among housewives was 60% and 34%, which was significantly higher than other occupations. The FEV_1/FVC ratio of housewives who frequently used hydrochloric acid (FEV_1/FVC=71.5) was lower than that of non-users (FEV_1/FVC=74.9) (p=0.024).

CONCLUSION: Patients with asthma experience significant workplace exposures that exacerbate their symptoms. Housewives experience significant exposure that triggers allergic and asthma symptoms. It is important to raise awareness about the prevalence and risks of occupational (including in-home) exposures in asthmatics patients and physicians to minimize asthma triggers and exacerbations.

KEYWORDS: Asthma, bleach, housewife, occupation, workplace exposure

Received: *09.08.2018* ***Accepted:*** *03.12.2018* ***Available Online Date:*** *19.08.2019*

INTRODUCTION

It is considered that occupational exposure (OA) accounts for up to 25% of cases of adult-onset asthma [1]. OA can cause asthma; it can also aggravate a pre-existing condition. Work-related asthma is a broad term that refers to asthma exacerbated or induced by exposures in the workplace [2]. Furthermore, depending on the pathogenic mechanism involved, OA is subdivided into immunological and nonimmunological forms. Immunological OA is characterized by asthma appearing after a latency period and can be caused by high- and low-molecular-weight agents that are either IgE-mediated or not. Irritants induce nonimmunological OA [3].

In Turkey, information regarding the relationship between asthma and work-related symptoms is scarce. This data would help to inform workplace policies, as well as raise awareness about occupational triggers for asthma among patients and clinicians. Previous studies have demonstrated the risk of asthma in certain occupations, including hairdressers, car painters, furniture makers, and healthcare workers [4–8]. However, to our knowledge, no study has evaluated occupational and workplace exposures of patients with asthma in Turkey. Moreover, housewives, who constitute the majority of asthmatic subjects in the outpatient clinics in Turkey, have not been evaluated in prior occupational asthma studies. Recent reports show that professional cleaners have high rates of asthma-like symptoms in Europe and North America [9]. Indeed, housewives in our country are exposed to a large number of chemical cleaning products [10].

The study was presented as poster discussion in European Respiratory Society congress in 29 September 2015, Amsterdam, Netherlands.

Address for Correspondence: İpek Özmen, Health Sciences University Süreyyapaşa Chest Diseases and Thoracic Surgery Research and Training Hospital, Chest Diseases, İstanbul, Turkey
E-mail: ipekozmen2011@gmail.com

This study aimed to investigate the association between asthma symptoms, occupation type, and workplace-associated exposures in patients with asthma at seven tertiary chest disease clinics in Turkey.

MATERIAL AND METHODS

This cross-sectional, multicenter, questionnaire-based study was conducted in seven locations across Turkey between May 2014 and January 2015. The study was approved by the local ethics committee of Ankara University (24-466; 14.01.2011) and performed in accordance with the Declaration of Helsinki. Informed consent was obtained from all patients.

Study Population and Study Areas

The study population comprised adult patients who had been diagnosed with asthma for at least six months prior to study and who were under follow-up in the pulmonary disease clinics in Ankara, İstanbul, Erzurum, Düzce, Trabzon, Denizli, and Diyarbakır. Asthma was diagnosed in accordance with the Global Initiative for Asthma (GINA) criteria [11], and it included assessment of respiratory symptoms such as wheezing, shortness of breath, chest tightness or cough, and variable expiratory airflow limitation. We invited patients with asthma to participate in the study, regardless of their age or working status. Patients who provided written consent for participation were enrolled in the study. They completed a questionnaire administered by a physician.

The term "housewife" in this study covers female patients who have not been working in another job. The main tasks of housewives in Turkey are dealing with the home's management (including cleaning) and organization.

Questionnaire and Clinical Data

Demographic data (sex, age, education level, occupation, and smoking history) and disease characteristics, such as asthma duration, history of childhood asthma, and atopy, were recorded by an investigator; and patients completed a standardized questionnaire. The questionnaire developed for this study was modified from existing validated questionnaires focusing on workplace exposure [12,13]. Our questionnaire included questions on the patients' occupation, suspected or known exposures in the workplace, duration of asthma and length of employment, as well as inquiries into the relationship between asthma symptoms and workplace exposure, and, if present, details on rhinitis and conjunctivitis symptoms. The current occupation and exposure-symptom relationship in that workplace were recorded. For subjects working in more than two jobs, the main occupation in which the subject spends most of the time was selected. The questionnaire was modified to include additional items that were relevant to the Turkish population (Table 1).

Spirometry and Allergy Testing

We performed pulmonary function tests (forced expiratory volume in one second [FEV_1], forced vital capacity [FVC], peak expiratory flow [PEF]) and evaluated them according to the American Thoracic Society/European Respiratory Society (ATS/ERS) guidelines [14]. According to the GINA guidelines for the diagnosis of asthma, an $FEV_1/FVC < 0.80$ was accepted as airflow limitation [11].

Skin-prick tests were carried out with a standard panel of airborne allergens consisting of grass *(Dactylis glomerata, Lolium perenne, Phleum pratense, Poa pratensis, Festuca pratensis*), weed (*Artemisia vulgaris, Urtica dioica, Taraxacum vulgare, Plantago lanceolata, Chenopodium album*), mold (*Alternaria alternata, Cladosporium herbarum, Aspergillus fumigatus*) allergens, cat and dog dander, and house-dust mites *(Dermatophagoides pteronyssinus and D. farinae).* A wheal size larger than 3 mm was considered as a positive reaction.

Table 1. The questionnaire

Is there any relation between your asthma symptoms and your workplace?	YES	NO
Does your asthma become worse at workplace?		
Did your asthma onset after starting employment?		
How long have you been working in this job?		
How long after you've started your complaints arose?		
Do your symptoms improve during weekends/holidays?		
Do you expose to dust, fumes, or gases at work		
Do you know the material?		
Is your workplace ventilated?		
Do you have respiratory protection devices?		
Do you also have rhinitis symptoms?		
Do your rhinitis symptoms become worse at workplace?		
Do you also have conjunctivitis?		
Do your conjunctivitis symptoms become worse at workplace?		
Did you have intense exposure to chemicals, smoke, or dust within 24 hours of onset of worsening asthma?		
Do you expose to cleaning supplies at home?		
Do you use bleach?		
Do you use hydrochloric acid?		

Data Management and Analysis

Two researchers extracted the data from the paper questionnaires and entered them into a secure password-protected electronic database. We compared differences between groups using the Student's t-test for continuous variables and the Chi-square test for categorical and dichotomous variables using the Statistical Package for the Social Sciences software version 20.0 (SPSS IBM Corp.; Armonk, NY, USA), considering p-values <0.05 to be statistically significant. The median with interquartile range assessed nonparametric continuous variables, while mean±standard deviation evaluated parametric continuous variables. Analysis used counts and percentages when applicable.

Table 2. Characteristics of patients with asthma

Number of patients	345
Age (year) *	42±13 (18-80)
Female, n (%)	188 (55)
Smoking	
Current smoker, n (%)	69 (20)
Ex-smoker, n (%)	49 (14)
Never smoked, n (%)	227 (66)
Smoking (pack-year)**	10 (5–20)
Duration of asthma (years)**	5 (2–11)
Employment duration (years)**	17 (7–25)
Time after employment of onset of asthma (year)**	10 (5–20)
Conjunctivitis, n (%)	105 (30)
Rhinitis, n (%)	179 (52)
FEV_1 %*	76±22

*mean±standard deviation; **median (IQR); FEV_1: Forced Expiratory Volume in one second

RESULTS

The study enrolled 345 patients (188 females, 54%) with a mean age of 42±14 years (18–80). The median duration of asthma was 8.7±9.5 years, whereas the mean duration of current employment was 17.9±12.1 years. Among the study group, 52% (n=179) of patients had rhinitis, and 30% (n=105) described conjunctivitis symptoms. In the whole group, 20% (n=69) of patients were active smokers, 65.8% (n=227) had never smoked, and 14.2% (n=49) were ex-smokers. Table 2 shows the baseline characteristics of the patients. Skin-prick tests were performed in 141 patients, revealing atopy in 88 (62.4%) cases. The largest proportion of patients was housewives (36.8%). Other common occupations were office workers (6.7%), textile workers (4.1%), students (3.8%), hospital staff (3.5%), and cleaners (2.9%) (Figure 1).

Of all subjects, 85% (n=294) stated that they had a diagnosis of asthma after starting work, whereas 15% (n=51) had pre-existing asthma. In patients whose asthma began after starting work, the onset of asthma symptoms occurred after an average of 10 (5–20) years of working. The percentage of patients who described worsening of asthma during work was 35% (n=120), with 23% (n=80) of the subjects reporting improvement of asthma symptoms during weekends and holidays. Among patients with a history of increased symptoms in workplace, 100 (83%) developed asthma after starting work, while 20 patients (17%) had pre-existing asthma. Patients who reported increased symptoms in the workplace were mostly car painters, cleaners, farmers, and textile workers (Table 3). A total of 102 patients (30%) described an increase in rhinitis symptoms in the workplace, and 20% (n=70) of patients with asthma reported an increase in conjunctivitis symptoms during working days. Men reported workplace-related symptoms more frequently than women did (p=0.001). Patients who reported work-related symptoms of asthma

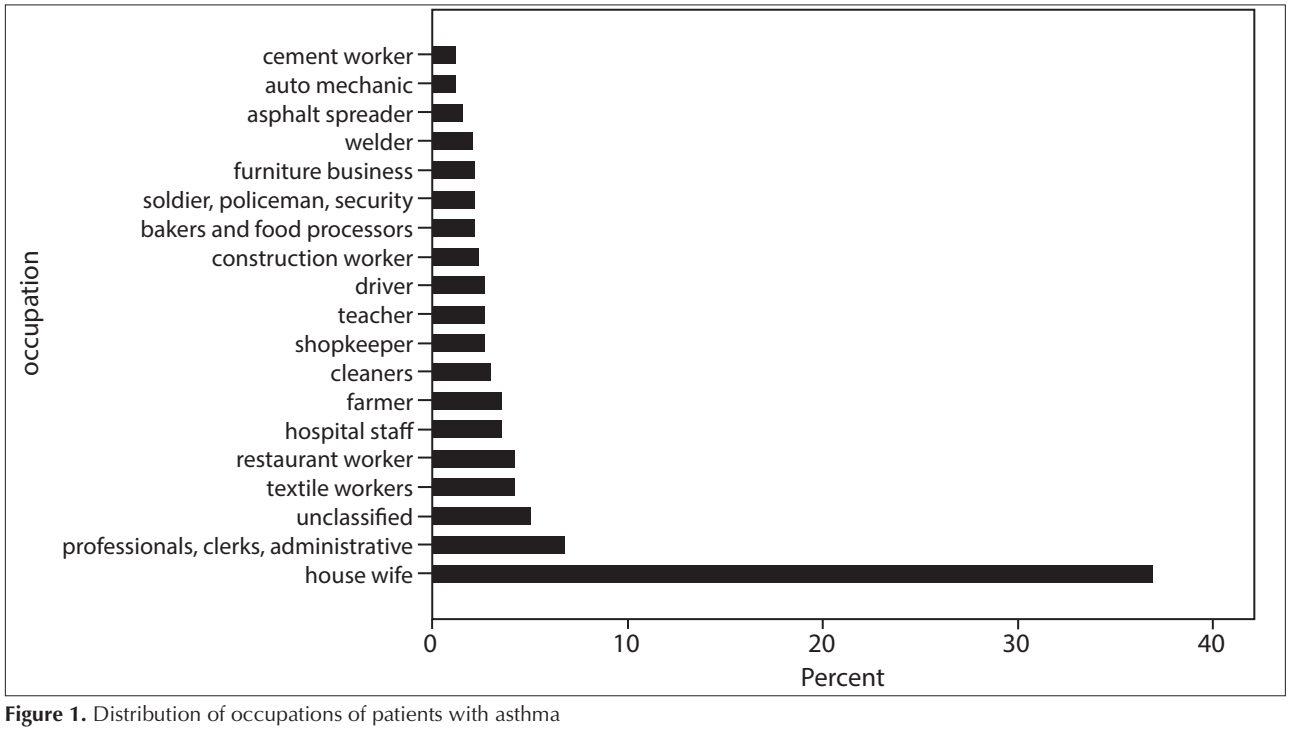

Figure 1. Distribution of occupations of patients with asthma

were younger than subjects who did not (p=0.018). In the group whose asthma symptoms increased during work, exposure to dust, fumes, and gases was higher than in the group whose symptoms did not increase (p=0.001). A higher number of patients with work-related symptoms than those without work-related symptoms described improvement in their asthma symptoms during weekends and holidays (p=0.001). The ratio of subjects who reported an increase in rhinitis and conjunctivitis symptoms during working periods was higher in the group with a history of work-related asthma symptoms (p=0.001). There was no difference between the two groups in terms of FEV_1 (77.2±21.2% vs. 75.3±23.7%) or FEV_1/FVC (74.6±11.7% vs. 73.9±11.9%) values (p>0.05) (Table 4).

Table 3. Work-related asthma history and exposures n =345

History of asthma	n (%)
Asthma onset after starting employment	294 (85)
Pre-existing asthma	51 (15)
Exposures at workplace	
Exposed to dust, fumes, or gases	173 (50)
Respiratory protection devices available	80 (23)
Intense exposures to chemicals, smoke, or dust within 24 hours of onset of worsening asthma	28 (8)
Relationship with workplace	
Increase in asthma symptoms at work	120 (35)
Improvement of asthma during weekends/vacation	80 (23)
Among subjects with history of increase in asthma symptoms at work	
Asthma onset after starting employment	100 (83)
Pre-existing asthma	20 (17)
Improvement of asthma during weekends/vacation	80 (66)
Exposure at home	
Exposure to cleaning supplies at home	149 (43)
Use bleach	143 (41)
Use hydrochloric acid	80 (23)

Half of the patients (n=173) reported workplace exposure to any kind of dust, fume, or gas. Exposure to cleaning supplies at home was present in 43% of subjects. The most common agent was dust, followed by cleaning supplies, paints, detergents, welding fumes, hair dyes, animal dander, latex, and formaldehyde. When comparing symptoms between patients with and without workplace exposure to dust, fumes, and gases, we found that increases in symptoms of asthma (n=106 vs. n=14), rhinitis (n=76 vs. n=26), and conjunctivitis (n=50 vs. n=20) were higher in the group that reported exposure (p<0.001). This difference was most striking for asthma symptoms. Table 5 compares the exposures and symptoms of housewives to those of both men and women in other occupations. Among housewives (n=127), 12% described an increase in their asthma symptoms during housework. This rate was lower than that of men or women in other occupations (both of which were 48%) (p=0.001). Fewer housewives described exposure to dust, fumes, or gases, or improvement in symptoms during holidays; however, the frequencies of bleach and hydrochloric acid use among housewives were 60% and 34%, respectively, which was significantly higher than in other occupations. The FEV_1/FVC ratio of housewives who frequently used hydrochloric acid (FEV_1/FVC=71.5) was lower than that of non-users (FEV_1/FVC=74.9) (p=0.024).

DISCUSSION

In this study, we found that asthma symptoms worsened during working hours in 35% of patients with an existing diagnosis of asthma. When housewives were excluded, the per-

Table 4. Characteristics of patients with and without increase in asthma symptoms at workplace

	With increase in asthma symptoms at workplace (n)	Without increase in asthma symptoms at workplace (n)	p
F/M	43/77	144/81	0.0004
Smoking			
smoker	27	42	>0.05
ex-smoker	22	27	
never smoker	77	15	
Pre-existing asthma +/-	20/100	31/194	>0.05
Workplace dust vapor exposure +/-	106/104	67/158	0.0004
Workplace ventilation +/-	43/77	109/116	0.016
Improvement in holidays +/-	67/53	13/212	0.0002
Rhinitis +/-	81/39	98/127	0.0001
Increase in rhinitis at workplace +/-	60/60	42/183	0.0002
Eye symptoms +/-	51/69	54/171	0.0003
Increase in eye symptoms at workplace +/-	43/77	27/198	0.0003
FEV_1/FVC %	74.6	74	>0.05

F: female; M: male; FEV_1: Forced Expiratory Volume in one second; FVC: Forced Vital Capacity

Table 5. Comparison of housewives, females with other occupations, and males with regard to exposures

	Housewives n=127 n (%)	Females with other occupations n=61 n (%)	Males n=157 n (%)	p
Asthma becomes more severe at work	15 (12)	29 (48)	76 (48)	0.001
Improvement of asthma during weekends/holidays	9 (7)	15 (25)	56 (36)	0.001
Exposure to dust, fumes, or gases	29 (23)	39 (64)	105 (67)	0.001
Uses bleach at home	76 (60)	29 (48)	38 (24)	0.001
Uses hydrochloric acid at home	43 (34)	19 (31)	18 (12)	0.001

centage of patients with worsening symptoms during work hours increased to 48%. To our knowledge, this is the first multicenter study to investigate the association between the workplace and symptoms for adults with asthma in Turkey. Our findings show the potential impact of OA, including in-home exposures, on asthma in our adult population.

In this study, majority of patients developed symptoms of asthma after being employed; onset occurred after an average of 10 years in their working environment. Our results are in concordance with previous studies that reported a high ratio of working adults with current asthma who developed the condition after years of exposure to agents at work [15,16]. Although our findings show the development of asthma after starting work, it should be kept in mind that asthma may start during the individual's working life, but it may not be caused by specific exposure in the workplace. On the other hand, 17% of the subjects of the group with a history of worsening asthma symptoms at workplace had pre-existing asthma who can be categorized as work-exacerbated asthma (WEA). Although diagnosing and differentiating correctly between OA and WEA is important, it is not easy. The general agreement that a patient with a previous diagnosis of asthma may develop OA, and that the concomitant onset of asthma associated with work does not rule out that it is a WEA, makes the situation more complex [17,18].

One-third of patients in this study reported worsening asthma during work that could be considered as work-related asthma. Likewise, a recent paper by Dudek et al. [13] showed that 65% of patients reported more severe symptoms of shortness of breath/wheezing/chest tightness at work. This ratio seems to be higher than our subjects' symptom rates during work; however, we included patients in our study irrespective of their occupations. Though 12% of housewives reported symptom increase during housework, excluding them raised the rate of patients whose asthma symptoms worsened in the workplace to 48%, a rate comparable to the Dudek study. In a previous report from Turkey including 1400 patients with asthma, 7.2% reported "increase in asthma symptoms at work" [19]. This lower rate of workplace-related asthma may be because the majority of the patients in that study were female (75%); and increases in asthma may not have been recorded as work-related if the patient was a housewife. In addition to asthma symptoms, our patients described increased rhinitis and conjunctivitis symptoms during working periods, which seemed parallel to worsening asthma in the workplace. Rhinitis often accompanies or precedes lower respiratory symptoms in patients with OA [20]. Some have suggested that the presence of work-related rhinitis symptoms should be taken into consideration when evaluating patients for occupational asthma [18,21,22]. Our results agree with the literature's common emphasis of the need for investigation of upper airways in patients with work-related asthma symptoms.

Assessments of patients with asthma-like symptoms and those with existing asthma should consider occupational risk factors. Several studies in Turkey have reported occupational asthma in hairdressers, auto repair workers, car painters, furniture workers, and healthcare workers [4-8]. Our results regarding exposures agree with previous reports. In a recent study that investigated risk of asthma in relation to occupation, Wortong et al. [16] reported that inorganic dust was the agent most significantly associated with asthma. Only one in seven employed adults with asthma discusses the possible role of work in their disease with their physician [22]. It seems likely that a similar proportion of patients in this study may not have spoken about dust or any other exposure they might have experienced if it had not been investigated by the questionnaire. We believe that physician recognition of work-related respiratory symptoms will help patients eliminate exposure to the substances exacerbating their illness. Professional and domestic cleaning has been associated with new-onset occupational asthma, as well as WEA and respiratory symptoms without asthma [9]. Some studies found higher asthma risks for home cleaners compared with other indoor cleaners [23,24]. A previous study reported that women employed in domestic cleaning with a recent history of asthma or chronic bronchitis experienced worsening of respiratory symptoms on workdays and on days in which they spent more time cleaning [25]. In light of these data, we decided to include housewives in the study and to enroll patients without making any occupational discrimination. We found that a small but significant group of housewives (12%) described an increase in their asthma symptoms during housework with exposure to cleaning materials at home. In professional cleaners, several studies have associated asthma symptoms with use of sprays and bleach, and waxing [24-26]. An epidemiologic study found use of bleach to be extremely common and consistently associated with respiratory symptoms, particularly with symptoms of asthma [27]. In agreement with these studies, our study found exposure to cleaning supplies at home to be very frequent (43%), as well as the use of bleach and hydrochloric acid among housewives. Surprisingly, bleach use was significantly more prevalent in housewives than in other working women. Furthermore, the FEV_1/FVC ratio of housewives who frequently used hydrochloric acid was lower than that of non-users. It is evident that asthmatic housewives in our population are

exposed to chemicals during housework; and physicians and patients should be aware that housewives experience "work-related asthma" due to such in-home exposures.

Our study has limitations that need to be considered. First, although the modified questionnaire was based on the National Institute for Occupational Safety and Health, it has not yet been validated [12]. However, we do not feel that this is an issue because the questions were clear and easily understandable. Second, the convenience sampling technique used in our study has the risk of identifying a population that is not representative of the larger Turkish population. Third, we lack the data about work change due to respiratory symptoms. However, by including seven regions in Turkey, and in particular including household exposures of housewives, we believe our study population is still very informative and likely representative of exposures experienced by the workforce in Turkey.

In summary, our study found that patients with asthma experience significant workplace exposures that exacerbate their symptoms. Limiting workplace exposure will lead to better asthma control. Housewives experience significant exposure that triggers allergic and asthma symptoms. Policymakers should seek ways to reduce dust and fume exposures in the workplace and provide adequate protective devices and environmental protections. It is important to raise awareness about the prevalence and risks of occupational (including in-home) exposures in asthmatic among patients and physicians to minimize asthma triggers and exacerbations.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Ankara University (24-466; 14.01.2011).

Informed Consent: Written informed consent was obtained from patients who participated in this study.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept – D.M., İ.Ö.; Design – D.M., İ.Ö., F.T., M.A., F.E.; Data Collection and/or Processing – D.M., P.A., İ.Ö., M.A., F.T., F.E., Y.B.; Analysis and/or Interpretation – İ.Ö., D.M., P.A.; Literature Search – D.M., İ.Ö., P.A., F.T., M.A.; Writing Manuscript – İ.Ö., D.M., P.A., Y.B.; Critical Review – D.M., P.A., İ.Ö., Y.B., M.A., F.T., F.E.

Acknowledgements: The authors acknowledge and thank the American Thoracic Society "Methods in Epidemiologic, Clinical and Operations Research" (MECOR) Programme, the Turkish Thoracic Society, Payam Nahid (Professor of Medicine, University of California, San Francisco), Professor Sonia Buist, MD (Professor of Medicine, Oregon Health & Science University) and Zuhal Karakurt, MD (Associate Professor of Medicine, University of Health Sciences Süreyyapaşa Chest Diseases and Thoracic Surgery Hospital), Ahmet Demir MD, MPH (Professor of Medicine, Hacettepe School of Medicine) for their invaluable support and helpful comments.

Conflict of Interest: The authors have no conflicts of interest to declare.

Financial Disclosure: The authors declared that this study has received no financial support.

REFERENCES

1. Sama SR, Milton DK, Hunt PR, et al. Case-by-case assessment of adult-onset asthma attributable to occupational exposures among members of a health maintenance organization. J Occup Environ Med 2006;48:400-7. [CrossRef]
2. Tarlo SM, Balmes J, Balkissoon R, et al. Diagnosis and management of work-related asthma: American College of Chest Physicians Consensus Statement. Chest 2008;134(3 suppl): 1S-41S. [CrossRef]
3. Muñoz X, Cruz MJ, Bustamante V, et al. Work-Related Asthma: Diagnosis and Prognosis of Immunological Occupational Asthma and Work-Exacerbated Asthma. J Investig Allergol Clin Immunol 2014;24:396-405.
4. Gülmez I, Çetinkaya F, Oymak FS, et al. Occupational asthma among hairdresser's apprentices [abstracts]. Eur Respir J 1998;12(Suppl 28):333s.
5. Ucgun I, Ozdemir N, Metintaş M,et al. Prevalence of occupational asthma among automobile and furniture painters in the center of Eskisehir (Turkey): the effects of atopy and smoking habits on occupational asthma. Allergy 1998;53:1096-100. [CrossRef]
6. Öner F, Mungan D, Numanoglu N, et al. Occupational asthma in the furniture industry: is it due to styrene? Respiration 2004;71:336-41. [CrossRef]
7. Sener O, Taskapan O, Ozangüç N. Latex allergy among operating room personnel in Turkey. J Investig Allergol Clin Immunol 2000;10:30-5.
8. Köse S, Mandiracioğlu A, Tatar B, et al. Prevalence of latex allergy among healthcare workers in Izmir (Turkey). Cent Eur J Public Health 2014;22:262-5. [CrossRef]
9. Siracusa A, De Blay F, Folletti I, et al. Asthma and exposure to cleaning products—a European Academy of Allergy and Clinical Immunology task force consensus statement. Allergy 2013;68:1532-45. [CrossRef]
10. Görgüner M, Aslan S, Inandi T, et al. Reactive airways dysfunction syndrome in housewives due to a bleach–hydrochloric acid mixture. Inhal Toxicol 2004;16:87-91. [CrossRef]
11. Global Initiative for Asthma. Global Strategy for Asthma Management and Prevention 2015. Available from: www.ginasthma.com
12. NIOSH Division of Respiratory Studies Initial Questionnaire of the NIOSH Occupational Asthma Identification Project (OAID) (n.d.). Retrieved 28 February 2004 Availale from http://www.cdc.gov/niosh/asthpage.html
13. Dudek W, Kupryś-lıpińska I, Wittczak T, et al. The prevalence of asthma work relatedness: preliminary data. J Occup Environ Med 2015;28:1025-9. [CrossRef]
14. Brusasco EV, Crapo R, Viegi G, et al. ATS/ERS Task Force Standardisation of Lung Function Testing: Standardisation of spirometry (2005). Eur Respir J 2005;26:319-38.
15. Knoeller GE, Mazurek JM, Storey E. Occupation held at the time of asthma symptom development. Am J Ind Med 2013;56:1165-73. [CrossRef]
16. Wortong D, Chaiear N, Boonsawat W. Risk of asthma in relation to occupation: A hospital-based case-control study. Asian Pac J Allergy Immunol 2015;33:152-60.
17. Cruz MJ, Muñoz X. Work-Related Asthma: the Dawn of Knowledge? Arch Bronconeumol 2017;53:180-1. [CrossRef]
18. Vandenplas O, Suojalehto H, Cullinan P. Diagnosing occupational asthma. Clin Exp Allergy 2017;47:6-18. [CrossRef]
19. Yildiz F, Mungan D, Gemicioglu B, et al. Asthma phenotypes in Turkey: a multicenter cross-sectional study in adult asthmatics; PHENOTURK study. Clin Respir J 2015;11:210-23. [CrossRef]
20. Tarlo SM, Lemiere C. Occupational asthma. N Engl J Med 2014;370:640-9. [CrossRef]
21. Stevens WW, Grammer LC 3rd. Occupational rhinitis: an update. Curr Allergy Asthma Rep 2015;15:487. [CrossRef]

22. Casey M, Stanton ML, Cummings KJ, et al. Work-Related Asthma Cluster at a Syntactic Foam Manufacturing Facility Massachusetts 2008–2013. Morbidity and Mortality Weekly Report 2015;64: 411-4.
23. Medina-Ramón M, Zock JP, Kogevinas M, et al. Asthma symptoms in women employed in domestic cleaning:a community based study. Thorax 2003;58:950-4. **[CrossRef]**
24. Zock JP, Kogevinas M, SunyerJ, et al. Asthma risk, cleaning activities and use of specific cleaning products in Spanish indoor cleaners. Scand J Work Environ Health 2001;27:76-81. **[CrossRef]**
25. Medina-Ramón M, Zock JP, Kogevinas M, et al. Short-term respiratory effects of cleaning exposures in female domestic cleaners. Eur Respir J 2006;27:1196-203. **[CrossRef]**
26. Obadia M, Liss GM, Lou W, et al. Relationship between asthma and work exposure among non-domestic cleaners in Ontario. Am J Ind Med 2009;52:716-23. **[CrossRef]**
27. Medina-Ramón M, Zock JP, Kogevinas M, et al. Asthma, chronic bronchitis, and exposure to irritant agents in occupational domestic cleaning: a nested case-control study. Occup Environ Med 2005;62:598-606. **[CrossRef]**