



# Symptoms and Awareness of Latex Allergy Among Healthcare Workers

Özgür KARTAL<sup>1</sup> , Gökhan AYTEKİN<sup>2</sup> , Ümit AYDOĞAN<sup>3</sup> , Oktay SARI<sup>3</sup> , Sait YEŞİLLİK<sup>1</sup> , Fevzi DEMİREL<sup>1</sup> 

<sup>1</sup> Department of Immunology and Allergic Diseases, University of Health Sciences, Ankara Gulhane Education and Research Hospital, Ankara, Turkey

<sup>2</sup> Department of Internal Medicine, Division of Clinical Immunology and Allergy, Necmettin Erbakan University, Meram Faculty of Medicine, Konya, Turkey

<sup>3</sup> Department of Family Medicine, University of Health Sciences, Ankara Gulhane Education and Research Hospital, Ankara, Turkey

Corresponding Author: Gökhan AYTEKİN ✉ ayteking@gmail.com

## ABSTRACT

**Objective:** To evaluate the knowledge levels, sensitivity status, familial latex sensitivity, and attitudes towards the prevention and treatment of latex allergies of healthcare workers (HCWs) at a tertiary hospital.

**Materials and Methods:** The study was carried out cross-sectionally between December 2012 and March 2013. A total of 566 HCWs at a tertiary hospital were included in the study.

**Results:** The data of a total of 566 [333 (58.8%) female and 233 (41.2%) male] HCWs were analyzed. They consisted of 179 (31.6%) physicians, 48 (8.5%) technicians, 238 (42%) nurses, 48 (8.5%) laboratory technicians and 53 (9.4%) patient care workers. The family history of atopy was significantly higher in female HCWs (24.3%) compared to males (17.2%) ( $p=0.041$ ). A significant difference was identified between the occupational groups in terms of the rate of allergic symptoms after coming into contact with medical latex products (nurses 59.7%, doctors 17.6%, technicians 5.7%, laboratory technicians 6.9%, patient care workers 10.1%;  $p=0.001$ ). Latex-related symptoms were significantly more common in atopic HCWs (52.3%) compared to non-atopic ones (19.4%) ( $p=0.001$ ). The rate of latex-food syndrome was significantly more frequent in female HCWs (16%) compared to males (8.9%) ( $p=0.038$ ). Symptoms that developed after contact with medical and non-medical latex products were significantly more common in female HCWs (79.9% and 80.5%) compared to the male HCWs (21.1% and 19.5%) ( $p=0.001$ ). The rate of non-HCW(s) who shared the same house/room with the HCWs after work and who had allergic symptoms while in the same environment with the HCWs was 18%. The rate of these individuals was reported to be highest among the nurses at 53% and there was a statistically significant difference in terms of occupational groups (physicians 25.5%, technicians 9.8%, laboratory technicians 2.9%, patient care workers 7.8%;  $p=0.030$ ). Multivariate regression analysis showed that personal history of atopy (OR= 28.657, 95% CI= 6.548-125.411,  $p=0.001$ ) and the type of gloves used (latex gloves) (OR= 8.730, 95% CI= 3.490-21.834,  $p=0.001$ ) were independent predictors for latex allergy.

**Conclusion:** In conclusion, latex is not only a cause of occupational allergy but is also an allergen that has the potential to cause allergic symptoms in people who share the same environment with HCWs. Questionnaires questioning the symptoms associated with past latex allergy may be an important tool for demonstrating latex sensitization in HCWs and managing latex-related reactions.

**Keywords:** Latex allergy, healthcare workers, type I reaction

## INTRODUCTION

Latex is a natural substance derived from the fluid of the *Hevea brasiliensis* (Hev b) tree grown in Africa and Southeast Asia and is used in various areas from aircraft tires to toys, various contraceptive products to protective

medical products such as gloves (1, 2). Although more than 250 natural latex proteins have been identified, only about sixty of them are capable of binding to human IgE. These antigens can cause type I and IV hypersensitivity in genetically susceptible individuals. In addition, these antigens can cause cross-sensitization with many tropical

fresh fruits (3). The prevalence of latex sensitization is 0.3-1% in the population (2, 3). In previous studies, atopy, frequency of using latex gloves, presence of hand dermatitis, and duration of time spent working in a hospital were found to be risk factors for latex allergy (4). Increased use of gloves to reduce the transmission of infections from blood-borne microorganisms since the 1990s has led to an increase in symptoms associated with latex, and since then, latex allergy has become a widespread occupational disease among healthcare workers (HCWs). The prevalence of latex allergy among HCWs is different in various studies and is reported as 3-17% (2, 5). Although the increase in the use of non-latex medical products is expected to decrease the prevalence of latex allergy, latex allergy remains a problem due to the continued sensitization of HCWs from non-medical latex products and the use of medical products containing latex in undeveloped countries. Therefore, we aimed to evaluate the knowledge levels, sensitivity levels, familial latex sensitivity, and the attitudes towards the prevention and treatment of latex allergies of HCWs working at a tertiary hospital and to determine the risk factors in this study.

## **MATERIALS and METHODS**

### **Study Group**

The study was carried out cross-sectionally between December 2012 and March 2013 at a tertiary hospital. A total of 566 HCWs who agreed to fill in the questionnaire were included in the study. Approval for the study was received from the Ethics Committee (August 6<sup>th</sup>, 2012; 1491-38-12/648-448.6). A questionnaire was administered to the HCWs who consented to participate in the study, under the supervision of the researchers. The data obtained following the study were compared under two headings: gender and occupation of the HCWs.

### **Questionnaire**

Since there is no national or international standardized questionnaire on latex allergy, we used a questionnaire form that we had used in a previous study on latex allergy (6). The questionnaire consists of 15 questions, not including the personal details of the HCWs. With this questionnaire, we aimed to gather data on demographic features of the HCWs as well as personal and family history of atopy, the number of invasive medical procedures, history of allergies to foods known to cross-react with latex (latex-food syndrome), information on the prevention and treatment of latex allergy, awareness of products

containing latex which the HCWs use in their daily lives and relevant health programs, and the type of gloves they use in the hospital.

### **Statistical Analysis**

Statistical analysis was performed with the IBM SPSS Statistics Version 25 software package. Normally distributed parameters were presented as mean  $\pm$  standard deviation and skewed parameters were expressed as median (interquartile range [minimum/maximum]). Descriptive data were presented as frequencies and percentages and compared using the Chi-squared test. Baseline characteristics were compared using the independent Student's t-test, Mann-Whitney rank-sum test, Fisher's exact test, or Chi-squared test where appropriate. To determine independent predictors for latex allergy, binomial logistic regression analysis was performed. Univariate regression analysis was performed for the parameters (Comparison of the participants with or without latex allergy in Table II) with  $p < 0.2$ . Multivariate regression analysis with the backward Wald method was performed for parameters with  $p < 0.2$  in univariate regression analysis. A p-value of less than 0.05 was accepted as statistically significant.

## **RESULTS**

The data of a total of 566 [333 (58.8%) female and 233 (41.2% male)] HCWs who filled in the questionnaire were analyzed. The mean age of the participants was  $34.2 \pm 6.6$  years (min: 21-max: 55). The occupations of the HCWs were as follows: 238 (42%) nurses, 179 (31.6%) physicians, 53 (9.4%) patient care workers, 48 (8.5%) technicians, and 48 (8.5%) laboratory technicians.

When we classified the duration of working in the department as less than 5 years, 5-10 years, 10-15 years, and more than 15 years, there was no significant difference between the durations and the presence of latex-related symptoms ( $p = 0.677$ ). The demographic data of the HCWs was classified into 5 groups according to the occupations and summarized in Table I.

Twenty-six HCWs (13 physicians, 1 technician, 10 nurses, 1 laboratory technician, and 1 patient care worker) had a personal history of latex allergy that was diagnosed by an allergy specialist (26/566, 4.6%). Three HCWs (3 nurses) had a family history of latex allergy that was diagnosed by an allergy specialist. No significant difference was found between these groups in terms of latex allergy

**Table I: Demographic characteristics of the HCWs according to occupation.**

	Physician	Technician	Nurse	Laboratory technician	Patient care worker	p
Age	35.8 ± 6.1	34.8 ± 7.0	32.0 ± 5.9	38.0 ± 7.8	34.4 ± 7.0	0.178
Gender (female, n%)	27 (15.1)	27 (56.3)	235 (98.7)	22 (45.8)	22 (41.5)	<b>0.001</b>
Family history of atopy, n (%)	35 (19.6)	7 (14.6)	178 (74.8)	40 (83.3)	42 (79.3)	0.355
Personal history of atopy, n (%)	47 (26.3)	14 (29.2)	68 (28.6)	7 (14.6)	13 (24.5)	0.364
History of latex-food syndrome, n (%)	17 (9.5)	1 (2.1)	35 (14.7)	3 (6.3)	9 (17.0)	<b>0.038</b>

HCWs: Health care workers.

**Table II: Comparison of HCWs with or without latex allergy.**

	HCWs with latex allergy n=26	HCWs without latex allergy n= 540	p
Age, year	35.27 ± 5.89	34.13 ± 6.64	0.391
Gender, female, n (%)	10 (38.5)	317 (58.7)	0.471
Profession, n (%)			0.262
Physician	13 (50)	166 (30.7)	
Technician	1 (3.8)	47 (8.7)	
Nurse	10 (38.5)	228 (42.2)	
Laboratory technician	1 (3.8)	47 (8.7)	
Patient care worker	1 (3.8)	52 (9.6)	
Family history of atopy, n (%)	12 (46.2)	109 (20.2)	<b>0.002</b>
Personal history of atopy, n (%)	24 (92.3)	125 (23.1)	<b>0.001</b>
Number of surgical procedures			
0	155 (28.7)	9 (34.6)	
1-3	233 (43.1)	11 (42.3)	0.937
4-10	133 (24.6)	5 (19.2)	
11-20	16 (3)	1 (3.8)	
≥21	3 (0.6)	0	
Latex glove use time at work			
Any	0	31 (5.7)	0.338
Once a month	10 (38.5)	239 (44.3)	
Once a week	0	18 (3.3)	
Daily, less than a hour	0	14 (2.6)	
Daily, 1-4 hours	8 (30.8)	96 (17.8)	
Daily, more than 4 hours	8 (30.8)	142 (26.3)	
Latex glove use, n (%)	24 (93.0)	250 (46.2)	<b>0.001</b>
Time spent in the profession, years	4.5 (0-23)	2 (0-32)	0.238

HCWs: Health care workers.

diagnosed by an allergy specialist ( $p= 0.555$ ). There was a statistically significant difference between HCWs with and without latex allergy in terms of a family history of atopy and the type of gloves used (respectively  $p= 0.005$  and  $p=0.001$ ) (Table II).

Univariate regression analysis revealed that a family history of atopy (odds ratio, OR= 3.389, 95% confidence interval, CI= 1.524-7.537,  $p= 0.003$ ), personal history of

atopy (OR= 39.840, 95% CI= 9.287-170.914,  $p= 0.001$ ), and the type of glove used (latex gloves) (OR= 15.412 95% CI=6.663-35.651,  $p= 0.001$ ) were significantly associated with latex allergy. Multivariate regression analysis showed that personal history of atopy (OR= 28.657, 95% CI= 6.548-125.411,  $p= 0.001$ ) and the type of glove used (latex gloves) (OR= 8.730, 95% CI= 3.490-21.834,  $p= 0.001$ ) were also independent predictors for latex allergy (Table III).

The family history of atopy was significantly higher in female HCWs compared to males (female HCWs 24.3% - male HCWs 17.2%,  $p= 0.041$ ). However, there was no significant difference between the genders in terms of the personal history of atopy (female HCWs 28.8% - male HCWs 22.8%,  $p= 0.106$ ). Although the highest rate of family history of atopy in occupational groups was among laboratory technicians, this difference was not statistically significant ( $p= 0.355$ ). No significant difference was identified between the occupational groups in terms of a personal history of atopy ( $p= 0.364$ ). The frequency of latex-related symptoms was 52.3 and 19.4% in atopic and non-atopic HCWs, respectively. There was a statistically significant difference in terms of latex-related symptoms between atopic and non-atopic HCWs ( $p= 0.001$ ).

A history of six or more invasive procedures was significantly higher in female HCWs compared to male ones (18.6% - 9.4%,  $p= 0.003$ ). In terms of the occupation of the HCWs, a history of 6 or more procedures/interventions was significantly higher in nurses compared to the other occupational groups ( $p= 0.009$ ).

Sixty-five HCWs (11.5%) had a history of the latex-food syndrome. Upon reviewing this condition according to gender, the rate of the latex-food syndrome was significantly higher in female HCWs than the males (female 16% - male 8.9%,  $p= 0.038$ ). Interestingly, the rate of the latex-food syndrome was highest in laboratory technicians at 17%. Kiwi ( $n= 20$ , 3.5%) was the most common among such foods. The most common reactions were "itching and redness all over the body" ( $n= 42$ , 64.6% of sixty-five HCWs) and "itching and redness around the mouth" ( $n= 25$ , 38.5%). After consumption of foods which cause the latex-food syndrome, life-threatening symptoms such as "shortness of breath, wheezing, cough" ( $n= 9$ , 13.9%) and "feeling faint, loss of consciousness" ( $n= 3$ , 4.6%) were identified in a total of 12 participants (18.5%).

Symptoms that developed after contact with medical and non-medical latex products and were associated with allergic reactions were significantly higher in female HCWs than the males ( $p= 0.001$ ) (Figure 1, 2). A total of 159 (28.1%) HCWs suffered allergic symptoms after exposure to medical latex products. The highest rate was in nurses at 59.7% and there was a statistically significant difference between the occupational groups (nurses 59.7%, physicians 17.6%, technicians 5.7%, laboratory technicians 6.9 %, patient care workers 10.1%;  $p= 0.001$ ). The most common symptom was itching and redness of the skin (145 HCWs, 25.6%). Thirty-four HCWs (6%) suffered from hand dermatitis. There was no statistically significant difference in terms of hand dermatitis between HCWs who used latex gloves and the ones who used latex-free gloves ( $p=0.081$ ).

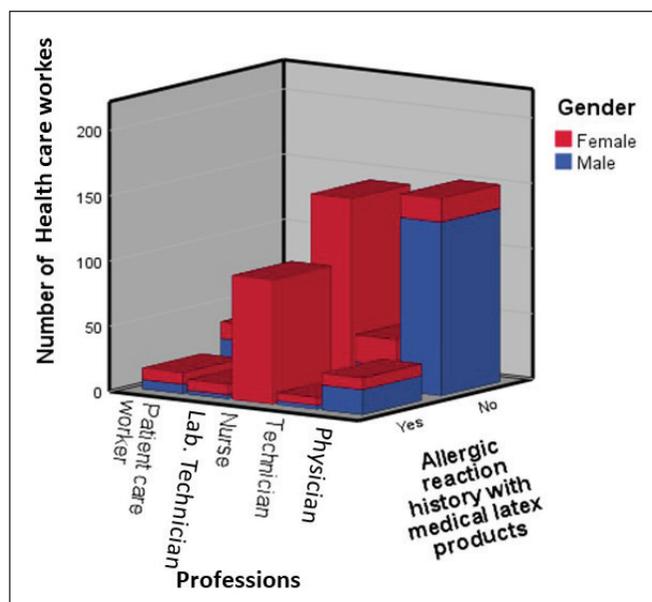
There is a statistically significant difference between HCWs with and without an allergic reaction history to medical/non-medical latex products in terms of gender, the number of invasive procedures, history of the latex-food syndrome, and latex glove use time at work (Table IV, V). Table VI presents detailed information on the distribution of these parameters based on the gender and occupation of the HCWs, and the habits of the HCWs regarding medical gloves.

HCWs were asked questions based on the knowledge that latex-related hypersensitivity symptoms could develop in non-healthcare professionals by the clustering, sticking or transportation of latex particles on HCWs (e.g., clothing, skin, hair) and transmission of these particles to other individuals who live in the same environment (e.g., the house, room). The HCWs reported a rate of 18% for non-HCW(s) who had shared the same house/room with the HCWs after work and who had experienced allergic symptoms while in the same environment with

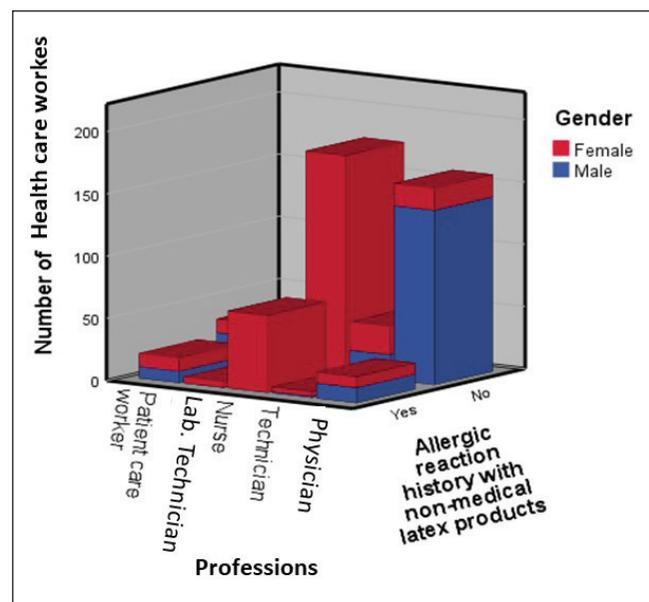
**Table III: Logistic regression analysis of possible risk factors associated with latex allergy.**

Variables	Univariate Analysis		Multivariate Analysis	
	OR (95% CI)	p	OR (95% CI)	p
Age	1.026 (0.968-1.087)	0.390	0.982 (0.898-1.073)	0.683
Gender	1.126 (0.501-2.526)	0.774	1.069 (0.247-4.624)	0.929
Time spent in the profession	1.161 (0.896-1.505)	0.259	1.023 (0.961-1.088)	0.478
Latex glove use	15.412 (6.663-35.651)	<b>0.001</b>	8.730 (3.49-21.834)	<b>0.001</b>
Presence of family history of atopy	3.389 (1.524-7.537)	<b>0.003</b>	1.556 (0.605-4.006)	0.359
Presence of personal history of atopy	39.840 (9.287-170.914)	<b>0.001</b>	28.657 (6.548-125.411)	<b>0.001</b>

OR: Odds ratio, CI: Confidence interval.



**Figure 1.** Allergic reaction history with medical latex products according to profession and gender.



**Figure 2.** Allergic reaction history with non-medical latex products according to profession and gender.

**Table IV: Comparison of HCWs with or without allergic reaction history with medical latex products.**

	HCWs without allergic reactions with medical latex products n= 407	HCWs with allergic reactions with medical latex products n=159	P
Gender, female, n (%)	206 (50.6)	127 (79.9)	<b>0.001</b>
Number of invasive procedures	1 (0-30)	2 (0-22)	<b>0.001</b>
Number of invasive procedures			<b>0.008</b>
0	134 (32.9)	30 (18.9)	
1-3	171 (42.0)	73 (45.9)	
4-10	91 (22.4)	47 (29.6)	
11-20	9 (2.2)	8 (5.0)	
≥21	2 (0.5)	1 (0.6)	
Latex-food syndrome, n (%)	33 (8.1)	32 (20.1)	<b>0.001</b>
Time spent in the profession (years)			0.266
<2	176 (43.2)	71 (44.7)	
2-5	103 (25.3)	50 (31.4)	
6-10	64 (15.7)	17 (10.7)	
11-15	33 (8.1)	9 (5.7)	
16-20	11 (2.7)	7 (4.4)	
≥21	20 (4.9)	5 (3.1)	
Latex glove use duration			<b>0.001</b>
Any	31 (7.6)	0 (0)	
Once a month	148 (36.4)	101 (63.5)	
Once a week	15 (3.7)	3 (1.9)	
Daily, less than a hour	14 (3.4)	0 (0)	
Daily, 1-4 hours	85 (20.9)	19 (11.9)	
Daily, more than 4 hours	114 (28)	36 (22.6)	

HCWs: Health care workers.

**Table V: Comparison of HCWs with or without allergic reaction history to non-medical latex products.**

	HCWs without allergic reactions to non-medical latex products n= 453	HCWs with allergic reactions to non-medical latex products n= 113	p
Gender, female, n (%)	242 (53.4)	91 (80.5)	<b>0.001</b>
Number of invasive procedures	2 (2-30)	2 (0-15)	<b>0.005</b>
Number of invasive procedures			
0	142 (31.3)	22 (19.5)	<b>0.037</b>
1-3	192 (42.4)	52 (46.0)	
4-10	101 (22.3)	37 (32.7)	
11-20	15 (3.3)	2 (1.8)	
≥21	3 (100)	0 (0)	
Latex-food syndrome, n (%)	37 (8.2)	28 (24.8)	<b>0.001</b>
Time spent in the profession			
<2	193 (42.6)	54 (47.8)	0.816
2-5	122 (26.9)	31 (27.4)	
6-10	69 (15.2)	12 (10.6)	
11-15	34 (7.5)	8 (7.1)	
16-20	14 (3.1)	4 (3.5)	
≥21	21 (4.6)	4 (3.5)	
Latex glove use duration			
Any			
Once a month	31 (0)	0	<b>0.001</b>
Once a week	182 (40.2)	67 (59.3)	
Daily, less than an hour	18 (4.0)	0 (0)	
Daily, 1-4 hours	12 (2.6)	2 (1.8)	
Daily, more than 4 hours	90 (19.9)	14 (12.4)	
	120 (26.5)	20 (26.5)	

HCWs: Health care workers.

the HCWs. The rate of these individuals was reported to be highest among the nurses at 53% and there was a statistically significant difference in terms of occupational groups (physicians 25.5%, technician 9.8%, laboratory technicians 2.9%, patient care workers 7.8%;  $p=0.030$ ). However, there was no significant difference between the HCWs' place of duty (e.g., operating room, dialysis, intensive care) and the reaction rate of these individuals ( $p=0.221$ ). The rate of non-HCWs who share the same house/room with HCWs and have allergic symptoms while in the same environment with HCWs was 28.3% in HCWs with latex-related symptoms and 14.0% in HCWs without latex-related symptoms, and this difference was statistically significant ( $p=0.001$ ).

## DISCUSSION

The prevalence of latex sensitization is 0.3-1% in the general population (2, 3). Although the prevalence of latex allergy among HCWs is different in various studies, it is regarded as 3-17% (7, 8). In previous studies, atopy,

frequency of using latex gloves, presence of hand dermatitis, and duration of time spent working in a hospital were reported to be risk factors for latex allergy (8).

Buss et al. reported a relationship between latex-related symptoms and the duration of time spent working in a healthcare facility (9). This is explained by the increase in latex sensitization following the absorption of latex antigens from the skin. Filon et al. also reported a similar relationship (10). However, there was no such relationship in our study. When we examined the time spent working in a healthcare facility, there was no significant difference between the frequency of latex-related symptoms among those working at a healthcare provider for less than 5 years, 5-10 years, 10-15 years, 15-20 years, and over 20 years. Also, there was no significant difference between HCWs with latex allergy and HCWs without latex allergy in terms of the period at the profession. This may be related to the latex antigen density not being the same in all departments of the hospital.

**Table VI: Awareness about the use of medical gloves and latex allergy among HCWs.**

	Female	Male	P	Physician	Technician	Nurse	Laboratory technician	Patient care worker	P
Do you know that latex can be a cause of allergy? (Yes, n %)	302 (90.7)	205 (88.0)	0.329	162 (90.5)	44 (91.7)	221 (92.9)	43 (89.6)	37 (69.8)	<b>0.001</b>
Which methods are used for the prevention and treatment of latex allergy? (Correct, n %)	200 (60.1)	133 (57.1)	0.188	73 (40.8)	18 (37.5)	94 (39.5)	22 (45.8)	32 (60.4)	0.068
What type of gloves do you wear?									
I don't know	24 (7.2)	25 (10.7)	<b>0.046</b>	19 (10.6)	6 (12.5)	10 (4.2)	1 (2.1)	13 (24.5)	<b>0.001</b>
I don't use any	3 (0.9)	3 (1.3)		8 (4.5)	1 (2.1)	0	0	4 (7.6)	
Latex	249 (74.8)	167 (71.7)		120 (67)	36 (75)	184 (77.3)	41 (85.4)	35 (66.0)	
Non-latex	26 (7.8)	12 (5.2)		12 (6.7)	3 (6.3)	17 (7.1)	5 (10.4)	1 (1.9)	
Both	31 (9.3)	19 (8.2)		20 (11.2)	2 (4.2)	27 (11.4)	1 (2.1)	1 (1.9)	
Type of gloves used (latex or latex-free) Latex, (n %)	303 (58.9)	211 (41.1)	0.883	159 (30.9)	44 (8.6)	220 (42.8)	43 (8.4)	48 (9.3)	0.785
Knowledge on non-medical latex products									
None	30 (9)	22 (9.4)	0.861	14 (7.8)	4 (8.3)	19 (8.0)	4 (8.3)	11 (20.8)	0.052
≥1	303 (91)	211 (90.6)		165 (92.2)	44 (91.7)	219 (92.0)	44 (91.7)	42 (79.3)	
All	0	0		0	0	0	0	0	
Knowledge on medical latex products									
None	21 (6.3)	16 (6.9)	0.470	9 (5.0)	2 (4.2)	15 (6.3)	2 (4.2)	9 (17.0)	0.106
≥1	312 (93.7)	216 (92.7)		169 (94.4)	46 (95.8)	223 (93.7)	46 (95.8)	44 (83.0)	
All	0	1 (0.4)		1 (0.6)	0	0	0	0	

HCWs: Health care workers.

A personal and family history of atopy is a risk factor for latex allergy (10, 11). In one study, latex-related symptoms were reported as 33.7% in atopic individuals and 20% in non-atopic individuals (12). In another study, a family history of atopy was reported to involve a 1.85-fold increased risk and a personal history of atopy a 2.29-fold increased risk of symptoms associated with latex gloves (4). The prevalence of latex sensitivity was 35% in atopic intensive care workers and 3.7% in non-atopic intensive care workers (11). Our study showed that the family history of atopy, personal history of atopy, and the type of glove used (latex or latex-free) were significantly associated with latex allergy. In addition, the personal history, and the type of gloves used (latex or latex-free) were independent predictors of latex allergy. On the other hand, the frequency of latex-related symptoms in atopic HCWs was approximately 3-fold higher than in non-

atopic HCWs, which indicated a statistically significant difference. In this respect, our study supports and verifies previous studies.

A history of frequent invasive procedures is the second most common risk factor for latex sensitization after being an HCW (13). Holter et al. reported that gender and atopy did not pose a risk for latex sensitization in surgical procedures (14). In our study, a history of more than 6 interventional procedures was more common in female HCWs compared to male HCWs. A history of more than 6 interventional procedures was more common in nurses compared to other occupational groups but this did not make a significant difference in terms of latex allergies diagnosed by allergy doctors in both female HCWs and nurses.

Latex proteins can cause cross-sensitization with many tropical plants (15). Buss and Frode reported that a history of the latex-food syndrome had a specificity value of 87.8% for latex allergy (9). In another study, Buss and Frode reported that the rate of the latex-food syndrome was 23% (16) while Blanco et al. reported this rate as 33% (17). In our study, this rate was lower (11.5%) than in the studies mentioned. This may be explained by the fact that a history of the latex-food syndrome was not supported by a prick test and the occupational group and age distributions of the HCWs were different from the studies mentioned in our study. It may also be related to the frequency of consumption of some tropical fruits. In our study, the food that most frequently caused symptoms was kiwi (3.5%). A 2.1% rate of anaphylaxis following consumption of these foods in the patients who described the latex-food syndrome is an important indicator that patients with latex allergies should be cautious while consuming these foods.

Many studies have shown that the most common latex-related symptoms are skin-related symptoms (12, 18, 19). A study by Holter et al. on 5087 HCWs in Norway reported that 21% of HCWs most commonly developed itching and redness of the skin after contact with products containing latex (14). Symptoms associated with latex were found to be twice as common in female HCWs than in male HCWs. This is explained by the fact that female HCWs work more frequently in areas with intensive exposure to latex. Furthermore, these symptoms mostly developed among nurses and laboratory technicians (10). Filon and Radman reported symptoms associated with latex gloves in 17.2% of HCWs and these symptoms were more common in females than in males; the female sex was a risk factor for symptoms associated with latex gloves, and the most common symptoms were erythema and redness (10). Similarly in our study, the most common symptoms associated with latex were itching and redness of the skin (25.6%). Among the occupational groups, these symptoms were most common in the nurses (36.6%). In our study, female HCWs reported 6-fold more symptoms with medical products containing latex and 4-fold more symptoms with non-medical latex products than male HCWs.

It is interesting that while it is known that latex is an allergen by 90% of HCWs in many occupational groups, the rate of those who correctly expressed the protection methods against latex allergy in the same occupational groups does not exceed 40%. It is also interesting that patient caregivers, who least state that latex is an allergen,

know the latex protection and treatment methods at the highest rate. This suggests that healthcare professionals have incomplete information about latex allergy and methods of protection from a latex allergy, and training is needed. In a study, 131 (84%) of 156 HCWs reported that they would benefit from the trainings about latex allergy (20). In another study, 90% of healthcare professionals did not know that different types of gloves are present in their departments, and 74.5% did not recognize latex-induced type I allergic reactions (21). A study conducted in Japan reported a latex awareness of 85% among HCWs (16). In our study, 34.3% of HCWs were able to correctly define latex and 57.8% gave correct answers about the prevention and treatment of latex allergy. Although this was not the desired level, the HCWs' level of awareness on latex allergies was acceptable. Al-Niaimi et al. reported that only 1 percent of HCWs could choose suitable gloves for specially prepared procedures (20). In another study, it was reported that only 44 percent of sixth-year medical students gave correct answers to questions that define latex allergy (22).

Latex antigens may be transmitted by skin contact or inhalation due to the scattering of antigens into the air. Therefore, latex allergy can cause symptoms related both to skin and mucous membranes, and the respiratory tract. The frequency of latex-related skin and respiratory symptoms in nurses was reported to be 35% in one study (9) and 50% in another one (12). In our study, the frequency of symptoms after contact with medical products was found to be 42.1% and the highest rate was among the nurses (59.7%). This is not surprising since nurses are the employees with the longest period of contact with latex-containing products among hospital staff. Latex antigens were also found in urban air samples due to their airborne transmission. These airborne particles can increase latex sensitization, either directly or indirectly (23). This raises the question of whether people working in environments with concentrated amounts of latex particles carry these antigens to a home/living environment, and whether these antigens pose a risk for the people close to HCWs. In our study, the rate of non-HCW(s) who shared the same house/room with HCWs and who had allergic symptoms while in the same environment with the HCWs were highest in nurses (53%) ( $p= 0.030$ ). There was a statistically significant difference between the HCWs who described itching and redness of the skin after contact with latex products and those who did not describe such symptoms in terms of non-HCW(s) who shared the same

house/room with HCWs and had allergic symptoms while in the same environment with the HCWs. This suggested that not only HCWs but also people close to HCWs who share the same environment with them are at risk of latex allergy. In addition, the rate of non-HCW(s) who shared the same house/room with HCWs after work and had allergic symptoms while in the same environment with the HCWs and described allergic symptoms with latex was significantly higher than those who did not describe allergic symptoms with latex. This can be explained with the effect of a family history of atopy on the development of latex allergy.

The absence of skin prick tests or allergen-specific IgE results of HCWs, the relatively small population of the study, and the cross-sectional design of the study are among the most important limitations of our study.

## CONCLUSION

Latex allergy remains an important occupational disease for HCWs, and although previous questionnaires that question symptoms associated with latex allergy have low specificity, they can be an important tool for demonstrating latex sensitization and managing latex-related reactions among HCWs. In addition, latex allergy causes some problems not only for HCWs but also for those who are not HCWs but share the same environment with them. In conclusion, it seems that healthcare workers still have some deficiencies in the knowledge of latex allergy and the prevention methods for it and they can benefit from training to be provided on latex allergy.

## REFERENCES

- Jacob JL, d'Auzac J, Prevot JC. The composition of natural latex from *Hevea brasiliensis*. *Clin Rev Allergy* 1993;11(3):325-37.
- Liss GM, Sussman GL. Latex sensitization: Occupational versus general population prevalence rates. *Am J Ind Med* 1999;35(2):196-200.
- Sicherer SH. Clinical implications of cross-reactive food allergens. *J Allergy Clin Immunol* 2001;108(6):881-90.
- Lagier F, Vervloet D, Lhermet I, Poyen D, Charpin D. Prevalence of latex allergy in operating room nurses. *J Allergy Clin Immunol* 1992;90(3 Pt 1):319-22.
- Wagner S, Breiteneder H. The latex-fruit syndrome. *Biochem Soc Trans* 2002;30(Pt 6):935-40.
- Kartal Ö, Sarı O, Güleç M, Aydoğan U, Musabak U, Sener O. Latex allergy symptoms and awareness of health care students. *Gulhane Medical Journal* 2015;57(4):352-6.
- Dieguez MC, Pulido Z, de la Hoz B, Blanco R, Cerecedo I, Fernandez-Caldas E, et al. Latex allergy in healthcare workers: An epidemiological study in a Spanish hospital. *Allergy Asthma Proc* 2007;28(5):564-70.
- Kose S, Mandiracioglu A, Tatar B, Gul S, Erdem M. Prevalence of latex allergy among healthcare workers in Izmir (Turkey). *Cent Eur J Public Health* 2014;22(4):262-5.
- Buss ZS, Frode TS. Latex allergen sensitization and risk factors due to glove use by health care workers at public health units in Florianopolis, Brazil. *J Investig Allergol Clin Immunol* 2007;17(1):27-33.
- Filon FL, Radman G. Latex allergy: A follow up study of 1040 healthcare workers. *Occup Environ Med* 2006;63(2):121-5.
- Watts DN, Jacobs RR, Forrester B, Bartolucci A. An evaluation of the prevalence of latex sensitivity among atopic and non-atopic intensive care workers. *Am J Ind Med* 1998;34(4):359-63.
- Palczynski C, Walusiak J, Hanke W, Gorski P. Latex allergy in Polish nurses. *Am J Ind Med* 1999;35(4):413-9.
- Wu M, McIntosh J, Liu J. Current prevalence rate of latex allergy: Why it remains a problem? *J Occup Health*. 2016;58(2):138-44.
- Holter G, Irgens A, Nyfors A, Aasen TB, Florvaag E, Overa KB, et al. Self-reported skin and respiratory symptoms related to latex exposure among 5,087 hospital employees in Norway. *Dermatology*. 2002;205(1):28-31.
- Garcia Ortiz JC, Moyano JC, Alvarez M, Bellido J. Latex allergy in fruit-allergic patients. *Allergy*. 1998;53(5):532-6.
- Buss ZS, Kupek E, Frode TS. Screening for latex sensitization by questionnaire: Diagnostic performance in health care workers. *J Investig Allergol Clin Immunol* 2008;18(1):12-6.
- Blanco C, Sanchez-Garcia F, Torres-Galvan MJ, Dumpierrez AG, Almeida L, Figueroa J, et al. Genetic basis of the latex-fruit syndrome: Association with HLA class II alleles in a Spanish population. *J Allergy Clin Immunol* 2004;114(5):1070-6.
- Amarasekera M, Rathnamalala N, Samaraweera S, Jinadasa M. Prevalence of latex allergy among healthcare workers. *Int J Occup Med Environ Health* 2010;23(4):391-6.
- Williams PB, Buhr MP, Weber RW, Volz MA, Koepke JW, Selner JC. Latex allergen in respirable particulate air pollution. *J Allergy Clin Immunol* 1995;95(1 Pt 1):88-95.
- Al-Niaimi F, Chiang YZ, Chiang YN, Williams J. Latex allergy: Assessment of knowledge, appropriate use of gloves and prevention practice among hospital healthcare workers. *Clin Exp Dermatol* 2013;38(1):77-80.
- Haktanir Abul M, Dereci S, Hacısalihoglu S, Orhan F. Is kiwifruit allergy a matter in kiwifruit-cultivating regions? A population-based study. *Pediatr Allergy Immunol* 2017;28(1):38-43.
- Erkekol FO, Celik GE, Hayran M, Dursun BA, Goksel OK, Misirligil MS, et al. The prevalence of latex allergy in sixth-year medical students: Assessment of knowledge, risk, and attitudes about future specialty direction. *Ann Allergy Asthma Immunol*. 2008;100(6):576-82.
- Douglas R, Morton J, Czarny D, O'Hehir RE. Prevalence of IgE-mediated allergy to latex in hospital nursing staff. *Aust N Z J Med* 1997;27(2):165-9.