

# The Prevalence of Allergic Contact Sensitization of Practicing and Student Nurses

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## Abstract

**Background:** Contact dermatitis (CD) is a significant problem among nurses. Although there are reports about the prevalence of CD from different parts of the world, data about its frequency in Turkey and about allergic contact sensitization among nurses is insufficient.

**Objective:** To define the frequency and patterns of allergic contact sensitization and related symptoms in practicing and student nurses.

**Methods:** There were 123 nurses in our hospital practicing in the in-patient clinics. All were invited to participate in the study. 69 working-in nurses and 79 student nurses participated in the study. The main reason for refusal of nurses was that they were usually having a shower daily after a hard working day and they had to postpone having a bath for 3 days if they had a patch test on their back. A ready-to-use patch test system (TRUE test®) with 29 standardized test substances was applied to all of the participants. History about symptoms of CD and allergic diseases was investigated by questionnaire.

**Results:** While 34.8% (24/69) of practicing nurses had symptoms of CD, 19% (15/79) of student nurses reported the symptoms ( $p=0.039$ ). The most prevalent positive reaction was to nickel sulfate followed by thimerosal. There was no difference for positive reaction rates between practicing and student nurses. Nurses who had symptoms of CD were older than those without symptoms ( $p=0.003$ ). The participants with symptoms of CD were more frequently from practicing nurses ( $p=0.047$ ).

**Conclusion:** CD is more frequent in practicing nurses than student nurses; allergic contact sensitization is not. This may be attributed to the length of occupation that is also correlated well with the length of exposure to the occupational irritants.

**Keywords:** Patch test; Allergic contact; Nurse; Eczema

## Introduction

Occupationally-induced dermatitis, especially hand dermatitis, is still amongst the most prevalent work-related diseases.<sup>1</sup> Contact dermatitis (CD) is the most common type of occupational

dermatitis, accounting for 97.2% of cases.<sup>2</sup>

Occupational CD is a condition that should be considered when dermatitis is caused by workplace exposures, or when a pre-existing skin condition is exacerbated by work.<sup>3</sup> Health care workers

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are one of the most commonly affected groups by occupational CD.<sup>4-5</sup> Members of health care sector are regarded to be at risk for developing CD, because they are frequently exposed to disinfectants and various chemicals.<sup>6-7</sup> The incidence of CD in nurses is reported from 7% to 46% in different studies.<sup>8-9</sup> The skin diseases would result in important problems including loss of working time (61%) and mental distress (48%).<sup>8,10</sup> Although there are recent reports about the prevalence of CD among nurses from different parts of the world,<sup>11-13</sup> data about the frequency in Turkey is insufficient. Also, the frequency and pattern of allergic contact sensitization in nurses (with and without symptoms) investigated by patch testing are not well studied.

Irritant contact dermatitis is the most common form of dermatitis experienced by nurses.<sup>14</sup> Frequent hand washing and drying, especially with paper towels, is a common cause of irritant CD.<sup>15</sup>

The objective of this study was to determine the frequency and patterns of contact sensitization and related symptoms in practicing nurses in Turkey. This group was compared with student nurses to determine to what extent allergic contact sensitization was due to occupational exposure.

## Materials and Methods

There were 123 nurses working in Ankara Children's Hematology-Oncology Education and Research Hospital. Between January 1, and March 31, 2011, all these nurses and student nurses who were training at Anatolian Nursery High School in Cubuk, Ankara were asked to participate in this study in a voluntary basis. The Institutional Review Board approved this study. Age, gender, and length of working as a nurse were recorded for responders. All participants completed a

questionnaire about their own dermatologic and allergic complaints, and family history of allergic and dermatologic diseases. About symptoms of eczema, the participants were asked if they ever had itching, erythema, dryness, scaling, fissuring and blistering of their skin. If there were symptoms of suspected CD, date of onset of the complaints, the relation with the workplace and work time, and other aggravating factors were questioned, detailed medical history was obtained and physical examination was performed by a physician to be sure about the diagnose of CD.

A ready-to-use patch test system (TRUE test<sup>®</sup>, Mekos Laboratories AS, Hillerød, Denmark) with 29 standardized test substances comprising of the most common allergens or allergen mixes selected in accordance with the recommendations of the International Contact Dermatitis Research Group (ICDRG) was used for patch test. Patch test plasters were applied on the upper back of the volunteers, and removed after two days. The first reading was performed on day 2 at least 20 minutes after removing the patches. On day 3, the routine final reading was made for all volunteers. If necessary, later readings on days 5 and 7 were performed. The tests were evaluated by the same allergist blinded to the answers participants had given on the questionnaire. After patch testing, the current clinical and occupational relevance of the positive patch test reactions were evaluated.

Results were expressed as absolute numbers (percentile), as mean and standard deviation or as median and interquartile range (IQR) as required. SPSS<sup>®</sup> ver 15.0 (SPSS Inc., Chicago, IL, USA) was used for statistical analyses. To compare variables of practicing and student nurses,  $\chi^2$  test and Mann Whitney U test were used. A 2-tailed p value <0.05 was consi-

**TAKE-HOME MESSAGE**

- The most prevalent work-related diseases is occupationally-induced dermatitis, especially hand dermatitis.
- Health care workers are one of the most commonly affected groups by occupational contact dermatitis.
- Health care workers are at risk of developing contact dermatitis due to exposure to disinfectants and various chemicals.
- Irritant contact dermatitis is the most common form of dermatitis experienced by nurses.
- The diagnosis of occupational contact dermatitis and the identification of the allergens are necessary to control the symptoms and take preventive measures appropriately.
- Nurses who are older and who had a longer period of occupation were found to have symptoms of contact dermatitis more frequently.
- Coexisting skin disease and allergic rhinitis were more frequent amongst those nurses with symptoms of contact dermatitis.

dered statistically significant.

**Results**

Sixty-nine working-in nurses and 79 student nurses participated in the study. There were 123 nurses in our hospital working in the in-patient clinics. All nurses who were working during the study period were asked for attending the study but only 69 (56%) were volunteered to have a patch test. The main reason for re-

fusal was that nurses were having a shower daily after a hard day working and they had to postpone having a bath for three days if they had a patch test on their back. Nurses who were not volunteered were generally not different from the study group in terms of CD symptoms frequency, age and length of occupation ( $p=0.079$ ,  $p=0.148$ , and  $p=0.152$ , respectively). The median (IQR) age of the study group was 22 (15), ranging between 14 and 45 years. Thirteen (8.7%) of studied nurses were male. The practicing nurses had a median (IQR) length of occupation at hospitals of 10 (9) years. Thirty-nine (26.3%) of all nurses had symptoms of CD, and a total of 49 participants (33.1%) had at least one positive patch test reaction. The most common sensitizations observed on patch test were to nickel sulfate ( $n=31$ , 21.0%) and to thimerosal ( $n=17$ , 11.5%). The other positive patch test results were for balsam of Peru ( $n=1$ ), cobalt chloride ( $n=2$ ), diazolidinyl urea ( $n=2$ ), fragrance mix ( $n=1$ ), colophony ( $n=1$ ), p-tert butylphenol formaldehyde resin ( $n=1$ ) and caine mix ( $n=1$ ). None of these participants had symptoms of CD. Hand disinfectants used in in-patient clinics were examined for their chemical contents but none of the aforementioned compounds were found in their ingredients.

Coexisting allergic diseases like allergic rhinitis and asthma were reported by 9.5% (14/148) of the participants. Twenty-five (16.8%) and 16/148 (11.0%) of the participants had family history of asthma and allergic rhinitis, respectively. Eleven (7.4%) of the participants had coexistent skin diseases diagnosed by a dermatologist; the diseases included seborrheic dermatitis ( $n=5$ ), pityriasis versicolor ( $n=3$ ), acne rosacea ( $n=1$ ), lichen planus ( $n=1$ ) and psoriasis ( $n=1$ ).

**Practicing and Student Nurses**

The median (IQR) age of the practicing

**Table 1:** Clinical features of practicing and student nurses. Data are shown as absolute numbers (%), or median (IQR).

	Working-in nurses (n=69)	Student nurses (n=79)	p
Age	30 (8.5)	15 (1)	<0.001
Male gender	8 (12%)	5 (6%)	0.402
With symptoms of contact dermatitis	24 (35%)	15 (19%)	0.039
Dental devices	31 (45%)	23 (29%)	0.068
Coexisting			
Respiratory tract diseases	1 (1%)	4 (5%)	0.372
Skin diseases	8 (12%)	3 (4%)	0.136
Allergic diseases	6 (9%)	8 (10%)	0.988
Asthma	1 (1%)	2 (3%)	1.000
Allergic rhinitis	6 (9%)	7 (9%)	1.000
Family history of			
Asthma	11 (16%)	14 (18%)	0.946
Allergic rhinitis	7 (10%)	9 (11%)	1.000
Eczema	9 (13%)	8 (10%)	0.767
Positive True Test® Result	22 (32%)	27 (35%)	0.910
Positive for Nickel	15 (22%)	16 (20%)	0.985
Positive for Thiomersal	8 (12%)	9 (12%)	1.000

nurses was 30 (8.5) years and of the student nurses was 15 (1) years ( $p < 0.001$ ). No difference was observed between practicing and student nurses in terms of frequency distributions of gender, coexisting dermatologic and allergic complaints, and family history of allergic diseases. Regarding the occupation, 34.8% (24/69) of practicing nurses and 19% (15/79) of student nurses reported to have symptoms of CD ( $p = 0.039$ ). A positive reaction to one or more contact allergens was noted in 32.4% (22/69) of the practicing and 34.6% (27/79) of the student nurses ( $p = 0.910$ ). The positive reaction rates for nickel sulfate and thimerosal were similar for practicing and student nurses; 21.7%

(15/69) and 20.3% (16/79) for nickel sulfate ( $p = 0.985$ ), 11.6% (8/69) and 11.6% (9/79) for thimerosal ( $p = 1.000$ ), respectively (Table 1).

#### Nurses with and without Symptoms of CD

Nurses who had symptoms of CD were significantly ( $p = 0.003$ ) older than the nurses with no symptoms. The participants with symptoms of CD were more frequently from practicing nurses ( $p = 0.047$ ). The length of occupation of practicing nurses with symptoms of CD was significantly ( $p = 0.012$ ) more than those without symptoms. Coexistent skin diseases and allergic rhinitis were sig-

**Table 2:** Comparing clinical features of the participants with and without symptoms of contact dermatitis. Data are shown as absolute numbers (%), or median (IQR).

Symptoms of contact dermatitis	With (n=39)	Without (n=109)	p
Age (year)	27 (16)	17 (13)	0.003
Occupation			0.047
Practicing	24 (62%)	45 (41.2%)	
Student	15 (39%)	64 (59.0%)	
Length of service for practicing nurses	13 (7)	5.5 (9)	0.012
Male gender	4 (10%)	9 (8.2%)	0.463
Dental devices	17 (44%)	37 (34.0%)	0.379
Coexisting			
Respiratory tract diseases	3 (8%)	2 (1.8%)	0.115
Skin diseases	6 (15%)	5 (4.5%)	0.038
Allergic diseases	5 (13%)	9 (8.2%)	0.293
Asthma	2 (5%)	1 (0.9%)	0.170
Allergic rhinitis	8 (21%)	5 (4.5%)	0.006
Family history of			
Asthma	9 (23%)	16 (14.6%)	0.341
Allergic rhinitis	4 (10%)	12 (11.0%)	0.582
Eczema	7 (18%)	10 (9.1%)	0.120
Positive True Test® Result	23 (59%)	26 (23.8%)	<0.001
Positive for Nickel	20 (51%)	11 (10.0%)	<0.001
Positive for Thiomersal	3 (8%)	14 (12.8%)	0.293

nificantly more frequent amongst nurses with symptoms of CD than those without symptoms ( $p=0.038$ , and  $p=0.006$ , respectively). There was no significant difference for gender and family history between the two groups with and without CD symptoms (Table 2).

The nurses with CD symptoms had more frequent positive reactions on patch

test compared to those without symptoms ( $p<0.001$ ). This was also valid for positive reactions to nickel sulfate ( $p<0.001$ ). However, there was no significant difference for the frequency of positive thiomersal reactions between the two groups with and without CD symptoms ( $p=0.293$ ) (Table 2).

### Nurses with Positive and Negative Patch Test Results

The most frequent positive patch test reaction was to nickel sulfate (63.2%, 31/49) followed by reaction to thimerosal (34.7%, 17/49). Participants with positive reactions on patch test had more frequent CD symptoms than those with negative patch test results ( $p < 0.001$ ). Similarly, symptoms of CD were more frequent amongst those participants with positive patch test reaction for nickel sulfate than with negative reactions ( $p < 0.001$ ). There was no significant difference between nurses with positive and negative patch test reactions in terms of frequency distribution of age, occupation status, length of occupation, gender, coexistent skin and allergic diseases and family history of allergic diseases (Table 3). All of the participants with a positive nickel sulfate reaction were female. For the variables analyzed, there was no significant difference between positive and negative nickel sulfate groups. Also for thimerosal, there was no significant difference between positive and negative groups for the variables analyzed. Most of the nurses with positive patch test for nickel sulfate had symptoms associated with nickel exposure (20/31), whereas the nurses with positive reaction to thimerosal had no symptoms related to exposure to materials including thimerosal. None of the participants with other sensitizations had complaints with clinical relevance to exposure to the materials caused positive reactions on patch test.

### Discussion

In this study, we aimed to determine the frequency and patterns of contact allergen sensitization of the nurses working in our hospital. To reveal the effect of occupation on contact sensitization, practicing nurses were compared with student nurses.

**Table 3:** Comparing clinical features of the participants with positive and negative patch test results. Data are shown as absolute numbers (%), or median (IQR).

Patch test result	Positive (n=49)	Negative (n=99)	p
Age (year)	27 (16)	17 (13)	0.556
Working-in	22 (45%)	46 (47%)	0.773
Length of service for working-in nurses	8 (9)	11 (10)	0.585
Male gender	2 (4%)	11 (11%)	0.123
With symptoms of contact dermatitis	23 (47%)	16 (16%)	<0.001
Dental devices	21 (43%)	33 (33%)	0.388
Coexisting			
Respiratory tract diseases	1 (2%)	4 (4.0%)	0.454
Skin diseases	4 (8%)	7 (7%)	0.538
Allergic diseases	6 (12%)	8 (8%)	0.310
Asthma	2 (4%)	1 (1%)	0.261
Allergic rhinitis	5 (10%)	8 (8%)	0.455
Family history of			
Asthma	10 (20%)	15 (15%)	0.606
Allergic rhinitis	4 (8%)	11 (11%)	1.000
Eczema	5 (10%)	12 (12%)	0.911

es. Practicing nurses had symptoms of CD more frequently than student nurses, but contact sensitization was not found more frequently. Older nurses and nurses who had a longer length of occupation also had more frequent symptoms, whereas frequency of contact sensitization was not correlated with age and length of occupation.

The diagnosis of occupational CD and the identification of the allergens are necessary to control the symptoms and take preventive measures appropriately. As well as identifying the causative agent, the discrimination of allergic and irritant CD

is also crucial for the proper management of patient. However, differential diagnose of allergic and irritant CD is challenging, because reliable data about symptoms, physical findings and exact history of occupational and domestic exposures at the beginning of the symptoms are usually inaccessible; these two pathologies frequently coexist.<sup>15</sup>

Telksniene, *et al*, found that while only 18.1% of the nurses had been affected by skin complaints before starting work at health care institutions, 47.5% of practicing nurses were suffering from skin problems.<sup>15</sup> On account of their findings, they concluded that the skin problems of nurses were of occupational origin. In accordance with their results, in our study, symptoms of CD were more frequent amongst practicing nurses than student nurses, and length of occupation of the participants with CD symptoms was longer than those without symptoms. However, there was no significant difference in age, length of occupation and being practicing or student nurses between the groups with and without positive reactions on the patch tests. All of these led us to consider that the symptoms in relation with CD were probably due to or induced by repeated exposure to irritant chemicals used at workplace.

Nurses who are older and who had a longer period of occupation were found to have symptoms of CD more frequently. This may be the result of longer and repeated exposure to chemicals as stated in the literature.<sup>14,15</sup> Repeated harmful exposures decrease the resistance of the skin and exhaust the repair capacity. Such conditions are observed in the nurses' occupational settings.<sup>15</sup> Another reason for this result can be the fact that in the near future, more attention is paid to use of less harmful materials in hospitals and nurses are more careful about the materials they use.

Compatible with the data reported by Flyvholm, *et al*, coexisting skin disease and allergic rhinitis were more frequent amongst those nurses with symptoms of CD compared to those without symptoms.<sup>16</sup> The literature about hospital-based studies shows that one-third of the cases of hand eczema are associated with atopy.<sup>10,17</sup> In the current literature, there are reports about the relation between hand eczema and allergic skin diseases like atopic dermatitis among nurses.<sup>13,16,18</sup> However, there was no participant having allergic skin diseases in our study population.

In the literature, both in the general population and in the patient groups with CD, the most prevalent positive patch test reaction is to nickel sulfate. For patient groups, the prevalence ranges from 6% to 20.9%.<sup>19-23</sup> With a frequency of 17.6% and 19.1%, nickel was also the most frequent test substance that produced positive reaction in the two large scale studies of patients with CD from Turkey.<sup>24,25</sup> The prevalence of allergic contact sensitization to nickel sulfate in general population was reported to be 17.6%.<sup>26</sup> To the best of our knowledge, there is no study from Turkey about the contact sensitization in general population.

In a recent study investigating occupational contact dermatitis among health care workers, positive reaction rate for nickel sulfate on patch tests was 56%; clinical relevancy rate was found to be 65%.<sup>14</sup> These are similar to the results obtained in our study in which the positive patch test reaction rate for nickel sulfate among the nurses with symptoms of CD was 59% and that all of them were clinically relevant. To the best of our knowledge, there is no report on the frequency of nickel positivity on patch test among the nurses—both with and without complaints of CD; there is no report comparing the patch test results between practic-

ing and student nurses, as well.

The most common positive reaction on patch test was to nickel sulfate (20.9%, 31/148) in our study. There was no difference for nickel sulfate positivity between practicing and student nurses. Also, there was not any history of nickel exposure related to symptoms of CD in the workplace. Nickel sensitization was reported by the participants to be the result of the use of metal accessories including nickel as it is highlighted in the literature.<sup>27-29</sup> The second most prevalent positive reaction found with patch testing was to thimerosal (11.4%, 17/148). Similarly, positive patch test reactions to thimerosal was commonly reported in other studies.<sup>23,30</sup> Thimerosal is used as preservative in vaccines, cosmetics and topical medications. There are a limited number of reports related with CD due to thimerosal exposure as well, and thimerosal sensitization is rarely found to be clinically important.<sup>31,32</sup> In keeping with the literature, none of our participants with thimerosal sensitivity reported reactions due to vaccination or use of material comprising thimerosal.<sup>32</sup>

The clinical relevance of the positive patch test reactions was investigated for the materials exposed in the workplace. Neither nickel sulfate nor other limited number of positive patch test reactions were found to be related with the occupational exposure, as in the studies of Strauss, *et al*, and Rudzki, *et al*, who reported that most of the positive patch test results in nurses were unrelated to professional exposure.<sup>33,34</sup> This is also compatible with the reports stating that occupation-related irritant CD is more common than occupation-related allergic CD.<sup>34,35</sup>

Although all nurses were asked for attendance, 56% were volunteered for the study. This is a limitation of our study. However, there was no difference in the frequency of symptoms related with CD, age and length of service between volun-

teered and not volunteered nurses.

In conclusion, CD was more prevalent among nurses practicing for long years at health care sectors, but allergic contact sensitization was not more frequent than student nurses. This may be attributed to the length of occupation that is also correlated well with the duration of exposure to the occupational irritants.

**Conflicts of Interest:** None declared.

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