

## SIDE EFFECTS OF HYGIENE PRODUCTS IN HEALTHCARE WORKERS AND TEMPORARY WORK INCAPACITY DUE TO THE USE OF HYGIENE PRODUCTS

Mirjana Paravina<sup>1</sup>, Marija Nedeva<sup>2</sup>

When performing their duties, healthcare professionals encounter a large number of diseased people on a daily basis at their workplaces in healthcare clinics and hospitals. This requires a special code of conduct. Prevention of infections and cleanliness are imperative. This process may cause side effects from the use of hygiene products, which is evident in every analysis of skin diseases, allergic and occupational conditions in particular. There is always a number of healthcare workers with contact dermatitis and the most common etiological factors are soaps, detergents, cleaning agents, infectious agents, medicines and disinfectants. Diagnostics, prevention, treatment and occupational rehabilitation, and assessment of work capacity are implemented in all cases of those affected by occupational allergic contact dermatitis.

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**Key words:** *healthcare workers, allergic contact dermatitis, hygiene products, work capacity*

<sup>1</sup>University of Niš, Faculty of Medicine, Niš, Serbia

<sup>2</sup>University of Niš, Faculty of Medicine, Doctoral Studies, Niš, Serbia

Contact: Mirjana Paravina  
44 Borova St., 18000 Niš, Serbia  
E-mail: mirjanaparavina@gmail.com

### Introduction

Changes in the skin may occur in any profession depending on the individual features of the skin, work conditions and occupational hazards.

These are more occupational dermatoses caused by chemical hazards (1):

1. Occupational Contact Dermatitis
    - a. Occupational Irritant Contact Dermatitis (most common type (2))
    - b. Occupational Allergic Contact Dermatitis (type IV (3, 4))
  2. Occupational Contact Erythema Multiforme
  3. Occupational Contact Urticaria Syndrome
    - a. Occupational Contact Urticaria
    - b. Occupational Protein Contact Dermatitis.
- Occupational allergic dermatosis, i.e., Occupational Allergic Contact Dermatitis (OACD) is

of particular medical, social and economic significance.

In their workplace, healthcare workers encounter a large number of people, both ill and healthy on a daily basis. This requires a special code of conduct. Naturally, all healthcare institutions have hygiene rules and use appropriate means. The employees may be exposed to those hygiene products, which in turn may be the cause of undesired changes in the skin as a consequence of the effects of those hygiene products.

If changes in the skin occur, it is necessary to perform an exposure and elimination test, as well as a patch test. Then the appropriate course of therapy should be decided. As for the diseased healthcare worker, further actions will be determined following the appropriate and regulated measures. Regarding the working environment, in which the allergic reaction to the product occurred, there must be insistence on implementing and strictly following protective measures, which will be dealt with in the text to follow.

### Aim

This study aimed to recognize and diagnose the occurrence of side effects in healthcare workers following the use of hygiene products, the administration of appropriate treatment and protection. This was intended to be done by following suitable measures of protection and enforcing rules for the strict administration of

protective measures in an adequate and approved manner for the use of the necessary hygiene products.

### Materials and Methods

The first step was to gather first-hand information about the possibility of allergic reactions in healthcare workers and study literature on the topic. This was followed by getting acquainted with all measures intended for treating and preventing side effects to the hygiene products when strictly following the prescribed measures.

### Results, Reference Data and Discussion

In 15 years, the results of epicutaneous testing in 962 diseased persons were analyzed at the Dermatological Clinic in Niš (5). Six hundred and sixty people (68.60%) tested were men and 302 (31.39%) were women; they belonged to different occupations (construction workers, housewives, farmers, miners, workers in the rubber and electronics industry, mechanics, hairdressers), as well as healthcare professionals (a total of 14 people).

Other occupations that were subject to the examination were workers in the wool and leather industry, textile and wood processing, wall and ironworks painters, custodians, healthcare professionals, etc.

In the patch tests, healthcare workers tested positive for procaine, aniline, aneurine, dental, peril, asepsol, lizol, kavit, and Teptih.

Custodians tested positive for Teptih, Ursol, lizol, and bis.

It was proved that healthcare professionals exhibit sensitivity to medicines, disinfectants and

cleaning agents. According to reference materials (6, 7) this is a matter of allergies to penicillin, streptomycin, novocain, sulfonamide, iodine compounds, largactil, procaine, gingicaine and peril spray. The role of latent sensibilization in the pathogenesis of occupational allergic dermatosis in healthcare professionals is stressed.

According to a report from 2002 (8), out of 5,839 tested patients with contact dermatitis, in 1,097 (19%), it was linked to their profession, and 60% of those patients suffered from allergic contact dermatitis. The most common allergens were carba mix, thiuram mix, epoxy resin, formaldehyde, and nickel.

Laberge et al. (9) assessed the importance of allergies to p-phenylenediamine (PPD) and determined the cross-reaction with other para-amino compounds. Contact allergy to PPD occurred in 13234 patients: 13.4% were hairdressers, 18.7% were people with atopy, 90.3% were sensitive to hair dye, 2.2% were sensitive to henna tattoos, 7.5% reacted to benzocaine, 6.0% to sulfa drugs, 1.5% to isopropyl-para-phenylenediamine, while 1.5% of patients reacted to para-aminobenzoic acid. It was concluded that PPD is a major cause of contact allergies. Dentistry professionals may be at increased risk of occupational allergic diseases, especially to methacrylates (10). A 28-year-old dental technician exhibiting itching and cracks on the fingers in the previous 6 months was presented. Patch testing showed a positive reaction to methyl methacrylate. Methacrylates are a compound of acrylic resins and can penetrate disposable surgical gloves. The use of nitrile rubber gloves when performing work duties is a sufficient protective measure in addition to appropriate preventive measures.

**Table 1.** Structure of examined patients by sex and place of residence

Sex	Male	Female	Total
Number	660	302	962
%	68.60%	31.39%	99.99%
Place of residence	Town	Village	Total
Number	490	472	962
%	50.92%	49.07%	99.99 %

**Table 2.** Age of examined patients

Age	No.	Percentage
Up to 20 y	57	5.90%
21–30 y	234	24.30%
31–40 y	255	26.40%
41–50 y	261	27.30%
51–60 y	109	11.31%
Over 60 y	46	4.78%
Total	962	99.99%

**Table 3.** Structure of examined patients by occupation

Occupation	Number of patients	Percentage
Construction workers	195	20.27
Housewives	85	8.83
Metal workers	67	6.96
Rubber workers	59	6.13
Electronic specialists	44	4.57
Hairdressers	41	4.26
Farmers	41	4.26
Miners	31	3.22

**Table 4.** Most common allergens (top 10)

Allergen	Number	Percentage
1. Kalium bichromate	91	28.60%
2. PAN	41	12.97%
3. PBN	40	12.65%
4. Formalin	23	7.29%
5. Anilin	21	6.64%
6. DM	18	5.69%
7. 4010	17	5.37%
8. Nickel sulfate	16	5.06%
9. Vikacid D	12	3.79%
10. Ursol	12	3.79%

ACD is most frequently caused by chemicals in rubber gloves (thiuram mix and tetraethylthiuram disulfide), preservatives (formaldehyde, formaldehyde emanators and isothiazolinones), excipients in handwashing liquids (weak allergens that are difficult to avoid) (8). To develop a preventive strategy, the authors suggest that skincare counseling be included in the education on hand hygiene.

The results from testing conducted at a clinical hospital and a private clinic in New Zealand were announced (11). Of 837 patients, 67 were healthcare professionals: 40% of nurses, 20% of allied health and 18% of doctors. Fifty-seven percent of these patients had positive patch tests: 16 reactions to accelerator rubber, 11 to fragrances, 10 to preservatives, and 6 to corticosteroids. The most common relevant antigens were methylisothiazolinone, hydroxyisohexyl 3-cyclohexene carboxaldehyde and methylisothiazolinone.

According to Mathias (12), the most common etiological factors that lead to the development of dermatosis in healthcare are soaps, detergents, cleaning agents, infectious agents, drugs and disinfectants.

Higgins CI et al. (13) performed an analysis of occupational skin diseases among Australian healthcare workers. In 22 years, they diagnosed occupational skin diseases in 555 (81.0%) out of the 685 healthcare workers included in the analysis. The most common occurrence was that of irritant contact dermatitis (79.19%), followed by allergic contact dermatitis (49.7%). Natural rubber latex was registered as the cause of allergy in 13.0% of the examinees. The largest number of substances causing allergic contact dermatitis are runner chemicals found in gloves (thiuram mix and tetraethylthiuram disulfide), preservatives (formaldehyde, formaldehyde releasers and isothiazolinones), excipients in hand cleaners and antiseptics. It is suggested that skin care advice should be incorporated into hand hygiene education. The use of alcohol-based hand rubs should be encouraged, weak allergens in skin cleaners should be substituted, and accelerator-free gloves should be recommended for healthcare workers with occupational skin diseases.

Franca et al. (14) have presented a study about occupational dermatoses in healthcare workers in a medical center in Portugal.

Contact dermatitis (eczema) represents about 90% of occupational dermatoses (15, 16). Healthcare workers are particularly susceptible to this type of skin disorder (17) as a result of their frequent contact with a large number of potential irritants and sensitizing agents, e.g. rubber gloves and disinfectants (13). The study involved 1,338 (76.85%) women and 403 (23.15%) men, whose median age was 41. A total of 1741 healthcare workers of different professions were analyzed. With a prevalence of 3.56%, occupational dermatoses were more frequent in women (82.26%). In the group with occupational dermatoses, 34 workers (54.84%) suffered from irritant contact dermatitis, 17 (27.42%) had latex

allergy, 6 (9.68%) had allergic dermatitis, and 5 (8.06%) had two simultaneous conditions—4 people had latex allergy and irritant contact dermatitis and 1 person had latex allergy and allergic dermatitis.

Cases of dermatitis were more common among individuals who had a personal atopic history, but the margin was not statistically significant.

Many other important and interesting findings were presented in the study. The definitive data showed that there was a prevalence of occupational dermatoses in the analyzed group of 1.741 workers of 3.56%. Primary prevention measures and the use of less sensitizing materials can reduce the occurrence of dermatoses in this professional group.

A retrospective study was conducted on 294 patients with OACD in the Allergy Unit of the Dermatology Department in Istanbul between 1996 and 2019 (18). OACD was registered in 10.5%, predominantly men. These were mostly construction workers, followed by hairdressers, metalworkers, healthcare workers, etc. The most common allergens were chromium in cement, thiuram in rubber gloves, hairdressing chemicals, resin/glues/plastic, metals, isothiazolinones, and fragrances.

Schwensen JF et al. (19) examined the occurrence of contact allergies among healthcare workers in Denmark. A retrospective study of patch test results of 1402 healthcare workers who had contact dermatitis was conducted as opposed to a control group of 1402 individuals with contact dermatitis. It was found that, in patients who have contact dermatitis and work in healthcare, there was a significant combination of contact allergy to thiuram mix, hand dermatitis and occupational contact dermatitis. In the future, legislative authorities may focus on the use of thiuram and carbamates in, for example, protective gloves, as it seems that improved production methods of protective gloves have not yet paid dividends to skin health or the workers in the healthcare sector.

After examining the diseased person and recording the specific clinical condition, it is highly relevant to collect a detailed history of the beginning of the disease, its localization and appearance, the person's lifestyle and habits, and movement within the workspace. This is done to establish possible links between the onset of the disease and working in a specific position, changes that may occur when absent from work and upon returning along with a description of the working conditions.

When providing a diagnosis, a test of exposition and elimination may be of great importance, with the patch test serving as the gold standard in diagnosing ACD (20).

Prevention has a great impact on the occurrence and frequency of ACD (21, 22). The first measure would be appropriate occupational treatment. Individuals with dry and sensitive skin should not work with irritants and sensitizers. It would be beneficial to conduct epicutaneous

testing before commencing work. Educating employees from the beginning of their formal education until the end of their service. Persistence on mechanization, automation and closed-circuit systems to eliminate the presence of sensitizers from the process whenever possible, adherence to sanitary regulations, make provisions that individual protective measures do not inhibit the work process, and make provisions that additional hand protective means do not irritate and sensitize the skin.

Treatment is symptomatic. Locally, one administers corticosteroid creams and if necessary, antibiotics, systemic antihistamines and possibly corticosteroids.

Causal treatment would be to prevent contact with the allergen causing the reaction.

By implementing adequate protective measures, one may attempt treatment while continuing service.

The diseased person may become temporarily incapacitated for work (23). In cases of high intensity and spread of the disease, it is necessary to exclude the person from work obligations for 2–3 weeks due to the possibility of further provocation of the disease by irritants. Then, for at least 2–3 additional months, they should be allowed to work in positions where they would not be in contact with irritants (7). According to some authors (24, 25), attempts should be made for the diseased person to stay in the same work position and accept minor outbreaks of OACD.

In cases when OACD is severe and frequently relapses, steps towards occupational rehabilitation must be taken. This implies a change of the work position or occupation. The worker should be referred to the Disability Board, which should (26):

- Establish the cause of the disability
- Denote loss of or diminished work capacity
- Denote risk of disability
- Assess remaining work capacity
- Denote the persistence of risk of developing a disability
- Give opinion on the possibility of occupational rehabilitation
- Point to the direction in which occupational rehabilitation should progress
- Give an opinion on the possibility of changing the position to a more suitable post without requiring occupational rehabilitation.

A person who still maintains work capacity for another full-time job is placed in the III category disability list. The right to disability retirement benefits is granted to an employee or a self-employed insured person who is placed in the III category disability list, but is not given the right to retraining or additional training due to age—50 years of age (for men) and 46 years of age (for women) (27).

Work capacity is assessed on the basis of the following elements:

- Work history—position where the person works, where the changes occurred and previous years of service

- Job description of the position where the worker is assigned (contact with denoted chemicals, duration of contact—in the course of the full working hours or occasionally and in which time intervals)

- In case of contact constant, exposure at the workplace should persist for at least a year, with 2–3 years if the contact is occasional—this does not apply to chemicals with high allergenic potential

- Worker's personal history—atopic constitution or previous allergic manifestations on the skin or other organs

- Dermatologist's report containing the diagnosis of allergic contact dermatitis with description of the clinical condition and course of the disease—a chronic illness with severe relapses, course of the disease at the workplace and home, duration of relapses after exposure and whether rehabilitation occurs with or without treatment.

If the listed conditions are fulfilled, the disease can be labeled as occupational.

Care should be taken that the new work position does not pose the same threat, i.e., that contact with the same or chemically similar matter does not continue, as well as contact with other irritants or matters with high allergenic potential. This could lead to the persistence of the disease or polysensitization. Persons with atopy are especially problematic, as well as so-called ubiquitous matters, contact with which continues in and out of the workplace. If one is dealing with an atopic person with any kind of allergic manifestations, even if contact dermatitis is not present, there should be follow-up check-ups every 6 months. Special attention should be paid to young people who are still being educated or are at the beginning of their careers and already have contact dermatitis. Professional orientation or retraining should be conducted immediately to avoid the development of the disease and the occurrence of disability (28).

Many of the consequences of the effects of the use of hygiene products among professionals in healthcare institutions would not occur should all follow the protocol prescribed by the Public Health Institute "Dr Milan Jovanović Batut" in the article Maintaining Hygiene in Healthcare Institutions (29).

Sections of this article will be cited here to be at hand to whoever is reading this paper.

Basic principles of cleanliness in a healthcare institution include: personal hygiene and hand hygiene; proper use of personal protective equipment; proper use of cleaning agents and/or disinfectants; use of suitable cleaning equipment, its maintenance and proper disposal; and waste management. Precise advice is given on every one of these points.

We arrive at the point of contact—cleaning agents and/or disinfectants.

It is prescribed that all detergents and disinfection agents used in healthcare institutions must be approved by the Ministry of Health. The choice is made by a hospital infection commission within the healthcare institution. Chemical cleaning agents and disinfectants must be properly labeled and stored to eliminate the risk of contamination, inhaling or contact with skin or mucosa. A safety technical list must be available for cases of emergency. Cleaning chemicals include neutral detergent, disinfectants, toilet and bathroom cleaning agents, as well as other chemicals procured at the request of and according to the needs of the healthcare institution.

Detergent is used for regular cleaning and removal of dirt.

Disinfectant is used after cleaning to remove blood, urine, saliva, and other excretion. It quickly kills most microorganisms and reduces their number.

Detergent and disinfectant packaging labels contain warnings and restrictions for their use with pictorial features:

- Corrosive

This symbol indicates products that are corrosive to metal, may cause severe skin burns and are harmful to the eyes. Example include hydrochloric and acetic acid, ammoniac and pipe-unclogging agent.

- Health hazard (exclamation mark)

This symbol represents irritants to the respiratory system, and indicates that the product can be harmful if inhaled. Potential effects include drowsiness, fainting, skin irritation and allergic reactions.

- Environmental toxicity (image of branched tree)

This label signifies products that are toxic to the environment and can lead to long term consequences in water systems. Examples include pesticides, biocides (disinfectants) (30), gasoline, and turpentine.

- Flammable (flame over circle)

This symbol warns that the product may cause a fire or an explosion. Examples include bleach, alcohol-based agents, oxygen for medical purposes.

- Serious health hazard (image danger)

Products marked with this symbol pose severe health risks if swallowed or inhaled, potentially causing death, organ damage, cancer, genetic defects, or asthma. Examples include biocidal products, turpentine, gasoline, and lamp oil.

The use of disinfection agents as part of the routine cleaning process is recommended in areas of high and medium risk: operating rooms, intensive and semi-intensive care units, maternity wards, newborn care wards, hemodialysis, transplant units, etc. Precise instructions are given on how to clean different rooms and, finally, wash hands, remove personal protection equipment and repeat hand washing before changing into personal clothes and footwear.

These recommendations for maintaining hygiene in a healthcare institution are so detailed and well-written that it is impossible to get around them quickly. It is very important to behave according to these recommendations.

## Conclusion

Healthcare institutions are filled with large numbers of people daily, both healthy and sick, thus making hygiene imperative. It is the reason for the use of hygiene products (soaps, detergents, cleaning agents, medicines, disinfectants, etc.). One must not forget that these agents may have side effects and cause irritant contact and/or allergic dermatitis, which in turn can affect one's health condition and even incapacitate a person. This would require absence from work, possible change of jobs or even cause one to retire on grounds of disability. The topic of present paper reveals an attempt to approach this issue from different points to achieve maximum effect.

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## NEŽELJENA DEJSTVA PREPARATA ZA ODRŽAVANJE HIGIJENE I PRIVREMENA RADNA NESPOSOBNOST KAO POSLEDICA NJIHOVE PRIMENE KOD ZDRAVSTVENIH RADNIKA

Mirjana Paravina<sup>1</sup>, Marija Nedeva<sup>2</sup>

<sup>1</sup>Univerzitet u Nišu, Medicinski fakultet, Niš, Srbija

<sup>2</sup>Univerzitet u Nišu, Medicinski fakultet, student doktorskih studija, Niš, Srbija

Kontakt: Mirjana Paravina  
Borova 44, 18000 Niš, Srbija  
E-mail: mirjanaparavina@gmail.com

S obzirom na to da se prilikom obavljanja posla zdravstveni radnici na radnim mestima u zdravstvenim ustanovama svakodnevno sreću sa velikim brojem osoba, bolesnih ili zdravih, neophodan je poseban režim ponašanja. Mora se, između ostalog, voditi računa o sprečavanju infekcija i redovnom čišćenju. Međutim, pri tome može doći i do ispoljavanja neželjenih dejstava samih preparata za održavanje higijene, što postaje očigledno pri osvrtnu na svaku analizu oboljenja kože, posebno alergijskih i profesionalnih. Zdravstveni radnici često obolevaju od kontaktnog dermatitisa, a najčešći etiološki faktori su sapuni, deterdženti, sredstva za čišćenje, infekcijski agensi, lekovi i dezinficijensi. Dijagnostika, prevencija, terapija, kao i profesionalna rehabilitacija i ocena radne sposobnosti, tada se sprovode kao kod svih obolelih od profesionalnog kontaktnog alergijskog dermatitisa.

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**Ključne reči:** *zdravstveni radnici, kontaktni alergijski dermatitis, sredstva za održavanje higijene, radna sposobnost*

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