



# The Use of Latex Powdered Gloves in Health Care and Skin Problems on the Hands: A Pilot Study in Croatian Hospitals

**Hana Knežević Krajina**<sup>1</sup>

**Bojana Knežević**<sup>2</sup>

<sup>1</sup>Teaching Institute of Public Health Andrija Stampar, 10000 Zagreb, Croatia

<sup>2</sup>University Hospital Centre Zagreb, 10000 Zagreb, Croatia

## Address for correspondence

Bojana Knežević

University Hospital Centre Zagreb

Kispaticeva 12, 10000 Zagreb

bojana.knezevic@kbc-zagreb.hr

## Abstract

**Background:** The prevalence of latex allergy in the population of health-care workers is higher than in the general population. In the last decade, the use of powder gloves has been reduced or banned due to the risk of

developing adverse effects and diseases to individuals exposed to them. Latex gloves are used on a daily basis in Croatian hospitals. Powdered latex gloves are still in everyday use in Croatia.

**Objectives:** The aim of this cross-sectional study was to do screening among healthcare professionals for hand diseases after wearing gloves, and to test a positive correlation between symptoms on the hands and work in the hospital.

**Subjects and methods:** The data were collected by the self-assessment questionnaire The Latex Allergy Screening Questionnaire. The participants were healthcare workers who regularly use latex gloves in hospitals.

**Results:** The study included 455 healthcare workers: 361 nurses, 71 physicians, and 23 other healthcare workers. The most often symptoms of dermatitis occur in workers who use gloves for more than three hours a day, with the highest frequency in the group wearing gloves between 3 and 5 hours a day. Contact dermatitis develops more significantly in the participants who wear gloves more than 5 hours a day ( $P=0.001$ ). Of all participants, after latex glove use, 45.05% had various symptoms on the skin of the hand related to gloves use and 18% reported contact urticaria after contact with latex gloves. Most of them (89.8%) who suffered from various symptoms related to gloves, did not have any symptoms when they were on holiday or sick leave.

**Conclusion:** Nearly half of the participants have some problems with the skin after wearing latex gloves. Most participants have had those symptoms withdrawn when they took a sick leave or a vacation. The ban on powdered gloves should be considered as a preventive measure.

**Key words:** rubber gloves; health care workers; occupational health, hospital

## Introduction

Latex (lat. Latex) as a natural and high quality product has a wide use in the clinical and dental practice, rubber industry, footwear industry, chil-

dren's toys, in the manufacturing of various rubber products such as dental prostheses, braces and condoms. In medicine, it is mostly used for making gloves and various types of catheters [1, 2]. Ninety-nine percent of natural rubber comes from a single source: a white milky fluid from the plant *Hevea Brasiliensis*. There are many proteins in the cells of the natural milky liquid of latex which are known to be strong allergens [3–6], especially if the trees are treated with stimulant and unnaturally forced to grow. Latex exposure at a workplace is one of the major risk factors for developing latex allergy [2, 5, 7, 8, 9]. The frequent use of latex gloves, especially powdered gloves, classifies healthcare professionals into the risk group for the development of professional allergies [10, 11, 12]. The risk is related not only to health care providers, but also to patients who may experience severe hypersensitivity reactions [13].

The frequency of latex allergy is higher in people with atopic diathesis, eczema or allergies to fruits and vegetables [14–16]. In the mid-1990s, the prevalence of allergy to Heva proteins in the general population was estimated to 3 to 9.5 percent [5–7]. Wu and authors conclude that high prevalence of latex allergy remains among healthcare workers, susceptible patients, and general population worldwide (9.7%, 7.2%, and 4.3%, respectively) [17]. Allergic reactions are most often manifested as skin allergies of varying degrees [18, 19]. The most severe reactions among patients occur during invasive surgical procedures, because they enable a rapid absorption of allergens [20].

In 2016, the American Food and Drug Administration (FDA) banned the use of powdered medical gloves because of a high risk of developing adverse effects and diseases to individuals exposed to them [27]. The risk relates to health care providers but also to the patients who may experience severe respiratory tract infections and hypersensitivity reactions. Powder particles can stimulate the immune response of the patient's body during surgery, leading to granuloma formation around the powder particle or the formation of adhesion, which can lead to surgical complications [19]. However, in many products in the world there are only limited number of latex derived products that have been approved and regulated by government agencies, such as FDA, whereas the majority of finished products do not label whether they contain latex. Latex gloves are

used on a daily basis in Croatian hospitals. Powdered latex gloves are still in common use in Croatia. The aim of the study was to research the prevalence of the hand dermatitis of healthcare workers in hospitals, and to test the positive correlation between dermatitis and work in hospital, as well as positive correlation between symptoms of allergic reactions to the commercial products in everyday life.

## Methods

The standardized Allergy Screening Questionnaire, created by the American Latex Allergy Association – ALAA translated to Croatian, was used in the study [21]. The self-reported questionnaire is used for screening for latex allergy and the participants reported all the skin problems related to the use of latex gloves.

The final survey questionnaire collected additional following data: job position, occupation, length of service, gender, age group and the hours of wearing gloves daily. Prior to completing the questionnaire, the participants signed the informed consent form. The filled questionnaires were collected in special boxes.

Healthcare workers in two Croatian hospitals were invited to fill in the questionnaire, and they received written information about the research and the approval of the hospital management and Ethics Committee. The participation in the study was anonymous and voluntary. They were included in the study regardless of earlier subjective latex related disorders. Healthcare workers who were not wearing gloves as personal protective equipment were excluded from the study. The participants in this study were healthcare workers from different clinical departments who wear medical gloves at work every day. Out of 467 participants, 12 respondents did not answer the question about how often do they wear gloves daily and were therefore excluded from the statistical data processing related to the characteristics of the participants.

Research was carried out at the University Hospital Centre Zagreb and Clinical Hospital Dubrava in Zagreb (between March and May in 2018) This study was approved by the Ethics Committee of the University of Zagreb School of Medicine, by the Ethics Committee of Univer-

sity Hospital Centre Zagreb, the Ethics Committee of Clinical Hospital Dubrava, and the management of both hospitals. The hospitals confirmed that powdered latex gloves are regularly ordered by the hospitals in Croatia.

## **Statistical analysis**

Descriptive statistics were made for all the examined variables, and the differences in the distribution of the individual categorical values were analysed by the  $\chi^2$  test. All the differences with P values less than 0.05 were considered significant. In this study, the connection of contact dermatitis symptoms that occur after wearing latex gloves at a workplace with cessation of wearing gloves during a sick leave or a vacation was analysed, as well as risk factors outside the workplace that cause similar symptoms and exposure to latex in the first year of life. The software used in this analysis is IBM SPSS Statistics software version 25.0 licensed for the Faculty of Medicine, University of Zagreb.

## **Results**

Demographic data and the data on daily glove wear are shown in Table 1. Most of the healthcare workers who participated in the study and regularly wear gloves, were nurses and medical technicians. Nurses (336/361; 93%) more often wear gloves every day ( $P=0.001$ ) than doctors do (52/71; 73%). Healthcare workers who wear gloves every day, usually wear them 3 to 5 hours a day (141/410; 34.4%). The most important results were found in: the daily gloves use in hours, the withdrawal of symptoms during the sick leave or vacation, the use of latex free gloves, suspected latex allergy, and the allergic reaction after contact with a rubber product outside of work.

The most often symptoms of dermatitis occur in workers who use gloves for more than three hours a day, with the highest frequency in the group wearing gloves between 3 and 5 hours a day. Contact dermatitis develop more significantly in the participants who wear gloves more

than 5 hours a day ( $P=0.001$ ). Almost half of the participants who use latex gloves responded positively to the issue of rash, itching, flaky or cracked skin, or contact dermatitis.

When asked if the symptoms of contact dermatitis withdraw after a sick leave or a vacation, about three quarter of the participants (184/205; 89.8%) answered positively. From the total of participants ( $N=205$ ) who had symptoms of contact dermatitis after wearing latex gloves, 179 participants suggested they sometimes uses latex-free gloves as well. Furthermore, 149 (83.2%) of these 179 participants, stated that they had no symptoms of dermatitis related to the latex free gloves.

Anamnestic data on exposure to latex are shown in Table 2. Participants who have dermatitis at work have more often medical history of invasive procedure in the first year of life (14/205; 6,8%) than participants without dermatitis (6/239; 0,03%) ( $P=0.02$ ).

Correlation between self-reported hand dermatitis at work and symptoms of allergic reactions to the latex in everyday life are shown in the Table 3. Of the total sample, 18% (82/455) indicated that they had hives, itching, redness within 30 minutes and /or vesicular disease during the day, after wearing gloves or in the presence of people wearing gloves. Healthcare workers with symptoms of contact dermatitis have significantly higher incidence of hives than people without contact dermatitis. People with symptoms of contact dermatitis are more likely to develop an allergic reaction when they are in contact with other latex-containing products such as wearing rubber clothing or elastic straps ( $P=0.00$ ), blowing balloons ( $P=0.03$ ), using condoms, diaphragms and other sexual aids ( $P=0.00$ ) (Table 3).

## Discussion

The symptoms of contact dermatitis associated with wearing latex gloves appeared in nearly half the participants (45.05%). This reaction is usually limited to the parts of the skin in contact with rubber products. Since health professionals often work in a wet environment and are exposed to many irritants, apart from allergic contact dermatitis, they can also develop irritant dermatitis so it cannot be concluded which type it is. In

some subsequent studies, allergy tests have shown that prevalence of allergic contact dermatitis is significantly lower than the overall prevalence obtained by the questionnaire [20]. This research confirmed that most of the participants that develop symptoms of contact dermatitis have professional ethology dermatitis, because 89.8% of participants responded that the symptoms completely withdraw during the vacation or a sick leave. In this research, the participants with the symptoms of contact dermatitis are more likely to have an allergic reaction outside of their workplace, such as medical examinations involving contact with mucous membranes, blowing balloons, using condoms and wearing rubber clothing or footwear ( $P=0,00$ ). Contact dermatitis symptoms associated with wearing latex gloves occur more often in the participants who have undergone a surgery or other invasive procedures in their first year of life ( $P=0,02$ ).

This research has confirmed that the participants with symptoms of contact dermatitis have much more frequent allergic reactions after a medical examination during which there is a contact of latex with a mucous membrane (dental, gynaecological, digital rectal exam) compared to the participants without contact dermatitis. The symptoms of an allergic reaction after a medical examination or other invasive procedure occurred at 8.3% of participants, which is significantly higher than with those who did not have the symptoms of contact dermatitis ( $P=0.00$ ). This confirmed that sensitization on latex proteins in a workplace, puts workers at risk of developing allergic reactions of varying intensity during personal medical examinations. It is important to note that wearing latex gloves during an episode of irritant dermatitis enhances the absorption of latex allergen and increases the risk of developing an allergic reaction to latex [21]. Also, contact dermatitis may be the first sign of an allergy development to latex and repeated exposure to latex can lead to more serious allergic reactions [22, 23]. The literature describes an anaphylactic reaction during a gynaecological examination in a nurse suffering from latex induced contact dermatitis on her hands, to which she has been exposed continually despite the symptoms. Latex allergy in this patient was subsequently confirmed by a prick test [13].

In this study, most of the symptoms occur in workers who use gloves for more than three hours a day. Since the frequency of symptoms is

greatest in those who wear gloves for hours, there is a possibility that they have developed irritant dermatitis caused by working in a wet environment or it may be the result of re-exposure to a weak irritant such as the powder in the gloves. The research carried out at the University Hospital in Bari confirmed that the most of reported cases of dermatitis are related to irritant contact dermatitis (85.1%) most commonly caused by exposure to chemicals found in latex gloves (bacterial endotoxins, ethylene oxide, powder) and wet work [24]. Wearing gloves continuously for more than two hours (in continuity) is considered working in a wet environment [25].

There is a significantly larger number of participants who had undergone a surgery or other invasive procedures in the first year of their life, had symptoms of contact dermatitis (14/205; 6.8%) in comparison to those who had not undergone that kind of surgery ( $P=0.02$ ). This research confirmed that the people who had undergone surgery or other invasive procedures in the first year of their lives, had more frequent symptoms of contact dermatitis or serious adverse events than those who had not been subjected to surgery in their infancy [26]. The literature describes a case of a four-year-old boy who developed an anaphylactic reaction five minutes after the beginning of a congenital strabismus operation. Subsequent testing confirmed the allergy to latex protein. Given that the boy had not previously been subjected to surgery, it was presumed that he had been exposed to latex through his mother who regularly used latex gloves during her work as a cosmetician in her home [20].

In this study, 18% of participants had the symptoms of urticaria associated with wearing latex gloves. What cannot be claimed with certainty is that this is an allergic reaction caused by specific latex proteins, since no specific IgE antibodies were measured in these participants. Half of the participants who had hives suffer from hay-fever, which goes in favour of atopic tendency. Other study of Work Ability Index in Croatian hospitals showed that a part of healthcare workers reported skin problems at work. Allergic dermatitis confirmed by medical doctor was present in 15% (109/721) nurses and in 15% (46/300) physicians [28].

The limitation of this study is that the questionnaire is used only for the screening on the latex allergy. It cannot be concluded that it is certainly the latex allergy, because there is no allergy test, such as prick test,

IgE antibodies or provocation test have been used. According to the literature, the most reliable indicator of latex allergy is a detailed anamnesis along with associating exposure and symptoms.

The results show that it is advisable to initiate an education on the use of latex gloves in the field of health protection at work, and to influence policy makers to ban the use of latex glove powders, which many other countries have already done [27]. After the implementation of the policy restricting the use of powdered gloves, some authors conclude that the medical community needs more understanding and education about latex gloves, latex sensitization, and available alternatives.

## **Conclusion**

This research confirmed that healthcare workers reported dermatological symptoms related to their working conditions and personal protective equipment. In this research, it can be concluded that the skin symptoms appear dominantly on the skin of the hand and after wearing latex gloves. Nearly half of the participants in the healthcare population have changed in the skin of their hands after wearing latex gloves. Most participants with symptoms of contact dermatitis have had those symptoms withdrawn when they took a sick leave or a vacation, which goes in favour of the professional ethology of the disease. Some of them have latex-related symptoms after using the rubber products in everyday life. A further research concerning latex gloves, powdered latex gloves and other latex products in a hospital setting is important. Education about latex, the awareness about everyday products containing latex is very important, as well as avoiding powdered latex gloves since they may be an occupational hazard. The ban on powdered gloves should be considered as a preventive measure.

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**Table 1.** Demographic characteristic of healthcare workers (N=455)

Latex exposure		N	%
Do you wear latex gloves regularly or are you in other way exposed to latex?	yes	410	90,1%
	no	45	9,9%
Do you have a medical history of operations or other invasive procedure?	yes	43	9,5%
	no	411	90,5%
Do you have a history of operation or other invasive procedure in the first year of your life?	yes	20	4,4%
	no	435	95,6%

**Table 2.** Self-reported exposure to latex by the participants (N=455)

	Symptoms of allergy		Hand dermatitis N (205)	Without dermatitis N (250)	No answer	P
<b>At work</b>	Hives, red itchy swollen hands within 30 minutes within a day after wearing latex gloves	N %	74/205 36%	8/218 3.54%	32 0.07 %	0.001
<b>In everyday life</b>	Itching, swelling or other allergy symptoms following medical exams as a patient	N %	17/205 8,3%	2/228 0,01%	22 0,05%	0.001
	Swelling or difficulty breathing after blowing up a balloon	N %	4/205 2%	0/228 0%	22 0,05%	0.03
	Itching or swelling after use of condoms, diaphragms or latex sexual aids	N %	19/204 9,3%	1/227 0,004%	24 0,05%	0.001
	Itching or discomfort after use of rubber or elastic bands or clothing	N %	50/203 24,4%	9/227 0,04%	25 0,05%	0.001

**Table 3.** Correlation between self-reported hand dermatitis at work and symptoms of allergic symptoms to the latex in everyday life.

	Item	N	%
<b>Profession</b>	Nurse	361	79,3 %
	Physician	71	15,6 %
	Other hospital staff	23	5,1 %
<b>Gender</b>	Male	77	16,9 %
	Female	378	83,1 %
<b>Age</b>	<30	129	28,4 %
	30–45	176	38,7 %
	45–60	136	29,9 %
	>60	14	3,1 %
<b>Length of service in healthcare</b>	≤10 years	183	40,2 %
	11–20 years	97	21,3 %
	21–30 years	95	20,9 %
	≥31 years	80	17,6 %
<b>Daily glove use</b>	<1h	79	17,4 %
	1–3h	115	25,3 %
	3–5h	147	32,3 %
	>5h	114	25,1 %