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# Investigating the allergy to latex gloves and some factors among nurses in hospitals of Babol University of Medical Sciences 2020

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## ABSTRACT

**Background:** The utilization of gloves is essential for safeguarding hands against contamination and minimizing the risk of transmitting microorganisms to both patients and healthcare personnel. This study aimed to ascertain the prevalence of latex glove allergies and explore the associated symptoms, medical records, and contributing factors among nursing staff at Hospitals affiliated with Babol University of Medical Sciences.

**Methods:** In this descriptive-analytical study, the studied population included 324 (60 male and 264 female) nurses. Data was collected using a researcher-made questionnaire with confirmed validity and reliability. Statistical analysis was performed using SPSS 22 software at a significance level of 0.05.

**Results:** A significant correlation was observed between female gender and latex glove allergies. Furthermore, 41.5% of the subjects experienced hand dermatitis, 23.2% suffered from urticaria, 10.2% exhibited upper respiratory symptoms, and 1.2% reported lower respiratory symptoms. Notably, 138 staff members with a history of atopy displayed a significant association with dermatitis and urticaria related to latex gloves. Additionally, a significant relationship was identified between the daily use of latex gloves and urticaria. Anaphylactic shock occurred in 3.4% of the staff.

**Conclusion:** The most severe reaction to latex gloves was anaphylactic shock, although it was infrequent in this study. Hand dermatitis emerged as the most prevalent symptom associated with latex allergy. Furthermore, latex glove allergies were more prevalent among staff with a history of atopy or those who used latex gloves extensively on a daily basis.

**Keywords:** Latex Gloves, Allergy, Nursing staff.

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## Introduction

The utilization of gloves is fundamental both as a principle of personal protection and an integral component of the clinical practices employed by healthcare providers (1). Gloves are recommended for safeguarding against contamination with organic matter and for mitigating the risks associated with the transmission of microorganisms among patients and healthcare personnel. Nevertheless, the prolonged and unnecessary use of gloves may result in adverse effects and skin damage(2). Today, latex is among the most extensively utilized materials in various human products, encompassing items such as gloves, pacifiers, tires, and more(3, 4). Specifically, latex gloves find extensive use across medical, dental, nursing, midwifery, and various other healthcare sectors (5). Latex, the primary material of these gloves, is derived from the rubber tree Hevea brasiliensis, which comprises proteins, carbohydrates, and a range of other organic and inorganic constituents (6).

According to Bousquet et al. the prevalence of latex allergy among healthcare workers exposed to latex-containing products was reported as 4.3%, whereas in the general population, this rate stood at a lower 1.37% (7) Nevertheless, there has been a significant increase in the use of latex gloves by healthcare workers in recent years, with approximately 5.7 million healthcare professionals annually utilizing a staggering 7 billion pairs of latex gloves (8). To date, researchers have identified eleven allergens, complete with their respective protein sequences, present in latex extracts. These allergens have the potential to enter the body through various routes, including healthy skin, the upper and lower respiratory tracts, the eyes, and the gastrointestinal tract (9).

Corn flour is commonly added as a powder to latex gloves to prevent them from sticking and to ease the process of putting them on. However, it's important to note that corn flour can serve as a carrier for latex proteins. Consequently, when these gloves are removed, latex proteins can disperse into airborne dust particles. Inhaling this allergen has the potential to trigger allergies in certain individuals, and even those not wearing gloves can inadvertently inhale it (10, 11). It is noteworthy that environmental particulates can be quantified (12, 13). Studies have reported elevated levels of latex allergens in specific environments, such as the operating room (OR), intensive care unit (ICU), and emergency department (ED)(10).

Latex allergies manifest in two primary types: Type I and Type IV. The most severe form of latex allergy, often referred to as "true latex allergy," is Type I, or immediate onset, which typically occurs within a range of 1 to 30 minutes. This type of allergy is triggered by an immune response involving the production of immunoglobulin E (IgE) antibodies (14). Individuals experiencing this type of reaction exhibit a systemic response to latex protein that can potentially escalate to anaphylaxis (14, 15). On the other hand, contact dermatitis represents a Type IV allergic reaction resulting from exposure to substances present in gloves. Symptoms of contact dermatitis manifest 6 to 48 hours following exposure to the allergen and typically include localized erythema, itching, and the development of urticarial lesions (14).

In this particular type of reaction, individuals exhibit allergies to other allergenic substances employed during the glove manufacturing process (15). Given the extensive utilization of latex gloves among healthcare providers, particularly within the staff of operating rooms (OR) and intensive care units (ICUs), the primary objective of this study was to assess the prevalence of latex glove allergies and explore their impact on the nursing staff working in educational facilities affiliated with Babol University of Medical Sciences.

## Methods

In this descriptive-analytical study, a total of 350 nursing staff members with a minimum of 1-month of work experience in various hospital units, including the operating room (OR), emergency department (ED), intensive care unit (ICU), coronary care unit (CCU), and maternity unit (MU), were selected

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through a census approach from hospitals affiliated with Babol University of Medical Sciences. Data pertaining to latex allergy were collected through separate questionnaires.

However, 8% of the initially chosen participants were excluded from the study due to a lack of cooperation or incomplete questionnaire submissions. Ultimately, the data of 324 staff members were included in the analysis. The information was gathered utilizing a set of questionnaires, including the Medical University of South Carolina (MUSC) questionnaire, the Nordic Occupational Skin Questionnaire (NOSQ2002), and a researcher-designed questionnaire (16, 17). The validity and reliability of these questionnaires were established through pretest and posttest assessments, with a confirmed Kappa coefficient of 0.79.

The questionnaires used in this study were entirely anonymous, ensuring that participant information remained confidential throughout all stages of the research. Data collected were solely utilized for research purposes. Information was gathered through face-to-face interviews, conducted with the consent of the staff, and was contingent upon their completion of the questionnaire. It's important to note that all participants used natural latex gloves during the study.

The questionnaire was structured into two distinct sections. The first section encompassed demographic data, including age, gender, marital status, educational background, job responsibilities, the specific occupational unit within the hospital, the ward within which they worked, total years of work experience, current work experience, and hours worked per week. The second section focused on the most significant occupational and non-occupational risk factors associated with latex allergy. These factors included personal or family history of atopy, physical symptoms attributed to latex glove usage (such as hand dermatitis, urticaria, upper respiratory symptoms, and lower respiratory symptoms), any history of allergic reactions to other stimuli, and the most common allergic reactions experienced due to exposure to various triggers, including food allergies, among others.

Physical complaints associated with latex gloves encompass a range of symptoms, including hand, forearm, and wrist dermatitis characterized by redness, itching, irritation, blistering, or skin cracking. Additionally, individuals may experience contact urticaria, which presents as swollen or itchy pink or red rashes measuring 1 to 5 cm in diameter on the body. Other symptoms include upper respiratory symptoms like runny eyes and nose, sneezing, and nasal congestion, as well as lower respiratory symptoms such as shortness of breath, wheezing, and chest pressure. Eye irritation and redness may also occur.

Subsequently, the collected data were subjected to analysis using SPSS 22, employing the chi-square test. This analysis aimed to assess the relationships between various reaction types and demographic variables (age, gender, occupation, and work experience), underlying factors (such as a history of atopy, frequency, and duration of latex glove usage), as well as physical complaints related to latex gloves. The significance level for these statistical evaluations was set at 0.05.

## Results

The study included a total of 324 participants, consisting of 60 males and 264 females. Among the participants, 41.2% fell within the age range of 20-29 years, and 40.6% had accumulated 5-10 years of work experience. A detailed breakdown of the demographic characteristics of the participants is presented in Table 1.

Among the participants, 56% exclusively used latex gloves, 43.3% employed nylon gloves underneath latex gloves, and a minority, 0.6%, utilized cotton gloves beneath latex gloves for their treatment and personal protection needs. Furthermore, Table 2 provides details regarding the specifications related to the usage of latex gloves among medical staff in hospitals affiliated with Babol University of Medical Sciences, including the number of times gloves were used, the duration of glove usage in hours, and the frequency of hand washing.

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**Table 1. Demographic characteristics of nursing staff working in hospitals affiliated to Babol University of Medical sciences**

| Variable | characteristics | Frequency | Percentage |
|---|---|---|---|
| **Gender** | Female | 264 | 81.4 |
| | Male | 60 | 18.6 |
| **marital status** | Single | 66 | 20.4 |
| | Married | 257 | 81.4 |
| **Education level** | MSc | 7 | 2.2 |
| | BSc | 221 | 68.4 |
| | ASc | 74 | 22.9 |
| | Diploma | 21 | 6.5 |
| **Occupational category** | Head nurse | 12 | 3.7 |
| | Nurse | 164 | 50.8 |
| | Anesthesia technician | 39 | 12.1 |
| | Operating room technician | 57 | 17.6 |
| | Midwife | 23 | 7.1 |
| | Practical nursing assistant | 24 | 7.4 |
| | Practical nurse | 4 | 1.2 |
| **Work experience** | <5 years | 104 | 32.2 |
| | 5-10 years | 131 | 40.6 |
| | 10-20 years | 67 | 20.7 |
| | >20 years | 21 | |

**Table 2. Specifications of how to use latex gloves in the medical staff of hospitals affiliated to Babol University of Medical Sciences**

| Title | the details | Frequency | Percentage |
|---|---|---|---|
| **Use gloves** | Use gloves once a day | 15 | 4.6 |
| | Use gloves twice a day Use | 28 | 8.7 |
| | gloves three times a day or more | 280 | 86.42 |
| **Hours of use of gloves** | Use gloves one hour a day | 114 | 35.3 |
| | Use gloves two hours a day | 100 | 31 |
| | Use gloves for three hours or more a day | 109 | 33.7 |
| **Frequent hand washing** | Less than five times | 52 | 16.1 |
| | Between six and ten times | 138 | 42.7 |
| | Between eleven and twenty times | 79 | 24.5 |
| | More than twenty times | 54 | 16.7 |

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The relationship between the number of hours of use and the number of times of latex gloves and the number of hand washing per day with allergy was estimated (Figure 1, 2, 3). Regarding atopy, 138 individuals, constituting 42.7% of the cases, had a history of eczema or dermatitis. Among the subjects, 41.35% experienced hand dermatitis, 23.2% reported urticaria, 10.2% exhibited upper respiratory symptoms, 1.2% manifested lower respiratory symptoms, and 3.4% encountered anaphylactic shock following the use of latex gloves. Additionally, a small proportion (1.5%) reported experiencing these complications specifically after dental procedures or examinations. The relationship between service history and working hours was estimated with sensitivity (Figure 4, 5).

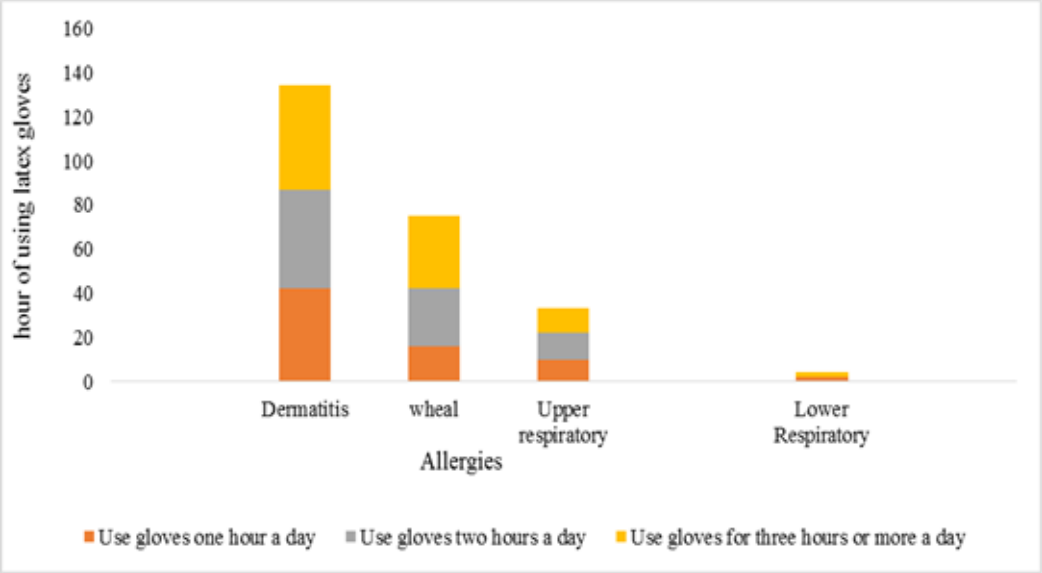


**Figure 1. Hours of using latex gloves a day and allergies**

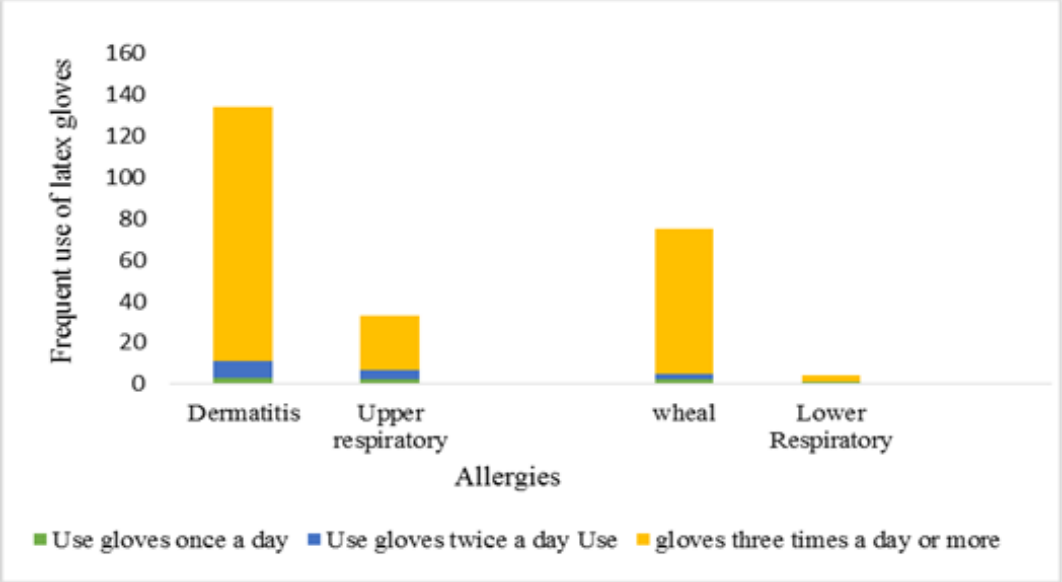


**Figure 2. Frequent use of latex gloves a day and allergies**

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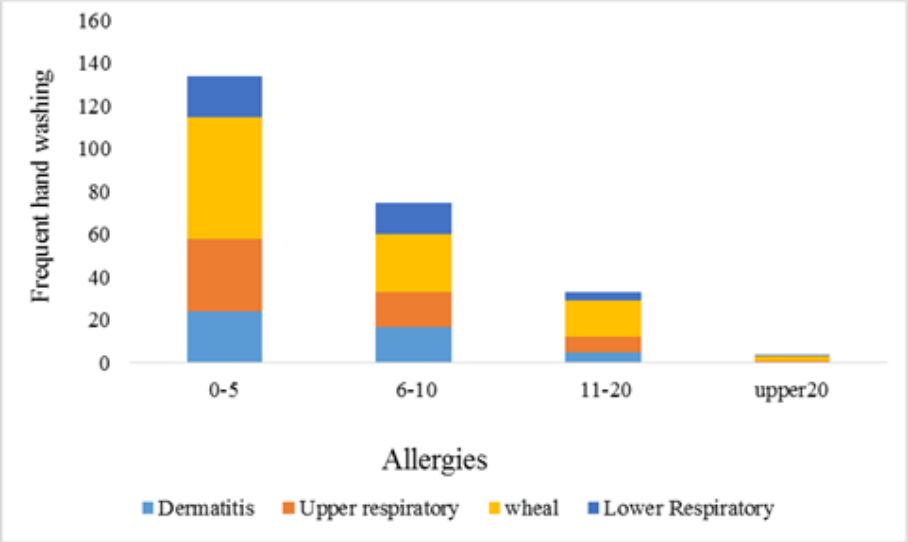


**Figure 3. Frequent hand washing and allergies**

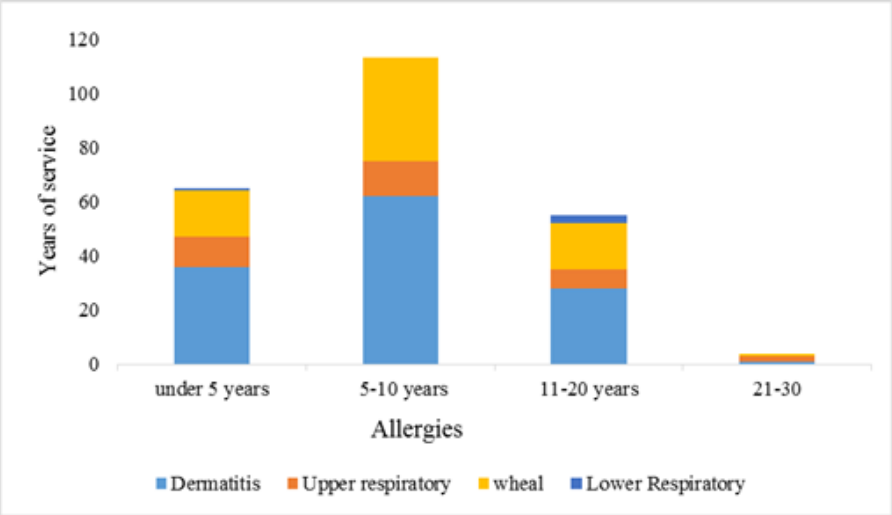


**Figure 4. Service history and allergies and allergies**

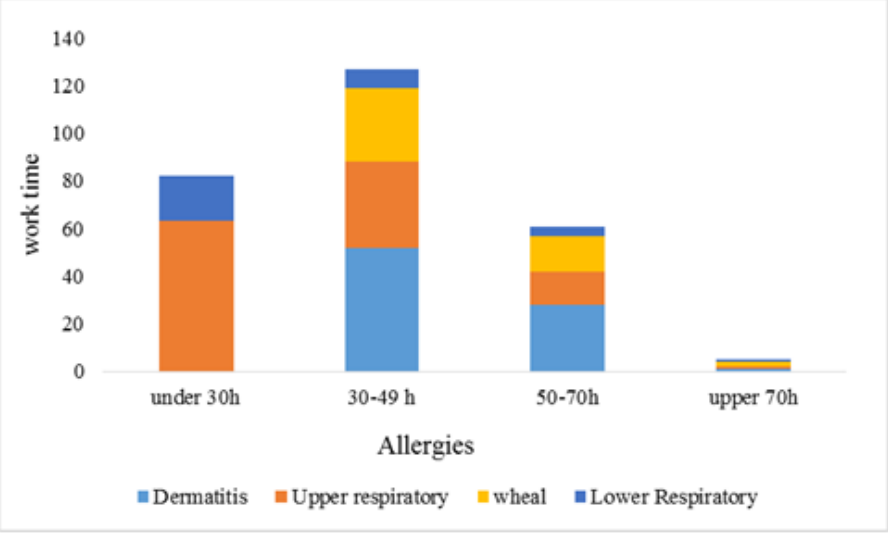


**Figure 5. Work time and allergies and allergies**

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## Discussion

The findings of our study indicate that there was no significant relationship between latex glove allergy and various factors, including the type of hospital wards, age, occupational category, and the type of hospitals. These results contrast with some previous studies (17). However, a significant association was observed between gender and the development of urticaria symptoms associated with latex glove allergies (p=0.04). This gender-related association is consistent with the results reported by Montnemery et al. and Meding (18, 19) but inconsistent with those of Sadeghian et al. and Bathaie et al (17, 20).

Among healthcare staff who regularly used latex gloves, a significant portion experienced hand dermatitis (41.5%), urticaria (23.2%), upper respiratory symptoms (10.2%), and lower respiratory symptoms (1.2%). These figures are in line with the findings of a study conducted by Resa'i et al (16).

Furthermore, our study revealed that the prevalence of latex allergy among healthcare workers was higher than that in the general population, consistent with other research (7, 21). Concerning atopy, a significant number of cases (42.7%) had a history of eczema or dermatitis. After using latex gloves, these individuals exhibited a significant association between their pre-existing dermatitis and the development of allergic reactions, particularly dermatitis and urticaria (p=0.00), mirroring results obtained by Lopes et al (22).

Interestingly, we found no correlation between the number of weekly working hours and latex allergy. However, there was a significant relationship between the daily hours of latex glove usage and latex-induced urticaria ($p<0.05$). Additionally, 48.3% of the staff reported working 50-70 hours per week, which was not significantly correlated with latex allergy ($p>0.05$), consistent with the findings of some researchers (16, 23) but inconsistent with others (24, 25). The duration of using latex gloves during shift work did show a significant relationship with urticaria ($p<0.05$). This may be attributed to prolonged exposure to synthetic materials in latex gloves, such as preservatives or materials used during glove manufacturing, including accelerators and antioxidants, or the multiple uses of latex gloves.

Notably, 86.42% of the personnel used latex gloves three or more times per day on average. Latex allergy, particularly Type I reactions, can lead to severe symptoms, including anaphylactic shock, within 1-30 minutes (9, 15). Latex allergy can even lead to anaphylaxis during surgical or medical procedures (26, 27). Inhalation of latex protein, which can occur due to the dispersion of latex particles in the air, can lead to symptoms of latex allergy even in individuals who do not wear gloves (6, 10, 24).

In our study, 3.4% of the staff experienced anaphylactic shock, with 1.5% of them attributing these complications to dental procedures and medical examinations. However, it remains unclear whether lidocaine injections during dental practice or other factors unrelated to latex allergy triggered these shocks. Further investigation and research are warranted in this regard.

Individuals with latex allergy can experience severe symptoms such as asthma, anaphylactic shock, and even death. Therefore, it is imperative for health professionals to recommend the use of low-protein latex products for sensitive individuals (28). Additionally, the use of vinyl gloves, along with the availability of adrenaline for emergencies, is emphasized for individuals with latex allergy and a history of anaphylactic shock (29). Latex allergy-induced anaphylaxis is the second leading cause of postoperative anaphylaxis, with rates as high as 20%(30).

While our study solely involved participants who used natural latex gloves, it is essential to consider the potential benefits of alternative gloves, such as non-latex or latex-free options, low-powder gloves, and low-protein gloves, in reducing latex allergy symptoms (31).

The primary consideration when selecting gloves should be their ability to function as a barrier for safe use. However, the impact of latex allergy on genetically predisposed individuals and the triggering of allergic reactions in these users should be a vital concern for health authorities (32). The latex glove manufacturing process is characterized by several key features: excellent barrier properties, high strength, good stretch, convenience, proper fit, and durability, especially in the case of powdered gloves.

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Manufacturers of synthetic gloves have consistently strived to develop gloves that mimic the properties of natural rubber latex gloves, with minimal risk of latex allergy and effective protective barriers.

It is crucial to emphasize that the production of high-protein, allergen-rich, and powdered latex gloves can significantly increase the risk of allergy among users, necessitating preventive or mitigate measures

Furthermore, 48.7% of the staff reported reduced and improved latex allergy symptoms after taking leave. This improvement may be attributed to reduced physical contact with latex glove allergens or reduced exposure to areas where latex products, such as latex gloves, are used. These findings align with those of previous studies (6, 33). Presently, users have the option to select low-protein, powder-free gloves, and low-powder latex gloves, which offer impermeability and reduced allergenicity (6).

In light of the high prevalence of latex allergy observed in this study, it is recommended that individuals suspected of having latex allergy undergo further testing. If confirmed, these individuals should be encouraged to use gloves to maintain safety and minimize the risk of allergic reactions. Additionally, measures such as using masks in areas contaminated with latex allergens, improving ventilation, and indoor air purification, especially in spaces like operating rooms and intensive care units, may help reduce airborne allergens. Training and increasing awareness among medical staff can also play a significant role in reducing or eliminating latex allergy.

## Conclusion

The results of the present study revealed that hand dermatitis was the most common symptom associated with latex allergy. The use of latex gloves during shifts was found to increase the incidence of urticaria, possibly due to prolonged exposure to synthetic materials in latex gloves and frequent glove use. Additionally, while the most severe reaction to latex gloves is anaphylactic shock, its occurrence rate was not significant in this study, and in some cases, its association with reactions to latex gloves remained unclear.

Furthermore, it was observed that latex glove allergy was more prevalent among staff with a history of atopy. Given that residual allergenic proteins in latex gloves can heighten the risk of allergic reactions in susceptible individuals, it is recommended that medical staff with a history of atopy opt for low-protein and powder-free gloves. Future research should focus on conducting more comprehensive investigations into anaphylactic shock associated with latex products

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**Compliance with Ethics Guidelines:** The authors certify that this manuscript is the original work of the authors, all data collected during the study are presented in this manuscript, and no data from the study has been or will be published separately.

**Competing Interests:** The authors declare that they have no conflict of interests.

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