

# Prevalence and Patterns of Latex Glove Allergy among Healthcare Workers in a Tertiary Care Center In South India - A Cross-Sectional Study

## Abstract

**Background:** Latex glove allergy and its impact on healthcare workers (HCWs) have been studied in many countries, but the data is scarce from developing countries. **Objectives:** We wanted to estimate the prevalence and patterns of latex glove allergy among HCWs and to study the factors associated with it. **Materials and Methods:** We conducted a cross-sectional study among 1088 HCWs of a tertiary care center in South India with the screening questionnaire adopted from “Allergy and Asthma network.” Skin prick test, patch test, and serum total immunoglobulin E (IgE) were performed only in consenting symptomatic HCWs. **Results:** The prevalence of latex glove allergy in our study subjects was 9.1% (99/1088). This includes latex protein allergy and contact dermatitis to rubber glove allergens. The most common manifestation of latex glove allergy was irritant contact dermatitis observed in 68 HCWs (68.6%). Other presentations were allergic rhinitis (40.4%), allergic contact dermatitis (17.1%), contact urticaria (11.1%), allergic conjunctivitis (6.06%), and asthma (3.03%). The risk factors associated with latex glove allergy in our study were atopy (OR = 20.51), working in both ward and operation theater (OR = 26.6), auxiliary staff (OR = 4.75), and more than ten years of hospital work experience (OR = 3.85). **Conclusion:** Our study reported a high prevalence of latex glove allergy. With irritant contact dermatitis being the most common manifestation in our study, HCWs at risk shall be educated on the appropriate use of gloves and hand moisturizer to prevent occupational irritant contact dermatitis (ICD). We recommend further research to address the gaps in our knowledge around latex allergy in a healthcare setting.

**Keywords:** Allergy, dermatitis, latex, occupational, prevalence, rubber

Vinupriya  
Sakkaravarthi,  
Laxmisha  
Chandrashekar,  
Medha Rajappa

Department of Dermatology,  
JIPMER, Pondicherry, India

## Introduction

Latex glove allergy and sensitization to natural rubber latex (NRL) have become an important occupational health hazard among healthcare workers (HCWs).<sup>[1]</sup> Skin manifestations of latex glove allergy include allergic contact dermatitis due to rubber accelerators in latex gloves; irritant contact dermatitis due to mechanical factors like occlusion, friction, sweating and presence of corn starch powder in latex gloves; contact urticaria, angioedema; and protein contact dermatitis due to latex protein allergen. Sensitization to latex will lead to systemic hypersensitivity reactions like allergic rhinitis, conjunctivitis, asthma, and anaphylaxis.<sup>[1]</sup> Even though in Europe and North America the problem has declined significantly, it still remains a problem in Asia.<sup>[2]</sup> Latex allergy has a negative impact on the quality of life and workability of

HCWs resulting in sickness absenteeism, and loss of job and income.<sup>[1]</sup> Data regarding the prevalence of latex allergy is scarce from developing countries.

## Materials and Methodology

We conducted a cross-sectional study from December 2015 to December 2017 among HCWs in our institute. Ethical clearance was obtained from the Institute Ethics Committee. We adopted a questionnaire from the “Allergy and Asthma network” for screening of latex allergy in HCWs.<sup>[3]</sup> This questionnaire was validated for use in the Western population. The questionnaire asked about demographic details, work nature, current symptoms on exposure to latex, frequency and duration of latex glove usage, family and personal history of atopy (including asthma, rhinitis,

**Address for correspondence:**  
Dr. Laxmisha Chandrashekar,  
Department of Dermatology,  
Jawaharlal Institute of Post  
Graduate Medical Education  
and Research (JIPMER),  
Pondicherry - 605 006, India.  
E-mail: laxmishac@gmail.com

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conjunctivitis, sinusitis, or dermatitis), symptoms of food allergy (itching, local redness or swelling of oral mucosa after eating avocados, bananas, kiwis, chestnuts, mangoes, melons, or peaches), symptoms of hand dermatitis, and severity of symptoms on past exposure to latex. The questionnaire-based prevalence of latex allergy was estimated in our population.<sup>[4]</sup> Symptomatic HCWs were clinically examined, and their symptoms were categorized.<sup>[5]</sup> Skin prick test, patch test, and total serum immunoglobulin E (IgE) were performed only in consenting symptomatic HCWs.

### Prick test

A skin prick test was performed in 61/99 (61.6%) HCWs with 1% latex protein extract (Creative Diagnostic Medicare Private Limited, India). Histamine 0.1% and buffered saline 0.9% were used as positive and negative controls, respectively. We read the test after 15 min. A wheal of diameter more than 3 mm compared to negative control was considered a positive reaction.<sup>[6]</sup>

### Patch test

Patch test was performed with the Indian standard series (Creative Diagnostic Medicare Private Limited, India) in 41 (47.6%) out of 85 HCWs who presented with contact dermatitis. Patch test was performed following the standard guidelines.<sup>[5]</sup> Patch test reading was done on days 2 and 4 and was graded with International Contact Dermatitis and Research Group (ICDRG) grading scale.<sup>[6]</sup> Day 4 reading was considered positive. Clinical relevance to positive patch test reaction was considered as “definite” if the patch testing with both the product containing the allergen and the allergen were positive, “probable” if the product used by the patient contains the positive allergen, “possible” if the distribution of dermatitis matches the use of the product that typically contains the positive allergen, “past” if the patient is currently not being exposed to the positive allergen, and “unknown” if no exposure can be identified to the positive allergen.<sup>[7]</sup>

### Serum total IgE

Serum total IgE has been estimated for 60 out of 99 symptomatic individuals with SDIlgE test kit (Vishat diagnostic private limited, India) (Standard range 40–640 IU/ml for adults).

### Statistical analysis

The statistical analysis was carried out using the IBM SPSS version 19 software. The distribution of categorical variables was expressed as frequency and percentage. Comparison between the groups was done using Chi-square or Fisher’s exact test. Dose-response was assessed using Chi-square for trends. The distribution of continuous variables was expressed as mean with standard deviation or median with interquartile range. The continuous variables were checked for normality using the Kolmogorov–

Smirnov test to assign the appropriate tests. A comparison of the two groups was performed either by Student’s t-test or Mann–Whitney *U* test. Mantel–Haenszel Chi-square test was used to test the linear association between ordinal variables. All statistical analyses were carried out at a 5% level of significance. *P* value (two-sided) less than 0.05 was considered significant.

## Results

A total of 1088 workers out of 4520 (24%) eligible HCWs responded to the screening questionnaire. Out of them, 99 (9.1%) HCWs were symptomatic. There were 27 (27.2%) males and 72 (72.7%) females among symptomatic HCWs. Mean age of the symptomatic HCWs was 32.52 years  $\pm$  7.7 SD. The HCWs in the symptomatic group were older than those in the asymptomatic group even after adjustment for years of experience ( $p = 0.048$ , OR = 1.04). Females were significantly more symptomatic as compared to males [Table 1].

The HCWs who participated in the study were doctors (58.5%), nurses (28.4%), and auxiliary staff (13.1%). There was a linear trend noted between job categories and latex glove allergy in which the auxiliary staff had the highest risk of latex glove allergy [Table 1]. Sixty-five percent (711 HCWs) of our study subjects have less than five years of work experience [Table 1].

A total of 99 (9.1%) HCWs reported symptoms in a screening questionnaire, which either occur or worsen within the hospital environment. This includes both latex protein allergy and contact dermatitis to rubber additives. There was a rising trend noted between years of work experience and glove allergy ( $p < 0.001$ ). HCWs with more than ten years of work experience had 3.85 odds (2.0–7.1 95% C.I.) of latex glove allergy than those with less than five years of experience [Table 1]. The prevalence was high in auxiliary staff (24.6%). The staff working in both ward and operation theatre had higher odds of 4.5 (1.8–11.2 95% C.I.) of having latex glove allergy than those working in laboratories [Table 1].

From the responses obtained from the screening questionnaire, the most common latex glove-related manifestation was contact dermatitis in 85 HCWs (85.8%). These HCWs were clinically examined and their hand eczema was further categorized into allergic (17, 17.1%) and irritant (68, 68.6%) contact dermatitis. This was followed by allergic rhinitis in 40 (40.4%), contact urticaria in 11 (11.1%), allergic conjunctivitis in 6 (6.06%), and asthma in 3 (3.03%). There was an overlap in clinical manifestations in 38 HCWs. None of the HCWs had serious reactions like anaphylaxis or angioedema.

Atopy was present in 11.8% ( $n = 129$ ) of the study subjects and was significantly associated with latex glove allergy (OR = 20.51 with 95% C.I. and range 12.8–32.8). Food allergy to pineapple, carrot, kiwi, apple, potato,

**Table 1: Baseline characteristics of the study subjects and study groups**

	Symptomatic <i>n</i> (%)	Asymptomatic <i>n</i> (%)	Odds ratio C.I.	<i>P</i>
Number of participants <i>n</i> (%)	99	989		
Age in years (mean±SD)	32.52±7.7	29.5±6.3		<0.001*
Sex <i>n</i> (%)				
Male	27 (27.2%)	462 (46.7%)		<0.001#
Female	72 (72.7%)	527 (53.2%)		
Job Category <i>n</i> (%)				
Doctor	41 (41.4%)	596 (60.2%)	1	<0.001**
Nurses	23 (23.2%)	286 (28.9%)	1.17 (0.6-1.9)	
Auxiliary staff	35 (35.3%)	107 (10.8%)	4.75 (2.8-7.8)	
Years of experience <i>n</i> (%)				
<5	44 (44.4)	667 (67.4%)	1	<0.001**
5-10	38 (38.3)	255 (25.7%)	2.25 (1.4-2.5)	
>10	17 (17.1%)	67 (6.7%)	3.85 (2.0-7.1)	
Place of work <i>n</i> (%)				
Lab	22 (22.2%)	101 (10.2%)	1	<0.001**
ICU	16 (16.1%)	70 (7%)	0.5 (0.2-1.0)	
OT	10 (10.1%)	266 (26.8%)	0.1 (0.07-0.3)	
Ward	38 (38.3%)	539 (54.4%)	0.3 (0.1-0.5)	
Ward and OT	13 (13.1%)	13 (1.3%)	4.5 (1.8-11.2)	

#Chi-square test; \*Mann-Whitney U test; \*\*M-H Chi-square for linear trend. SD: standard deviation; CI: confidence interval

papaya, and grapes was present in 23 (2.1%) out of 1088 HCWs and was significantly associated ( $p < 0.001$ ) with latex glove allergy (60.8%). We observed a linear trend between latex glove allergy and using more than five gloves per day (OR = 3.84 with 95% C.I. and range 2.1-6.7) [Table 2]. HCWs using the gloves for more than 4 hours a day had a higher prevalence (11.4%) of latex glove allergy. The prevalence of latex glove allergy among those using powdered gloves (12.9%) was higher ( $p < 0.001$ ) than those using non-powdered gloves (6.9%). The highest prevalence (26.7%) was seen in those who used hand rubs frequently (>10 times per day). A linear trend was noted between the frequency of hand rubs used per day and latex glove allergy ( $p < 0.001$ ) [Table 2].

The skin prick test was positive in 15/61 (24.5%) HCWs. Hand eczema was the manifestation in all the 15 HCWs, allergic rhinitis in 7, contact urticaria in 3, and bronchial asthma in 1. Female gender ( $p = 0.044$ ) and using more than five gloves per day ( $p = 0.027$ ) were the factors significantly associated with skin prick test positivity. Patch test was positive in 11/41 (26.8%) HCWs. The clinical relevance was “possible” in 7/11 positive patch test reactions to “thiuram mix” which is a rubber additive typically present in latex gloves. The grade of all positive patch test reactions did not change in day 2 and day 4 readings [Table 3].

The median serum total IgE value was 150.80 IU/ml with an interquartile range of 552.15 IU/ml. Out of 60 symptomatic HCWs for whom serum IgE has been done, only 8 had values >640 IU/ml (Standard range 40–640 IU/ml for adults).

## Discussion

Our study reported a 9.1% prevalence of latex glove allergy based on the screening questionnaire. Questionnaire-based prevalence of latex allergy reported in other studies ranged from 4.2% in Turkey to 47% in Italy.<sup>[8]</sup> This wide range may be because of the difference in the work nature of study subjects, type of latex gloves, and criteria used for diagnosing latex allergy. The studies with the least reported prevalence had estimated only type 1 allergic manifestations. They did not include contact dermatitis which was the major latex glove-related manifestation in our study.<sup>[5,9]</sup> Other studies which reported higher prevalence had a smaller sample size which was not representative and cannot be generalized.<sup>[10,11]</sup>

Irritant contact dermatitis was the most common manifestation in our study subjects. This finding was in accordance with the studies conducted by Kose *et al.*<sup>[9]</sup> in Turkey, Khader *et al.*<sup>[11]</sup> in Jordan, and Suli *et al.*<sup>[12]</sup> in Italy. In the study conducted by Kose *et al.*<sup>[9]</sup> in Turkey, allergic rhinitis was the most common type 1 latex allergy similar to our study. In all other studies, contact urticaria or allergic conjunctivitis was the most common type 1 reaction compared to allergic rhinitis.<sup>[5,10-16]</sup>

We observed a linear trend between latex glove allergy and the risk factors like job categories (OR = 4.75), more than ten years of work experience (OR = 3.85), usage of more than five gloves per day (OR = 3.84), and usage of hand rub more than 10 times per day (OR = 5.26). Amarasekera *et al.*<sup>[17]</sup> reported that duration in the service (OR = 1.006)

**Table 2: Risk factors associated with latex allergy among study subjects**

	Symptomatic (n=99)	Asymptomatic (n=989)	Odds ratio with C.I.	P
Atopy n (%)				
Yes	60 (60.6%)	69 (6.9%)	20.51	<0.001*
No	39 (39.3%)	920 (93%)	(12.8-32.8)	
Food allergy n (%)				
Yes	14 (14.1%)	9 (0.9%)	17.93	<0.001*
No	85 (85.8%)	980 (99%)	(6.9-48.1)	
No. of gloves used per day n (%)				
<2	20 (20.2%)	317 (32%)	1	<0.001#
2-5	40 (40.4%)	511 (51.6%)	1.24 (0.7-2.1)	
>5	39 (39.3%)	161 (16.2%)	3.84 (2.1-6.7)	
Hours of usage of glove n (%)				
≥4	4 (4%)	31 (3.1%)	1.29	0.626
<4	95 (95.9%)	958 (96.8%)	(0.32-3.7)	
Type of gloves n (%)				
S <sup>s</sup>	48 (48.4%)	645 (65.2%)	1.99	<0.001*
U <sup>ss</sup>	51 (51.5%)	344 (34.7%)	(1.31-3.01)	
Hand rub usage times n (%)				
<5	27 (27.2%)	388 (39.2%)	1	<0.001#
5-10	31 (31.3%)	489 (49.4%)	0.91 (0.5-1.5)	
>10	41 (41.4%)	112 (11.3%)	5.26 (3-8.9)	
Chemical exposure (%)				
Yes	64 (64.6%)	301 (30.4%)	4.17	<0.001*
No	35 (35.3%)	688 (69.5%)	(2.7-6.44)	
Frequent surgeries n (%)				
Yes	11 (11.1%)	6 (0.6%)	20.47	<0.001*
No	88 (88.8%)	983 (99.3%)	(7.39-56.69)	

#M-H Chi-square for linear trend; <sup>s</sup>S- Sterile gloves; <sup>ss</sup>U- Unsterile glove. CI: confidence interval; \*Chi-Square test

**Table 3: Clinical profile of patch test positive individuals**

Age in years	Sex	Job category	Symptoms	Prick test result	Patch test result	Relevance
29	F	Nurse	Hand eczema	Positive	Thiuram mix (+++), potassium dichromate	Relevant
48	M	Aux. staff	Hand eczema	Negative	PPD, nickel	Not relevant
40	F	Aux. staff	Hand eczema	Negative	Thiuram mix (+)	Relevant
74	M	Aux. staff	Hand eczema	Negative	Thiuram mix (+++), black rubber mix, formaldehyde	Relevant
34	F	Aux. staff	Hand eczema	Negative	Potassium dichromate, nickel	Not relevant
45	F	Aux. staff	Hand eczema, allergic rhinitis	Negative	Thiuram mix (+++), nickel	Relevant
32	F	Aux. staff	Hand eczema, urticarial	Negative	PPD, thiuram mix (+++)	Relevant
39	F	Aux. staff	Hand eczema	Negative	Formaldehyde, benzocaine, neomycin	Not relevant
39	F	Aux. staff	Hand eczema	Negative	Cobalt, PPD, fragrance mix	Not relevant
38	F	Doctor	Hand eczema, urticaria	Positive	Potassium dichromate, thiuram mix (+), epoxy resin	Relevant
45	M	Aux. staff	Hand eczema, allergic rhinitis	Positive	Thiuram mix (+)	Relevant

Aux. staff-Auxiliary staff

and wearing gloves for >1 hours (OR = 3.2) were significantly associated with latex allergy. Suli *et al.*<sup>[12]</sup> reported that auxiliary staff had 3.1 times the odds of being symptomatic than other job categories. These results were consistent with our study. In other similar studies, atopy and food allergy were the most common risk factors

associated with latex allergy.<sup>[5,9-13,15-18]</sup> Supapvanich *et al.*<sup>[19]</sup> reported that atopy, asthma, and multiple surgeries in the past were not significantly associated with latex allergy and that the sensitized nurses worked two years lesser than the non-sensitized nurses, used lesser pairs of gloves, and wore them for a shorter duration per day. These were not

consistent with our results and could be explained by the small number of sensitized nurses ( $n = 16$ ) in this study.

### Limitations

The study was limited by its cross-sectional design. The screening questionnaire used in this study was not validated for the Indian population. It is possible that the perception of food allergy might have been different for the interviewer and the interviewee. The low positivity rate (24.5%) of the skin prick test could be explained by the fact that the commercially available liquid latex allergen used in our study may not represent the latex allergens in the gloves used by HCWs in our institute. Not all the HCWs who reported contact dermatitis or allergy were tested as they did not give consent for the same. Antigen-specific IgE estimation was not performed in our study.

### Conclusion

Our study reported a high prevalence of latex glove allergy in a single tertiary care center in South India. We infer that HCWs with a history of atopy, who work in operation theatre setup, auxiliary staff, and those with more than ten years of experience are at a higher risk of developing latex allergy. With irritant contact dermatitis being the most common manifestation in our study, HCWs at risk shall be educated on the appropriate use of gloves and hand moisturizer to prevent occupational ICD. We recommend further research to address the gaps in our knowledge around latex allergy in a healthcare setting and we also recommend developing a validated screening questionnaire for latex allergy in the Indian population.

### Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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### Conflicts of interest

There are no conflicts of interest.

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