

The Prevalence of Latex Sensitivity among Operating Room Personnel: A Systematic Review and Meta-Analysis

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Abstract

Aims: Latex sensitivity has been a concern for health-care workers in recent years. Due to the excessive exposure to latex products in the operating room, the personnel of this department are exposed to high sensitivity to these products. Therefore, the present study was conducted to investigate the prevalence of latex sensitivity among operating room personnel. **Materials and Methods:** This systematic review and meta-analysis conducted based on a Preferred Reporting Items for Systematic Reviews and Meta-Analysis checklist. The present study researchers explored four international databases, namely Medline/PubMed, ProQuest, Scopus, and Embase in February 2020. The selected keywords for international databases were classified into three categories (a) operating room personnel, (b) latex sensitivity, and (c) prevalence. The collected data were entered into the EndNote X8 software and analytical analysis was performed by STATA statistical software version 12. **Results:** Seventy-five articles were found by searching for databases. After several screening steps, 12 articles entered the final analysis. The results show that the prevalence of latex sensitivity in total is 14.76 (confidence interval 95%: 9.27–20.25). Meta-regression results showed that the relationship between the years of study and the prevalence of latex sensitivity is not statistically significant ($P = 0.222$). **Conclusion:** The results of the present study showed that sensitivity to latex is significantly prevalent among operating room staff. Due to the importance of sterility and sensitive working conditions in the operating room, as well as frequent contact with latex products, it is important to pay attention to the side effects caused by latex powder.

Keywords: Latex hypersensitivity, meta-analysis, operating room personnel, prevalence

INTRODUCTION

Latex sensitivity has been a concern for health-care workers (HCWs) in recent years.^[1,2] Repeated exposure to rubber products and latex-containing equipment appears to be a major risk factor for latex sensitivity.^[2] The prevalence of latex allergy in the general population is <1%,^[3] while worldwide, the prevalence is estimated at 9.7% in HCWs.^[4,5] HCWs are more sensitive than other groups due to exposure to direct contact with medical latex products and latex glove powder.^[4] In the 1990s, latex allergies peaked among HCWs in Europe

and North America but declined due to advances in glove manufacturing, educational and practical interventions, and the use of low-protein, powder-free gloves.^[6] In recent years, the number of people with allergies to natural latex has increased. The increasing use of latex gloves and other latex products in HCWs has led to a parallel increase in latex-related side effects.^[3] In Asia, however, the prevalence of latex allergies is

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still high (12.1%) percent, while in Europe and North America, it is about 5%.^[6] Estimation of the prevalence of allergy in high-risk groups depends on how clinical findings and techniques used to prove allergy are examined.^[7] The diagnosis of latex allergy is based on individual's history and accurate allergological evaluation. Patients with a history of side effects during medical or surgical procedures should undergo latex skin prick tests (SPTs), latex-specific immunoglobulin (Ig) E (sIgE) measurement, and challenge tests (nasal, conjunctival, bronchial, intravaginal, sublingual, and cutaneous).^[5,8]

Special tests (bronchial, nasal, and conjunctival) due to their high sensitivity and specificity are considered as a reference test for the diagnosis of allergic occupational diseases.^[9] In addition, the conjunctival sensitivity test is the most sensitive diagnostic method in eye allergy to latex (sensitivity of 92%), while the sensitivity of the skin scratch test is 84% with latex and 88% with sIgE.^[10]

More than 50% of people who are sensitive to latex have a history of some type of atopic disease. Among HCWs, a quarter had a positive skin test for latex.^[11] Symptoms of latex sensitivity may include itching, rash, urticaria, rhinorrhea, chest tightness, and even anaphylactic shock.^[12] It is important to correctly diagnose latex allergies to choose the right method of prevention and treatment. To reduce the sensitivity, gradual corrective measures have been taken, such as replacing natural rubber latex allergy with other materials or using powder-free gloves, as effective methods have been identified.^[13] Due to the excessive exposure to latex products in the operating room, the personnel of this department are exposed to high sensitivity to these products. On the other hand, in the studies conducted, this complication has been studied less specifically in the operating room staff. Therefore, the present study was conducted to investigate the prevalence of latex sensitivity among operating room personnel as a systematic review and meta-analysis.

MATERIALS AND METHODS

The aim of this study was to investigate the prevalence of latex sensitivity among operating room personnel in a systematic review and meta-analysis based on a Preferred Reporting Items for Systematic Reviews and Meta-Analysis checklist.

Search strategy

The present study researchers explored four international databases, namely Medline/PubMed, ProQuest, Scopus, and Embase in February 2020. For higher precision and investigation of the gray literature, Google Scholar was explored, as well.

The selected keywords for international databases were classified into three categories as follows: (1) related to operating room personnel (operating room staff, operating room nurses, operation room nurses, and operation room technicians), (2) related to latex sensitivity (latex allergy, latex sensitivity, latex hypersensitivity, rubber latex allergy, rubber latex allergies, natural rubber latex allergy, rubber allergy, rubber

allergies, latex allergies, and rubber additives), and (3) related to prevalence (prevalence, frequency, incidence, epidemiology, posture, upper extremity, and lower extremity). The collected data were entered into the EndNote X8 software (New Mexico, USA) and the repetitive articles were automatically omitted. Then, articles were separately evaluated by two researchers.

Inclusion and exclusion criteria

The first criterion for entering the study was the language of the articles, which were included only in English studies due to language constraints.

Evaluation of the article's quality

Joanna Briggs Institute Checklist was used to check and control the quality of articles. The tool answers 9 questions in the form of "Yes, No, indeterminate and Not Used" and aims to evaluate the methodological quality of studies. The scores of this questionnaire are classified into three categories: low quality (Scores 1 and 2 of 9 questions), medium quality (Scores 3–6 of 9 questions), and high quality (Scores 7–9). Only one study was in the medium category and the rest were high-quality studies.

Statistical analysis

Cochran's test (with a significance level of <0.1) and its combination using the I^2 statistic (with a significance level >50%) were performed to investigate the heterogeneity between the studies. Meta-regression was used to investigate the relationship between quantitative variables and the prevalence of latex sensitivity. All analyses were performed using STATA statistical software version 12 (College Station, Texas, USA).

RESULTS

Description of searching for articles

Seventy-five articles were found by searching for databases. After removing the duplicate studies and irrelevant studies in the title and abstract stage, 24 articles entered the next stage, in which the full text of the articles was reviewed and ten articles entered the final analysis. Furthermore, by checking the references of the submitted articles, two studies were added and finally, 12 studies were reviewed [Figure 1].

Description of the included studies

Among these articles, there were two studies in Iran^[14,15] and Chile each, and Australia, Canada, France, Indonesia, South Korea, Turkey, Switzerland, and the United States each had one article [Table 1]. Among the reviewed studies, all studies evaluated both sexes. Furthermore, studies were classified based on the human development index, which had nine very high index studies and three high index studies.

The results of meta-analysis of the studies

Due to the high heterogeneity in the results of the study, the model of random effects was used and two indicators Q and I² were calculated for the prevalence of sensitivity to latex. The results show that the prevalence of latex sensitivity in total was 14.76 (confidence interval [CI] 95%: 9.27–20.25) and in countries with very high human development index

Table 1: Summary of the studies included in systematic review and meta-analysis

Number	Author (year)	Year of study	Country	HDI	Sample size	Population	Mean of age	Tools	Prevalence	SOA
1	Reisli (2009)	-	Turkey	Very high	208	Operating room personnel	29	Questionnaire- Skin prick tests - IgE measurement	12.5	7
2	Nabavizadeh (2009)	2008	Iran	High	580	Operating room personnel	-	Questionnaire - skin prick tests	17.9	8
3	Miri (2007)	2002	Iran	High	512	Operating room personnel	39	Skin prick tests, IgE, latex specific IgE tests	11.5	8
4	Rodas (2006)	2005	Chile	Very high	94	Operating room personnel	40	Skin prick tests	12.76	6
5	Huda (2005)	2002	Indonesia	High	271	Operating room nurses	36	Skin prick tests	6.27	7
6	Guzmán (2005)	-	Chile	Very high	95	Operating room personnel	37	Skin prick tests	25.3	7
7	Hwang (2002)	1996	Korea	Very high	61	Operating room nurses	28	Questionnaire - skin prick tests	9.8	7
8	Hack (2001)	-	Australian	Very high	76	Operating room nurses	33	Questionnaire- skin prick tests- IgE measurement	1.102	7
9	Mace (1998)	-	Canada	Very high	247	Operating room nurses	-	Skin prick tests	4.9	8
10	Konrad (1997)	-	Switzerland	Very high	101	Anesthesiology staff	30	Skin prick tests	15.8	7
11	Zaza (1994)	1992	USA	Very high	1738	Operating room nurses	45	Self-reporting questionnaire	21.3	8
12	Lagier (1992)	1991	France	Very high	248	Operating room nurses	34.50	Questionnaire - skin prick tests	41.1	8

HDI: Human Development Index, SOA: Score of Quality Assessment, IgE: Immunoglobulin E

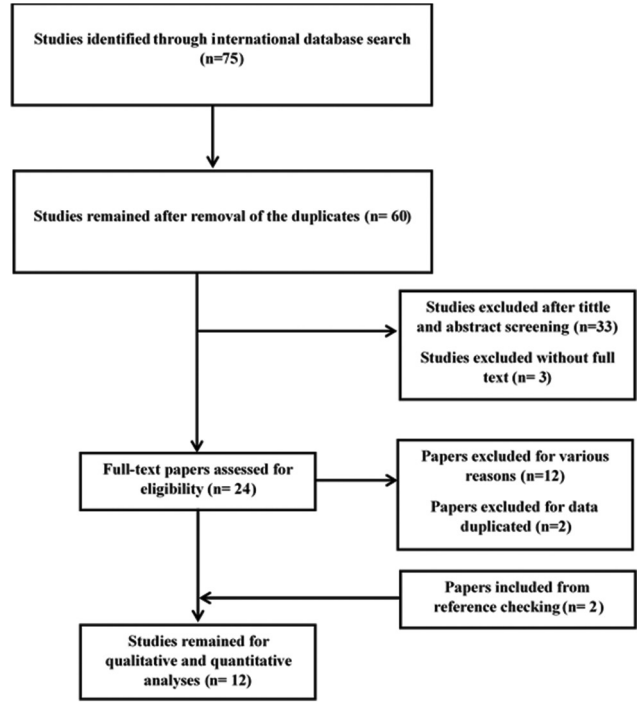


Figure 1: Flowchart of the included studies in systematic review

was 15.87 (CI 95%: 8.12–23.63) and in countries with high human development index was 11.87 (CI 95%: 5.48–18.26) [Figure 2]. The results of the heterogeneity are equal to: $I^2: 96.6\%$, $Q = 325.03$, $df = 11$, $P < 0.001$.

The results of meta-regression of the studies

A meta-regression test was used to investigate various factors on the prevalence of latex sensitivity. The results of a survey of the relationship between the years of study and the prevalence of latex sensitivity showed that the prevalence has decreased in recent years, but this decrease is not statistically significant ($P = 0.222$) [Figure 3].

DISCUSSION

The aim of this study was to investigate the prevalence of latex sensitivity among operating room personnel using a systematic review and meta-analysis study. The results of this study, after reviewing 12 studies, showed that this disorder had a significant prevalence (14.76%) among operating room staff.

Different methods of questionnaires and skin tests were used to investigate the prevalence of sensitivity in different studies. Among these methods, SPTs using six studies and IgE measurement (IgE) in three studies, respectively, had the highest and lowest prevalence of the tools used.^[16-21]

In general, the diagnostic sensitivity and specificity of SPTs evaluation are less than that of sIgE.^[8] Specific challenge tests (conjunctival, nasal, and bronchial) are considered as reference tests for allergic occupational diseases diagnosis due to their high sensitivity and specificity.^[9] In between them, the conjunctival sensitivity challenge test is reported to

Author_Year	Country	ES (95% CI)	% Weight
Very high			
Reisli,2009	Turkey	12.50 (8.01, 16.99)	8.47
Rodas,2006	Chile	12.76 (6.02, 19.50)	7.90
Guzmán,2005	Chile	25.30 (16.56, 34.04)	7.31
Hwang,2002	South Korea	9.80 (2.34, 17.26)	7.70
Hack,2001	Australia	1.10 (-1.25, 3.45)	8.83
Mace,1998	Canada	4.90 (2.21, 7.59)	8.79
Konrad,1997	Switzerland	15.80 (8.69, 22.91)	7.80
Zaza,1994	USA	21.30 (19.38, 23.22)	8.88
Lagier,1992	France	41.10 (34.98, 47.22)	8.07
Subtotal (I-squared = 97.3%, p = 0.000)		15.87 (8.12, 23.63)	73.75
High			
Nabavizadeh,2009	Iran	17.90 (14.78, 21.02)	8.72
Miri,2007	Iran	11.50 (8.74, 14.26)	8.78
Huda,2005	Indonesia	6.27 (3.38, 9.16)	8.76
Subtotal (I-squared = 93.0%, p = 0.000)		11.87 (5.48, 18.26)	26.25
Overall (I-squared = 96.6%, p = 0.000)		14.76 (9.27, 20.25)	100.00

Figure 2: Prevalence of latex hypersensitivity in neck among studies included

be the most sensitive diagnostic method in latex eye allergy (92% sensitivity and 100% specificity), while the sensitivity of SPT with latex is 84% and of IgE – 88%.^[10]

One of the most important factors in sensitization in operating room personnel was the use of powder latex gloves. The personnel of this department have been more exposed to this complication due to dealing with the sterile field and its frequent use.^[4,17] Among the studies conducted, the highest and lowest prevalence reported rates were in France (41.1%)^[21] and Australia (1.1%),^[20] respectively. It was also found that about a third of these studies were conducted in Asia.

Survey of the symptoms of latex sensitivity revealed that only half of the people were clinically symptomatic, and the clinical consequences for the other 50% remained uncertain. The risk factors for this disorder include previous history of atopy, eczema, and longer exposure to latex gloves.^[3] In most studies, in addition to examining the prevalence of sensitivity, the characteristics and symptoms created inpatients were evaluated. The most common symptoms identified include atopy, urticaria, itching and redness, eczema, and rash, which were noted in most studies.^[17-19,21,22] In general, allergic reactions include two types, I and IV. Type I reactions (IgE-mediated) manifest as localized or generalized urticaria, conjunctivitis, rhinitis, asthma, and anaphylaxis. Type I reaction is an immediate reaction that begins within 5–30 min after contact with latex and often subsides within 24 h. Type IV (cell-mediated) reactions are in the form of contact dermatitis, and its manifestations are in the form of acute contact dermatitis. These symptoms occur 96–48 h after contact, and as a result, the skin becomes dry, scaly, and thick.^[23,24]

CONCLUSION

The results of the present study showed that sensitivity to latex is significantly prevalent among operating room staff. Due to the importance of sterility and sensitive working conditions in the operating room, as well as frequent contact with latex products, it is important to pay attention to the side effects

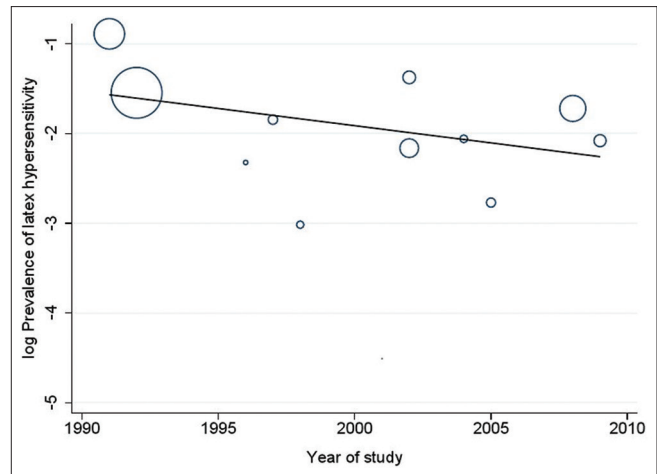


Figure 3: Meta-regression analysis of the prevalence of latex hypersensitivity on the year of study

caused by latex powder. Since the operating room is considered one of the most important and sensitive parts of any hospital, it is very important to pay attention to the health of its staff because affecting people's health is not only problematic for them but also the efficiency of the treatment system.

Study limitations

One of the limitations of the present study is the difference in assessment tools in the studies studied. Different tools can reduce the accuracy of the assessment. Therefore, to achieve better results, it is recommended that in future studies, only items that are more similar in terms of methodology be used.

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Conflicts of interest

There are no conflicts of interest.

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