
Prevalence of skin test reactions to natural rubber latex in hospital personnel in Russia and eastern Europe

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Background: Allergic reactions to natural rubber latex have increased during the past 10 years, especially in many health care workers (HCWs) who have high exposure to latex allergens. The prevalence of skin test reactions to natural rubber latex in Russia, the Commonwealth of Independent States (CIS), and eastern Europe is unknown.

Objective: The purpose of this study was to determine the prevalence of skin test reactivity to natural rubber latex in a population of HCWs exposed to latex.

Methods: Nine hundred one HCWs regularly exposed to latex were evaluated using an allergy history questionnaire. Subjects were tested for latex allergy by titrated skin prick test with a biologically standardized latex extract. The diagnosis of latex allergy was defined by the presence of clinical symptoms when exposed to latex along with a positive skin prick test to latex.

Results: Forty-nine (5.4%) HCWs were skin test-positive to latex. Seventeen (1.9%) HCWs were classified as latex-allergic based upon positive skin tests to latex associated with allergy symptoms with exposure. Seven of 901 HCWs had experienced anaphylactic reactions to latex. The most frequently reported symptom related to latex exposure was contact urticaria.

Conclusions: The prevalence of latex allergy among HCWs in Russia, the CIS, and adjacent eastern European countries is considerably less than reported in HCWs exposed to latex in western Europe and the United States. The low prevalence of latex allergy in Russia and the CIS suggests that lessened exposure to natural latex powdered gloves may diminish the prevalence of latex sensitization in HCWs in Russia and the CIS.

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INTRODUCTION

Latex allergy has been recognized as a major source of occupational rhinitis, asthma, and dermatitis among health care workers (HCWs) in the United States, western Europe, and Japan.^{1–9} Among western European HCWs evaluated by latex skin prick test, the prevalence of natural rubber latex allergy has ranged up to 11%.^{1,3,6} A high prevalence of latex allergy has also been found among physicians (9.9%) and operating-room nurses (8.2%) examined in Canada and the United States.^{5,7} In agreement with skin prick tests, recent serologic studies of HCWs in the United States found up to 18% prevalence of latex sensitization.^{1–10} The prevalence of latex sensitization in eastern Europe, Russia, and the Commonwealth of Independent States (CIS) has not been reported. As the onset of the human immunodeficiency virus epidemic occurred later in eastern Europe, less exposure to latex gloves among HCWs may affect the prevalence of latex

sensitization in eastern Europe and Russia. Several crossreacting allergens have been observed from various fruits and plants such as avocado, banana, and kiwi. It has been suggested that frequent ingestion could be an additional risk factor for developing latex allergy.^{11,12} However, consumption of tropical fruits may be less common in eastern Europe, most of Russia, and the CIS, although regional differences in diet exist between southern semitropical zones of Russia (Krasnodar region) and Ukraine (Crimea) and northern temperate zones of both countries.

The presence of specific immunoglobulin E in natural rubber latex-allergic patients may be verified by skin prick tests (SPTs) or by serologic methods. Until recently, the limited knowledge of the relevant latex allergens had been a major hindrance to the laboratory evaluation of latex allergy and for laboratory monitoring of the natural history of latex sensitization. Recently, the major latex allergens have been identified and several biologically standardized. Natural rubber latex extracts have now become available for skin prick testing in Europe.^{13–15} The objectives of this study were to estimate the prevalence of latex sensitization among health care personnel in Russia, the CIS, and eastern European countries and to evaluate patients for symptoms of allergy to foods that crossreact with latex. Exposure to latex and tropical fruits, which may be more regionally variable in eastern

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Europe, Russia, and the CIS than has been observed in western Europe and the United States, was expected to influence the frequency of latex sensitization and the development of allergy symptoms to latex-crossreactive foods.

MATERIALS AND METHODS

Subjects

Nine hundred one HCWs exposed to latex were interviewed by the local investigator, who filled out a detailed questionnaire (translated into the major language of the country) about symptoms possibly associated with latex allergy. The questionnaire included a detailed description of each symptom and signs of the disease in question. Symptoms associated with contact urticaria, angioedema, contact dermatitis, asthma, rhinoconjunctivitis (RC), and anaphylaxis were marked on each patient sheet by the investigator. Oral allergy symptoms to foods crossreactive to latex were also evaluated by questioning each patient about oral itching, perioral erythema, edema of lips, tongue, and throat, gastrointestinal complaints, or urticaria immediately after eating apple, avocado, banana, chestnut, or kiwi. In addition, subjects were asked about food-related anaphylaxis. Latex allergy was determined by the presence of symptoms when exposed to latex combined with a positive SPT (wheal diameter of ≥ 3 mm) to natural rubber latex. Subjects reporting no symptoms of latex allergy but having a positive SPT were considered latex-sensitized.

SPT

After obtaining informed consent all subjects were tested by titrated SPT with a biologically standardized 1, 10, and 100 histamine equivalent prick (HEP) Soluprick SQ Latex (*Hevea brasiliensis*) glycerinated extract (ALK-Abello, Horsholm, Denmark) containing 320, 32, and 3.2 μ g of protein, respectively. The extract is a nonammoniated latex extract biologically standardized according to the Nordic Guidelines.¹⁶ Only if the skin test was negative with 100 HEP was the evaluation for latex allergy regarded as negative.

SPT was performed in duplicate with a lancet having a 1-mm tip according to the European Academy of Allergy

and Clinical Immunology recommendation.¹⁷ Patients were tested by applying the allergen extract to the volar surface of the distal forearm, including a histamine standard of 10 mg/mL as the positive control and the diluent as a negative control. Wheals were read after 15 minutes. Wheal reactions were outlined with a fine marker and transferred to paper with transparent tape. SPT results were recorded by measuring the largest wheal diameter of the latex skin test reaction. The mean value of duplicate tests was used. Skin tests with inhalants or foods were not performed.

DATA EVALUATION

Data tabulations and computations were performed in Microsoft Excel software (Redmond, WA). The χ^2 test was used to ascertain an association between asthma and rhinitis and latex sensitization.

RESULTS

In 1999, 15 centers included approximately 60 subjects per site. A total of 901 HCWs were enrolled in the study. The mean age was 37 years with a range of 17 to 75 years. The female:male ratio was approximately 4:1.

Characteristics of Allergy Status of Investigated Populations

Mean prevalence of the reported RC symptoms in all studied centers was 23.4 (standard deviation [SD] 10.5%) ranging from 6.5% in Kazan, Russia (approximately 1,000 km east of Moscow) to 35 to 38% in the cities of Yalta, Simferopol, Crimea (southern Ukraine) and Rostov-on-Don (southern Russia). The mean of reported asthma symptoms was 10.9 (SD 7.3%), with the lowest prevalence in Tbilisi and Kiev (5% each) and the highest (up to 33.3%) in Yalta, Crimea, Ukraine. Dust was the most commonly reported triggering factors of both upper and lower respiratory symptoms. On average, 14.8% (SD 8.5%) RC patients and 7.4% (SD 6.9%) asthma patients considered their symptoms to be triggered by dust allergens. Pollens were associated with 12.9% (SD 9.7%) RC symptoms and 5.1% (SD 6.1%) asthma symptoms (Fig 1).

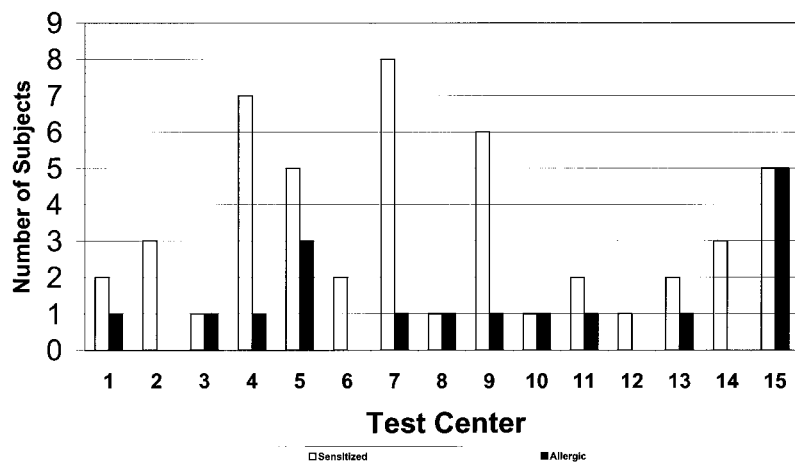


Figure 1. Depiction of the number of subjects at each study site who were latex-sensitized ($n = 49$) as determined by a positive SPT to latex, or latex-allergic ($n = 17$) by case history and positive latex SPT. Study sites were located in Poland, Lithuania, Hungary, Ukraine, Belarus, Georgia, and Russia. Those study sites in Ukraine, Belarus, and Georgia are referred to as CIS study sites.

High center-to-center differences in the prevalence of reported skin symptoms were noted with mean rate of urticaria 16.1% (SD 12.6%) ranging from 0% in Kazan, Russia to 46.7% in Moscow, Russia, whereas the mean rate of eczema was 10.9% (SD 8.3%) ranging from 0% in Vinitza, Ukraine and Tbilisi, Georgia to 29.4% in Yalta, Crimea, Ukraine.

Allergic reactions to food were infrequent, with a mean of 4.6% (SD 4%) patients reporting food allergy symptoms. No allergic reaction to food was reported in Kazan, Russia and Tbilisi, Georgia but in Yalta, Crimea, Ukraine the incidence of allergic reactions to food was 9.8%, the most frequent being kiwi associated with adverse reactions in 7.8% of HCWs in Yalta, Crimea, Ukraine, and 10% of HCWs in Rostov-on-Don, Russia.

Association between Reported Allergy Symptoms and Positive Test Results to Latex Allergens

Latex allergy symptoms. Seventy-three of 901 HCWs (8.1%) reported symptoms associated with exposure to latex. Only 17 of 73 HCWs (23.3%) who reported symptoms associated with latex exposure had positive SPTs with at least one concentration of *H. brasiliensis* extract, which resulted in 1.9% prevalence for symptomatic latex allergy in the whole studied population of HCWs. Nine HCWs of 537 (1.7%) who did not complain of any allergic symptoms had skin reactions with the *H. brasiliensis* extract. In HCWs reporting respiratory symptoms upon latex exposure, positive skin test results were seen in 33.3% of those experiencing RC and 50% of those experiencing asthma.

Food allergy symptoms. Although in the subgroup of persons reporting food allergy the incidence of positive latex SPT results was relatively low at 17.1% (7 of 41), a history of allergic reactions to apple were associated with 54.5% rate of positive SPTs with latex allergen extracts (6 of 11). In HCWs who reported respiratory symptoms to food, positive SPT results to *H. brasiliensis* were noted in 44.4% (4 of 9) of HCWs experiencing RC and 50% (4 of 8) of HCWs experiencing asthma. The presence of oral symptoms upon exposure to food was connected with high incidence of positive latex SPT results, 28.6% being positive among HCWs who reported oral swelling upon exposure to selected fruits.

Inhalant allergy symptoms. In HCWs reporting respiratory symptoms to dust, pollens, latex, and animals, positive test results for latex extract were observed more frequently than among asymptomatic persons. Asthma symptoms upon exposure to animals were associated with positive latex skin test results in 27.8%, whereas RC symptoms upon animal exposure were associated with 17.8% latex skin test positivity. Asthma and RC symptoms triggered by dust and/or pollens were associated with a positive latex SPT result in 10 to 12% of HCWs.

Skin allergy symptoms. The incidence of positive latex skin test results in HCWs reporting urticaria was 14% (21 of 150), whereas the rate was 11.7% (11 of 94) in those reporting eczema, not significantly different from the incidence of positive latex skin tests in patients reporting asthma symptoms (13.3%).

Allergy symptoms in HCWs associated with positive SPT results to *H. brasiliensis*. Forty-nine (5.4%) HCWs (12 males and 37 females) were skin test-positive to latex but the prevalence varied highly from center to center. In most centers the prevalence of latex-positive results was below 3.5% but in two centers exceeded 13% (Yalta, 13.7% and Krasnodar, 13.3%; Fig 1).

Only 18 (36.7%) of latex SPT-positive HCWs reported allergy symptoms upon latex exposure (Table 1). Nine persons (18.4%) did not report any symptoms, whereas 22 (44.9%) persons reported allergic symptoms not related to latex exposure. The most frequently reported latex-related allergic manifestation was contact urticaria, followed by contact dermatitis and angioedema (Table 1). The overall prevalence of a positive clinical history of latex-associated allergy symptoms and a positive skin test to latex allergens was less than 2% among the studied group of HCWs.

Fourteen of 18 (77.7%) HCWs with symptomatic latex allergy also reported respiratory symptoms upon inhalant allergen exposure, whereas 11 of 18 (61.1%) reported non-latex-related skin symptoms.

Of the 22 HCWs who had positive latex SPT results but did not associate their symptoms with latex exposure, 8 (36.4%) reported allergic respiratory symptoms induced by other allergens, 13 (59.1%) non-latex-related skin symptoms, and 1 (4.5%) complained of both respiratory and skin symptoms.

Fifty-five HCWs (6.1%) reported symptoms upon latex exposure, even while being latex skin test-negative (Table 2). Most of these latex SPT-negative HCWs claimed skin 65.4% (36 of 55) and/or upper respiratory symptoms 29.1% (16 of 55) upon latex exposure. Thirty-nine of these 55 HCWs (70.1%) also reported respiratory allergic symptoms upon exposure to pollens, dust, or animal dander and 36 of 55 (65.4%) reported non-latex-related skin symptoms.

Twenty-seven of 901 HCWs (2.99%) had experienced anaphylactic reactions to latex. It was surprising to notice that 20 (2.2%) of the subjects reported latex-associated anaphylaxis without being skin test-positive to latex.

Subjects were also asked about anaphylaxis and oral allergy symptoms to latex cross-reacting foods. Very few patients had experienced such symptoms.

No systemic reactions to the latex SPTs were noted. The average wheal size increased with the strength of the latex extract used. The majority of patients reacted to 1 and 10 HEP latex concentrations (Table 3).

Table 1. Reported Symptoms among Latex-Allergic Subjects

Clinical symptoms	No. subjects	Percentage
Contact urticaria	22	45
Contact dermatitis	12	25
Angioedema	10	20
RC	9	18
Asthma	7	14
Anaphylaxis	7	14

Table 2. Reported Symptoms to Latex among Non-Skin Test Positive

Clinical symptoms	No. subjects	Percentage
Contact urticaria	128	15
Contact dermatitis	82	10
Angioedema	35	4
RC	15	2
Asthma	7	1
Anaphylaxis	20	2

Table 3. Skin Test Reaction to Latex

Potency (HEP)	No. reactors	Cumulated	Wheal size (mean, mm)	Wheal size (max, mm)
1	26	26	4	20
10	12	38	5	22
100	11	49	6	25

No significant ($P > 0.05$) association with allergic asthma or rhinitis was reported among those with positive skin test results to latex.

DISCUSSION

Previous studies in HCWs exposed to latex have shown a high frequency of latex sensitization, likely attributable to a high degree of exposure to airborne natural rubber latex glove-derived particles. In regularly exposed HCWs, the reported prevalence of latex sensitization range from 8.9 to 17.6%.¹⁻¹⁰ In contrast, we report a lower prevalence (5.4%) of latex sensitization among HCWs in Russia and eastern Europe.

In this study of latex allergy among HCWs as defined by a positive latex skin test associated with a clinical history of allergic response to latex exposure was less than 2%, significantly less than in previous reports of HCWs in the United States and western Europe.¹⁻¹⁰ The reported symptoms were in accordance with previously published studies noting clinical responses to latex.¹⁻¹⁰ However, one discrepant observation was the high frequency of self-reported anaphylaxis in latex skin test-negative individuals. An explanation may be that these HCWs had reactions related to either drugs or other hospital environment triggers of anaphylaxis, or that the accepted definition of anaphylaxis was liberated to include events such as vasovagal syncope.

Approximately 50% of natural rubber latex-allergic HCWs have experienced symptoms after eating apple, banana, avocado, chestnut, kiwi, melon, and papaya.^{12,18,19} Between 55 to 80% also demonstrate presence of specific immunoglobulin E antibodies to these foods when evaluated by *in vitro* methods.^{12,18,19} In this study, clinical symptoms to latex cross-reacting foods were rare, perhaps related to infrequent consumption of tropical foods in these countries.

However, the greater prevalence of latex sensitization noted among HCWs studied from areas of southern Russia such as Krasnodar and from southern Ukraine such as Yalta and Simferopol, Crimea suggest that tropical fruit exposure,

more common in these semitropical areas, may have contributed to the increased prevalence of latex sensitization seen in Crimea and Krasnodar when compared with the other study centers.

This multicenter study of latex allergy among HCWs in eastern Europe, the CIS, and Russia indicates that in the study population of HCWs, the prevalence of latex allergy as demonstrated by a positive skin test associated with a clinical history of latex reactivity was considerably less (1.9%) than that reported in western Europe and the United States. These observations are consistent with both the lesser frequency of use of natural rubber latex gloves and the more common re-use of latex gloves after repetitive washing, a common practice in Russia and the CIS. This may also reflect previous findings that airborne natural rubber latex concentrations in the work areas of Moscow hospitals are rather low compared with concentrations reported from American hospitals and are dependent on the intensity of latex glove usage.²⁰

Further, less exposure to tropical fruit in the more temperate zones of Russia and the CIS may also have contributed to the lesser prevalence of sensitization to natural rubber latex. This association between tropical fruit plant exposure and latex allergy is further supported by the greater prevalence of sensitization to latex among HCWs in Yalta, Crimea and Krasnodar, Russia, two semitropical regions where glove utilization patterns are no different from in other areas of Ukraine and Russia. Finally, it is possible that the gloves used in these eastern European centers may have had lower levels of extractable latex allergen.

CONCLUSION

The overall very low prevalence of latex allergy in Russia and the CIS, excluding Yalta and Krasnodar, gives further support to latex exposure, especially in the form of repetitively changed powdered natural rubber latex gloves as a critical factor for inducing sensitization to latex.

It will be interesting to observe whether the prevalence of sensitization to natural rubber latex increases in Russia, the CIS, and eastern Europe as utilization of natural rubber latex gloves increases consequent to the burgeoning epidemics of human immunodeficiency virus, tuberculosis, and viral hepatitis in Russia and the CIS countries related to socio-economic situations such as potential drug abuse and poor living conditions in correctional institutions in these countries. Further studies of the prevalence of latex allergy among HCWs of Russia and the CIS is warranted to establish the evolution of the prevalence of latex sensitization under conditions of increased requirement for frequent use of natural rubber latex gloves. Continued investigation of the prevalence of latex allergy in Russia and the CIS is clearly warranted as the pattern of natural rubber latex glove usage evolves in response to the growing epidemics of infectious, contagious diseases in these areas.

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