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# Atopic status and latex sensitization in a cohort of 1,628 students of health care faculties

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ABSTRACT

**Background:** Atopic diseases have increased since the second half of the previous century. Atopic workers are at higher risk to be sensitized to latex, and the first years of exposure are supposed to be especially risky.
**Objective:** To assess atopic status and rate of latex sensitization in health care students starting their exposure to latex gloves.
**Methods:** We analyzed medical surveillance data from 1,628 health care students from 2010 to 2016. Students completed a questionnaire focused on their previous and current latex exposure and personal and family histories of allergic diseases; underwent skin prick testing with common allergens and latex extract (and/or total and latex-specific immunoglobulin E in serum); and underwent a medical examination.
**Results:** Skin prick test results for common inhalant allergens showed that 807 of 1,628 students (49.6%) had atopy. Atopy by skin prick testing was associated with male sex (odds ratio 1.49, 95% confidence interval 1.18–1.86), a personal history of oculorhinitis or asthma (odds ratio 10.22, 95% confidence interval 7.4–14.13), and atopic eczema (odds ratio 1.87, 95% confidence interval 1.05–3.36) at multivariate regression analysis. Eleven students (0.7% of total population) were found to be sensitized to latex and all had atopy.
**Conclusion:** Despite the high prevalence of atopy in health care students of Trieste, the latex sensitization rate is very low and comparable to general population. This is reasonably due to the low exposure to latex gloves at the time of the evaluation and to low latex release from the gloves currently used in our hospital.


## Introduction

Latex sensitization and allergic symptoms are crucial aspects for health care workers who can be exposed to latex gloves and can develop skin, respiratory, and systemic allergic symptoms.[1,2] The introduction of non-powdered latex gloves, with low allergen release, and non-latex gloves in all public hospitals of the Friuli Venezia Giulia region of Italy have lowered the prevalence and incidence of latex allergy and symptoms in health care workers.[3–5] Preventive measures can be used to decrease latex sensitization and to avoid latex exposure in individuals with allergic symptoms who can be considered at higher risk to develop latex allergy.[5]

Latex allergy has increased in the recent past with the widespread use of latex gloves after the 1980s to prevent blood-transmissible diseases. Latex allergy causes cutaneous and respiratory allergic diseases in health care workers, with a reaction mediated by immunoglobulin E (IgE). The rate of latex sensitization has been estimated at approximately 1% in the general population and 5% to 12% in those with occupational latex exposure.[1,2,6]

Of health care workers of the University Hospital of Trieste, approximately 6% were detected as having positivity to latex by skin prick tests (SPTs) from 1997 through 1999,[4] and glove-related symptoms were present in 21.8% of the cohort, probably in part ascribable to mild nonspecific reactions to gloves or delayed hypersensitivity reactions to rubber-related haptens. The use of powder-free latex gloves decreases the latex release from the glove and avoids air contamination. Their use contributes to preventing new latex sensitizations and decreases cutaneous symptoms in workers, proving to be a necessary primary prevention measure.[7]

Students attending health care courses can be exposed to latex. Therefore, extension of the preventive protocol is of crucial importance to identify individuals at risk of sensitization or already sensitized to latex, with the aim of avoiding exposure at an early stage.[5] Moreover, younger individuals could be at higher risk to develop latex sensitization and symptoms. According to the importance of the first years of occupational exposure to allergens at work in developing sensitization and allergic symptoms, Gautrin et al[8] reported a higher incidence of sensitization to high-molecular-weight allergens during apprenticeship than at a subsequent retesting of the same cohort while working (7.3–1.3 cases/100 person-years). The first year is crucial for the development of sensitization, and symptoms occur during the second or third year.

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Another reason it is important to identify students at risk is the fact that young people are more allergic than older people. It is well known that a global epidemic of allergic diseases, such as asthma, allergic rhinitis, and eczema, occurred in the second half of the previous century, especially until 1990, in children.[9] The "hygiene hypothesis"[10] was formulated to explain this phenomenon suggesting that a lower exposure to bacterial endotoxins and less frequent infections in early life are related to a higher risk of developing atopic diseases and asthma. After 1990, the prevalence pattern of asthma showed opposite trends in different industrialized countries, although the prevalence of allergic rhinitis still seemed to be increasing.[9] In Italy, 3 multicenter cross-sectional surveys on respiratory diseases were carried out in young adults from 1991 through 2010 (the Italian arm of the European Community Respiratory Health Survey, the Italian Study on Asthma in Young Adults, and Gene-Environment Interactions in Respiratory Disease [GEIRD]). These studies reported an increase in the national median prevalence of asthma and rhinitis from 4.6% to 6.6% and from 19.4% to 25.8%, respectively, during the past 10 years, with a similar trend in men and women and higher asthma prevalence in the Mediterranean area than in the subcontinental area of the country.[11] Focusing on a young population, a cross-sectional study carried out in Brescia from 2002 to 2003 in primary school children found that 49% of the studied population had atopy by SPT (although approximately half these children were asymptomatic for asthma or allergic rhinitis) and 10.2% of the population had physician-diagnosed asthma, with higher rates in boys.[12]

With the aim of evaluating students at risk for developing latex allergy or already sensitized to this allergen, we examined students attending the health care faculties at the University of Trieste to assess the atopic status of this young adult population and to define the rate of latex sensitization occurring during the first years of occupational exposure to latex gloves. Our final aim was to suggest preventive measures and the avoidance of latex gloves in individuals already sensitized or with allergic respiratory symptoms.

## Methods

### *Study Population*

The study population consisted of 1,628 students attending the health care faculties of the University of Trieste from 2010 through 2016, specifically the faculties of obstetrics, nursing, laboratory technicians, physiotherapy, radiology technicians, odontology, dental hygienists, medicine, biology and medical residents. In accord with the medical surveillance protocol of the hospital, at the beginning of their apprenticeships in the wards, the students completed a questionnaire providing descriptive data about their previous and current latex exposure and atopic status. They also underwent SPT with common allergens and latex extract and underwent a medical examination. The medical surveillance examination occurred during the first year of study in 77.5% of the population, the second year in 16.1%, the third year in 11.7%, and later in 2.4% of the student population, depending on the time of beginning the apprenticeship during the specific degree course. A written informed consent was obtained from each student before SPT. All data analyzed in this study were collected during compulsory medical surveillance examinations in accord with the protocol of the hospital and Italian law for the prevention of occupational diseases. Therefore, no specific consent for data collection was needed and no institutional review board approval was required.

### *Questionnaire*

Before SPT, all students completed a self-reported standardized questionnaire to collect demographic data (age, sex, course of study), exposure data (use of gloves at work, number of gloves used per day, hours of use, kind of gloves), and information about family and personal histories of allergic disorders (asthma, hay fever, food allergies, atopic dermatitis), use of medicines for allergic diseases, and symptoms related to glove use and current or previous hand dermatitis.

Atopy was defined as a positive SPT result or specific IgE to at least 1 common allergen. Asthma was defined as the presence of attacks of cough, wheezing, and dyspnea that required pharmacologic treatment (bronchodilators, inhaled corticosteroids, or their combination). Rhinitis was defined as the presence of sneezing and/or itchy, runny nose. Atopic eczema was defined as an itchy dermatitis in the flexures during childhood or currently. Latex glove-related symptoms were defined as erythema or itching; contact urticaria (self-reported wheal and flare reactions at the site of glove contact that appear within 10–15 minutes of usage); contact dermatitis (self-reported erythemato-papulous persistent eruption that appears on the skin after 2–3 days of contact with latex gloves); and rhinitis or asthma when using latex gloves.

Familial atopy was defined as allergic rhinitis, asthma, or atopic eczema reported in parents.

### *Skin Prick Testing*

Before SPT, an interview with a trained physician was performed to identify and exclude students at risk for severe adverse reactions to SPTs. The criteria for exclusion were a severe asthma attack in the past year or a history of anaphylactic shock or severe reaction to latex. For these subjects and for students taking antihistamine medication at that time, SPTs were not performed and serum was tested for total and latex-specific IgE (radioallergosorbent test; Pharmacia, Boulder, Colorado). Nineteen subjects did not undergo SPT but total and latex-specific IgE levels in serum were measured.

Skin prick tests included common inhalant allergens, perennial (*Dermatophagoides farinae* and *Dermatophagoides pteronyssinus* and dog and cat dander), and pollens (*Gramineae*, *Parietaria* species, *Betulaceae*, and *Oleaceae*). Extracts of common allergens and of latex were supplied by Lofarma Allergeni (Milan, Italy). The protein concentration of this latex extract was 12.5 mg/mL.[3] The positive control was 1% histamine dihydrogen chloride solution and the negative control was 1% glycerinate solution. SPTs were performed by trained registered nurses. Skin test sites were clearly marked, a drop of extract was placed on the skin, and this spot of skin was pricked with commercially available skin test lancets (Hollister Stier Laboratory, Spokane, Washington). All tests were read and recorded after 15 minutes, and a wheal of at least 3 mm was considered a positive result. A single positive response to an inhalant allergen was considered the determining criterion for atopy (by SPT). One case of a false positive SPT result occurred (in subject with a wheal reaction to the negative control solution) and his serum was tested for total and latex-specific IgE levels. No adverse reaction to SPT was recorded.

Students sensitized to latex obviously must avoid latex gloves. Students with atopy and common allergic symptoms were asked to avoid latex gloves as a preventive measure. Non-latex gloves are available for all students.

### *Statistical Analyses*

Data analysis was performed with STATA 13.0 (STATA Corp, College Station, Texas). Continuous data were summarized as mean and SD. The difference between mean values was tested by Student *t* test. Categorical data were analyzed by the likelihood $\chi^2$ test with Yates correction, as indicated by the data. Fisher exact test was used if the expected number of observations in any cell was smaller than 5. Odds ratios (ORs) and 95% confidence intervals (CIs) were calculated after adjusting for confounding factors (sex, age)