

Latex gloves use and symptoms in health care workers 1 year after implementation of a policy restricting the use of powdered gloves

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Background: Latex sensitization related to glove use is a complex problem, and glove use policies that restrict exposure to powdered latex gloves alone may not provide adequate safety. This study explored health care workers' (HCWs') latex glove use and reports of related health symptoms 1 year after implementation of the latex glove replacement policy.

Methods: Two cross-sectional surveys. One was a population-based survey of HCWs at the institution (National Surveillance System for Hospital Health Care Workers); the second, a detailed survey of HCWs stratified by exposure to latex gloves (Latex Symptom Survey).

Results: The prevalence of symptoms of dermatitis reported by latex glove users was 40.3% (National Surveillance System for Hospital Health Care Workers) and 50.0% (Latex Symptom Survey). Symptom reports increased as exposure to latex gloves increased (pairs used per day, occupations with more glove use, working in higher exposure areas, more tenure, and more hours of use per day). Aerosol symptoms and urticaria related to latex glove use were reported much less frequently than were rash, chapping, itching, or redness. HCWs, even those with skin symptoms, continued to choose latex gloves in more than 80% of the cases.

Conclusions: Stepwise preplacement evaluation at employee health clinics is recommended to identify and protect employees sensitized to latex. The medical community needs more understanding and education about latex gloves, latex sensitization, and available alternatives. (AJIC Am J Infect Control 2000;28:352-8)

An academic health center instituted a glove use policy in February 1997. Powdered latex gloves for non-sterile procedures were phased out of use and replaced with a choice of nonlatex or powder-free latex gloves. However, during the study period, powdered latex gloves continued to be available for sterile surgical and dental applications. This study explores glove use and reports of related health symptoms 1 year after a policy that restricted the use of powdered latex gloves was implemented. Stepwise preplacement evaluation at

employee health clinics is recommended to identify and protect employees sensitized to latex.

BACKGROUND

Latex gloves became more widely used in health care settings with the introduction of Universal Precautions in the middle of the 1980s. It has been estimated that almost 12 billion latex examination gloves and 2 billion latex surgical gloves were used in the United States between 1988 and 1992.¹ The reasons frequently mentioned for the use of latex gloves are their competitive price, their excellent barrier characteristics, and their fitting properties.² Prevalence studies of latex allergy among health care workers (HCWs) in the United States provide a broad range of symptoms estimates, from 3.8% to 22%.³⁻⁵ As latex exposure increases, workers and patients are at more risk to become sensitized to latex. The allergenic potency of latex is demonstrated in studies of children with spina bifida, which confirmed that sensitization to latex is related to exposure to latex proteins. As high as 67% of these children, who were exposed recurrently to latex through repetitive surgical procedures and hospitalizations, tested positive for IgE-mediated sensitization as measured by skin prick testing.^{6,7}

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Both the presence of powder and the amount of latex protein in the glove contribute to latex sensitization. The amount of extractable latex allergen in medical gloves varies considerably, even in the same brand from year to year and from batch to batch, resulting in difficult control of latex exposure.⁸⁻¹⁰ Powdered latex gloves often have a higher protein content than powder-free gloves,¹¹ and the powder increases aerosolization of latex proteins.¹²⁻¹⁴

Development of latex allergy does not have to result in HCWs leaving their professions. Latex-sensitized HCWs have been able to continue working and avoid disability by using only nonlatex gloves and working in a powder-free latex glove environment.¹²

Reports to the Food and Drug Administration of systemic, anaphylactic latex reactions included several deaths among patients and HCWs, which prompted health care institutions to develop glove policies (US Food and Drug Administration. Federal Register Notice. Final Rule: Natural Rubber-Containing Medical Devices; User Labeling. 1997 Sept 30; 62[189]: 51021-51030). Many policies restrict persons with symptoms from wearing latex gloves or from risk of exposure to powdered latex gloves. Because anaphylactic latex allergy is not necessarily preceded by more benign skin symptoms, asymptomatic workers are not protected by these policies. In a recent study of anesthesiologists who use latex gloves, the prevalence of latex allergy was higher in asymptomatic persons than in persons who reported clinical symptoms.¹⁵ Another study¹⁰ demonstrated that the incidence of latex sensitization was approximately the same at two hospital sites with different practices (one with powder-free latex gloves and the other with powdered latex gloves). Yet medical institutions have commonly drafted glove policies that assume that an environment of powder-free latex gloves is protective.

At an academic health center, a policy was instituted in February 1997 to offer HCWs the choice of powder-free latex and latex-free gloves for nonsterile procedures. This policy was instituted because persons on the task force thought that powder-free latex gloves or latex-free gloves would reduce the aerosolization of latex proteins and thus decrease allergic reactions to latex. After the first year of implementation, the Institutional Task Force on Latex Gloves recommended expansion of the policy for sterile procedures.

METHODS AND RESEARCH DESIGN

Setting

Two cross-sectional surveys on glove-related symptoms were administered to HCWs at an academic health

center to establish the point prevalence of self-reported latex glove-related symptoms. The academic health center is a public medical center with a fully integrated hospital, schools of medicine and dentistry, graduate education, and research facilities. The facility located in a suburb has strong connections with area hospitals where many of the students, residents, and faculty members provide services or medical training. Skin, mucous membrane, or respiratory symptoms were specifically evaluated. Other objectives of the surveys were to determine the acceptance of the new glove policy and to increase the awareness about the potential for latex sensitization among HCWs who wore latex gloves.

The Centers for Disease Control and Prevention awarded the academic health center one of a group of competitive, cooperative grants to take part in the National Surveillance System for Hospital Health Care Workers (NaSH). The NaSH program is primarily designed to track HCWs' blood and body fluid exposures. With interest in latex-glove usage after a new policy that restricted latex glove use, the director of the Employee Health Service expanded the NaSH program at this health center to address latex glove concerns.

Instruments and sample

Two surveys were completed: (1) the NaSH survey of health care employees at the health center with 34% respondents (1073 of 3115 eligible) and (2) the Latex Symptom Survey (LSS) of selected groups of employees and students, designed to query in-depth on risk factors, glove use, and symptoms. The standard NaSH Health Care Survey was customized for this program and expanded with 5 questions on latex glove use. The additional questions identified HCWs who wore protective gloves and then asked about symptoms related to use of latex gloves. Symptoms surveyed were related to dermatitis complaints (any rash, chapping, itching, or redness), urticaria (hives or water blisters), respiratory problems (chest tightening, wheezing, cough, breathing difficulty, and asthma) or rhinoconjunctivitis (runny nose, congestion, and hay fever). Other questions were about type of glove used, pairs used per day, and tenure at the institution. Demographic information about age, sex, occupation, and area of work was obtained through the Human Resources database. The objectives of the LSS survey were to obtain further information about risk factors for latex-related symptoms and to support the validity of the NaSH survey results. The LSS and the questions added to the NaSH survey were designed by us and reflected information in the literature on latex surveys used by other medical facilities.^{16,17} The Institutional Review Board approved the surveys before distribution.

Procedures

To attain maximum participation, intensive marketing was initiated through the institution's newsletter, the internal broadcast e-mail system, and postings around the health center. Support from the unions and from management was actively sought to encourage HCW participation. Presentations on the latex glove survey program were made to the Labor Management Committee, Infection Control Committee, and Employee Health Advisory Committee. In addition, the director of Employee Health Service reviewed the objectives of the program individually with the Infection Control Committee chair, the infection control nurses, the director of Research and Safety, and the director of Hospital Operations.

The revised NaSH survey form was mailed through the interdepartmental mail to all health care employees with an addressed return envelope. A letter from the director of Employee Health Service described the objectives of the survey and assured the respondent that no personal identifiers would be disclosed to ensure confidentiality.

Groups of workers stratified by level of exposure to powdered latex gloves were selected for the LSS survey. This second questionnaire was designed to have survey participation that represented different levels of exposure, assuming that the latex glove policy was generally followed for the past year. Work areas were organized into 3 levels of exposure:

1. High exposure areas (operating rooms and dental clinics), where most staff members were still using powdered latex gloves
2. Moderate exposure areas (ambulatory clinics, medical and surgical wards, bone marrow transplant unit, intensive care unit, neonatal intensive care unit, and emergency department), where most staff members were using powder-free latex or latex-free gloves with occasional use of powdered latex for sterile procedures
3. Low exposure areas (medical records, dietary, clerical staff, first- and second-year medical students) where staff members were either (1) not using any gloves but were in the common health center ventilation system or (2) using solely latex-free gloves.

Once the groups were selected, appointments were made for an interviewer to attend staff meetings and classes to administer the questionnaire. The response rate at the meetings was typically better than 90% of those attending, exclusive of the physicians in the population. Most of the doctors surveyed were contacted at their clinics or were approached outside of grand round lectures. Because grand round lectures are an open forum to the health care center, it is not possible

Table 1. Population characteristics of NaSH and LSS respondents

Characteristics	Surveys	
	NaSH (n = 1073) n/total n* (%)	LSS (n = 475) n/total n* (%)
Men	270/1040 (25.9)	160/442 (36.2)
Women	774/1040 (74.1)	282/442 (63.8)
43 y or older	501/1038 (48.5)	138/460 (30.0)
Younger than 43 y	533/1038 (51.5)	322/460 (70.0)
<1 y tenure†	96/1058 (9.1)	98/447 (21.9)
1-2 y tenure	104/1058 (9.8)	68/447 (15.2)
3-4 y tenure	125/1058 (11.8)	74/447 (16.6)
>5 y tenure	733/1058 (69.3)	207/447 (46.3)

*Missing values not included.

†Tenure = years at the Academic Health Center.

to approximate the response rate for this group. To reach a representative group of first- and second-year students, the interviewer attended a required lecture for each class, announced the research program, distributed questionnaires, and had a colleague collect the completed forms as the students exited.

To minimize a bias toward reports by staff members with health symptoms, the interviewer, with the support of the group manager, emphasized that everyone at the staff meeting finish the questionnaire. In some instances, when the time to complete the survey was a consideration to a subject, the interviewer individually responses.

Data analysis

Data from the surveys were analyzed by using SPSS for Windows (version 7.5, SPSS, Chicago, Ill). χ^2 tests for 2×2 contingency tables were used to assess the univariate relation between descriptive variables and symptoms. Multivariate predictors of symptoms were assessed by using logistic regression models.

RESULTS

Tables 1, 2, and 3 summarize the survey results. The populations who took part in the two surveys were similar (Table 1). More than 60% of the HCWs surveyed were employed at the academic health center for more than 3 years, and women were the majority. Table 2 shows the characteristics of the latex glove users with symptoms of dermatitis who responded to NaSH and LSS surveys. Again the group is similar in being predominantly composed of women, the majority younger than age 43 years, with more than 5 years tenure at the institution. Finally, Table 3 presents the prevalence of the reported dermatitis among the two

Table 2. Characteristics of latex glove users with symptoms of dermatitis

Characteristics	Survey	
	NaSH (n = 216) n/total n* (%)	LSS (n = 170) n/total n* (%)
Men	49/210 (23.3)	40/156 (25.6)
Women	161/210 (76.7)	116/156 (76.3)
43 y or older	66/208 (31.7)	51/163 (31.3)
Younger than 43 y	142/208 (68.3)	112/163 (68.7)
<1 y tenure	17/215 (7.9)	19/167 (11.4)
1-2 y tenure	27/215 (12.6)	24/167 (14.4)
3-4 y tenure	26/215 (12.1)	37/167 (22.2)
>5 y tenure	145/215 (67.4)	87/167 (52.1)

*Missing values not included.

Table 3. Prevalence of skin symptoms reported by latex glove users

Skin symptoms while wearing latex gloves	NaSH n (%)	LSS n (%)
Dermatitis (any rash, chapping, redness, or itching)	216 (40.3)	170 (50.0)
Urticaria (any hives or water blisters)	19 (3.6)	20 (5.8)

*Percentage of 536 (NaSH) and 340 (LSS) latex glove users. Some persons reported both types of skin symptoms.

surveyed populations of latex glove users (NaSH and LSS). More than 40% of the two groups of respondents reported chapping, redness, rash, or itching related to latex glove use, and only a much smaller percentage reported urticaria (3.6% in the NaSH and 5.8% in the LSS).

NaSH Health Care Survey

Among the 1073 respondents, 24% (258) reported symptoms of dermatitis (redness, itching, rash, or chipping) while wearing any type of gloves, 2.7% (29) reported urticaria, and 7.1% (76) reported respiratory/mucous membrane symptoms. However, of 536 HCWs who used latex gloves, the prevalence of symptoms when wearing gloves was much higher; 40.3% (216) reported symptoms of dermatitis, 3.6% (19) reported urticaria, and 10.6% had respiratory or mucous membrane symptoms.

Of the 216 HCWs with symptoms of dermatitis associated with latex glove use, 12% used powdered latex and 54% reported use of both powder-free and powdered latex gloves. This finding was a surprising result in view of the policy (February 1997) directed at minimizing powdered latex glove use at the academic health center instituted 1 year earlier. NaSH data

Table 4. Occupational distribution NaSH survey

Occupational group	HCW respondents		Latex glove users with symptoms of dermatitis	
	n	%	n	%
Clerical/administrative staff	281	27.2	7	3.3
Other staff	235	22.8	36	17.1
Nursing	172	16.7	63	30.0
Clinical laboratory technician	111	10.8	44	21.0
Surgical medical staff	87	8.4	21	10.0
Clinical dental staff	53	5.1	23	11.0
Nonsurgical medical staff	39	3.8	7	3.3
Maintenance	21	2.0	3	1.4
Security	10	1.0	—	—
Housekeeper	10	1.0	4	1.9
Phlebotomist/intravenous team	7	0.7	2	1.0
Laundry staff	5	0.5	—	—
Transport/service	1	0.1	—	—
Total	1032	100	216	100

showed that those workers studied were a very stable population. Most workers (67.4%) had been at the institution longer than 5 years; and 81% had been at the academic health center at least 3 years. The numbers of persons within each occupational group who responded to the survey and the numbers among latex glove users with symptoms are presented in Table 4. HCWs who wore gloves frequently accounted for 78.2% of those reporting symptoms but represented only 46.5% of the total NaSH respondents.

HCWs in jobs that commonly use gloves (surgical workers, nurses, nonsurgical medical, clinical dental staff, phlebotomists, housekeepers, and clinical laboratory technicians) reported more symptoms of dermatitis when compared with workers in occupations that rarely use gloves (laundry, clerical, transport, security, and maintenance staff). As the number of pairs of latex gloves used per day increased, the likelihood for workers to report these symptoms progressively increased. Table 5 presents these findings.

The data suggest a survivor effect. Persons younger than age 43 years were more than twice as likely to report having dermatitis when compared with older persons wearing gloves (odds ratio [OR] 2.2, 95% confidence interval [CI] 1.7-3.0, $P < .001$). In addition, there was a suggestion that women subjects were 1.4 times more likely than men to report symptoms (95% CI, 1.0-2.0, $P = .054$).

Table 5. Risk factors for symptoms of dermatitis in latex glove users (NaSH data)

Risk factors	OR*	95% CI
Occupations that use latex gloves	12.4	7.3-21.2
7-30 pairs of latex gloves/day	3.0	2.0-4.4
>30 pairs of latex gloves/day	6.1	2.8-13.1

* $P < .001$.**LSS**

Half of the latex glove users in the survey reported symptoms of dermatitis (170 of 340). Of these, 61.2% were nurses, physician assistants, nurse clinicians, nurse aides, technicians, dental assistants, and dental hygienists; 18.2% were physicians (faculty or residents); 16.5% were medical and dental students; and 4.2% were other workers (dietitians, café workers, and clerical workers).

Different measures of exposure to gloves, including tenure at the academic health center, years in clinical profession, job titles, pairs of gloves used per day, and hours of glove use per day were considered. These were correlated with reports of symptoms. More frequent use of gloves was associated with an increasing frequency of dermatitis reports. Table 6 summarizes the findings relating symptoms of dermatitis to variables measuring different exposure levels.

The data from the medical and dental students surveyed showed that as they spent more time in training, the students developed skin symptoms related to glove use. Their glove use increased along with the opportunity for clinical activities by their fourth year of training compared with earlier years. Consistent with the NaSH results, women surveyed in the LSS were 3 times more likely to report symptoms than men (OR = 3.1, 95% CI, 2.0-4.7, $P < .001$).

The LSS survey also showed that respiratory/mucous membrane complaints and urticaria symptoms related to the use of latex gloves were much less frequently reported than were symptoms of dermatitis (8% reported aerosol symptoms, 6% reported urticaria, and 50% reported symptoms of dermatitis).

DISCUSSION

The population survey data demonstrated that symptoms of dermatitis are more often reported by younger HCWs. This finding is consistent with a study in Taiwan in which 2793 patients were studied to determine the frequency and causes of occupational contact dermatitis.¹⁸ The investigators found that occupational dermatitis was 1.9 times more common in men ages 25 to 49 years, and 3.7 times more com-

Table 6. Risk factors for symptoms of dermatitis in latex glove users (LSS data)

Risk factors	OR	95% CI
>5 y in the profession	1.8*	1.1-3.0
>3 y at the academic center	2.2†	1.5-3.4
Working in moderate exposure area	1.9*	1.2-3.2
Working in high exposure area	2.9*	1.6-5.0
Use of latex gloves >4 h/day	2.6*	1.4-4.8
1-6 pairs of latex gloves/day	2.8*	1.5-5.3
7-30 pairs of latex gloves/day	4.0†	2.1-7.7
>30 pairs of latex gloves/day	6.4*	2.0-20.7

* $P < .05$.† $P < .001$.

mon in men younger than age 25 years than it was in men older than 50 years. Holness¹⁹ also described some evidence that occupational skin disease affected mostly persons younger than age 40 years.

In another study in Italy, occupational dermatitis among hospital workers was found more frequently in persons younger than age 31 years and in women.²⁰ The reason why women are more likely to report dermatitis associated with latex exposure is not clear. It is possible that women are exposed to wet, irritant environments (ie, doing domestic chores) more than men, that women are more likely to complain and note discomfort, or that women have skin more susceptible to irritation. The two surveys in this study consistently found that women are at increased risk for the development of skin problems related to glove use. In contrast, in a study by Holness et al,²¹ being a woman was not associated with an increase in contact dermatitis among health care workers. These investigators found that women were more likely to have dry skin but not to have dermatitis by self-report or examination. They found differences in practices and hours using gloves among men and women. Factors associated with an increase in skin problems, previously reported in the literature, like taking care of children younger than age 4 years, not washing dishes with a dishwasher, and metal sensitization were not found to correlate with dermatitis in their study.

The survey results show that as exposure to latex gloves increases, reports of skin symptoms increase as well. Several studies have shown that latex sensitization may exist in exposed HCWs even when they are asymptomatic. The decision of when to restrict the use of latex gloves, even the powder-free latex gloves, becomes of great importance.^{10,15} It is clear that if the skin is damaged, the risk to become sensitized is greater.¹⁵

Major strengths of the study are evident in the consistent findings of two independent surveys and the breadth of the study population. The study captured

information on symptoms associated with use of latex gloves and on glove-wearing behavior from representatives of multiple subgroups in the health center population—faculty, staff, and students; and from those with low, moderate, and high levels of latex glove use. However, the study is limited by recall bias because of the reliance on self-reported symptoms and behaviors. In addition, although reasonable for a mailed survey, the response rate of 34% for one of the surveys, the NaSH survey, was lower than was anticipated.

The current policy at the academic health center encourages HCWs to use powder-free or latex-free gloves to reduce the likelihood of latex sensitization. The policy assumes that HCWs will select the appropriate nonallergenic glove, especially when they have skin symptoms. However, the present study shows that the policy and availability of alternative gloves are not sufficient for HCWs to make the right choice. In more than 80% of the NaSH surveyed cases, HCWs with skin symptoms continued to choose latex gloves. Furthermore, because latex sensitization may develop without overt skin symptoms, any damage in skin should trigger use of latex-free gloves. It is clear from our study that even at an academic health center, the medical community needs education about the development and risks of latex sensitization and appropriate preventive resources.

An appropriate venue for HCW education would be the preplacement evaluations, in which Employee Health Services would have the opportunity to provide specific glove recommendations to each HCW. The program would include:

1. A questionnaire about allergies to foods, frequent surgeries, any reaction during dental or invasive surgical procedures, rash on hands, and history of atopy, allergic rhinitis, eczema, or asthma to help determine the risk for latex sensitization
2. A radioallergosorbent test for IgE latex antibody measurements for workers with any hand rash related to glove use (this test is now standardized by the Food and Drug Administration and performed at relatively low cost)
3. Avoidance of latex gloves until diagnostic workup has been completed for any worker with hand rash history
4. Avoidance of personal protective equipment containing latex for workers with a positive radioallergosorbent test; sensitized HCWs restricted to a powder-free latex glove environment; HCWs with latex allergy would be issued medical alert identification, carry injectable epinephrine, and be instructed in its use
5. Sequential workup with use test, skin prick test for latex, and a patch test for HCWs with a negative

radioallergosorbent test but a clear history of reaction to latex gloves

Determining the cause of the skin problem reported in preplacement questionnaire of HCWs is important. In most cases, the cause is an irritant or a contact dermatitis to one of the chemicals added to the natural latex rubber rather than to the latex protein. For these dermatitis problems, different strategies must be considered. Thus the diagnosis has crucial consequences for the HCW and for the employing institution.

SUMMARY

The Employee Health Service of an academic health center surveyed HCWs on glove use and signs of latex-related problems (dermatitis, urticaria, mucous membrane irritation, and respiratory symptoms), 1 year after implementation of a new glove-use policy. Powdered latex examination gloves were phased out of use and replaced with a choice of nonlatex or powder-free latex gloves. However, during the study period, powdered latex gloves continued to be available for sterile surgical and dental applications. Two independent surveys demonstrated that (1) dermatitis complaints significantly correlate with glove use, (2) workers more frequently report dermatitis (rash, chapping, itching, or redness) than they report urticaria, respiratory symptoms, or rhinoconjunctivitis (which have a higher prediction for type I hypersensitivity to latex),⁴ and (3) HCWs, even those with skin symptoms, choose the more-allergenic powdered latex gloves over available nonpowdered, less allergenic alternatives. Limiting the availability of powdered latex gloves is not sufficient to reduce skin symptoms or to reduce the prevalence of latex sensitization among HCWs. Stepwise preplacement evaluation at employee health clinics is recommended to identify and protect employees sensitized to latex.

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