Health Care Worker Disability Due to Latex Allergy and Asthma: A Cost Analysis

ABSTRACT

Objectives. The reported prevalence of occupational allergy to natural rubber latex is 8% to 17%, and that of latex-induced occupational asthma is 2.5% to 6%. Conversion of medical facilities to "latex-safe" can reduce employee sensitization, impairment, and disability. The purpose of this study was to determine the cost of a latex-safe approach, compared with that of continued latex glove use, and to identify the level of worker disability required to make the latex-safe approach financially preferable to a health care institution.

Methods. The costs of 2 strategies—latex-safe vs the status quo—were calculated from the perspective of 3 health care institutions. A break-even point was calculated for each facility.

Results. In all facilities, the cost of using nonlatex gloves exceeded the cost of using latex gloves. In all 3 facilities, however, 1% or fewer of those at risk would have to become fully disabled or fewer than 2% would have to become partially disabled for the continued use of latex gloves to exceed the cost of the latex-safe approach.

Conclusion. Health care facilities, regardless of size, are likely to benefit financially from becoming latex-safe even if latex-related disability levels are extremely low. (*Am J Public Health.* 1999;89:1024–1028)

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Occupational latex allergy was initially reported in US health care workers in 1992. Prevalence estimates over the last 5 years have varied from 8% to 17%.[1–5] At a conservative 8% prevalence, 586 080 health care workers are sensitized to latex and are at risk for potentially serious and fatal allergic reactions.[6] Sensitization to latex is primarily mediated by direct contact with latex gloves and by latex antigens aerosolized with glove powders in the donning and doffing process.[7–12] Once a worker is sensitized and has an allergic reaction, continued exposure to latex antigens can result in progressive morbidity, increased sensitivity to other antigens, and possibly mortality from anaphylactic reactions.[1,13] The only known treatment for latex allergy is cessation of exposure.

Data on latex allergy are scarce because of its recent recognition, but latex allergy and asthma are believed to be similar to other immunoglobulin E (IgE)–mediated occupational sensitizers.[14] Studies have documented that occupational asthma, arising from exposure to several substances, can lead to permanent impairment.[15] However, the extent of disability caused by such impairment is currently unknown.

Disability technically results when an individual's earning capacity is compromised by work-related impairment.[16] Impairments can be temporary, permanent, full, or partial. Only persons who lose income because of an acquired impairment are eligible for compensation. Disability from occupationally induced allergies is compensable under workers' compensation law.

Patients are also susceptible to the same latex-related risks as health care workers. Both workers and patients can be protected from the potential risk of latex exposure by the conversion of medical facilities to what is known as "latex-safe," defined here specifically as the use of nonlatex gloves. Moving to a latex-safe environment has met with considerable resistance because of concerns about the cost of nonlatex gloves,[17] their protective features,[18–20] and their tactile quality as reported by surgeons.

The Centers for Disease Control and Prevention[21] has addressed the safety of nonlatex gloves. It does not favor one glove type but stresses that barrier protection should be appropriate for the risks anticipated. Cost and tactile quality issues remain unresolved. The purpose of this study was to determine the cost of a latex-safe approach, compared with that of continued latex glove use, and to identify the level of worker disability required to make the latex-safe approach financially preferable to a health care institution.

Methods

We did a cost analysis of 2 strategies—latex-safe vs the status quo—from the perspective of the health care institution. Three different types of facilities in Georgia were chosen for the study: a tertiary-care hospital, a community hospital, and an outpatient internal medicine clinic. Data on glove costs and purchasing patterns were collected from the purchasing department at each facility. No data were available to estimate the number of sensitized employees who would actually develop serious, sustained impairment or qualify for disability. Therefore, we calculated the per-

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This paper was accepted January 21, 1999.

centage of those at risk for disability who would have to become permanently fully or partially disabled for a latex-safe approach to be less costly than the status quo. Periods of liability and levels of disability payment were varied in a sensitivity analysis.

Glove Cost and Use

Facilities reported the type, quantity, and manufacturer of gloves purchased. Nonsterile nonlatex alternatives are vinyl and nitrile gloves; nitrile offers superior durability. Sterile nonlatex alternatives are polymer or synthetic rubber surgical gloves. Prices were obtained from manufacturers, distributors, and the Internet. The unit price for the comparable nonlatex alternative was substituted for the latex glove price and was used to calculate the health care facilities' annual glove costs in the latex-safe setting. The price for nonsterile gloves was a weighted average of costs for vinyl and nitrile, used in the laboratory and surgery areas. The average price per pair was used for sterile nonlatex gloves.

Latex Sensitization and Disability Risk

We assumed, on the basis of documented prevalence rates, that 8% of the employees routinely exposed to latex glove use would develop IgE-mediated latex allergy, with 2.5% of this number also developing latex-related asthma.[1,22–24]

Diagnostic Costs

Data to determine treatment paths and costs for allergic reactions to latex are not available. Insurance also complicates the question of who bears treatment costs. Therefore, only the cost of diagnosis was included in the analysis. Latex allergy may be diagnosed after an evaluation by an allergist, serum latex-specific IgE antibody testing, and skin-prick tests. Skin-prick tests are used to identify other associated allergies present and to test for latex allergy in cases in which medical centers have developed their own antigens. Diagnosis of latex-related occupational asthma also requires pulmonary function testing and a chest x-ray. Charges for these procedures were converted to actual costs based on our institution's standardized cost-to-charge ratio of 0.715.

Disability Costs

In Georgia, most health care institutions self-insure for workers' compensation. Workers who qualify for permanent total disability receive wage replacement benefits equal to two thirds of their average weekly wage ($300 maximum) for 400 weeks. Workers who qualify for permanent partial disability also receive wage replacement benefits equal to two thirds of their average weekly wage ($192.50 maximum) for 350 weeks. The largest group of health care workers affected by latex allergy is registered nurses; at their pay levels, they would qualify for the maximum payment. We calculated the present value of 400 weeks of permanent total disability wage replacement payments and 350 weeks of permanent partial disability payments at the maximum payment level. We used the recommended discount rate of 3.0%.[25]

TABLE 1—Medical Facility Description and Comparison

Facility Features	Tertiary-Care Hospital[a]	Community-Based Hospital[b]	Outpatient Clinic[c]
No. of beds/rooms	894	523	22
Average daily census	659	314	67
Total personnel	5800	2750	24
Exposed personnel	5521	2600	22
Prevalence-based estimate of workers with latex allergy (8%)	442	208	2
Prevalence-based estimate of workers with latex-induced asthma (2.5%)	138	65	1

[a]Large, nonprofit, county-owned teaching hospital with Level I trauma center.
[b]Medium-sized, nonprofit, nonteaching hospital.
[c]Residency program-affiliated internal medicine outpatient clinic.

Excluded Costs

Latex allergies likely involve a range of other costs, such as increased sick leave, increased employee turnover, and decreased on-the-job productivity caused by mild allergic reactions. These costs, along with medical care costs for disabled employees and the costs of diagnostic tests for exposed workers without allergy or asthma, were excluded because they are impossible to quantify with accuracy. In addition, costs associated with patients who were allergic to latex were not taken into account. Excluding these costs results in an underestimate of the total cost of continuing latex glove use in the workplace.

However, neither the costs of developing and implementing policies for avoiding latex use nor the costs of in-service training of staff on latex-safe procedures were included in the analsyis. Excluding these costs results in an underestimate of the total cost of converting to a latex-safe work environment.

Sensitivity Analysis

Our calculations were based on Georgia's workers' compensation payment rules. Most states also pay wage replacement benefits equal to two thirds of the weekly wage, but the maximum payment and duration of payments vary by state. We did a sensitivity analysis of the level and duration of disability payments. In addition, we explored the effect on costs if (1) latex produced impairment rates similar to those of other occupational sensitizers and (2) nitrile was the required nonlatex substitute.

Results

Table 1 shows descriptive data on the 3 health care facilities. Identification of employees commonly exposed to latex was based on 3 factors: the requirement to attend blood-borne pathogen training, the employee's job title, and the employee's actual work location. With these criteria it was determined that 92% of the clinic employees, 95% of the community-based hospital employees, and 95% of the tertiary-care hospital employees were exposed to latex.

When a conservative prevalence-based estimate (8%) was used, 442 people in the tertiary-care hospital would be at risk for latex-related disability, whereas 208 and 2 would be at risk in the community-based facility and the clinic, respectively.

Latex and nonlatex glove prices are shown in Table 2. In this market, prices are negotiated on an annual basis and vary by glove type, manufacturer, and volume purchased. Table 3 shows the annual glove use and costs for each facility. The tertiary-care facility uses 7.2 million pairs of gloves annually, whereas the community-based hospital uses 3.5 million and the clinic uses 10 620. Nonsterile gloves constitute 96%, 98%, and 99% of the gloves used in the tertiary-care facility, the community hospital, and the clinic, respectively, whereas nitrile gloves account for 12%, 22%, and 0% of nonsterile glove use. The cost of purchasing the same number and mix (sterile and nonsterile) of nonlatex gloves is shown. The total costs for nonlatex gloves exceed those for latex gloves in all settings.

The costs for diagnosis of latex allergy were those accrued for an appointment with a

TABLE 2—Glove Price Range, in Dollars, in the 3 Health Care Settings

	Tertiary-Care Hospital	Community-Based Hospital	Outpatient Clinic
Nonsterile (100-count box)			
Powdered latex	3.99	4.01	5.95
Unpowdered latex	5.43	6.86	8.39
Powdered vinyl	3.65	...	5.95
Unpowdered vinyl	...	4.27	...
Nitrile	11.25	11.25	...
Sterile surgical (pair)			
Powdered latex	0.30–1.58	0.32–1.14	0.50
Unpowdered latex	1.73–2.59	1.27–3.33	...
Powdered nonlatex	2.50–3.00	2.50–3.00	3.95

Note. Data provided by each facility's purchasing department for gloves currently in use. Costs of non-latex substitutes not currently in use by a facility were obtained from manufacturers, distributors, and the Internet. "..." = not available.

TABLE 3—Annual Glove Use and Cost in the 3 Health Care Settings

	Tertiary-Care Hospital	Community-Based Hospital	Outpatient Clinic
Glove type			
Nonsterile (100-count box)	139 128	68 440	210
Sterile (pair)	288 932	79 544	120
Latex annual cost, $			
Nonsterile	592 466	391 697	1 616
Sterile	339 952	106 269	60
Latex total cost, $	932 418	497 966	1 676
Latex-safe annual cost, $			
Nonsterile	653 644	396 688	1 250
Sterile	794 563	218 746	474
Latex-safe total cost, $	1 448 207	615 434	1 724

physician trained in allergy and immunology ($122), skin-prick testing ($50), and radioallergosorbent IgE serum testing ($21), for a total of $193 per latex-allergic employee. The costs for diagnosis of latex-induced occupational asthma also included pulmonary function testing ($127) and chest x-ray ($75), for a total of $395 per employee with latex-induced asthma.

Table 4 shows the number of workers needed to become permanently fully or partially disabled for the cost of continued latex glove use to equal that of converting to latex-safe. The present value of total disability wage replacement payments for the maximum period for 1 employee with latex allergy or latex-induced asthma is $108 917. The present value of partial disability payments for the maximum period for 1 employee is $61 988. Diagnostic tests cost, on average, $241 per person at risk for disability. Because of the additional cost of converting a facility to latex-safe, the break-even point for the tertiary-care facility is 4.73 (1.07%) of those at risk for full disability and 8.29 (1.88%) of those at risk for partial disability. The break-even point is lower for the community-based facility. When the marginal cost of converting to latex-safe and the size of the disability payments are taken into account, the break-even point for the clinic is close to zero, and the clinic should become latex-safe.

For the sensitivity analyses, we gathered data on workers' compensation benefit programs from across the nation. The lowest values for the duration of and level of benefits offered in the United States for permanent total and partial disability payments were used to calculate the break-even point for the 3 health care facilities.[26] For permanent total disability, 257 weeks is the minimum duration, and $271 per week is the lowest payment level. The minimum permanent partial disability package is 200 weeks at $126 per week. These figures indicated that 7.82 people, or 1.77% of the impaired population, would have to become fully disabled for the cost of the latex-safe option to equal that of the status quo for the tertiary-care facility; 4.70% of the population would have to become permanently partially disabled.

The lowest estimate of sustained impairment from studies of IgE-mediated occupational asthma is 29% of the exposed population.[27] If latex allergy follows a similar impairment pattern and if all impairment translates into permanent partial disability, the cost of workers' compensation would rise to $7.9 million for the tertiary-care facility. If durable nitrile is the required nonlatex substitute, converting to latex-safe would cost $1.4 million more than the status quo for the tertiary facility. However, only 3% of those at risk would have to become disabled for the latex-safe option to remain preferable financially.

Discussion

When only glove costs were considered, our data indicated that a latex-safe approach was more expensive for each facility than was continued latex glove use. Additional glove costs were highest for the tertiary-care hospital, which used the most sterile gloves. Although institutions may not have identified latex-allergic workers at this point in time, existing data indicate the presence of individuals with early stages of disease.[1] The impairment and disability that may accompany latex allergy introduce disability costs into the financial decision about whether an institution should become latex-safe.

Partial disability costs may arise as workers with a diagnosis of occupationally induced latex allergy or asthma move to jobs that minimize their contact with latex. If these jobs pay less, workers will be eligible for workers' compensation. In other cases, workers may become so sensitized to latex that employment is not possible because of the ubiquitous nature of latex. Catastrophic anaphylactic reactions are also possible.

At present, the former scenario of partial disability and job change seems more likely than the latter ones involving total disability. Both types, however, are possible and would entail significant expense for the health care institution. From a financial standpoint, the institution must determine whether the known increased expense of the latex-safe approach is preferable to possible disability payments.

Data here indicate that the break-even points for the 3 health care institutions are at extremely low rates of permanent disability. For the tertiary-care facility, if more than 1.07% of those at risk (5 people) become fully disabled or more than 1.88% (9 people) become partially disabled, the latex-safe approach would be cost saving.

These results were based on Georgia's very conservative workers' compensation benefits. Evidence from 3 types of facilities

TABLE 4—Break-Even Analysis for the Costs of Disability Due to Latex Allergy and Asthma From Continued Latex Use Compared With the Costs of Converting the Facility to be Latex-Safe

	Tertiary-Care Hospital	Community-Based Hospital	Outpatient Clinic
Additional costs of becoming latex-safe, $	515 789	117 468	48
At-risk pool of workers	442	208	2
Average diagnostic costs per worker, $	241	241	241
Total disability wage replacement and diagnostic costs per worker, $	109 158	109 158	109 158
Partial disability wage replacement and diagnostic costs per worker, $	62 229	62 229	62 229
Break-even no. of people on total disability	4.73	1.08	0.0004
Percentage of at-risk pool	1.07	0.45	0.02
Break-even no. of people on partial disability	8.29	1.89	0.0008
Percentage of at-risk pool	1.88	0.78	0.04

in Georgia and the sensitivity analysis showed that very low levels of disability are required to make the latex-safe approach financially preferable even in cases in which benefits are limited. In states with more generous benefits, converting to a latex-safe environment would be financially advantageous at even lower disability levels.

Many other costs that would favor the latex-safe conversion were excluded. In particular, possible patient-related liability costs were not included. Excluded costs would be offset, to some degree, by the transaction costs of changing practices within a facility. However, a few institutions have made the transition to latex-safe environments. Their experiences could help others reduce transition costs.[12]

The costs of temporary disability were not included in the current analysis. Latex-allergic workers must be removed from exposure. Resulting job changes are likely to be permanent, not temporary. Excluding any costs associated with temporary disability increases the degree to which the costs of the status quo are underestimated.

A few institutions have partially converted their facilities by making the areas that use nonsterile gloves, primarily nonsurgical areas, latex-safe. Our data indicate that 96% to 99% of glove use involves nonsterile gloves and suggest that conversions that focus on nonsterile gloves can greatly affect levels of latex antigens in the environment.

Others have advocated a switch to powder-free latex gloves only.[29] In the community hospital, substituting powder-free nonsterile latex gloves for powdered gloves would increase annual glove costs by $73 000. Using powder-free gloves would significantly reduce the amount of latex antigen in the environment. However, it would increase the cost of converting to a latex-safe environment and would not protect patients or those already sensitized to latex, or prevent continued sensitization.

This study found that 3 health care facilities of varying size and orientation are likely to benefit economically from becoming latex-safe by using nonlatex gloves. Latex allergy appears to be a rare case in which primary prevention will likely prove to be cost saving. The applicability of these findings is limited by the effect of state-to-state variability in workers' compensation laws and by whether the facility self-insures. For those facilities that self-insure, the calculations presented here can be easily reproduced with data from their purchasing departments and the parameters established by their states' workers' compensation laws. □

Contributors

V.L. Phillips and M.A. Goodrich together planned the study, collected and analyzed the data, and wrote the paper. V.L. Phillips revised the paper several times. T.J. Sullivan contributed to discussions about the study and commented on several drafts of the paper.

Acknowledgments

Dr Goodrich was supported by National Institute for Occupational Safety and Health training grant TO1/CCT41062 and American Cancer Society Physician Training Award in Preventive Medicine grant 95–2.

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