

# Natural Rubber Latex Allergy Workers' Compensation Claims: Washington State Healthcare Workers, 1991-1999

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Occupational reaction to natural rubber latex experienced by healthcare employees was examined using data of all workers' compensation claims filed by state-insured healthcare employees in Washington State for the period 1991-1999 (n = 65,703). As latex reaction is not a condition for which there are specific identification codes, these claims were estimated by coupling source and nature of injury records that were consistent with reactions to latex. It was found that the claim rate was on average 2.66 per 10,000 state-insured healthcare workers annually. The most common condition experienced was dermal (84.3%), and most common body part affected was the hand (70.0%). Because few claims cited respiratory or conjunctivitis as reaction experienced, little evidence was discovered to support that glove powder acted as a widespread latex allergen transmitter in healthcare environments. Most cases did not require indemnity payment for lost work time (81.2%), suggesting most reactions were minor. The average cost per natural rubber latex claim was \$2,759.10, compared to \$3,178.18 for the average healthcare worker claim for all causes. Overall, the average cost per state-insured healthcare worker employed during this time was under \$0.74 per year. Nursing aides/orderlies were the most frequent healthcare occupation filing a claim (33.2%). The majority of claimants were female (87.9%), and unmarried workers (52.0%) filed slightly more claims than married workers (48.0%). In comparison with other workers' compensation claims filed by healthcare workers during this period, 0.34 percent of the total was potentially related to natural rubber latex, with other common healthcare workplace items cited more frequently as source of occupational injury.

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In the late 1980s, the Centers for Disease Control and Prevention (CDC) issued universal precautions that recommended the use of gloves by healthcare workers as a protective barrier against blood-borne pathogens.<sup>(1)</sup> Subsequently, natural rubber latex (NRL) gloves became the barrier of choice, and over the next decade their use significantly increased in medical practice.<sup>(2)</sup> As the use of NRL gloves became more visible in the workplace, and several case studies of allergic reaction from various other rubber medical products emerged, researchers began to assess the degree to which NRL affected the occupational well-being of healthcare workers.<sup>(3-4)</sup> In doing so, the primary focus of these research endeavors was on determining the allergic sensitization rates of employees in healthcare environments.

These combined attempts, using various methods including skin patch tests, in vitro tests, and even questionnaires, to determine a standard healthcare employee NRL sensitization rate have yielded widely inconsistent results. For example, Kim<sup>(5)</sup> found a sensitization rate of 1.9 percent among 1967 healthcare workers, Turjanmaa<sup>(6)</sup> found a sensitization rate of 2.9 percent among 512 hospital employees, and Wrangsjö et al.<sup>(7)</sup> reported a sensitization rate of 3.5 percent among 202 hospital and dental clinic workers. Vanderplas et al.<sup>(8)</sup> found a sensitization rate of 4.7 percent among the 201 hospital personnel, Mace et al.<sup>(9)</sup> found a sensitization rate of 6.9 percent among 247 operating room nurses, and, in one of the largest studies conducted to date, Hamann et al.<sup>(10)</sup> performed skin-prick tests on 2166 dental workers over the course of two years and found a sensitization rate of 6.2 percent among all subjects tested. Grzybowski et al.<sup>(11)</sup> published data finding the presence of anti-latex IgE antibodies in 8.9 percent of their sample of 741 registered nurses, Konrad et al.<sup>(12)</sup> found a 15.8 percent sensitization rate from an anesthesiology staff in a Swiss healthcare facility, Yassin et al.<sup>(13)</sup> reported a general healthcare employee sensitization rate of 17 percent, and Johnson<sup>(14)</sup> estimated a 43 percent sensitivity rate using a questionnaire of healthcare professionals in the United Kingdom.

In addition to lack of consistency among healthcare worker sensitization results, there is no conclusive evidence, based on studies using referent populations as controls, that their rates differ from the average rate among individuals in the general population. In the most recent general population study to date, Saxon et al. tested 1997 consecutive blood samples from the Oklahoma Blood Institute at three separate laboratories and showed the sensitization rates ranged between 5.4 percent and 7.6 percent.<sup>(15)</sup> This result was consistent with the findings of other large sample population latex sensitization studies such as Ownby et al.<sup>(16)</sup> who found a rate of 6.4 percent, Lebenbom-Mansour et al.<sup>(17)</sup> who found a rate of 6.7 percent, and Porri et al.<sup>(18)</sup> who found 6.6 percent.

Because these point estimates fall within the confidence intervals of many of the studies on healthcare workers, it is currently impossible to conclude whether occupational use of NRL products in healthcare settings leads to a higher risk of acquiring sensitivity.<sup>(8-11)</sup> As a result of the fact that there have been no controlled prevalence studies matching one population against a control population, Saxon et al. noted in their conclusion that, “[w]hile other groups have been suggested to be at increased risk for sensitization due to occupational exposure [to latex], e.g., health care workers and NRL workers, the data for this is not convincing.”<sup>(15)</sup>

Importantly, while there have been significant investigative resources dedicated to measuring sensitization rates, little attention has been focused on examining actual allergic reactivity experienced by healthcare workers in their occupational settings. As NRL sensitization is a condition that only indicates that an individual’s immune system has produced immunoglobulin E (IgE) antibodies in response to prior contact with an NRL allergen, many individuals who test positive for the presence of latex-specific IgE antibodies may never experience an allergic reaction from contact with NRL.<sup>(19)</sup> To date, there have been no controlled studies or consistent results that have correlated sensitization rates with clinical reactivity rates, and thus reactivity cannot be predicted from simply obtaining sensitization rates from healthcare worker populations alone.

The use of workers’ compensation data as a means of examining NRL allergy experienced by healthcare workers is compelling for several reasons. First, because workers’ compensation claims are filed only when employees experience a medical condition, the claims are based on reports of reaction as opposed to the potential for reactivity. Second, large populations can be examined over long periods of time, without the constraints typically inherent to clinical studies that examine smaller populations over relatively short periods of time. Last, they allow for the measurement of various other important elements, such as lost work time, cost, reaction type, and employee demographics that are associated with reactions. Recently, the method of using workers’ compensation data has been used to assess healthcare worker NRL reactions in Minnesota, Rhode Island, and North Dakota.<sup>(20-22)</sup> The present study is a continuation of that line of research and contributes to the literature by

examining estimated NRL allergy claims of state-insured healthcare workers in Washington State for the period 1991-1999.

## METHODS

Data from all workers’ compensation claims made in Washington State for the period beginning January 1, 1991, through December 31, 1999, was provided by the Washington State Department of Labor and Industry’s Data Analysis Unit. In all, over 2 million workers’ compensation claims were examined. Using SIC codes between 8000-8099, healthcare service employee claims were isolated. Washington State has trained personnel to assign codes to claims during processing following the American National Standards Institute Z16.2 System.

Because Washington State does not code specifically for allergic reaction to latex, those healthcare worker claimants who listed either “gloves” (ANSI Z16.2 code = 1010) or “rubber products” (ANSI Z16.2 code = 5510) as the source of condition were identified and sorted by those whose reported symptoms were consistent with reactions from latex product use. Claims matching the first criteria were excluded if nature of condition codes indicated “contusion” (ANSI Z16.2 code = 160), “scratches” (ANSI Z16.2 code = 300), “sprains” (ANSI Z16.2 code = 310), or “teeth” (ANSI Z16.2 code = 902).

The two types of allergic responses that may result from contact with NRL are classified as Type IV and Type I allergic reactions.<sup>(23-24)</sup> Type IV reactions are the most commonly experienced of the two, are T-cell mediated, and are a reaction to the chemicals used in the production of the latex as opposed to latex itself. These reactions have a delayed onset time of several hours to days and are characterized by redness, eczema, scaling, and/or swelling and cracking of the dermal surface. Type I allergic reactions are IgE-mediated, and are actual responses to latex allergens. These reactions have an immediate onset time, may be localized or systemic, and can result in dermal irritation, urticaria (hives), swelling or conjunctivitis in the eyes, rhinitis, difficulty in breathing, and, in rare instances, anaphylactic shock.

Some researchers have also hypothesized that latex allergens may bind to cornstarch powder frequently used in NRL gloves as a donning agent, and potentially elicit respiratory reactions when inhaled by allergic individuals.<sup>(25-26)</sup> It should be noted that synthetic latex, such as latex paint, does not provoke latex allergic reaction.<sup>(27)</sup> A third condition, contact irritant dermatitis, while not a true allergic reaction, may report similar symptoms as the Type IV allergic reaction. It is the most frequent medical condition resulting from glove use (as opposed to other NRL medical products), and is caused by such things as the abrading of the glove surface on the hands, or sweat buildup from hand occlusion in the gloves.<sup>(23-24)</sup>

In the present study, claims that were accepted in the estimate as latex-related included all dermal conditions, conjunctivitis, rhinitis, and asthmatic/respiratory conditions. Claims were also accepted if the nature of injury reported was recorded as “ill-defined” or “unspecified.” Only those claims that clearly did

not fit what would be consistent with reactions to latex, such as those described as "sprains" and "contusions" were excluded; to this extent, this method was designed to err on the side of conservatively overestimating the number of NRL-related workers' compensation claims.

Washington State collects and combines data from both employers whose workers are covered by their state-insurance fund, and those employers who choose to cover their workers by self-insuring or electing coverage through private insurers. This distinction is particularly important in that the data recorded for the state-funded employers is much more complete and accurate than that reported by self-insurers. For example, in many instances the data for employees of self-insured employers are missing fields such as source of injury, which makes it impossible to assess whether the condition experienced by the employee was potentially due to NRL. In almost all cases, while indemnity costs are reported, no costs are recorded for medical expenses, thus making the self-insured data questionable. Thus, this study confined its analysis exclusively to employees covered by the state fund, as is consistent with previous research examining occupational skin disorders in Washington.<sup>(28)</sup>

Initially, the annual number of Washington State healthcare workers was obtained from the state's Department of Labor Web site. However, as the exact number of healthcare workers employed by state-insured and self-insured employers was not subdivided in the original total, a proportion for each group was obtained and applied to the total healthcare worker state population figures to derive an estimate of the number of those covered by state insurance. As the Department of Labor and Industries attempts to track the full time equivalent (FTE) hours worked by employees in each category, it was possible to make such a derivation, consistent with previous research, using Washington State workers' compensation data.<sup>(28)</sup> State fund workers are estimated by SIC category, and self-insured employees by risk class.

Using 1999 estimates, it was found that the total FTEs of both groups combined was 142,787.3, of which 78,860 (55.23%)

were by healthcare workers covered by the state insurance fund, and 63,927 (44.77%) FTEs were by healthcare workers covered by self-insured employers. This ratio was then applied to the overall number of employed healthcare workers for each year to calculate the population for each group. While it is possible that this proportion varied somewhat between years, the overall claim ratio for Washington State over the last nine years reveals little change in the proportion of state- versus self-insured filing claims, and is therefore likely to be a sufficiently reliable measure for determining an approximate denominator for determining the proportion of healthcare workers who file NRL claims.

## RESULTS

For the period 1991-1999 there were a total of 223 estimated NRL allergy workers' compensation claims filed in Washington State by state-insured healthcare workers. During this nine-year period, the average number of state-insured healthcare workers making estimated NRL allergy-related workers' compensation claims was 24.78 annually, and represented a total average of 0.0266 percent, or 2.66 claims per 10,000 healthcare workers per year. A  $\chi^2$  test for variations in number of NRL claims relative to total workers' compensation claims by year was not statistically significant ( $p = 0.079$ ), demonstrating no change in latex claim rates as a proportion of all claims during this period. A yearly breakdown of claim rate by year is provided in Table I. Of the claims, 74 (33.2%) were by nursing aides/orderlies; 36 (16.1%) by dental assistants; 23 (10.3%) workers of unreported occupations; 19 (8.5%) clinical laboratory technicians; 11 (4.9%) dental hygienists; 10 (4.5%) maids/housemen; 7 (3.1%) health aides; 6 (2.7%) each by laundry workers and registered nurses; 4 (1.8%) health technicians; 3 (1.3%) each by technicians (n.e.c.), cooks, licensed practical nurses, and physicians; 2 (0.9%) each by managers/administrators and janitors; and 1 (0.45%) each by a biological technician, radiological technician, science technician, bookkeeper, administrative support personnel,

**TABLE I**  
Estimated NRL claims as a percentage of HCW population

Year	Estimated number of claims	Estimated state-insured HCW population	Percentage filing potential NRL claims (%)	Claims per 10,000 HCW's	Claims as a percentage of state-insured HCW claims (%)
1991	12	84,213	0.0142	1.42	0.1532
1992	31	88,636	0.0350	3.50	0.3627
1993	30	90,762	0.0331	3.31	0.3563
1994	22	91,569	0.0240	2.40	0.2843
1995	32	93,051	0.0344	3.44	0.4352
1996	19	94,017	0.0202	2.02	0.2831
1997	25	96,209	0.0260	2.60	0.3778
1998	26	99,553	0.0261	2.61	0.4044
1999	26	101,744	0.0256	2.56	0.4297

waiter/waitress, food preparer, building service supervisor, baggage porter, welfare service aide, and repairman.

An examination of the claimant demographics revealed that a majority of claimants were female, 196 (87.9%), and the minority male, 27 (12.1%). The marital status of claimants was almost evenly distributed with 116 (52.0%) single, and 107 (48.0%) married. There was a wide range in the ages of those making claims, with 12 claimants (5.4 percent) being 17–19 years old, 74 claimants (33.2%) being 20–29, 63 claimants (28.3%) being 30–39, 47 claimants (21.1%) being 40–49, 23 claimants (10.3%) being 50–59, and 2 (0.9%) claimants being 60–69. There were 2 claimants (0.9%) whose ages were unreported.

The greatest nature of injury reported by the claimants was contact dermatitis, cited in 136 (61.0%) of the total claims. Dermatitis was the next most frequently cited ailment with 30 (13.5%) claims, followed by 25 (11.2%) claims of ill-defined symptoms, 11 (4.9%) claims of allergic dermatitis, 6 (2.6%) claims of skin condition, 5 (2.2%) claims of boils, 3 (1.35%) claims of conjunctivitis, 2 (0.90%) claims each of rhinitis, toxic unspecified, and multiple injuries, and 1 (0.45%) claim was unclassified. Thus, of all claim types, a minimum of 188 (84.3%) were dermal in nature. This breakdown by nature of injury is illustrated in Figure 1.

The most commonly reported affected body part was the hand, as indicated in 156 (70.0%) of the claims. This was followed by multiple parts with 27 claims (12.1%), upper extrem-

ities with 13 (5.8%) claims, fingers with 6 (2.7%) claims, hand and fingers with 5 (2.2%), and eye with 4 (1.8%) claims. Both body system and respiratory system each had 3 (1.35%) claims, the arms and forearms each had 2 (0.90%) claims, and the wrist had 1 (0.45%) claim. There was 1 claim (0.45%) for which the body part was unspecified. Figure 2 shows the distribution of claims by affected body part.

Washington State records six general types of costs associated with workers' compensation claims: total medical cost, total indemnity (time-off) cost, total pension cost, total loss of earnings potential cost (the amount an employee may have lost in terms of wages by working at a lower paying job while retraining or recuperation), total permanent partial disability (PPD) costs, and total cost of claims paid to date. In many cases, there are miscellaneous costs associated with claims, such as legal and personal expenses, that do not fit in the listed categories, and are simply added into the claim paid-to-date amount. Thus, for the purposes of this report, another category labeled "miscellaneous costs" was added and computed by subtracting the sum of all other categories from the paid-to-date category, though it was impossible to determine which exact expenses were included as miscellaneous on a case-by-case or aggregate basis.

Claims were grouped according to the level of indemnity payments involved to demonstrate potential time away from work associated with latex claims. The results depicted in Figure 3

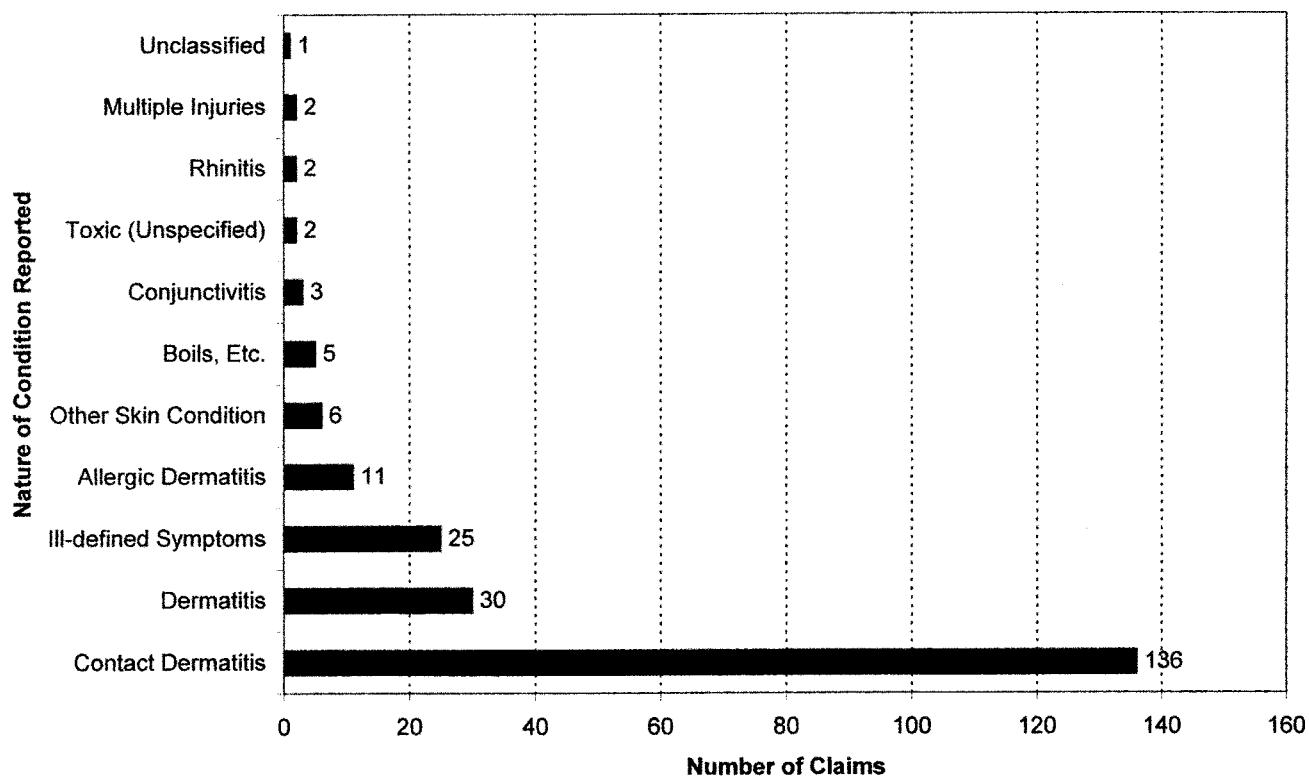
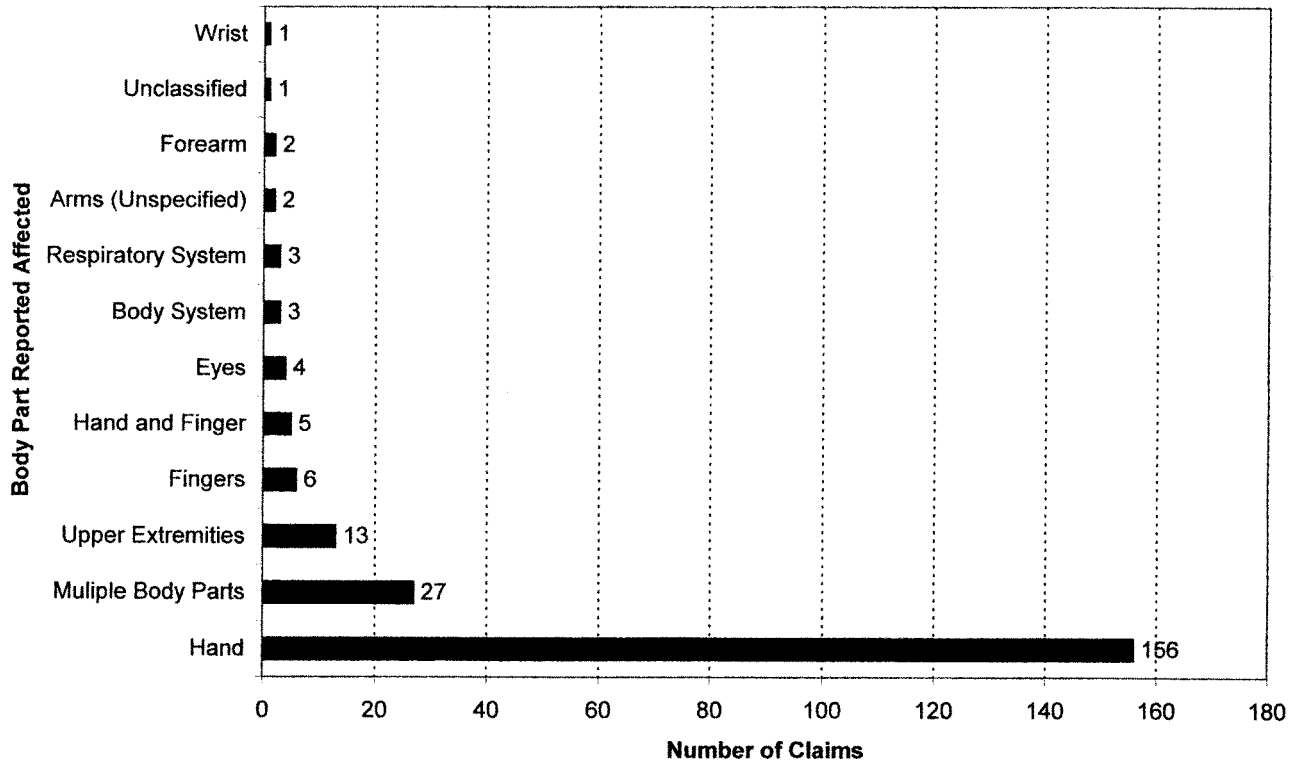


FIGURE 1  
Reported nature of condition.



**FIGURE 2**  
Body part reported affected.

show that, in general, the majority (81.2%) of claimants did not collect any indemnity payments for time off of work.

For the period 1991–1999, the total cost of all potential NRL workers' compensation claims by the state-insured healthcare workers claims was \$615,247.72, equaling a total annual average cost of \$68,360.86, and representing an average cost per state-insured healthcare worker employed in Washington State of under \$0.74 per year. The total cost of all workers' compensation claims made by state-insured healthcare employees during the nine-year period was \$208,815,669.09, of which the estimated NRL claims constituted less than 0.3 percent. Of all state-insured healthcare worker claims made during this period, the average cost of a non-NRL workers' compensation claim was \$3,179.60 as compared to the \$2,759.10 from those potentially associated with NRL. Thus, in comparison to other state-insured healthcare workers, the cost of workers' compensation claims stemming from potential NRL use was low, both in terms of average cost per claim and as a proportion of all costs. A breakdown of costs by type is provided in Table II, and Table III provides a summary of cost statistics across years.

During the 1991–1999 period, 65,703 workers' compensation claims were filed by all state-insured healthcare workers in Washington State. Those claims estimated to be NRL related constituted 0.34 percent of the total claims, and with respect to source of reported injury, those found to be potentially related to latex were generally lower than those from other

common items found in healthcare workplaces. For example, during the same time period there were 248 healthcare employee workers' compensation claims filed from use of pots and pans, 320 from trays/racks, 330 from soap and detergent, 362 from cabinets, 408 from bags and sacks, 504 from chairs and benches, 530 from paper and pulp items, 903 from beds, 1036 from office machines, 1111 from doors, 1245 from boxes/cartons, 1636 from dollies, 2966 from bodily motion, and 4167 from the floor. From the standpoint of both cost and source of injury, the estimated NRL claims did not stand out as any more significant than other common sources of workers' compensation claims among state-insured healthcare workers in Washington State. A comparison of these claim types are provided in Figure 4.

## DISCUSSION

An examination of NRL-related workers' compensation claims filed by Washington State state-funded healthcare workers revealed a low overall prevalence of claim rates relative to even the lowest estimates of sensitization rates. On average, for the nine-year period examined, the claim rate for potential NRL-related claims was 2.66 claims per 10,000 healthcare workers annually. Especially noteworthy was the finding that although the use of NRL gloves by healthcare workers increased dramatically during this period, the annual claim rate did not exhibit any statistically significant change during the same time. This

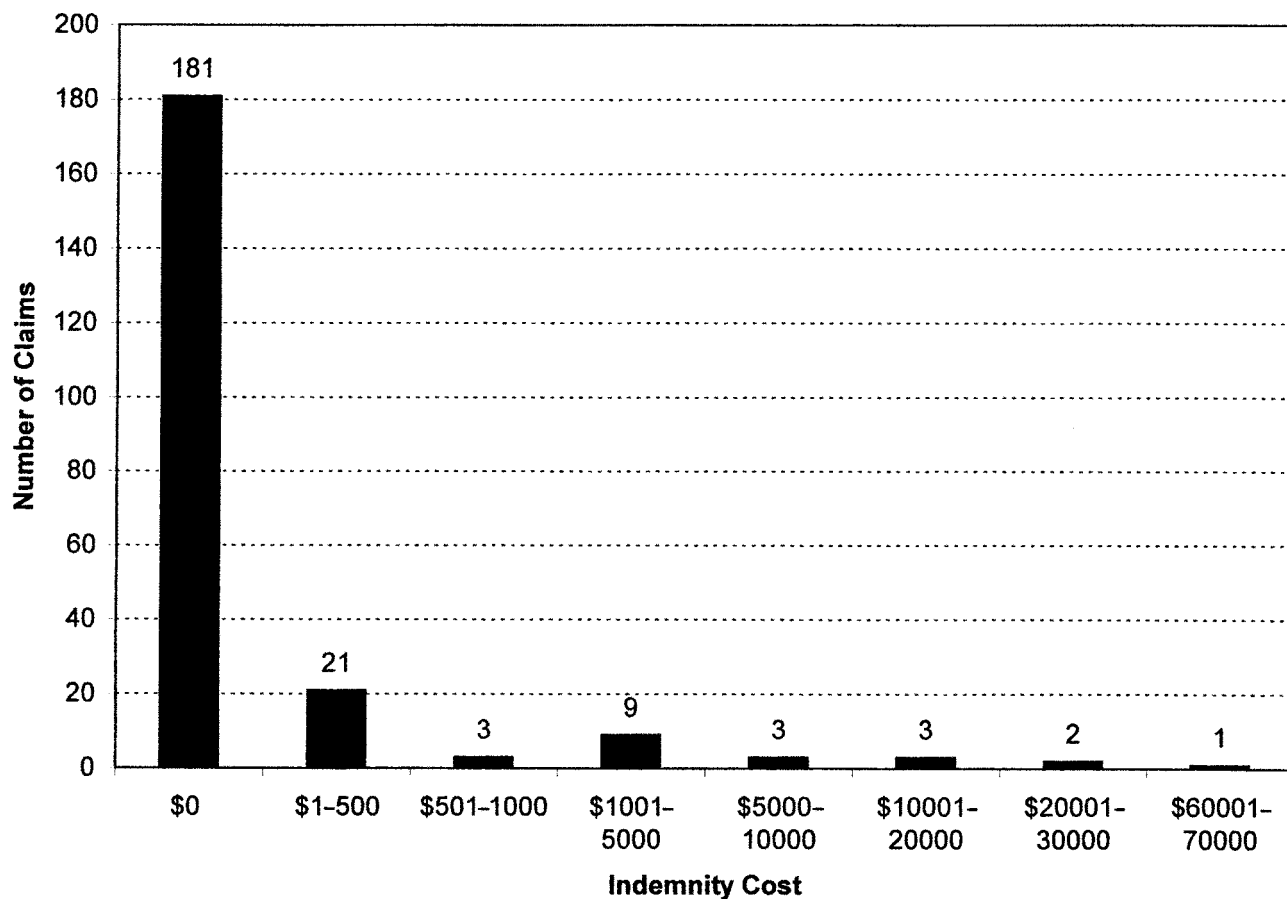


FIGURE 3

Reported indemnity payment for lost work time.

result strongly indicates that the increased contact of healthcare workers with NRL gloves from 1991 to 1999 did not result in any change in the rate of reported reaction claims.

The vast majority of estimated latex reactions experienced by healthcare workers were dermal in nature, and most reports of these reactions were localized to the hands. There were only 10

total reports that cited respiratory system, body system, or eyes affected. These findings tend to indicate that Type I systemic reactions to latex were rare, and NRL glove powder did not produce a widespread effect among the healthcare workers, as very few claims reported conditions consistent with what would be expected if aerosolized allergens were a major source of

TABLE II

Annual breakdown by cost category for estimated HCW NRL claims

Year	Total medical cost (\$)	Total indemnity cost (\$)	Total pension cost (\$)	Total loss of earning potential cost (\$)	Total PPD cost (\$)	Total misc. cost (\$)	Total cost (\$)
1991	1,748.82	2,564.36	0.00	0.00	0.00	109.22	4,422.40
1992	10,482.82	2,511.25	0.00	0.00	0.00	5,978.72	18,972.79
1993	5,320.56	3,789.20	0.00	17.31	0.00	72.30	9,199.37
1994	18,001.25	33,322.53	0.00	430.02	0.00	44,176.40	95,930.20
1995	12,041.60	12,024.02	0.00	0.00	0.00	26,273.73	50,339.35
1996	28,510.46	95,623.57	0.00	0.00	0.00	65,571.66	189,705.69
1997	32,182.94	41,543.24	0.00	0.00	0.00	71,521.44	145,247.62
1998	28,518.36	18,583.76	0.00	0.00	0.00	43,806.23	90,908.35
1999	6,298.18	4,211.32	0.00	0.00	0.00	43.65	10,553.15

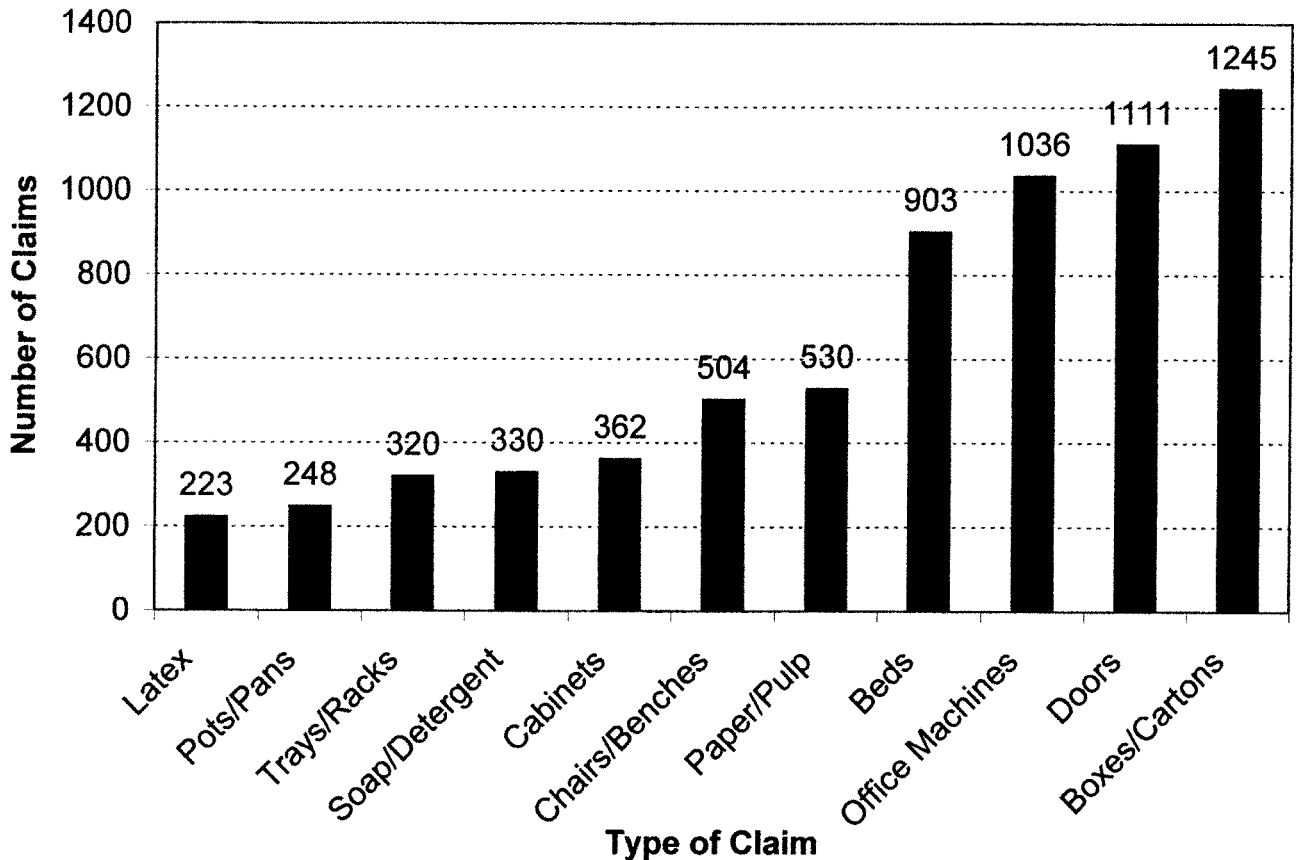
**TABLE III**  
Cost summary statistics for estimated HCW NRL claims

Summary data category	Total medical cost (\$)	Total indemnity cost (\$)	Total pension cost (\$)	Total loss of earning potential cost (\$)	Total PPD Cost (\$)	Total misc. cost (\$)	Total cost (\$)
Total for all years	143,104.99	214,173.25	0.00	447.33	0.00	257,553.35	615,278.92
Average annual cost	15,900.55	23,797.03	0.00	49.70	0.00	28,617.04	68,364.32
Average cost per claim	641.73	960.42	0.00	2.01	0.00	1,154.95	2,759.10
Annual average cost per all self-insured HCW's	0.17	0.26	0.00	0.00	0.00	0.31	0.73

allergic reaction. To this extent, the Washington State results do not support the hypothesis that latex allergens spread by glove powder act as a significant conduit for eliciting allergic reaction from employees in healthcare environments.

The cost of NRL claims was also shown to be on average \$419.23 less than those from other sources in healthcare set-

tings, representing only 0.34 percent of all healthcare employee workers' compensation claims over nine years. The number of estimated reactions did not stand apart from injuries sustained from other common items commonly found in healthcare workplaces, such as soap, bags, and office machines. This finding, however, should not undermine the importance of addressing



**FIGURE 4**  
Estimated HCW NRL claims vs. other HCW claims by number.

NRL allergic reaction among workers in healthcare settings, as developing policies to minimize any potential source of occupational illness should be a paramount concern to employers.

One shortcoming of this study is that it is likely that not all incidents of reaction to NRL by Washington State healthcare workers resulted in the filing of workers' compensation claims, as suggested previously in an establishment level awareness survey by the Washington Safety and Health Assessment and Research for Prevention (SHARP) Program.<sup>(29)</sup> It is probable that some workers experienced some form of reaction to NRL, such as contact dermatitis, and opted against making a claim. To this extent, this study is limited to estimating the maximum prevalence of incidents deemed serious enough to file a claim, but not prevalence of all reactions experienced by healthcare workers. However, because it was found that there were no claims made citing permanent partial disability, pension costs, and very minimal loss of earning potential, it is reasonable to assume the threshold for filing a claim was low, and many of the incidents that occurred were reported.

Because the data did not include claimant identifiers, it is impossible to tell if some latex-allergic employees experienced more than one reaction over the time period examined, and therefore the assumption that every claim represents a separate allergic worker cannot be assumed. Some potential for overestimation bias also exists because no specific code for NRL reaction exists in the Washington State workers' compensation coding system, and it is possible that some claims in which the symptom and source of injury were consistent with what would be found for an NRL-induced claim, and thus counted as one in this study, may actually have been from another source. It is not possible to determine how this overestimation bias offsets the aforementioned underestimation vulnerability.

This study has used workers' compensation data to provide a basis for understanding the effect of occupational exposure to NRL on healthcare employees over a nine-year period in Washington State. In doing so, it differed from most of the approaches used in past research by estimating actual reactivity as opposed to sensitivity, and was able to provide estimates of the costs, reaction types, and prevalence of condition relative to other sources of injury in healthcare environments. The disparity found between workers' compensation claim rates to NRL and past estimates of sensitivity illustrate the necessity of designing research endeavors that emphasize the examination of reactivity, as opposed to sensitivity, to gain a comprehensive understanding of the problem in the future.

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