# Occupational Skin Diseases in Washington State, 1989 Through 1993: Using Workers' Compensation Data to Identify Cutaneous Hazards

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ABSTRACT

*Objectives.* This study sought to characterize occupational dermatoses and cutaneous hazards.

*Methods.* Workers' compensation claims filed for skin disease in the Washington State Fund were analyzed for 1989 through 1993; incidence rates for industries and employers were calculated, and cutaneous hazards associated with the highest rates were identified.

*Results.* A total of 7445 claims were filed for skin disorders, principally contact dermatitis; 675 (9.1%) involved more than 3 missed workdays. The rate of accepted skin disorder claims was 1.0 per 1000 full-time employee-years. The highest incidence rates (4.6 to 30.7 accepted claims per 1000 full-time employee-years) were in certain manufacturing industries (plastics related, concrete products, aircraft parts, sporting goods, and boat building), wholesale farm product raw materials, automotive glass replacement, and beauty shops. Seven of the 10 employers with the highest incidence rates (19.6 to 85.5 accepted claims per 1000 full-time employee-years) used fiber-reinforced plastics (composites) and exposed workers to epoxy and other resin systems associated with contact dermatitis.

*Conclusions.* Workers' compensation data identify known and emerging workplace cutaneous hazards and show promise for targeting prevention efforts. (*Am J Public Health.* 1998;88: 1047–1051)

## *Introduction*

Occupational skin disorders are the most commonly reported category of occupational illnesses not resulting from acute or cumulative trauma, with an estimated 64 200 cases recorded in 1995 in the Bureau of Labor Statistics Annual Survey of Occupational Injuries and Illness.[1] Bureau of Labor Statistics data indicate a steadily increasing number of cases over the last 10 years.[2]

We studied a population-based workers' compensation database with internal denominator data to identify industries and hazards associated with skin disorders.

## *Methods*

Workers' compensation claims for skin conditions filed between January 1, 1989, and December 31, 1993, were identified through the database of the Washington State Department of Labor and Industries State Fund (the state's exclusive provider of workers' compensation insurance). Excluded from analysis were claims from self-insured employers (350 to 400 larger employers).

A claim represented an occupational skin disorder if the "nature of injury" involved codes 180 to 184 or 189 of the American National Standards Institute Z16.2 system.[3] During claims processing, trained personnel assign one "nature" to each claim.

For each claim, we extracted information on claimant demographics and income, illness characteristics, claim characteristics (adjudication results and type of benefits provided), and employer information. Information on race/ethnicity is not included in the claims system; we used the method of Passel[4] to identify Hispanic surnames. For each employer, we extracted descriptive information as well as employee hours reported.

Claimants receive wage replacement ("time loss") payments when they lose more than 3 days of work. Nearly all individuals having accepted claims, with or without time loss, receive medical benefits. A small number of claims in minor categories that typically include more than 3 days away from work (i.e., "kept on salary" and "loss of earning power benefits") were considered time loss claims.

We calculated incidence rates for occupational skin disorders among all employers. Industry-specific rates were computed according to 2-, 3-, and 4-digit Standard Industrial Classification codes, as well as by the 10 major industrial sectors.[5] Rate calculation was based on accepted claims in a category per 1000 full-time equivalent employee-years. Rates for employer and Standard Industrial Classification code are reported only if at least 10 claims were filed and at least 50 000 hours were reported (25 full-time equivalent employee-years, or an average of 5 employees) over the entire period for the business or category.

We determined probable cutaneous hazards on the basis of a review of claims records, a review of the available medical and industrial hygiene literature, and an assessment of the products and processes involved for a specific employer or cate-

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gory. Employers were contacted to verify uncertain exposures.

In order to compare occupational skin disorder claimants with other Washington State working populations, demographic information on all workers' compensation claimants in 1993 was also extracted, along with information on the state's total workforce, from the Washington State Office of Financial Management[6] and Employment Security Department.[7]

## Results

In the 5-year study period, 7445 claims for occupational skin disorders were filed, representing 7058 individuals. As shown in Table 1, nearly 90% of these claims were for dermatitis. Medical benefits only were provided in 5020 (88.1%) of the 5695 accepted claims. Five claims were not adjudicated as either accepted or rejected.

Total medical bills (including pharmacy payments) were $1.22 million (median: $97 per claim), and time loss payments were $1.23 million. The 652 time loss claims accounted for 38 623 days of lost time. The average time loss payment was $1881 for 59 lost days; the median amount of lost time for these claims was 11 days. An additional 15 lost time claims were not included in this calculation because their compensation was not comparable (e.g., employees were kept on the payroll or received "loss of earnings protection" benefits).

Occupational skin disorder claimants were similar in terms of age to the overall population of state fund claimants (medians: 31.4 and 32.0 years, respectively) but had lower mean annual wages ($14 280 and $18 936, respectively). The proportion of male occupational skin disorder claimants slightly exceeded that in the overall state workforce (63% vs 54%). The proportion of skin disease claimants with Hispanic surnames (13.2%) exceeded the proportion of Hispanics in the state's workforce (4%) and the proportion in all claim categories (7.3%).

Most claims involved disorders affecting either the hands, wrists, and/or fingers (2232 claims; 39.5%) or the arms (1015; 17.8%). In 1528 (26.8%) claims, multiple body parts (including the upper extremity) were affected. Smaller proportions involved the head or neck (517; 9.1%), the lower extremity (214; 3.7%), and the trunk (138; 2.4%).

Industrial classification information was not available on 37 accepted occupational skin disorder claims, leaving 5657 available for classification. Five 2-digit Standard Industrial Classification categories accounted for 39% of these claims: eating and drinking establishments (746 claims), agricultural production–crops (524), health care services (375), special trade construction contractors (343), and wholesale trade in nondurable goods (214). The overall incidence rate of claims among state fund employers was 1.0 per 1000 full-time equivalent employee-years.

Table 2 shows the number and incidence rate of claims for the 10 major Standard Industrial Classification sectors and selected industry categories. Among the major industrial sectors, the highest rates of accepted occupational skin disorder claims were seen in agriculture/forestry/fishing (2.8 per 1000 full-time equivalent employee-years), manufacturing (1.8), and construction (1.3). Several larger 3-digit Standard Industrial Classification categories (employing an average of at least 4000 full-time equivalents) had notably elevated claims rates relative to the overall state fund rate, including aircraft and parts manufacturing (5.0), miscellaneous plastic product manufacturing (4.8), beauty shops (4.6), fruit and tree nut crop production (3.7), miscellaneous food and kindred product manufacturing (3.2), and painting contractors (2.9).

The ten 4-digit Standard Industrial Classification categories with the highest incident rates of occupational skin disorders (range: 5.3 to 30.7 per 1000 full-time equivalent employee-years) are shown in Table 2. Based on our review, 7 of these (plastics-related manufacturing, aircraft part manufacturing, boat building, industrial pattern manufacturing, and sporting goods manufacturing) are likely to include significant exposure to resin systems involved in fiber-reinforced plastics (i.e., composite materials using fiberglass or advanced fibers). The remaining highest-rate industries include wholesale trade in farm product raw materials, automotive glass replacement shops, and concrete products manufacturing (other than block and brick).

Based on American National Standards Institute "source of injury" codes, 56.8% of the 5695 accepted occupational skin disorders were ascribed to some type of chemical exposure. The most commonly noted types of chemical exposure were soap/detergent (12.2% of claims) and solvent/degreaser (3.4%). Vegetation (including poison oak/ivy) and apparel (including gloves) were also major sources noted, accounting for 9.6% and 4.0% of claims, respectively.

Table 3 shows information for the 10 employers with the highest incidence of occupational skin disorders; these cases were reviewed in more detail. The likely principal cutaneous hazards were identified for 9 of these employers. Seven of the 10 employers use fiber-reinforced plastics (including advanced composite materials); their employees are likely to have significant dermal exposure to the associated epoxy and related resin systems.

**TABLE 1—Nature and Status of State Fund Claims for Occupational Skin Disorders, 1989 through 1993**

| Nature of Injury Code(s)[a] | Description | No. Claims Filed (% of Total) | Status of Claims: Time Loss[b] (% of Filed Claims) | Status of Claims: Medical Bills Only[c] (% of Filed Claims) | Status of Claims: Rejected (% of Filed Claims) |
|---|---|---|---|---|---|
| 180–182 | Dermatitis, including allergic and other contact dermatitis | 6666 (89.5) | 651 (9.8) | 4614 (69.2) | 1421 (21.3) |
| 183 | Primary infection of skin | 220 (3.0) | 21 (9.5) | 105 (47.7) | 94 (42.7) |
| 184 | Other skin conditions | 429 (5.8) | 19 (4.4) | 226 (52.7) | 183 (42.7) |
| 189 | Skin condition, unstated | 130 (1.7) | 7 (5.4) | 75 (57.7) | 47 (36.2) |
| Total | | 7445 (100) | 675 (9.1) | 5020 (67.4) | 1745 (23.4) |

*Notes.* Claims "not yet allowed" (n = 3) and "provisional" (n = 2) are not included in status columns; hence, the subtotals do not sum to 7445.
[a]American National Standards Institute Z16.2 codes.
[b]Accepted claims with more than 3 days lost from work, including claims in which the claimant remained on the payroll.
[c]Claims with 3 or fewer days lost from work.

**TABLE 2—State Fund–Accepted Occupational Skin Disease Claim Rates, by Industry: 1989 through 1993**

| Standard Industrial Classification Codes | Description | Claims, No. | Employee Hours (Ten Thousands) | Claim Rate per 1000 Full-Time Employee-Years (Rank[a]) |
|---|---|---|---|---|
| 01–09 | Agriculture, forestry, and fishing | 734 | 52 900 | 2.8 |
| 017X | Crop production: fruits and tree nuts | 352 | 19 300 | 3.7 |
| 10–14 | Mining | 13 | 2 667 | 1.0 |
| 15–17 | Construction | 585 | 90 800 | 1.3 |
| 172X | Painting and paper hanging | 43 | 2 995 | 2.9 |
| 20–39 | Manufacturing | 1136 | 128 000 | 1.8 |
| 282X | Plastics materials and synthetics | 14 | 345 | 8.1 |
| 2821 | Plastics materials and resins | 13 | 215 | 12.1 (2) |
| 3083 | Laminated plastics plate and sheet | 28 | 182 | 30.7 (1) |
| 3089 | Plastic products, NEC | 72 | 2 728 | 5.3 (10) |
| 3272 | Concrete products (not block, brick, or ready mix) | 20 | 753 | 5.3 (9) |
| 3543 | Industrial patterns | 14 | 281 | 9.9 (3) |
| 3721 | Aircraft | 48 | 1 281 | 7.5 (4) |
| 3732 | Boat building and repairing | 60 | 2 011 | 6.0 (7) |
| 3949 | Sporting and athletic goods, NEC | 55 | 1 637 | 6.7 (6) |
| 40–49 | Transportation and utilities | 140 | 53 400 | 0.5 |
| 491X | Electric services | 22 | 2 603 | 1.7 |
| 50–51 | Wholesale trade | 334 | 87 900 | 0.8 |
| 515X | Farm product raw materials | 11 | 1 108 | 2.0 |
| 5159 | Farm product raw materials, NEC | 10 | 280 | 7.1 (5) |
| 52–59 | Retail trade | 1144 | 220 000 | 1.0 |
| 581X | Eating and drinking places | 746 | 80 400 | 1.9 |
| 60–67 | Finance, insurance, and real estate | 65 | 84 500 | 0.2 |
| 651X | Real estate operators and lessors | 47 | 13 100 | 0.7 |
| 70–89 | Services | 1351 | 365 000 | 0.7 |
| 723X | Beauty shops | 132 | 5 767 | 4.6 |
| 7536 | Automotive glass replacement shops | 11 | 369 | 5.9 (8) |
| 91–97 | Public administration | 155 | 51 100 | 0.6 |
| 951X | Environmental quality | 61 | 6 053 | 2.0 |
| 01–97 | Total state fund | 5657 | 1 136 267 | 1.0 |

*Note.* NEC = not elsewhere classified. One full-time employee-year = 2000 hours. Shown are the highest rate 3-digit classification within each major sector and the 10 highest 4-digit classifications regardless of sector. As a result, listed classifications may not be exclusive. A threshold of at least 10 claims and at least 50 000 hours reported was required for an industrial classification to be included here. No subdivisions of mining met this threshold.

[a] Ten highest claim rate industries at the most specific industrial classification level.

## *Discussion*

Occupational skin diseases are preventable; efforts at identifying the sources of these disorders can lead to successful prevention intitatives. When an exposure to a sensitizing agent or irritant is identified, steps can be taken to eliminate or reduce the exposure.

The US Public Health Service established a year-2000 objective of reducing occupational skin disorders or diseases to an incidence of no more than 55 per 100 000 full-time workers.[8] The rates we found exceeded that goal. The 1993 Bureau of Labor Statistics survey (based on employer surveys) found 0.76 skin disorder cases per 1000 workers and 0.16 skin disorder cases causing at least 1 day away from work per 1000 workers (C. A. Burnett, B. Lushniak, W. McCarthy, and J. Kaufman, unpublished data, 1998 [now submitted for publication]), similar to the workers' compensation data reported here. However, the Bureau of Labor Statistics data did not provide employer-specific rates, nor did they provide the same level of detail regarding cases and exposures as the workers' compensation data reported here.

The 1988 National Health Interview Survey (NHIS) found that 11.2% of working adults reported dermatitis in the preceding 12 months; 15.2% of these individuals (1.7% of the total, equivalent to 1.87 million workers nationally) attributed their rash to chemicals or other substances encountered at work.[9,10] These data (based on telephone interviews and self-reports of dermatitis) demonstrate a prevalence of work-attributed dermatitis that is 17-fold the incidence reported here. While prevalence data should exceed incidence rates as a result of chronic cases, the NHIS data suggest a problem of great magnitude.

Kanerva and colleagues' population-based studies of occupational skin disorders in Finland, based on mandatory physician reporting, indicate an incidence similar to that described here, with 0.55 cases annually per 1000 members of the workforce (including part-time workers) between 1990 and 1993.[11,12]

Occupational dermatitis can be persistent and devastating to workers, causing interference with work and leisure activities and frequently requiring a change in jobs.[13,14] We were unable to measure this dimension of disability.

Surveillance of occupational skin disorders via workers' compensation data has been undertaken on an experimental basis in 3 states (Ohio, Oregon, and Washington) as part of the National Institute for Occupational Safety and Health's Sentinel Event Notification System for Occupational Risk (SENSOR) program. Workers' compensation data are attractive for surveillance because they constitute an existing database containing pertinent information (including employee, employer, occupation, and possible causal agent). Workers' compensation systems have been used previously in occupational skin

**TABLE 3—Individual State Fund Employers with Highest Claims Rates for Skin Conditions, Identified by Their Standard Industrial Classification (SIC): 1989 through 1993**

| SIC Code | SIC Description | Claims, No. | Employee Hours | Claim Rate per 1000 Full-Time Employee-Years | Identified Cutaneous Hazard |
|---|---|---|---|---|---|
| 3721 | Aircraft mfg. | 20 | 467 662 | 85.5 | Composite-fiber system |
| 3949 | Sporting and athletic goods mfg. | 21 | 639 424 | 65.7 | Composite-fiber system |
| 3728 | Aircraft equipment mfg, NEC | 65 | 2 047 917 | 63.5 | Composite-fiber system |
| 4213 | Trucking other than local | 16 | 534 762 | 59.8 | Unknown[a] |
| 9512 | Public administration of land, mineral, and wildlife conservation | 25 | 1 081 289 | 46.2 | Vegetation |
| 3949 | Sporting and athletic goods mfg. | 18 | 1 002 518 | 35.9 | Composite-fiber system |
| 3728 | Aircraft equipment mfg, NEC | 20 | 1 249 601 | 32.0 | Composite-fiber system |
| 3721 | Aircraft mfg. | 11 | 929 611 | 23.7 | Composite-fiber system |
| 3089 | Plastic products mfg., NEC | 17 | 1 589 434 | 21.4 | Composite-fiber system |
| 5142 | Packaged frozen foods | 12 | 1 226 133 | 19.6 | Wet work, seafood protein |

*Note.* A threshold of 10 claims and 50 000 hours was used for inclusion. One full-time employee-year = 2000 hours. mfg. = manufacturing; NEC = not elsewhere classified.

[a]This employer was the subject of an "outbreak" of dermatitis resulting in a state Occupational Safety and Health Administration program inspection and a National Institute for Occupational Safety and Health health hazard evaluation,[29] although the identity of the cutaneous hazard(s) remains uncertain.

disorder studies,[15,16] and they are considered adequate for surveillance.[17] However, workman's compensation data are recognized to involve severe limitations.

Workers' compensation data underreport the frequency of cases of occupational diseases because of reporting disincentives and difficulties in recognizing occupational disorders. In 2040 workers surveyed and examined by Discher and colleagues, 76 probable occupational skin conditions were identified, of which only 11 (14.5% of the total) could be found in workers' compensation records.[18] While the number of these conditions treated by a health care provider (report of being seen by a provider is required to appear in the workers' compensation reporting system) is unknown, this information suggests that workers' compensation data may underestimate the magnitude of the problem by nearly sevenfold.

Another limitation of workers' compensation data in Washington State is the amount of information available on claims from self-insured employers; data are not available from many large employers (including major manufacturers and most hospitals). This may mean that the data underrepresent the relative importance of certain exposures, such as latex exposures in hospitals.

The worker's compensation database described here cannot accurately distinguish between allergic and irritant dermatitis. Information on patch testing is not typically found in the records.

We identified industries previously noted to have high rates of occupational skin disorders, as well as some unexpected industries. Most of the industries and employers identified with high incidence rates are associated with established hazards linked to contact dermatitis. This finding provides some validation that such an analysis, if used for surveillance purposes, can identify with reasonable specificity ongoing or emerging cutaneous hazards that deserve additional exposure-elimination or -reduction efforts. However, we cannot determine the overall sensitivity of this method or whether such an analysis is systematically insensitive to certain types of hazards.

Investigators have previously noted the problem of dermatitis among cosmetologists,[19] agricultural workers,[20] and cement-exposed workers,[21] as found in this study. In addition, our investigation of some unexpectedly high-rate industries often revealed the presence of established cutaneous hazards. Businesses in Standard Industrial Classification category 7536 (automotive glass replacement shops) make extensive use of acrylate resins, which are potent sensitizers.[22] The employer with the most claims in category 3543 (industrial pattern manufacturing) makes parts out of advanced composite materials, and the employer with the most claims in category 5159 (wholesale trade in farm product raw material) principally deals in hops, a known cutaneous hazard,[23,24] and hops products.

Fiber-reinforced plastics (i.e., composite materials) were found consistently as a principal hazard in our analysis of specific industry and employer incidence rates, suggesting that these exposures have high attack rates for occupational dermatitis. Composite materials are found in aerospace/defense industry parts, sporting goods (e.g., fishing rods, golf-club shafts), boat building, and electronics. Fiber-reinforced thermosetting plastics involve the use of highly reactive chemicals in a matrix with fibers to achieve specific, desirable physical properties. The resin system (epoxy and others) itself, the hardeners, and other associated chemicals can cause allergic or irritant dermatitis. Occasionally, the fibers themselves (fiberglass, graphite, and synthetics) may be associated with irritation as well. Epoxy and related resin systems are also widely found in construction materials (paints and grouting) and in adhesives, where they are commonly associated with sensitization and allergic contact dermatitis.[25–27] Prevention of dermatitis arising from these resin systems requires additional vigilance.[28]

## *Conclusions*

Workers' compensation data provide useful information on the occurrence of occupational skin disorders. While some of our findings are specific to Washington State and may underrepresent certain industries or hazards, these data show promise in terms of detecting important cutaneous hazards and prioritizing prevention efforts. Additional efforts should be directed toward preventing contact dermatitis due to work with epoxy resins and composite materials, in response to high incidence rates. □

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