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# Dermatitis among workers in Ontario: results from the Occupational Disease Surveillance System

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## ABSTRACT

**Objectives** Dermatitis is the most common occupational skin disease, and further evidence is needed regarding preventable risk factors. The Occupational Disease Surveillance System (ODSS) derived from administrative data was used to investigate dermatitis risk among industry and occupation groups in Ontario.

**Methods** ODSS cohort members were identified from Workplace Safety and Insurance Board (WSIB) accepted lost time claims. A case was defined as having  $\geq 2$  dermatitis physician billing claims during a 12-month period within 3 years of cohort entry. A 3-year look-back period prior to cohort entry was used to exclude prevalent cases without a WSIB claim. Workers were followed for 3 years or until dermatitis diagnosis, age 65 years, emigration, death or end of follow-up (31 December 2016), whichever occurred first. Age-adjusted and sex-adjusted Cox proportional hazard models estimated HRs and 95% CIs. The risk of dermatitis was explored using a job exposure matrix that identifies exposure to asthmagens, many of which also cause contact dermatitis.

**Results** Among 597 401 workers, 23 843 cases of new-onset dermatitis were identified. Expected elevated risks were observed among several groups including furniture and fixture industries, food and beverage preparation and chemicals, petroleum, rubber, plastic and related materials processing occupations and workers exposed to metal working fluids and organic solvents. Decreased risk was observed among farmers, nurses and construction industries, and occupations exposed to latex and indoor cleaning products.

**Conclusions** ODSS can contribute to occupational dermatitis surveillance in Ontario by identifying occupational groups at risk of dermatitis that can then be prioritised for prevention activities.

## INTRODUCTION

Dermatitis is one of the most common work-related diseases in many high-income countries.<sup>1,2</sup> Contact dermatitis constitutes the largest component of work-related dermatitis. Occupational contact dermatitis (OCD) has a significant impact on workers' quality of life, ability to do their jobs and health service utilisation<sup>3</sup>; however, challenges in recognising and measuring exposures limit implementation of prevention strategies.

There are two types of contact dermatitis: irritant contact dermatitis, which is more common, and allergic contact dermatitis.<sup>1</sup> A worker can develop both irritant and allergic dermatitis,

## Key messages

### What is already known about this subject?

► Dermatitis is one of the most common work-related diseases, and a number of occupations are exposed to known risk factors such as wet-work, irritants (metal working fluids and organic solvents) and allergens (metals, rubber additives and acrylates).

### What are the new findings?

► The Occupational Disease Surveillance System (ODSS) confirmed many well-established high-risk groups for dermatitis including workers in the food and beverage industry, workers in painting and decorating occupations, barbers and hairdressers as well as workers exposed to metal working fluids and acrylates.  
► Other notable high-risk groups included workers in furniture and fixture industries, metal fabricating and transportation equipment.

### How might this impact on policy or clinical practice in the foreseeable future?

► ODSS can provide quantitative risk estimates for occupational diseases, such as dermatitis, at a population level that are necessary to support the targeting of work-related disease prevention programmes.

simultaneously or at different times or body locations.<sup>4</sup> The majority of irritants are chemicals, including cleaning agents, metal working fluids and organic solvents that damage the epidermal barrier after cumulative exposure to the agent.<sup>4</sup> Allergens, such as metals (nickel, chromium and cobalt), rubber additives in gloves, preservatives, epoxies, resins and acrylates can lead to allergic contact dermatitis.<sup>4</sup> Workplace-based studies have found excess dermatitis risk among certain workers including farmers, beauticians, chemical workers, cleaners, construction workers, cooks and caterers, electronics workers, hairdressers, health and social care workers, machine operators, mechanics, metalworkers and vehicle assemblers.<sup>5</sup> Wet-work is considered to be the main risk factor for irritant dermatitis among these groups, although many are also exposed to both irritants and allergens.<sup>5</sup>

Ongoing monitoring is needed to identify industrial and occupational groups at risk of dermatitis to effectively support strategies for disease



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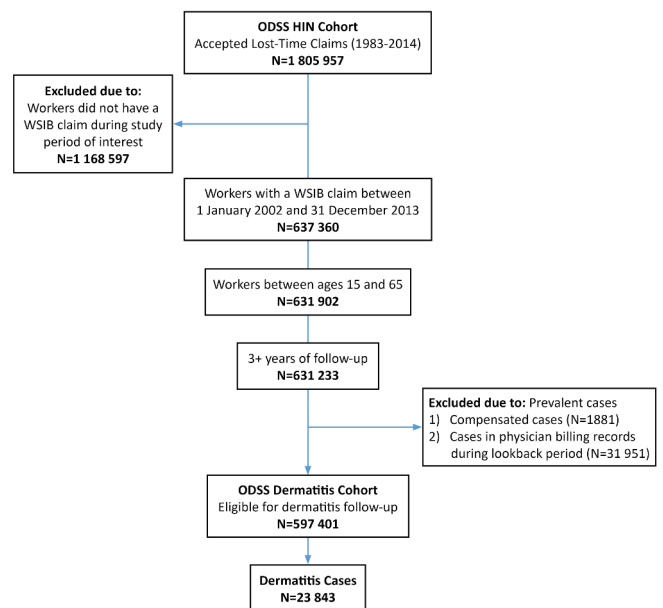
prevention. However, surveillance of occupational skin disease is challenging. Workers compensation system data generally capture only severe OCD and under-represent mild OCD cases.<sup>6</sup> Administrative health data are useful for monitoring trends in disease at the population level, but do not include patients' occupation or industry information.<sup>4</sup> Accordingly, it is challenging to determine accurate estimates of prevalence and incidence for occupational dermatitis. Published estimates show an incidence of approximately seven cases of occupational skin disease per 10 000 workers per year in Germany,<sup>7</sup> and eight cases per 10 000 workers per year in Finland.<sup>8</sup> In 1991, there was an annual incidence of 7.7 cases per 10 000 workers,<sup>9</sup> with a range of 8.1–6.7 per 10 000 during the period of 1993–1997 in the USA.<sup>10</sup>

Attempts have been made to establish surveillance systems for occupational dermatitis in various jurisdictions. Approaches to surveillance include physician-diagnosed cases of occupational skin disease and patch test data. Patch testing is the diagnostic test used to identify causative allergens and diagnose allergic contact dermatitis. While these data provide information regarding trends in allergic contact dermatitis, they are not useful in examining the more prevalent irritant contact dermatitis. The European Surveillance System on Contact Allergies collects patch test information through electronic data capture from clinicians in 12 countries,<sup>11</sup> and publishes summary data on OCD and by occupational group.<sup>12</sup> The EPIDERM is a UK surveillance system that collects data on cases of occupational skin disease from consultant dermatologists and occupational physicians.<sup>5</sup> The North American Contact Dermatitis Research Group pools data from 13 patch test clinics in the USA and Canada and investigates the trends in allergens over time,<sup>13</sup> as well as often reports on occupational groups and workplace allergens.<sup>14–16</sup> Surveillance based on clinical case reporting and patch test data offer an opportunity to collect detailed information on individuals, including occupation and industry of employment, but are limited to reporting only on those cases in the participating clinics, rather than the population as a whole.

In Canada, the single payer universal health system and comprehensive administrative health databases, managed at the provincial level, help facilitate disease surveillance. However, these databases do not contain information on occupation and industry of employment making it difficult to conduct occupational disease surveillance.<sup>17</sup> To overcome this challenge, Cherry *et al* linked workers' compensation claims (with data on occupation and industry of employment at the time of injury or illness) to physician billing records.<sup>18</sup> A similar approach was taken to develop the Occupational Disease Surveillance System (ODSS) in Ontario, Canada.<sup>17</sup>

The ODSS was established to facilitate the investigation of risk of cancers and other diseases, such as contact dermatitis, asthma, asbestosis and silicosis among workers in Ontario. ODSS links Workplace Safety and Insurance Board (WSIB) time-loss claims records to various administrative health databases with data on outpatient physician billing records, hospital discharge data and ambulatory care records.<sup>17</sup> Physician billing data had not been previously used to monitor trends in work-related contact dermatitis as has been done for other diseases such as work-related asthma.<sup>18</sup>

Job-exposure matrices can be used to assign exposure based on job title information and investigate the relationships between exposures and health outcomes. Although much is known about exposures that can lead to OCD, there is no existing job-exposure matrix for dermatitis-specific exposures. However, many exposures cause both asthma and contact dermatitis.<sup>19–21</sup> The Occupational Asthma-specific Job Exposure Matrix (OAsJEM)



**Figure 1** Derivation of the ODSS Dermatitis Cohort from the ODSS HIN Cohort. ODSS, Occupational Disease Surveillance System; WSIB, Workplace Safety and Insurance Board; HIN, Health Insurance Number.

identifies job groups with exposure to compounds that are known to cause occupational asthma.<sup>22 23</sup> The original version of OAsJEM<sup>22</sup> was used to determine the risk of atopic dermatitis in the offspring of mothers with occupational exposure during pregnancy.<sup>24</sup> The OAsJEM was recently updated with information on 30 specific asthma-causing agents<sup>23</sup>; some of these, including epoxy resins, latex, organic solvents and metal working fluids, are also common causes of OCD.

This study aims to characterise risk of dermatitis among industry and occupation groups between 2002 and 2016 in Ontario, Canada using the ODSS. A secondary objective is to explore risk of OCD by exposure with the application of the OAsJEM.

## METHODS

The ODSS is described elsewhere in detail.<sup>17</sup> Briefly, through a series of deterministic and probabilistic linkages, WSIB time-loss claims records (1983–2014) were matched to the Ontario Health Insurance Plan's (OHIP) Registered Persons Database (1990–2015) and the OHIP eClaims Database (1999–2016) to create the study cohort. The study population includes all workers, aged 15–65 years, with an accepted lost-time WSIB claims between 1 January 2002 and 31 December 2013. This is a dynamic cohort as workers could enter the study population at any time during this study period. In an attempt to identify new dermatitis cases, workers with a dermatitis compensation claim were excluded. Furthermore, a 3-year look-back period preceding cohort entry was used to exclude prevalent cases identified in the physician billing records (figure 1).

## Exposure

Jobs at time of claim were coded by the WSIB according to the Canadian Classification Dictionary of Occupations (CCDO 1971) and Canadian Standard Industry Classification (SIC 1970). The OAsJEM was used to assign each occupation to 'high', 'medium' or 'unexposed' categories for multiple asthmagens associated with the occupation. Each asthmagen was analysed separately as an exposure variable.

### Case definition

Physician billing records from the OHIP eClaims database using the International Classification of Diseases, Ninth Revision codes 691 or 692<sup>25</sup> were used to identify cases of dermatitis. These records do not have job-title information. The case definition was met if a worker had at least 2 OHIP eClaims in a 12-month period during the 3-year follow-up period after cohort entry. The case definition follows similar criteria as asthma, another occupational disease with short latency and both irritant and allergic mechanisms, and one for which there are generally accepted case definitions in studies using administrative health data.<sup>18 26</sup>

### Statistical analysis

Workers were followed until date of diagnosis, emigration out of province, age 65 years, end of 3-year follow-up or death, whichever occurred first. Age-adjusted and sex-adjusted Cox proportional hazard models were used to generate HRs with 95% CIs for the industry and occupation groups at the division, major and minor levels. For each analysis, the risk of contact dermatitis in an occupation or industry group of interest was compared with all other workers in the cohort. These analyses were also sex-stratified. Cox proportional hazard models were used to estimate risk of contact dermatitis due to exposure to each asthmagen (derived from OAsJEM) at the binary level (exposed vs unexposed), as well as categorical level (high or medium exposure vs unexposed).

In accordance with Cancer Care Ontario disclosure guidelines, no counts <5 or corresponding model outputs are reported. Results were also suppressed where counts <5 would be identified due to additivity across subgroups. HRs with clinical significance, relevant to prevention and >10% (HR <0.90 or >1.10) are emphasised. Analyses were completed using SAS V.9.4 (SAS Institute, Cary, North Carolina, USA).

### RESULTS

In total, 23 843 cases of contact dermatitis were identified among 597 401 workers eligible for follow-up (figure 1). The study cohort is 62% male with mean age of 39.5 years (SD: 12.2) at cohort entry.

#### Industry

At the division level (1-digit SIC code), increased risk (10% or higher) of contact dermatitis was observed among workers in the manufacturing industries. Decreased risk was observed among workers in agriculture, forestry, mines, quarries and oil wells and construction industries (table 1).

At the major level (2-digit SIC code), statistically significant ( $p < 0.05$ ) increased risks were observed for food and beverage, furniture and fixture, rubber and plastics products, metal fabricating and transportation equipment industries (table 2). Elevated, but non-significant risks were observed among non-metal mines, and petroleum and coal products industries. Statistically significant decreased risks were detected in experimental and institutional farms, forestry, general contractors and personal services. Non-significant decreased risks were observed among metal mines and services incidental to mining (online supplementary table A1).

At the minor level (3-digit SIC code), statistically significant increased risk was observed among industries in fruit and vegetable processing, bakery products, plastics fabricating, office furniture manufacturers, workers in hardware, tool and cutlery manufacturing, motor vehicle parts and accessories manufacturers and barber and beauty shops (table 2). Non-significant

elevated risks were observed among industries in beverage, fabricated structural metal, wire products manufacturers, machine shops, aircraft parts manufacturers and railroad rolling stock industries. Decreased risk of contact dermatitis was observed among all types of agricultural industries, including livestock farms and field crop farms, logging, building construction, highway, bridge and street construction, personal services in private households and laundries, cleaners and presses (except self-service) (online supplementary table A1).

#### Occupation

At the division level (2-digit CCDO code), statistically significant increased risk was seen among workers in occupations in social sciences, other crafts and equipment operations, artistic and recreational, machining and related (table 1). Decreased risk was detected in occupations in medicine and health, farming, horticulture and animal husbandry, construction trades and mining and quarrying (table 1).

At the major level (3-digit CCDO code), statistically significant increased risks were observed across occupations in food and beverage, metal machining and processing of chemicals, petroleum, rubber, plastics and related materials (table 3). Elevated, but non-significant, risks were observed in occupations in product fabricating, assembling and repairing. Statistically significant decreased risk was seen in nursing therapy and related assisting occupations, farm, nursery and related workers, occupations in excavating, grading, paving and construction trades (online supplementary table A2).

At the minor level (4-digit CCDO code), significant elevated risk was observed among barbers and hairdressers, machinist and machine tool setting-up, machine tool operating, painting and decorating under product fabricating, assembling and repairing occupations (table 3). Non-significant elevated risks were also observed among workers in tool and dye making, cabinet and wood furniture makers, bookbinders, printing and related occupations. Decreased risk was observed among nurses, nursing assistants, farm workers, foremen in construction trades, concrete finishing, roofing, waterproofing, carpenters, brick and stone masons and construction trades occupations including excavating, grading and paving (online supplementary table A2).

#### Occupational Asthma-specific Job Exposure Matrix

The job exposure matrix analysis provided insight on the association between contact dermatitis and exposure to 30 agents (online supplementary table A3). Elevated risk was observed among occupations with exposure to aliphatic amines, metal working fluids and acrylates as well as occupations with high exposure to isocyanates and organic solvents (figure 2). Non-significant increased risk was observed among workers exposed to acrylates and isocyanates. Decreased risk was observed among workers exposed to latex and indoor cleaning products (figure 2).

### DISCUSSION

The ODSS confirmed positive associations for many of the industries and occupations with previously recognised risk of contact dermatitis. With the identification of occupation and industrial information, these findings provide strong and consistent evidence of increased risk of dermatitis in several occupations and industries. These results support the previously published literature, which indicates a need to focus on exposures including wet-work, frictional trauma, metal working fluids and organic solvents.<sup>1-6 14-16 19-21</sup>

**Table 1** HRs and 95% CIs for dermatitis by Industry and Occupation Division Groups

	Cases (workers)	HR (95% CI)†
Industry (Division)*		
(1) Agriculture	224 (7959)	<i>0.78 (0.69 to 0.89)</i>
(2) Forestry	33 (1377)	0.71 (0.50 to 1.00)
(4) Mines, quarries and oil wells	83 (3025)	0.83 (0.67 to 1.02)
(5) Manufacturing industries	4404 (112 487)	<b>1.10 (1.06 to 1.14)</b>
(6) Construction industry	1362 (50 852)	<i>0.79 (0.75 to 0.84)</i>
(7) Transportation, communication and other utilities	1681 (48 474)	0.97 (0.92 to 1.02)
(8) Trade	3999 (110 951)	<i>0.95 (0.92 to 0.99)</i>
(9) Finance, insurance and real estate	194 (5460)	0.92 (0.80 to 1.06)
(10) Community, business and personal service industries	7558 (181 429)	1.02 (0.99 to 1.05)
(11) Public administration and defense	1886 (48 361)	1.00 (0.95 to 1.05)
Occupation (Division)‡		
(11) Managerial, administrative and related occupations	514 (12 720)	0.98 (0.90 to 1.07)
(21) Occupations in natural sciences, engineering and mathematics	291 (7608)	1.05 (0.94 to 1.18)
(23) Occupations in social sciences and related fields	542 (11 151)	<b>1.12 (1.03 to 1.22)</b>
(27) Teaching and related occupations	901 (19 039)	<b>1.07 (1.00 to 1.15)</b>
(31) Occupations in medicine and health	1777 (42 982)	<i>0.90 (0.86 to 0.95)</i>
(33) Artistic, literary, recreational and related occupations	248 (5524)	<b>1.16 (1.02 to 1.32)</b>
(41) Clerical and related occupations	2042 (48 636)	1.03 (0.98 to 1.08)
(51) Sales occupations	1914 (49 574)	0.97 (0.92 to 1.01)
(61) Service occupations	3996 (97 397)	<b>1.04 (1.01 to 1.08)</b>
(71) Farming, horticultural and animal husbandry occupations	370 (12 299)	<i>0.85 (0.76 to 0.94)</i>
(75) Forestry and logging occupations	36 (1154)	0.93 (0.67 to 1.28)
(77) Mining and quarrying including oil and gas field occupations	54 (1870)	0.88 (0.67 to 1.14)
(81) Processing occupations	534 (13 894)	1.06 (0.97 to 1.15)
(82) Processing occupations	859 (20 697)	<b>1.09 (1.02 to 1.17)</b>
(83) Machining and related occupations	1177 (30 682)	<b>1.13 (1.06 to 1.20)</b>
(85) Product fabricating, assembling and repairing occupations	2140 (56 646)	<b>1.07 (1.03 to 1.12)</b>
(87) Construction trades occupations	1358 (49 560)	<i>0.82 (0.77 to 0.87)</i>
(91) Transport equipment operating occupations	1309 (40 639)	<i>0.93 (0.88 to 0.99)</i>
(93) Materials handling and related occupations NEC	908 (25 290)	1.03 (0.96 to 1.10)
(95) Other crafts and equipment operating occupations	157 (3668)	<b>1.19 (1.02 to 1.39)</b>
(99) Occupation not elsewhere classified	1303 (36 375)	1.01 (0.96 to 1.07)

Statistically significant ( $\alpha=0.05$ ) increased risks are bolded and statistically significant decreased risks are italicised.

\* (Canadian Standard Industry Classification-80) Industry Division Group.

† The risk of contact dermatitis in a particular group relative to all other workers in the cohort, adjusted for birth year and sex.

‡ (Canadian Classification Dictionary of Occupations 1971) Occupation Division Group. NEC, not elsewhere.

In ODSS, the increased dermatitis risk seen among workers in food and beverage industries, hairdressing and personal service occupations is likely due to exposure to wet-work. Wet-work is defined as activities where workers have to wash their hands >20 times per shift, immerse their hands in liquid for >2 hours per shift or wear waterproof gloves and is the main risk factor for irritant contact dermatitis.<sup>5</sup> Exposure to different chemicals, cleaning products and organic solvents may cause contact dermatitis among workers in these industries. Organic solvents have a wide variety of uses including painting, surface coating, dry cleaning, metal degreasing and cleansing.<sup>27</sup> Inhalation and skin exposure to solvents are known to cause many adverse health effects, including contact dermatitis which is reflected in the findings from OAsJEM.

Expected increases in risk, observed among workers in furniture and fixture industries, and metal machining occupations, is possibly due to chemical exposure or chronic mechanical/frictional trauma.<sup>28</sup> Friction damages the skin, localises lesions and facilitates entry of allergens and irritants into the skin.<sup>28</sup> Potent irritants and allergens including solvents, oils, metal-working

fluids and chlorinated agents are common workplace exposures that are known to cause dermatitis among workers in metal machining and fabrication occupations.<sup>29,30</sup> Additionally, results from the OAsJEM analysis identified increased risk of dermatitis among workers exposed to metal working fluids (MWF). MWF are widely used in manufacturing industries, particularly in metal machining, grinding and cutting operations.<sup>29</sup> According to the Health and Safety Executive of the UK, OCD is the most common type of disease caused by dermal exposure to MWF and is common among metalworkers.<sup>29</sup> Results from the OAsJEM also indicated workers with a high exposure to isocyanates had an increased risk of dermatitis, which is expected based on previous knowledge of the sensitising potency of isocyanates.<sup>30</sup> Isocyanates are used in foams, coatings and plastics, particularly polyurethane, which may explain the increased risk seen among workers in plastics fabricating and related materials.

Gathering descriptive epidemiological data on potential work-related diseases in the workforce is a fundamental feature of surveillance efforts and is necessary for planning prevention initiatives. One of the objectives of this analysis is to identify new

**Table 2** HRs and 95% CIs for dermatitis by selected industry groups

Industry (major, minor)*	Cases (workers)	HR (95% CI)†
(01) Experimental and institutional farms	224 (7959)	0.78 (0.69 to 0.89)
(011) Livestock and livestock combination farms	34 (1318)	0.72 (0.51 to 1.00)
(013) Field crop and field crop combination farms	16 (714)	0.67 (0.41 to 1.08)
(04) Forestry	28 (1302)	0.64 (0.44 to 0.92)
(031) Logging	26 (1172)	0.66 (0.45 to 0.96)
(09) Metal mines	37 (1357)	0.81 (0.59 to 1.12)
(10) Non-metal mines	6 (143)	1.28 (0.58 to 2.85)
(13) Services incidental to mining	16 (729)	0.67 (0.41 to 1.09)
(14) Food and beverage industries	612 (14 586)	<b>1.12 (1.03 to 1.21)</b>
(103) Fruit and vegetable processing	63 (1278)	<b>1.31 (1.02 to 1.67)</b>
(107) Bakery products	124 (2343)	<b>1.35 (1.14 to 1.62)</b>
(109) Beverage	72 (1790)	1.14 (0.90 to 1.44)
(16) Rubber and plastics products industries	334 (7755)	<b>1.15 (1.03 to 1.28)</b>
(165) Plastics fabricating	290 (6510)	<b>1.18 (1.05 to 1.32)</b>
(22) Furniture and fixture industries	202 (4719)	<b>1.21 (1.06 to 1.39)</b>
(264) Office furniture manufacturers	70 (1490)	<b>1.34 (1.06 to 1.69)</b>
(26) Metal fabricating industries	851 (22 430)	<b>1.10 (1.03 to 1.18)</b>
(302) Fabricated structural metal	58 (1563)	1.13 (0.87 to 1.46)
(305) Wire and wire products manufacturers	63 (1479)	1.17 (0.92 to 1.50)
(306) Hardware, tool and cutlery manufacturers	163 (3830)	<b>1.22 (1.05 to 1.43)</b>
(308) Machine shops	125 (3343)	1.12 (0.94 to 1.34)
(28) Transportation equipment industries	776 (19 138)	<b>1.11 (1.03 to 1.19)</b>
(321) Aircraft and aircraft parts manufacturers	39 (855)	1.32 (0.96 to 1.81)
(325) Motor vehicle parts and accessories manufacturers	492 (11 417)	<b>1.14 (1.05 to 1.25)</b>
(326) Railroad rolling stock industry	10 (262)	1.13 (0.61 to 2.11)
(31) Petroleum and coal products industries	8 (189)	1.24 (0.62 to 2.49)
(34) General contractors	470 (17 440)	0.80 (0.73 to 0.88)
(404) Building construction	247 (9621)	0.76 (0.67 to 0.86)
(406) Highway, bridge and street construction	104 (3562)	0.89 (0.73 to 1.08)
(50) Personal services	92 (2838)	0.78 (0.64 to 0.96)
(872) Barber and beauty shops	7 (72)	<b>2.18 (1.04 to 4.55)</b>
(873) Private households	46 (1204)	0.86 (0.65 to 1.15)
(874) Laundries, cleaners and pressers (except self-service)	32 (1281)	0.63 (0.45 to 0.89)

Statistically significant ( $\alpha=0.05$ ) increased risks are bolded and statistically significant decreased risks are italicised.

\***(Canadian Standard Industry Classification-80) Industry Major Group;** (Canadian Standard Industry Classification-80) Industry Minor Group.

†The risk of contact dermatitis in a particular group relative to all other workers in the cohort, adjusted for birth year and sex.

or unexpected groups demonstrating increased risk of dermatitis for further investigation or intervention. The ODSS generated unexpected increased risk of OCD among several groups, such as industries in electric power utility, electrical machinery, equipment and supplies, radio and television broadcasting as well as occupations in welfare and community services and attendants in sports and recreation. The previously unrecognised findings emphasise the importance of an ongoing system like ODSS to guide research, as well as prevention.

**Table 3** HRs and 95% CIs for dermatitis by selected occupation groups

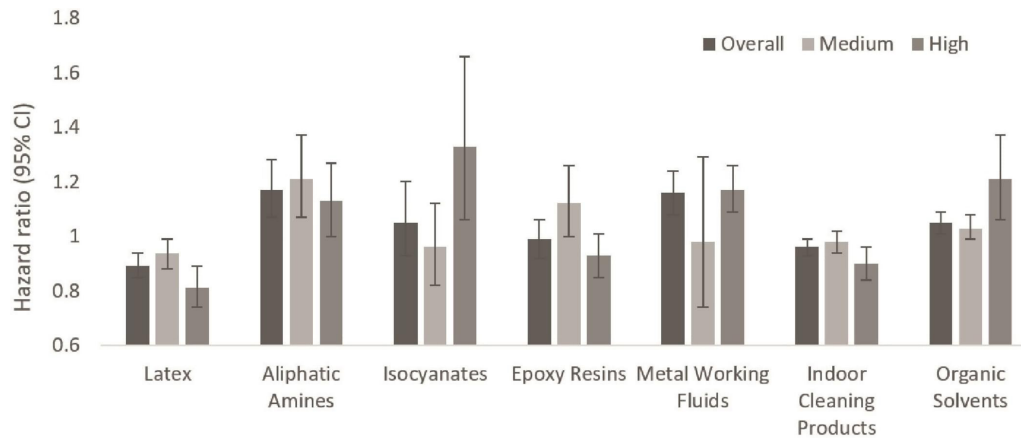
Occupation (major, minor)*	Cases (workers)	HR (95% CI)†
(313) Nursing therapy and related assisting occupations	1506 (37 585)	0.87 (0.82 to 0.92)
(3131) Nurses, registered, graduate and nurses-in-training	457 (12 011)	0.81 (0.74 to 0.89)
(3134) Nursing assistants	134 (4065)	0.71 (0.60 to 0.84)
(6143) Barbers, hairdressers and related occupations	25 (376)	<b>1.49 (1.00 to 2.20)</b>
(6191) Janitors, charworkers and cleaners	972 (24 942)	0.99 (0.92 to 1.05)
(7182/7195) Farm, nursery and related workers	306 (10 258)	0.85 (0.76 to 0.95)
(7182) Farm workers	98 (4200)	0.66 (0.54 to 0.80)
(816/817) Chemicals petroleum rubber plastic and related materials processing occupations	380 (8823)	<b>1.15 (1.03 to 1.27)</b>
(821/822) Food and beverage and related processing occupations	638 (14 678)	<b>1.12 (1.04 to 1.21)</b>
(8228) Occupations in labouring and other elemental work: food, beverage and related processing	342 (7192)	<b>1.21 (1.09 to 1.35)</b>
(831) Metal machining occupations	286 (6712)	<b>1.28 (1.14 to 1.43)</b>
(8311) Tool and die making occupations	74 (1814)	1.23 (0.98 to 1.54)
(8313) Machinist and machine tool setting-up occupations	117 (2710)	<b>1.29 (1.08 to 1.55)</b>
(8315) Machine tool operating occupations	84 (2009)	<b>1.24 (1.00 to 1.53)</b>
(854) Fabricating assembling and repairing occupations wood products	123 (3210)	1.13 (0.95 to 1.35)
(8541) Cabinet and wood furniture makers	78 (2005)	1.15 (0.92 to 1.43)
(859) Other product fabricating assembling and repairing occupations	469 (10 691)	<b>1.19 (1.09 to 1.31)</b>
(8595) Painting and decorating occupations, except construction	78 (1659)	<b>1.33 (1.07 to 1.67)</b>
(871) Excavating grading paving and related occupations	92 (3566)	0.77 (0.63 to 0.95)
(8710) Foremen: excavating, grading, paving and related occupations	10 (473)	0.64 (0.34 to 1.18)
(8711) Excavating, grading and related occupations	69 (2804)	0.74 (0.58 to 0.93)
(878/879) Other construction trades occupations	1010 (38 462)	0.79 (0.74 to 0.84)
(8780) Foremen: other construction trades occupations	34 (1569)	0.65 (0.47 to 0.91)
(8781) Carpenters and related occupations	136 (5715)	0.73 (0.62 to 0.86)
(8782) Brick and stone masons and tile setters	30 (1260)	0.73 (0.51 to 1.04)
(8783) Concrete finishing and related occupations	12 (527)	0.70 (0.40 to 1.23)
(8787) Roofing, waterproofing and related occupations	34 (1586)	0.67 (0.48 to 0.94)
(951) Printing and related occupations	100 (2413)	1.13 (0.93 to 1.37)
(9517) Bookbinders and related occupations	26 (565)	1.18 (0.81 to 1.74)
(9519) Printing and related occupations, NEC	26 (555)	1.24 (0.85 to 1.82)

Statistically significant ( $\alpha=0.05$ ) increased risks are bolded and statistically significant decreased risks are italicised.

\***(Canadian Classification Dictionary of Occupations 1971) Occupation Major Group;** (Canadian Classification Dictionary of Occupations 1971) Occupation Minor Group.

†The risk of contact dermatitis in a particular group relative to all other workers in the cohort, adjusted for birth year and sex.  
NEC, not elsewhere classified.

Prevalent cases were excluded to establish a disease-free cohort and the risk of dermatitis was analysed based on new-onset dermatitis. This is more likely to affect workers in high-risk occupations with frequent exposure to wet-work. For example, janitors, charworkers and cleaners are expected to be at high risk of OCD due to exposure to wet-work and cleaning products; however, results from ODSS and OAsJEM show a decreased risk among these workers and those who are exposed to indoor cleaning products. About 2500 dermatitis cases were identified among janitors, charworkers and cleaners; however, this was reduced to 972 cases after excluding prevalent cases, which only represent 38% of the original count. Analysing the



**Figure 2** Risk of dermatitis using occupational exposure information from the Occupational Asthma-specific Job Exposure Matrix.

risk of disease based on new-onset dermatitis, after excluding prevalent cases, certainly changes the interpretation of results in some well-established high-risk occupations. Decreased risks detected for farming and construction groups also differ from previous findings.<sup>31 32</sup> This may be due to job change when a worker is unable to perform current duties due to skin condition or the effect of ongoing prevention measures in these well-established high-risk occupations.

Although nurses have been previously identified to be at high risk of irritant contact dermatitis, primarily due to wet-work, this was not reflected in the ODSS findings. Results from OAsJEM also show a significant decreased risk of dermatitis among workers, such as nurses, exposed to latex, even though exposure to latex (in rubber gloves or footwear) is known to cause contact dermatitis.<sup>33</sup> This may be explained by the prevention measures put in place to reduce exposure to, and effects of, natural rubber latex in Western industrialised countries.<sup>33</sup> Although prevention measures, such as use of gloves or skin barrier creams in wet activities and hand alcohol instead of soap and water as disinfectant, have been promoted in healthcare, the prevalence of dermatitis among healthcare workers remains high.<sup>34 35</sup> The low risk of OCD among nurses could be explained by differential outcome misclassification because healthcare workers may not seek treatment for dermatitis, opting instead to self-manage until their skin condition resolves<sup>36</sup> and therefore not diagnosed with OCD by physicians.

### Limitations and strengths

Although occupation and industry information were collected, no lifetime work history or exposure assessment information was available. Hence, the main limitation of the study is the assignment of exposure at a single point in time, which would have introduced an element of exposure misclassification. Limiting to a 3-year time window for case ascertainment was intended to reduce this misclassification because it increases the likelihood that a worker held the job of record at the time of disease onset, which in turn increases the likelihood that dermatitis onset relates to exposures in that particular occupation. Another limitation of this study was the use of job title information as a surrogate of exposure. Applying the OAsJEM was intended to refine the exposure assessment. Although the OAsJEM performed well, assigned exposures may not be representative of skin exposure among exposed groups. For example, it fails to characterise the risk of dermatitis among workers exposed to wet-work. ODSS is unable to capture risk of disease among certain industries which are not covered by the WSIB including

self-employed individuals, the financial sector, the entertainment industry and some other industries. Because entry into the ODSS requires an accepted lost-time claim, workers from high hazard industries (industries with high incidence of preventable occupational injuries and illnesses, and workers' compensation claims) are over-represented in ODSS. For the purposes of occupational disease surveillance, this over-representation is acceptable because these high hazard industries are also at increased risk of exposure to chemical, biological and physical hazards that can result in occupational disease. The prevalence of 4.0% in this study is relatively low, which may be due to health-related help-seeking behaviour related to unawareness and avoidance.<sup>36</sup> Unlike other occupational diseases, workers with occupational skin disease may not seek medical help and choose to self-treat using over-the-counter medication, which under-represents occupational skin diseases in administrative data sources.

A strength of this study is that it uses a linkage-based approach with population level administrative data and compensation claims data to provide a large sample of male and female workers in Ontario, which allows for the examination of disease risks at detailed levels as 3-digit SIC and 4-digit CCDO codes, and stratification by sex. The data sources are relatively complete and cover the population comprehensively, which provide a practical and inexpensive means of data collection. WSIB captures and verifies the information on the claimant's occupational history during the adjudication process resulting in high data quality. This is an important advantage over other data sources (eg, Canadian Census) that rely on an individual's self-report of occupational information which is susceptible to error and lack detail, leading to misclassification that may bias surveillance results. The WSIB is estimated to cover 70%–75% of Ontario's working population; therefore, the ODSS results are generalisable to Ontario's general working population. Because the majority of compensation claims are for work-related injuries, ODSS results are most generalisable to high-hazard industries in Ontario, which are over-represented in this study cohort. These industries are also highly likely to be exposed to chemicals and other factors that increase the risk of OCD. Workers were compared with other workers in Ontario rather than the general population, which reduces the likelihood of the healthy worker effect. The ODSS cohort will continue to increase with future linkage updates. This will support the examination of trends over time that reflect changing workplace environments.

## CONCLUSION

This study shows that the usage of workers' compensation claims and administrative health databases is a valid and feasible approach for occupational disease surveillance. Expected associations between occupation, industry and dermatitis risk in many groups were identified. Some findings differed from earlier investigations, where increased risks were detected in several previously unrecognised groups and decreased risks were observed across some well-established high-risk groups. These new associations deserve further investigation and emphasise the importance of a surveillance system to guide research, as well as prevention, leading to better health and safety.

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