

A descriptive study of workers' compensation claims in Washington State orchards

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Background	Previous studies have reported high rates of occupational injury and illness among workers in the tree fruit industry. However, many common and preventable risk factors and conditions in orchards have not been investigated.
Aims	To identify and rank risk conditions leading to workers' compensation claims among orchard workers with respect to frequency, severity and cost.
Methods	State Fund workers' compensation claims between 1996 and 2001 for orchard workers in the main tree fruit growing region of Washington were reviewed and categorized according to cause of injury. Descriptive analyses were performed to characterize claims by cause of injury.
Results	Of the 13 068 claims in the dataset, 4020 (31%) were determined to be ladder-related injuries. Ladder-related claims accounted for nearly half (48%) of all 'compensable' claims (e.g. claims involving time loss, disability or 'loss of earning power' in addition to medical expenses). Claims related to ladders were not only the most frequent but also the most expensive collectively in terms of medical aid, time loss and other costs. On a per-claim basis, ladder-related injuries were among the most severe and costly reported injuries. Other common causes of injury among claims were branches and vegetation, structure and material and ground-related injuries.
Conclusions	There is a strong and compelling need to develop interventions to reduce the number of ladder-related injuries in orchards.
Key words	Accidents; occupational; agriculture; industrial insurance; ladder injuries; orchards; tree fruit industry; Washington/epidemiology; workers' compensation.

Introduction

Washington is one of the most productive agricultural states in the United States. In 2002, Washington was the nation's leading producer of apples, sweet and tart cherries and pears, and was one of the top producing states for apricots, plums and peaches [1]. Each year agricultural production and related services in Washington account for \$28 billion, and ~170 000 workers are employed in agriculture [2,3]. The tree fruit industry is by far the largest sector of agricultural employment in Washington; over one-third of all agricultural jobs in 2002 involved deciduous tree fruit work [3].

High rates of injury and illness in agriculture have been well documented. The occupational fatality rate among agricultural workers of 22.7 deaths per 100 000 employed in 2002 was second only to the mining industry [4].

Non-fatal injuries are also common in agricultural work [5–8]. Orchard work is particularly hazardous; a 1991 study by the Washington State Department of Labor & Industries (L&I) found that orchard work accounted for ~40% of all claims in Washington's agricultural industry [9]. Despite recognition of high rates of injury and illness among farm workers in general [5–7], and orchard workers in particular [9–13], relatively little information on risk conditions and causes of injury among orchard workers is available.

Previous studies have used Washington State workers' compensation claims data to analyze work-related injuries and illnesses [7,9,14–19]. Each year, L&I manages ~180 000 workers' compensation claims for all industries in Washington State [20]. Approximately two-thirds of all full- and part-time non-federal workers in Washington State are covered by L&I's State Fund industrial insurance program. In addition to this program, L&I also oversees self-insurance programs, which are typically utilized by businesses with a large number of employees.

The goal of this study was to identify and rank risk conditions leading to workers' compensation claims among orchard workers with respect to frequency, severity and

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cost. This study is part of the Orchard Injury Project, a National Institute for Occupational Safety and Health (NIOSH)-funded effort to identify and address risk factors for injury and illness among orchard workers. In addition to analyzing workers' compensation data, investigators with the Orchard Injury Project have conducted worker surveys and key informant interviews [12,13]. By triangulating between analyses of quantitative and qualitative information, we will develop a comprehensive picture of occupational hazards in the tree fruit industry.

Methods

This is a descriptive study of workers' compensation claims filed in the main tree fruit growing region of Washington State (Region 5) for injuries that occurred in orchards between 1996 and 2001. The primary source

of data for this study was L&I's computerized workers' compensation claims database. The database includes information about the claimant, employer, source and nature of the occupational injury or illness, claim status and costs associated with the claim. L&I collects most of this information from the 'Washington State Fund Report of Industrial Injury or Occupational Disease', a document with sections that are completed by the claimant, physician and employer.

Data were extracted from the L&I database on 27 March 2003. The process by which claims were selected for analysis and classified by cause of injury is summarized in Figure 1. Claims for injuries that occurred between 1 January 1996 and 31 December 2001 were included in the study. We excluded claims from 2002 because workers have 1 year from the date of the injury to file claims; therefore it is likely that not all claims for the year 2002 would have been reported at the time of data extraction. The study sample consisted of all Region

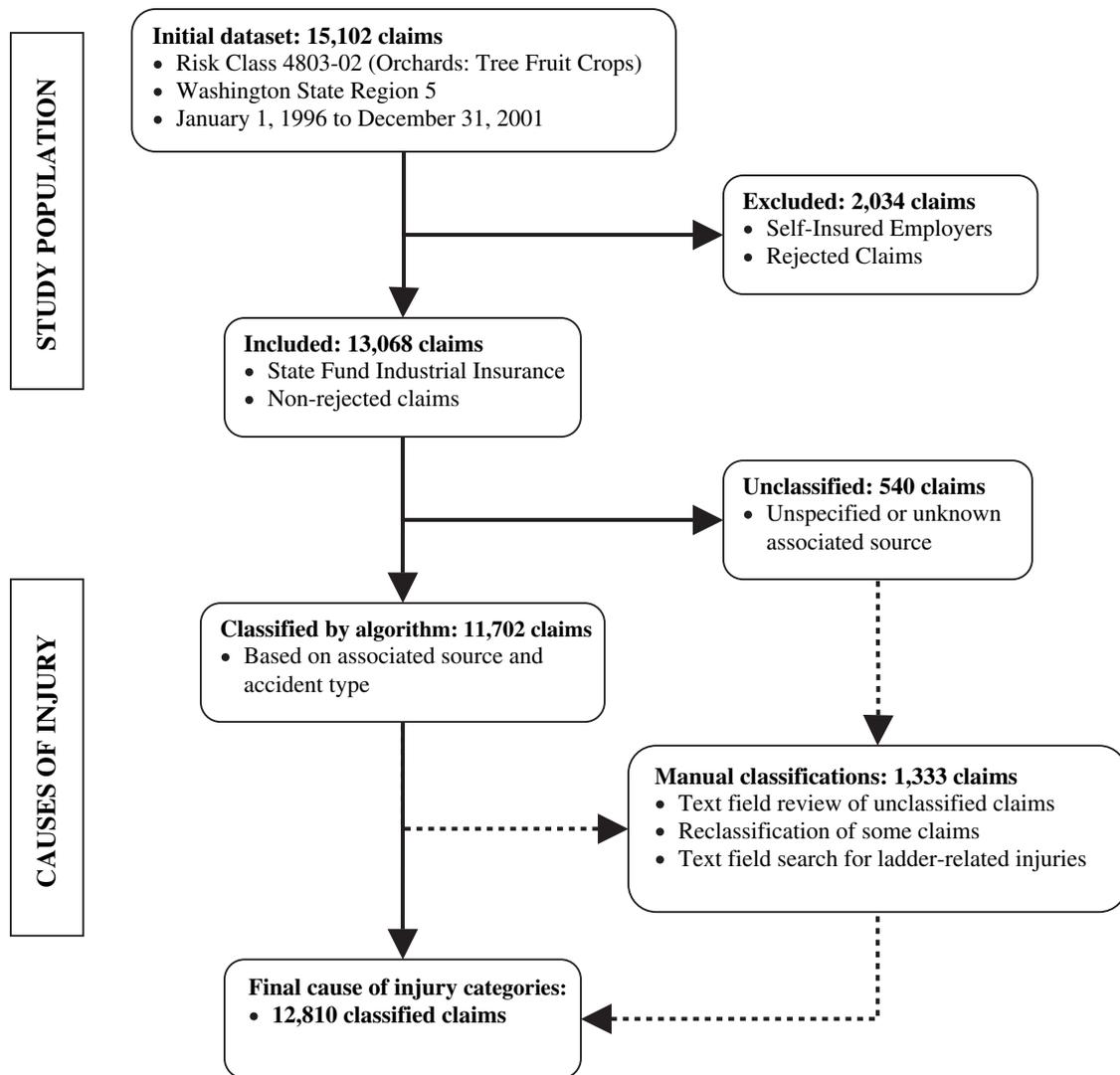


Figure 1. Procedures for selection of study population and classification of causes of injury.

5 claims that were (i) classified as Risk Class 4803-02 (Orchards: Fruit Tree Crops), (ii) covered by the State Fund industrial insurance program and (iii) not rejected by L&I. Approximately 97% of the total acreage of orchards in Washington State is located within Region 5 [21]. Risk classifications describe specific industrial sectors and are assigned by policy managers in L&I's Employer Services Section. In this study, we used the Risk Class for 'Orchards: Fruit Tree Crops' to identify both orchard worker claims and full-time equivalent (FTE) employment data. Claims covered by self-insurance programs were excluded from the final dataset because of differences in reporting requirements for self-insured employers. Claims are rejected if the claims manager at L&I determines that the injury or illness was not work-related and that determination is not overturned on appeal. We excluded rejected claims to ensure that this study was limited to occupational injuries or illnesses. A small proportion of claims (2%) were still open at the time of data extraction; these claims were included in the dataset. In Washington State, workers' compensation claims remain open until they have been paid out in full; a claim's designation as open or closed is distinct from its status as accepted or rejected.

All claims were classified by cause of injury using algorithms based on American National Standards Institute (ANSI) Z16.2 codes for 'associated source' and 'accident type'. Accident type describes the action leading to the occurrence of an injury (e.g. fall from ladder, overexertion). Associated source refers to the object, equipment or agent that was related to the injury (e.g. tractor, insecticide). After attempting to categorize all claims by algorithm, some claims (10%) were manually classified based on a review of short text descriptions of the accident, the nature of the injury and the body part injured. The combined use of algorithms and manual classifications helped ensure that claims were assigned to the appropriate cause of injury categories. Claims were manually classified if they were (i) not classifiable based on the algorithms, (ii) systematically misclassified by the algorithms or (iii) related to ladders but assigned to other categories by the algorithms. Particular emphasis was placed on classification of claims in the ladder category to facilitate sub-analyses of the aetiology of ladder-related injuries. Only a small proportion of claims that were assigned to other categories by algorithm were re-assigned to the ladder category (1%, $n = 158$); rankings of other cause of injury categories by claim frequency were not affected by these reassignments. Consequently, the degree of bias attributable to this differential classification of ladder claims is minimal.

Statistical analyses were performed using Intercooled Stata 7.0 [22]. Claim incidence rates by cause of injury were calculated based on the number of FTE workers in Risk Class 4803-02 in Washington State as reported to L&I by State Fund employers. L&I derived FTEs by

dividing reported work hours by 2000 (40 h/week, 50 weeks/year). The amount of lost work time for each claim was estimated by L&I based on time loss compensation; in this study, we conducted analyses using estimated time loss as a proxy measure of injury severity. We also investigated the costs of claims in each cause of injury category. Claim expenses are reported for total estimated costs, and also separately for medical compensation and time loss payments.

Because compensable claims are generally more severe and costly than non-compensable claims, we stratified by compensation status in some analyses. A claim is classified as compensable by L&I if the worker sustains an injury resulting in time loss, disability or 'loss of earning power' in addition to medical care. Compensable claims include payment for these consequences of the injury in addition to paying medical expenses. A claim is classified as non-compensable by L&I if the injured worker receives medical attention, but the injury does not result in any time loss, disability or loss of earning power. Non-compensable claims only include payment for medical expenses. In this study, claims classified by L&I as compensable, 'kept on salary', 'total permanent disability' and 'loss of earning power' were considered to be compensable claims. Occupational fatalities were not included as either compensable or non-compensable claims in these analyses.

All financial compensation data are based on case reserve estimates; these estimates account for future expenses associated with claims that were still open at the time of data extraction. For closed claims, costs are equal to the amount paid. Medical costs were not adjusted for inflation between 1996 and 2001.

Results

A total of 13 068 non-rejected, State Fund claims were reported among orchard workers in Region 5 between 1996 and 2001. Prior to analysis, there were 1375 (9%) rejected claims and 773 (5%) self-insured claims excluded from this study (114 claims were both rejected and self-insured). Most claimants in this study were male (84%), and the mean age among claimants was ~35 years (Table 1).

The average annual claim incidence rate was 97.8 per 1000 FTEs; ~1 in 10 orchard workers filed a claim each year (Table 2). On average, the claim incidence rate decreased by 3.6% per year over the 6-year study period ($P < 0.001$, test for trend). Nearly one-third of all claims ($n = 4020$) were ladder-related injuries (Table 3). Trees, branches and vegetation were the next most frequent cause of injury ($n = 1674$). Over half of the claims related to trees, branches or vegetation were eye injuries (56%, $n = 944$). Non-powered tools were also a common cause of injury ($n = 904$); almost half of the claims in this category were caused by pruning shears (50%, $n = 448$).

Table 1. Demographic characteristics of claimants and frequencies by claim status and season of injury ($n = 13\,068$)

Variable	<i>n</i>	%
Sex		
Male	11 002	84.2
Female	2064	15.8
Not reported	2	0.02
Age (years)		
<20	713	5.5
20–29	4261	32.6
30–39	3710	28.4
40–49	2467	18.9
50–59	1174	9.0
≥60	529	4.0
Unknown	214	1.6
Claim status		
Non-compensable ^a	9823	75.2
Compensable ^{b,c}	3057	23.4
Kept on salary ^c	139	1.1
Total permanent disability ^c	26	0.2
Fatal	15	0.1
Not yet allowed	5	<0.1
Loss of earning power ^c	3	<0.1
Season of injury		
January–March	2464	18.9
April–June	3103	23.8
July–September	4652	35.6
October–December	2849	21.8

^aA claim is classified as non-compensable by L&I if the injured worker is compensated for medical expenses but the injury does not result in any time loss, disability or loss of earning power.

^bA claim is classified as compensable by L&I if the worker sustains an injury resulting in time loss, disability or loss of earning power in addition to medical care.

^cClaims assigned to these categories by L&I were included as compensable claims for all analyses in this study.

Table 2. Annual frequencies and incidence rates for all non-rejected, State Fund claims among orchard workers in the main tree fruit growing region of Washington State, 1996–2001

Year	<i>n</i> (%)	Incidence ^{a,b}
1996	2325 (18)	105.0
1997	2393 (18)	104.2
1998	2515 (19)	100.6
1999	2065 (16)	96.4
2000	2076 (16)	94.6
2001	1694 (13)	86.2
Total	13 068	97.8 ^c

^aPer 1000 FTEs.

^bTrend in annual incidence rates was statistically significant ($P < 0.001$).

^cThis is the average annual claim incidence rate.

The total cost of claims filed with State Fund employers in the Region 5 tree fruit industry was an estimated \$50.5 million over the 6-year study period, or ~\$8.4 million per year (Table 4). The median cost per claim

Table 3. Claim frequencies and incidence rates by cause of injury among orchard workers in the main tree fruit growing region of Washington State, 1996–2001

Cause of injury	<i>n</i> (%)	Incidence ^a
Ladders	4020 (31)	30.20
Vegetation, trees, branches	1674 (13)	12.57
Non-powered tools	904 (7)	6.79
Structure, material	891 (7)	6.69
Particles	862 (7)	6.47
Tractors, machinery	806 (6)	6.05
Ground	730 (6)	5.48
Motor vehicles	603 (5)	4.53
Toxics	484 (4)	3.64
Other musculoskeletal injuries	376 (3)	2.82
Carried containers	285 (2)	2.14
Large containers	264 (2)	1.98
Insects, animals	228 (2)	1.71
Powered tools	137 (1)	1.03
Violence	12 (0)	0.09
Others	534 (4)	4.01
Not specified	258 (2)	1.94
Total	13 068	98.16

^aPer 1000 FTE years.

was higher for compensable claims (which includes claims classified as kept on salary, total permanent disability and loss of earning power) than for non-compensable claims (\$2544 versus \$218). Although only 25% of claims were considered to be compensable in this study ($n = 3225$), these claims account for 88% of the total estimated cost of all claims in the dataset. Almost half of the compensable claims were related to ladders (48%, $n = 1549$). Ladder-related claims were significantly more likely to be compensable than other claims in the dataset ($P < 0.001$, chi-square test). Ground-related injuries (e.g. trips and falls resulting in sprains or strains), motor vehicle injuries and other musculoskeletal injuries also had a high proportion of compensable claims (38, 33 and 33%, respectively). Although eye injuries were fairly common ($n = 1832$), only 2.3% of these claims were compensable. The combined estimated cost of claims for eye injuries was just >\$600 000 for the 6-year study period (results not shown).

Claims with time loss were analyzed separately. A median of ~7 weeks of work missed was observed among the 2915 claims with estimated time loss information. Claimants with motor vehicle-related injuries or ground-related injuries had a median of nearly 3 months of time loss. Ladder-related injuries were the third highest category in terms of missed work (~10 weeks), followed by injuries caused by tractors or machinery (~9 weeks).

Ladder-related claims were far more expensive than any other category, with an average annual cost of \$3.6 million. Sprains and strains were the most common type of ladder-related injury (38%, $n = 1511$) (Table 5). However, fractures and dislocations were the most costly,

Table 4. Estimated costs by cause of injury for claims among orchard workers in the main tree fruit growing region of Washington State, 1996–2001^{a,b}

Cause	All claims ^c			Compensable claims ^d			Non-compensable claims		
	<i>n</i>	Median (\$)	Combined cost (\$)	<i>n</i> (%) ^e	Median (\$)	Combined cost (\$)	<i>n</i> (%) ^e	Median (\$)	Combined cost (\$)
Ladders	4020	392	21 513 311	1549 (39)	2684	20 343 931	2471 (62)	246	1 169 381
Vegetation, trees, branches	1674	191	2 107 512	146 (9)	1296	1 656 475	1528 (91)	175	451 037
Non-powered tools	904	255	1 540 314	137 (15)	1440	1 228 531	767 (85)	234	311 783
Structure, material	891	232	2 940 332	139 (16)	2759	2 593 379	751 (84)	202	338 880
Particles	862	167	212 295	18 (2)	473	30 631	844 (98)	169	181 664
Tractors, machinery	806	344	4 623 301	196 (24)	4159	4 275 697	608 (75)	253	323 065
Ground	730	456	4 280 455	275 (38)	2880	4 029 960	455 (62)	262	250 495
Motor vehicles	603	534	4 539 649	199 (33)	4490	3 315 342	398 (66)	321	282 722
Toxics	484	153	238 978	23 (5)	1748	1 074 415	460 (95)	142	131 346
Other musculoskeletal injuries	376	337	1 350 586	124 (33)	1095	1 200 352	252 (67)	260	150 234
Carried containers	285	383	841 688	89 (31)	1380	697 574	196 (69)	264	144 114
Large containers	264	313	1 423 750	68 (26)	3071	1 334 566	196 (74)	248	89 184
Insects, animals	228	150	86 640	15 (6)	521	30 864	213 (93)	145	55 777
Powered tools	137	370	252 105	27 (20)	1384	205 141	110 (80)	290	46 964
Violence	12	581	423 024	1 (8)	n/a	2700	7 (58)	189	1983
Others	534	383	3 594 093	170 (32)	4762	2 964 265	358 (67)	238	455 093
Not specified	258	230	529 562	49 (19)	2710	463 472	209 (81)	206	66 090
Total	13 068	282	50 497 601	3225 (25)	2544	44 480 297	9823 (75)	218	4 449 812

^aResults are reported for all claims combined and separately by compensation status ‘within each cause of injury category’.

^bAll costs are reported in US dollars and have not been adjusted for inflation between 1996 and 2001.

^cIn addition to compensable and non-compensable claims, this category also includes claims for fatalities and claims that were classified by L&I as ‘not yet allowed’. Consequently, totals may be higher than the sum of compensable and non-compensable claims for some causes of injury.

^dIncludes claims classified by L&I as kept on salary, total permanent disability and loss of earning power.

^eThese percentages describe the proportion of claims within each cause of injury category that were classified as compensable or non-compensable.

Table 5. Characteristics of ladder-related claims among orchard workers in the main tree fruit growing region of Washington State, 1996–2001

Injury nature	<i>n</i> (%) ^a	Compensable ^b (%) ^c	Median cost (\$) ^d	Total cost (\$) ^d
Sprains, strains	1511 (38)	549 (36)	365	5 873 934
Contusions	1051 (26)	228 (22)	263	3 057 610
Fractures, dislocations	495 (12)	422 (85)	4619	7 913 456
Multiple injuries	299 (7)	130 (44)	553	2 035 487
Cuts, scratches	240 (6)	43 (18)	283	306 054
Others	81 (2)	22 (27)	556	336 570
Ill-defined	343 (9)	155 (45)	449	1 990 201
Total	4020	1549 (39)	392	21 513 312

^aThese percentages describe the proportion of all ladder-related claims that are attributable to each nature of injury category.

^bIncludes claims classified by L&I as kept on salary, total permanent disability, and loss of earning power.

^cThese percentages describe the proportion of ladder-related claims within each nature of injury category that were classified as compensable.

^dFor ladder-related claims by nature of injury category, reported in US dollars without adjustment for inflation between 1996 and 2001.

both as a group (\$7.9 million total) and on a per-claim basis (median = \$4619). Text descriptions on the workers’ compensation claim forms provide information on the nature of some accidents and injuries. Based on a qualitative review of text fields for ladder claims, we found

that some ladder-related injuries resulted from (i) unstable placement of the ladder on a slope, (ii) overextension causing loss of balance, (iii) being struck by a ladder that fell over onto the worker and (iv) slipping on the ground or on discarded fruit while descending from the ladder.

Discussion

Workers' compensation data in Washington State have been successfully used for surveillance of work-related injuries and illnesses in previous studies [7,9,14–19]. As with previous studies among agricultural workers in Washington State [7,9] and in California [6], we observed a wide variety of types of injuries and similarly found that sprains and strains were the most common type of injury (results not shown) [7,9]. Our findings support the argument that orchard workers are exposed to a diverse assortment of occupational hazards [23].

Unlike previous studies of workers' compensation claims among agricultural workers, in this analysis we were able to restrict enrollment to only include orchard workers. This is a strength of the study because it allowed us to investigate workplace hazards that are particular to the tree fruit industry and may differ from risk factors in other agricultural settings. Also, in this investigation we were able to explore the underlying mechanism that caused each injury, whereas previous studies have reported claim frequencies in terms of the type of injury or illness that was sustained.

Another strength of this study is that it allowed us to provide quantitative evidence that ladder-related injuries are frequent in the tree fruit industry, and that these injuries appear to be particularly severe and costly relative to other causes of injury or illness in orchards. We found that ladder-related claims were the most frequent, severe and costly injuries in terms of the total number of claims filed, total workdays missed and total expenses incurred. Within the dataset, almost half of the compensable claims (e.g. severe injuries involving time loss, disability or other costs in addition to medical expenses) were related to ladders. On a per-claim basis, ladder claims were among the most severe and costly reported injuries in terms of median expenses incurred and lost work time.

Although not as frequent as ladder-related claims, a high rate of claims for injuries caused by contact with branches or vegetation was also observed in this study. Many of the vegetation claims were eye injuries. Although relatively frequent, eye injuries were less severe (in terms of time loss, cost and compensation status) than other kinds of injuries. A unique aspect of eye injuries is that corneal abrasions—a common minor eye injury—typically heal within 24–48 h [24]. Time loss payments in most workers' compensation systems usually begin after a minimum threshold of lost work time (>3 days in Washington). Thus, the major cost of a large number of eye injuries is borne by the temporarily disabled worker who may miss several days of work, but will rarely receive time loss payment. Eye injuries are easily preventable with safety glasses; interventions among orchard workers have led to reductions in the number of reported eye injuries in recent years [25].

The data utilized in this study were collected and maintained for industrial insurance purposes rather than

for epidemiologic surveillance. Consequently, claims data may not be representative of all injuries that occur in orchards. Any work-related injuries or illnesses not reported to L&I would have been missed in this study, and therefore our results probably underestimate the true burden of injury and illness among orchard workers. The magnitude of under-reporting to L&I is unknown. However, several barriers to reporting injuries have been previously identified, including (i) fear of employer retribution; (ii) lack of recognition of occupational injuries and illnesses by physicians, workers and employers; (iii) undocumented worker status and fear of deportation; (iv) administrative barriers and (v) alternate medical insurance providers [18,26]. It is also possible that FTEs are under-reported to L&I. Low FTEs would produce claim incidence rates that are arbitrarily high. As with injuries, the degree of potential under-reporting for FTEs in this study is unknown.

The completeness and accuracy of the data were a concern for some variables. In a separate analysis, Snyder *et al.* [13] found that there may have been data errors for some claims. Additionally, some fields taken from the claim form (e.g. marital status, number of dependents) were often incomplete. These fields were not critical to our analyses; reporting was more complete for other fields of greater interest such as gender, date of injury and financial compensation for claims. Incomplete coding of the source and nature of injury limited our ability to classify all claims in the dataset by cause of injury. However, after reviewing the text fields and classifying claims manually, we were able to assign a cause of injury for all but a small proportion of claims (2%).

The exclusion of self-insured employers limits our ability to generalize these results to all Washington State orchards. Self-insurance programs are generally utilized by large employers, and risk conditions may be different between small and large agricultural operations. Excluding rejected claims may also have affected the results of this study. Differences in the proportion of rejected claims in each cause of injury category were observed. Approximately 43% of claims related to exposure to toxics were rejected, whereas the proportion of rejected claims for the dataset as a whole was only 9% (results not shown). Consequently, the frequency and incidence of injuries associated with particular exposures—such as pesticides and other toxicants—may be underestimated in this study.

Although it is likely that many injuries in orchards are caused by multiple exposures or risk conditions, cause of injury categories was mutually exclusive. Since the ANSI Z16.2 coding system used by L&I only assigned one associated source and accident type value per claim, it would have been very difficult to characterize multifactorial injuries using workers' compensation data.

In this study, common causes of injury were identified and descriptive analyses of the frequency, severity and cost of these injuries were conducted. Causes of injury

in orchards were evaluated to prioritize remedial actions. In terms of the frequency, severity and cost of work-related injuries in orchards, ladder accidents emerged as an important issue. The results of this analysis demonstrate a strong and compelling need to develop interventions to prevent ladder-related injuries in orchards.

Future studies using workers' compensation data would benefit from further development of the methodology for categorizing causes of injury. Analyses of the reliability of workers' compensation data could also be conducted to better understand its strengths and limitations.

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Conflicts of interest

The authors declare that they have no competing financial interests.

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