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Work-Related Injuries in Drywall Installation

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Administrative data sources were used to describe the work-related injuries of drywall carpenters, to calculate rates of occurrence, and to explore high risk sub-groups. Health insurance eligibility files were used to identify a cohort of active union carpenters affiliated with a union local whose predominant work involved drywall installation in the state of Washington. These files contained the hours worked by each individual for each month between January 1989 and December 1995, providing person-hours at risk as a union carpenter. The Washington Department of Labor and Industries (L&I) provided records of workers' compensation claims filed by these individuals. Over seven years 1773 drywall carpenters filed 2567 workers' compensation claims representing an overall rate of 53.3 per 200,000 hours worked. These claims were filed by 1046 different individuals, or 59.0 percent of the cohort. Claims resulting in paid lost time from work were filed at a rate of 12.5 per 200,000 hours worked (n = 609) by 445 (25.1%) different individuals. The most common mechanisms of injury involved being struck (38.3%), overexertion (28.1%), and falls (13.2%). Struck by injuries most commonly involved cuts to the upper extremity. Overexertion injuries were most commonly described as sprains or strains involving the back. Sheetrock was associated with over 40 percent of these injuries. Falls most commonly involved injuries to the knee followed by the back and multiple injuries. Struck by injuries decreased steadily with increasing age and increasing time in the union. There was a steady increase in the rate of falls with increasing age. Overexertion injuries were responsible for the greatest proportion of costs for medical care, permanent impairment, and paid lost days. The high rates of overexertion injuries among these workers is consistent with known ergonomic stresses on drywall jobs. However, these workers are also at high risk of acute traumatic injuries.

Keywords Construction Workers, Injury, Sheetrock, Falls, Overexertion, Struck, Cohort Studies, Surveillance

Construction workers have higher rates of nonfatal injuries than other U.S. workers,[1] and they are also among the most likely workers to experience serious occupational injuries.[2] Fatal and lost work time injuries in the construction trades continue to rank among the highest in the United States.[3–6] Although there are few sources of information specific to drywall work, there are data suggesting that these individuals may be a high-risk group for injuries, including disabling events, within the construction trades. Practical problems which make the study of construction workers and their safety and health hazards difficult are especially salient when considering those who do drywall work. This is a very mobile workforce with individuals frequently changing job sites and employers. On residential drywall projects particularly, sites are typically small with few workers at any given site.

Based on analyses of Bureau of Labor Statistics (BLS) data, rates of traumatic injury resulting in days away from work have been reported to be higher among drywall workers than for all construction workers combined.[7] Analyses of workers' compensation claims of musculoskeletal injuries and disorders among union carpenters in Washington State revealed that carpenters affiliated with a union local doing predominantly drywall work had rates of injuries to the axial skeleton (back sprains, back and neck sprains, and back ill-defined conditions) that were twice as high as those of their union counterparts doing heavy or light commercial carpentry work or pile driving. These individuals also had higher rates of sprains to the shoulder, forearm, knee, and ankle than other union carpenters.[8]

The high rates of musculoskeletal injuries among drywall carpenters are not surprising. They have exposures[9] to recognized occupational risk factors for back disorders—heavy work, materials handling, pushing, twisting, frequent lifting over 25 pounds

(4 ft × 8 ft sheetrock = 80 lbs), and awkward postures.[10–14] The heavy weight and bulky size of drywall sheets present ergonomic risk for injuries to multiple body parts.[9] Physical demands on these workers are increasing as the use of heavier and bulkier materials increases, such as 12-foot sheets of drywall with weights in excess of 100 pounds per sheet.

To describe the work-related injuries of drywall carpenters, to calculate rates of occurrence, and to explore high-risk subgroups, a historical cohort of union drywall carpenters was identified and their workers' compensation claims were analyzed for the years 1989–1995.

METHODS

Data Sources and Linkage

Health insurance eligibility files from the Carpenters Trusts of Western Washington were used to identify a cohort of active union carpenters affiliated with a union local whose predominant work involved drywall installation. Each of these individuals worked at least three months of union hours between 1989 and 1995. These files contained the hours worked by each individual for each month between January 1989 and December 1995, providing person-hours at risk as a union carpenter. The Washington State and the national union membership files of the United Brotherhood of Carpenters and Joiners of North America (UBC) provided dates of birth, gender, and earliest date of union activity for cohort members. No race information was available from these sources.

The Washington State Department of Labor and Industries (L&I) provided records of workers' compensation claims filed by these individuals during this time period, including medical-only claims as well as those which resulted in lost work time. The compensation claims data included the date of injury, American National Standards Institute (ANSI) codes describing the events in terms of body part injured, the nature of the injury, the type of event causing the injury, and the source of the injury as recorded on the first report of injury. Because Washington is one of six states with state-administered workers' compensation programs, the Department of Labor and Industries was also able to provide not only the amount of lost work time associated with each injury but also the costs associated with lost time and medical care.

A unique identifier was assigned to each individual by the Carpenters Trusts of Western Washington. Data from all sources were provided with this identifier to allow linkage of data on an individual level.

Events of Interest and Time at Risk

Only events which occurred in a month that the individual worked union hours were counted so that events and time at risk were counted on the same basis for rate calculations. Initially, we included all claims filed by these workers, excluding claims which were rejected for workers' compensation coverage. Later analyses were limited to events which resulted in paid lost time from work and events that resulted in loss of time from work of more than three months.

Person-hours of work as a union carpenter were used as the measurement of time at risk. The individual was considered to be at risk of filing a claim at any time he or she was working union hours. The occurrence of one injury did not remove the worker from the risk set for a new event as long as he or she was still working. Although person-hours are used as the measurement of time at risk, the person-month is effectively the unit of analysis since we do not know when the hours in any given month were accumulated. All hours in months in which an injury occurred were counted as time at risk for that injury.

ANALYSES

Using these data, descriptive statistics were generated on age, gender, time in the union, and hours worked. The sum of hours worked by the entire group was calculated by adding all hours worked over the seven-year period. The sum of hours worked was calculated by five-year age groups and time in the union in two-year increments. Age and time in the union were both treated as time-varying variables with time at risk accumulating in the appropriate strata over the seven-year period. Crude and stratified incidence density rates were calculated per 200,000 hours worked.

For the most prevalent injury mechanisms, time at risk and events were stratified by categories of age and time in the union for multivariate analyses using Poisson regression. A popular application of Poisson regression is the modeling of failure rates for different subgroups within the population under study. The effect measure in these analyses is the rate ratio.[15] In this case, it was used to determine whether rates of the most common types of injuries among these workers were significantly different across strata of age and time in the union. This technique is particularly useful in the analyses of longitudinal data for a dynamic cohort, such as this one, because it allows maximal use of available data for each individual.[16]

Costs associated with these compensation claims for medical care, paid lost time, and permanent impairment were calculated and compared for the most common mechanisms of injury, as were number of days paid. All descriptive analyses and data stratification were done using SAS [SAS Version 6.12].[17] Poisson regression was done using EGRET.[18]

RESULTS

Description of the Cohort and Hours Worked

From the union eligibility files, 1773 carpenters were identified who were affiliated with a union local whose predominant work involved drywall installation between 1989 and 1995. Union carpenters hang drywall but do not perform drywall finishing tasks such as taping, plastering, or sanding. There were only 11 females (0.6%) in the cohort. Because of the small number of women in the cohort, no gender-specific analyses were

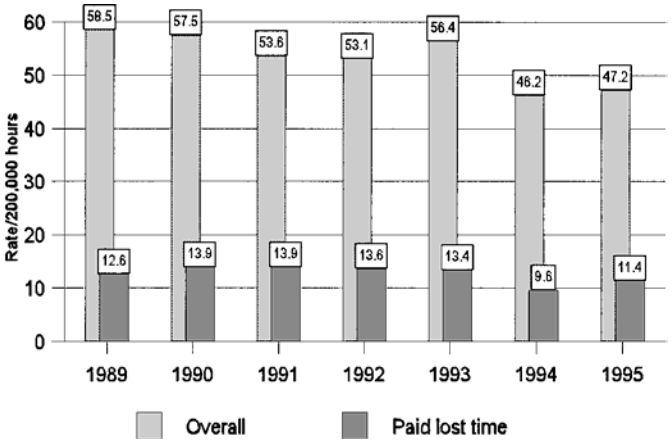

FIGURE 1
Claim rates among union carpenter drywall installers in Washington State by year, 1989–1995.

performed. Age at entry into the study cohort (not union initiation) ranged from 18 to 66 years of age, with a mean of 32 years and a median of 31 years. Seventy-five percent of the cohort were 37 years old or younger. Time in the union ranged from less than one year to 42 years. Mean time in the union was seven years, median was two years, and 75 percent had been in the union 12 years or less.

Over this seven-year period of time the cohort worked a total of 9,631,822 hours. Hours worked per person ranged from 66 to 16,033. The mean number of hours worked per month after entry into the cohort was 129 hours and ranged from 22 hours to 246 hours, representing a mean of 1548 hours per year.

Claims Filed for Work-Related Injuries and Disorders

Over this seven-year period of time, the cohort filed 2567 workers' compensation claims representing a crude rate of 53.3 per 200,000 hours worked. These claims were filed by 1046 different individuals, or 59.0 percent of the cohort. All but 57 of these claims were medical or paid lost time claims. Claims resulting in paid lost time from work, which occurs after the third lost day in Washington, were filed at a rate of 12.5 per 200,000 hours worked (n = 609). The paid lost time claims were filed by 445 (25.1%) different individuals (see Figure 1 for rates by year). Two-hundred thirty (230) claims resulted in three months or more of paid lost time. These more serious claims were filed by 203 different individuals or 11.5 percent of the cohort.

The overall rates at which claims were filed decreased steadily with increasing age (Figure 2A). Individuals under the age of 20 filed claims at a rate of 92.1 per 200,000 hours worked. Although those under the age of 20 also had the highest rate of claims resulting in paid lost time from work, there is not the consistent decline in paid lost time claims with increasing age. The more serious events which resulted in prolonged loss of time from work were lowest among the oldest age group (e.g., over age 60) and among those under age 20 (Figure 2B).

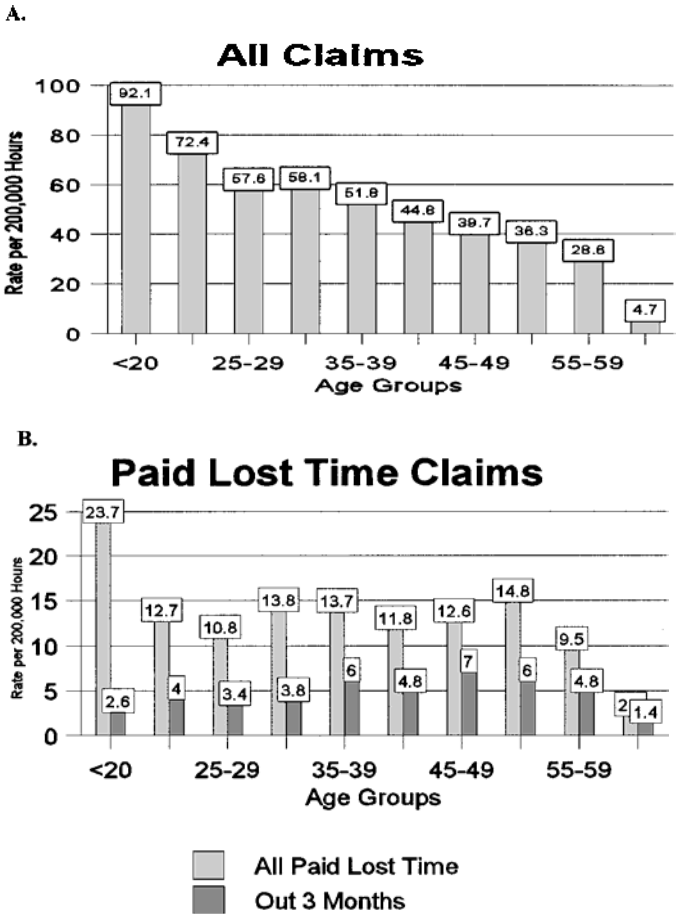

FIGURE 2
Age-specific claims rates among union drywall installers, Washington State 1989–1995: A. All claims, B. Paid lost time claims.

In Figures 3A and 3B the rates of claims are presented by time in the union. There is a decline overall in claim rates after four years of union membership, but this pattern is not seen for paid lost time claims and claims resulting in prolonged loss of time from work.

ANSI Code Descriptions of Claims

The frequencies and the rates of filing claims are presented in Table I by body part injured, nature of injury, type (mechanism), and source for all claims filed and for those that resulted in paid lost time. Overall, the most frequent body parts injured were the back, fingers, and eyes. Back injuries were also the most common body part injured in claims that resulted in paid lost time, but the back accounted for a greater percentage of the more serious events (29.1% vs. 17.1%). Eye injuries rarely resulted in paid lost time. Injuries involving the knees, fingers, wrists, and shoulders were responsible for greater proportions of the paid lost time claims.

Overall and for claims resulting in paid lost time, the nature of the injuries were most commonly described as sprains and cuts.

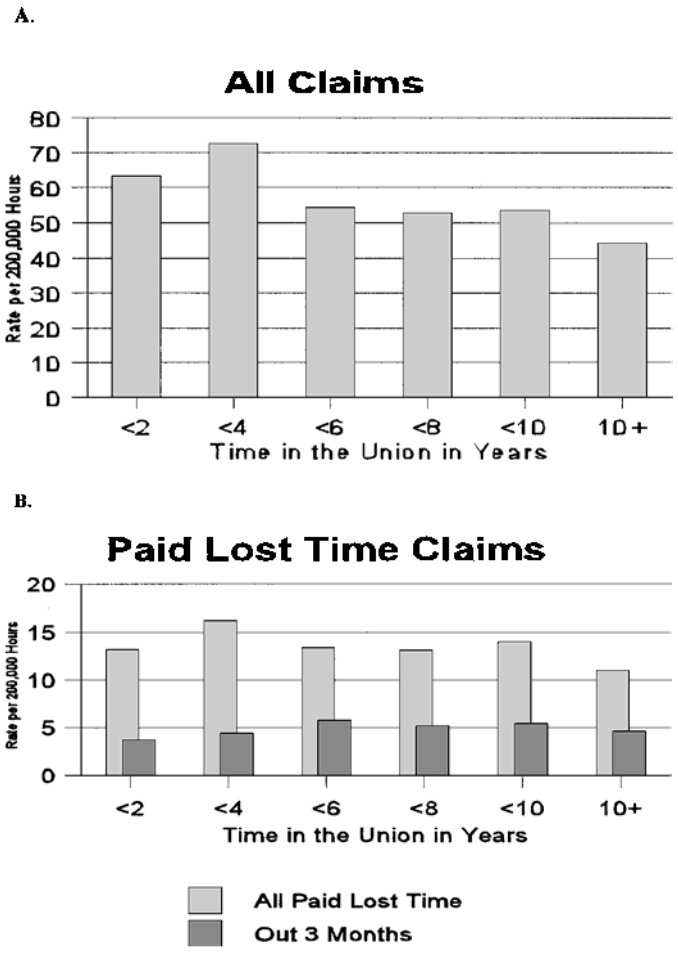

FIGURE 3
Rates of filing claims among union drywall installers by time in the union, Washington State 1989–1995: A. All claims, B. Paid lost time claims.

There were a number of objects or materials associated with these injuries with the most common being sheetrock, particles, structural metal, metal items, and metal fasteners. Sheetrock was associated with over 25 percent of the more serious injuries. The rate of paid lost time claims associated with sheetrock was over three times greater than the rate associated with any other single object.

The 230 claims which resulted in paid lost time of at least three months most commonly involved the back (27%), followed by the shoulder (10.9%), wrist (9.6%), and the knee (8.3%). Over half (52%) were described as sprains followed by ill-defined symptoms (11%), fractures (8.8%), and nerve conditions (8.4%). Sheetrock was most frequent source of injury (27.4%), followed by the floor (10.2%), and work surface (8.8%) consistent with patterns seen for all paid lost time claims.

The most common mechanism of injury involved being struck, followed by overexertion and falls. Struck by injuries most often resulted in cuts (69.6%) and the upper extremity was the most common body part injured (68.5%). The sources of injury were most commonly structural metal, unspecified metal items, knives, and sheetrock. Overexertion injuries were most commonly described as sprains or strains (80.3%) and they predominantly involved the back (49.1%). Sheetrock was associated with over 40 percent of these injuries. Overexertion injuries were most often due to lifting (40.8%), followed by carring (9.2%), and pushing or pulling (5%). However 44 percent of these injuries were described as "unspecified," providing little information about what the individual was actually doing when he or she was injured. Falls most commonly involved the knee (15.4%), followed by the back (13.1%) and multiple injuries (12.8%). The nature of the injuries sustained in falls were predominantly sprains (38.9%), contusions (21.9%), and cuts (12.6%), followed by injuries of a more serious nature such as fractures (9.9%) and multiple injuries (12.8%). In the case of falls, the source associated with the injuries describe what the person fell on and does not provide any information about what the person was doing at the time of the fall. Many falls among these workers are from elevations, including ladders and platforms. The distribution of the descriptions of these falls are presented in Figure 4.

With few exceptions, the patterns for claims that resulted in paid lost time from work (greater than three days of missed work) were very similar. The object most commonly associated with struck by injuries with paid lost time was sheetrock. The nature of paid lost time falls were most often described as sprains or fractures, with the latter consistent with more serious injuries.

Crude rates and rate ratios, stratified by categories of age and time in the union, are presented in Table II along with the adjusted rate ratios resulting from multivariate analyses with Poisson regression for injuries resulting from being struck, overexertion injuries, and falls. Rates of struck by injuries decrease

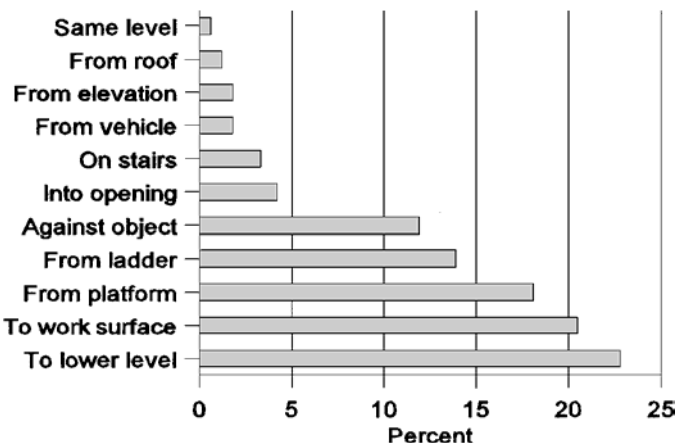

FIGURE 4
Description of work-related falls from compensation claims, union carpenter drywall installers, Washington State 1989–1995.

TABLE I

ANSI codes[B] on workers' compensation claims of drywall carpenters Washington State 1989–1995

	All claims		Paid lost time claims	
	Frequency (%)	Rate[A]	Frequency (%)	Rate[A]
Body part injured				
Back	433 (17.1)	9.0	177 (29.1)	3.7
Finger(s)	415 (16.4)	8.6	44 (7.2)	0.91
Eye(s)	366 (14.5)	7.6	7 (1.2)	0.15
Hand	207 (8.2)	4.3	33 (5.4)	0.69
Wrist	130 (5.1)	2.7	43 (7.1)	0.90
Knee	126 (5.1)	2.6	54 (8.9)	1.1
Shoulder	95 (3.8)	2.0	43 (7.1)	0.90
Back/neck	93 (3.7)	1.9	29 (4.8)	0.60
Elbow	80 (3.2)	1.7	23 (3.8)	0.48
Foot	66 (2.6)	1.4	18 (3.0)	0.37
Multiple	64 (2.5)	1.3	24 (3.9)	0.50
Forearm	65 (2.6)	1.3	6 (1.0)	0.12
Ankle	61 (2.4)	1.3	22 (3.6)	0.47
Neck	42 (1.7)	0.87	18 (3.0)	0.37
Abdomen	35 (1.4)	0.73	20 (3.3)	0.42
Nature of injury				
Sprain	859 (34.0)	17.8	313 (51.7)	6.5
Cut	777 (30.8)	16.1	68 (11.2)	1.4
Scratches	335 (13.3)	7.0	8 (1.3)	0.17
Contusion	174 (6.9)	3.6	35 (5.8)	0.73
Ill-defined symptoms	103 (4.1)	2.1	50 (8.3)	1.0
Fracture	67 (2.7)	1.4	43 (7.1)	0.90
Multiple injures	37 (1.5)	0.77	13 (2.1)	0.27
Nerve condition	34 (1.3)	0.71	25 (4.1)	0.52
Dislocation	25 (0.99)	0.52	16 (2.6)	0.33
Hernia	21 (0.8)	0.44	19 (3.1)	0.40
Source of injury				
Sheetrock	334 (14.0)	7.0	143 (25.2)	3.0
Particles	259 (10.9)	5.4	3 (0.5)	0.06
Structural metal	210 (8.8)	4.4	27 (4.7)	0.56
Metal items	162 (6.8)	3.4	19 (3.3)	0.39
Metal fasteners	127 (5.3)	2.6	13 (2.3)	0.27
Floor	106 (4.4)	2.2	47 (8.3)	0.98
Bodily motion	104 (4.4)	2.2	41 (7.2)	0.85
Work surface	97 (4.1)	2.0	45 (7.9)	0.93
Metal chips	78 (3.3)	1.6	2 (0.4)	0.04
Timber/slab	79 (3.3)	1.6	24 (4.2)	0.50
Knife	54 (2.3)	1.1	4 (0.7)	0.08
Ground outdoors	55 (2.3)	1.1	29 (5.1)	0.60
Scaffolds	39 (1.6)	0.81	8 (1.4)	0.17
Non-power tool	39 (1.6)	0.81	13 (2.3)	0.27
Building structure	35 (1.5)	0.73	4 (0.7)	0.08
Pipe fittings	36 (1.5)	0.75	8 (1.4)	0.17
Type of injury				
Struck	946 (38.3)	19.6	102 (17.3)	2.1
Overexertion	694 (28.1)	14.4	281 (47.6)	5.8
Fall	325 (13.2)	6.7	139 (23.6)	2.9
Abraded	304 (12.3)	6.3	9 (1.5)	0.19
Bodily reaction	104 (4.2)	2.2	41 (6.9)	0.85

[A] All rates are per 200,000 hours worked.

[B] All others each accounted for < 1.5 percent or rate of < 0.75/200,000 hours.

steadily with increasing age and increasing time in the union. Those in the union two to four years had the highest rates of overexertion injuries, but there is no distinct pattern in the rates of injury based on age or time in the union. Likewise for falls, there was really no pattern based on time in the union. However, there was a steady increase in the rate of falls with increasing age, with those over the age of 45 having a 60 percent higher rate of falls than those under age 30.

Costs Associated with Drywall Injuries

The costs associated with these compensation claims for medical care, paid lost time, and permanent impairment are presented

TABLE II
Stratified rates and rate ratios for most common work-related injuries among drywall carpenters Washington State 1989–1995 by type of injury

		Rate ratios	
	Crude rate[A]	Crude	Adjusted (95% CI)[B]
Struck by injuries			
Age			
<30	28.6	1	1
30–44	17.8	0.62	0.76 (0.66, 0.90)
> =45	0.8	0.38	0.52 (0.40, 0.70)
Time in the union			
<2 years	27.2	1.0	1.0
2–4 years	30.0	1.1	1.1 (0.92, 1.4)
4–6 years	22.4	0.83	0.87 (0.70, 1.1)
6–8 years	18.4	0.67	0.73 (0.56, 0.96)
8–10 years	18.6	0.68	0.76 (0.58, 1.0)
10+ years	14.0	0.51	0.66 (0.54, 0.82)
Overexertion injuries			
Age			
<30	13.8	1	1
30–44	15.4	1.1	1.2 (0.99, 1.5)
> =45	11.6	0.85	0.95 (0.70, 1.3)
Time in the union			
<2 years	13.6	1.0	1.0
2–4 years	19.4	1.4	1.4 (1.1, 1.8)
4–6 years	12.8	0.94	0.90 (0.66, 1.2)
6–8 years	14.2	1.0	0.98 (0.71, 1.4)
8–10 years	13.6	1.0	0.92 (0.65, 1.3)
10+ years	13.8	1.0	0.96 (0.74, 1.2)
Falls			
Age			
<30	6.6	1	1
30–44	6.6	1.0	1.2 (0.87, 1.6)
> =45	8.0	1.2	1.6 (1.1, 2.4)
Time in the union			
<2years	7.4	1.0	1.0
2–4 years	7.0	0.95	0.95 (0.63, 1.4)
4–6 years	7.6	0.97	1.0 (0.66, 1.5)
6–8 years	6.2	0.83	0.80 (0.49, 1.3)
8–10 years	8.4	1.1	1.1 (0.68, 1.7)
10+ years	6.0	0.82	0.69 (0.48, 1.0)

[A]Rate is per 200,000 hours worked.
[B]Adjusted rate ratios and confidence intervals from Poisson regression analyses. Separate models created for each of the three types of injury.

for overall claims filed and for the three most common mechanisms of injury in Table III. Although struck by injuries were the most common injuries, they accounted for a relatively small percentage of costs for medical care (12.8%) and even lesser percentages for time loss (8%) and permanent impairment (7.1%). Overexertion injuries accounted for approximately 50 percent of medical costs, indemnity, and impairment costs. Falls were responsible for 25 percent of the costs for permanent impairment and approximately 30 percent of costs associated with medical care and paid lost time.

Costs associated with claims for which the injury source was coded as sheetrock were calculated separately. These claims accounted for 26.5 percent of medical costs ($960,446), 32.1 percent of dollars for paid lost days ($1,919,679), and 20.9 percent of permanent impairment costs ($220,109).

DISCUSSION

Overall rates of workers' compensation claims are very high among these drywall workers—25 percent higher than rates identified using the same methods of cohort analyses for all union carpenters in western Washington State.[19] Nearly 60 percent of this cohort filed at least one claim in this seven-year period, 25 percent had a claim which resulted in at least four days away from work, and 11 percent had claims which resulted in prolonged loss of time from work of three months or more. This group represents a very young cohort with little union experience, indicating that many people do not stay in drywall work for long periods of time.

Injuries most commonly resulted from being struck, overexertion, and falls, in that order. Injuries from being struck predominantly involved cuts to the upper extremities, overexertion injuries most often involved the back, and falls most often involved injuries to the knees. Different patterns of risk were seen for these common injuries. Rates of injuries from being struck decreased with increasing age and increasing time in the union, while rates of falls increased with increasing age and did not appear to be significantly related to time in the union.

Overexertion injuries were responsible for the greatest proportion of costs for medical care, permanent impairment, and paid lost days. Claims for which sheetrock was identified as the object associated with injury alone accounted for approximately 30 percent of costs. Falls had the highest mean costs per case, indicating the serious nature of these injuries.

The use of union records allowed us to identify a well-defined occupational cohort of construction workers who could be followed overtime despite the job mobility these workers experience. By combining data from several sources, linked on an individual basis, we were able to identify events of interest and time at risk. However, in interpreting these findings it is important to keep in mind that we studied claims that were filed. Anything which influences why a worker chooses to file a claim, or not, will be reflected in the results. In addition, there are limitations imposed by coded data available in compensation records. Coded injury descriptions—such as "struck by," "overexertion," and even "falls"—provide limited information about what actually happened at the time of injury. However, the analyses stratified by injury mechanism provided more revealing information about the nature of the injuries, the objects associated with the injuries, and high-risk subgroups.

These data did not provide any individual exposure information. We do not know the distribution of hours worked by the cohort on residential compared to commercial projects, and we were unable to identify the type of jobs these individuals were working on when injured. This makes it impossible for us to identify whether rates of injuries vary by type of site. The nature of some of the injuries, such as those involving structural metal, seem more consistent with commercial projects, but the data do not allow us to determine whether certain types of injuries are more prevalent on residential or commercial projects.

Analyses of Bureau of Labor Statistics (BLS) data for 1992 and 1993 revealed that falls, bodily reaction, and overexertion injuries accounted for 84 percent of the total days away from work among drywall installers in 1992 and 1993. Falls from scaffolds resulted in the greatest lost workdays. Overexertion was responsible for more lost workdays than falls from the same level. One-third of trunk injuries occurred while lifting building materials, particularly drywall, and problems were more commonly reported in lifting than in carrying tasks.[7] These patterns are similar to the patterns we saw in this group of union carpenters who do predominantly drywall installation, although for a large percentage of claims the type of overexertion was unspecified,

TABLE III
Costs associated with drywall injuries Washington State 1989–1995

	Overall		Struck by		Overexertion		Falls	
	Mean	Total	Mean	Total	Mean	Total	Mean	Total
Medical	$1,412	$3,623,897	$492	$465,455 (12.8%)	$2,486	$1,725,179 (47.6%)	$3,067	$996,658 (27.5%)
Permanent impairment	$409	$1,051,117	$79	$74,635 (7.1%)	$835	$579,693 (55.2%)	$803	$261,262 (24.9%)
Time lost	$2,331	$5,982,821	$509	$481,522 (8.0%)	$4,561	$3,165,162 (52.9%)	$5,480	$1,780,874 (29.8%)

providing no clear information about what the worker was doing when injured. These findings are also consistent with analyses of the workers' compensation experience of North Carolina homebuilders engaged in drywall work during 1986–1994.[20] Even though the reporting definitions are different for North Carolina and Washington, and the fact that North Carolina drywall workers install and finish as well, the patterns by mechanism for serious injuries were similar to those observed among the Washington cohort.

The high rates of overexertion injuries among these workers are not surprising based on knowledge of known ergonomic stresses on drywall jobs.[9] While overexertion injuries were the most common lost time injuries among drywall workers and plasters in Ontario, fall injuries were 50 percent more prevalent among drywall workers than for all construction. Most of these falls occurred in direct installation, consistent with the high rates of falls among these Washington carpenters who do predominantly drywall installation. Falls were more prevalent on residential drywall projects, mainly because of improper work platforms. Cuts were common on non-residential projects and were commonly from metal studs and ceiling tracks.[21]

There is evidence that falls among these workers are associated with manual materials handling tasks such as handling drywall sheets from scaffolds.[21] Half of non-fatal falls in the West Virginia construction industry occurred among individuals who were using power tools or handling materials at the time of their falls.[22] Considering the weight and size of materials drywall installers must handle, the contribution of these materials to causes of acute injuries warrants further exploration. The increasing risk of falls with aging has been reported by others[23] but is particularly interesting, and somewhat surprising, in this very young cohort.

CONCLUSIONS

Drywall workers are clearly a high-risk group for occupational injury, and these findings are also consistent with high turnover in this trade. Interventions on their behalf are indicated and could increase longevity in the trade. Anecdotal evidence suggests that at least some of them go to other types of carpentry while others may be lost to the trade due to high injury rates.

The high rates of overexertion are not surprising based on what we know of materials these workers must handle and their job demands. However, these workers are also at high risk of acute traumatic injuries from being struck and from falls. The different patterns of risk for injuries resulting from being struck, overexertion, and falls provide information that could be helpful in targeting interventions. The decreasing risk of struck by injuries with age and time in the union, as well as the nature of these injuries, indicate that they may very well be related to training and/or experience level.

The lack of any real pattern of risk by age or experience for overexertion injuries is likely related to the heavy nature of all drywall work. Ergonomic solutions to alleviate the physical demands on these workers are needed. Swedish investigators have reported greater satisfaction among a small team of carpenters installing 3 ft by 8 ft wallboard in a seven-unit multi-family residential building compared to installation of 4 ft by 8 ft wallboard by the same carpenters in a similar space. These investigators report a modest cost increase for the shorter board (< 1 cent per square foot installed) which could easily be offset if it prevented injury.[24] Alternative methods of transporting and hanging wallboard could result in fewer injuries and cost savings. These issues become even more important with increasing use of 12-foot sheetrock.

Schneider[25] described examples of ergonomic interventions appropriate for drywall installation including dollies designed to move drywall through narrow openings, mechanical lifts, raised cutting surfaces, and the use of frequent, short, breaks. Work organization issues could help address some of the stresses in transporting materials. These include timing of delivery of materials to job sites and the use of lifts to place sheetrock at aboveground levels when needed so workers do not carry materials to second-floor, and even higher, work areas.

The costs of injury which we report as directly associated with sheetrock are likely an under-representation. Because the source of injury for falls is coded as the object to which the person fell, we cannot determine for these injuries how many were actually associated with handling sheetrock. Addressing some of the ergonomic challenges faced by these workers could have an effect on more acute injuries, such as falls, due to the heavy nature of the materials they handle and their awkwardness.

Although these data provide information about injuries of drywall carpenters, more information about the circumstances surrounding the injuries experienced by these workers would also be useful. We do not understand the reason that falls increase with increasing age in this relatively young cohort of workers. In addition, for overexertion injuries there is the potentially significant interplay between cumulative exposures, the rates at which they accrue, and peak exposures. For example, one exposure or a series of peak exposures may be predictive of an overexertion injury. A peak exposure could also represent the "straw that broke the camel's back" following longer-term cumulative exposures. Consideration needs to be given to ways we can measure and evaluate cumulative stresses, exposure rates, and peak exposures among these high-risk workers. Access to more detailed information, not available through these passive surveillance methods, is needed to more clearly understand the etiology of these common injuries among drywall carpenters and to inform interventions.

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