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Twenty Years of Workers' Compensation Costs Due to Falls From Height Among Union Carpenters, Washington State

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Background *Falls from height (FFH) are a longstanding, serious problem in construction.*

Methods *We report workers' compensation (WC) payments associated with FFH among a cohort (n = 24,830; 1989–2008) of carpenters. Mean/median payments, cost rates, and adjusted rate ratios based on hours worked were calculated using negative-binomial regression.*

Results *Over the 20-year period FFH accounted for $66.6 million in WC payments or $700 per year for each fulltime equivalent (2,000 hr of work). FFH were responsible for 5.5% of injuries but 15.1% of costs. Cost declines were observed, but not monotonically. Reductions were more pronounced for indemnity than medical care. Mean costs were 2.3 times greater among carpenters over 50 than those under 30; cost rates were only modestly higher.*

Conclusions *Significant progress has been made in reducing WC payments associated with FFH in this cohort particularly through 1996; primary gains reflect reduction in frequency of falls. FFH that occur remain costly.* Am. J. Ind. Med. 57:984–991, 2014.

KEY WORDS: falls from height; occupational injury; costs; construction work; carpenters; cohort study; workers' compensation payments

BACKGROUND

Progress in occupational injury prevention is most often marked by reduction in injury rates. Cost data provide an additional metric that reflect a combination of the frequency and severity of injury events. Analyses of costs also provide a marker of economic burden that is not discernible in injury rates [Rice, 2000] that, in the context of occupational injury, may speak more clearly to business owners or policy makers than rate data alone.

The inherent risk of working at height that is associated with construction affects the safety of workers broadly across the industry; falls from height (FFH) have been and remain a serious cause of morbidity and the leading cause of mortality in the industry [Sorock et al., 1993; Cattledge et al., 1996; Derr et al., 2001; Courtney et al., 2002; Horwitz and McCall, 2004; Dong et al., 2009, 2012; BLS, 2010; Shishlov et al.,

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2011]. In 2012, data from the Census of Fatal Occupational Injuries captured 775 deaths in the construction industry. Falls (including slips and trips) were responsible for 280 of these fatalities or 36%. Further, these deaths among construction workers accounted for 42% (280 of 668) of all deaths caused by falls across all private industries in the U.S. in 2012 [BLS, 2013a,b].

We report on workers' compensation (WC) payments for work-related FFH among a large cohort of union carpenters in Washington State over a 20-year period (1989–2008). During this period a number of factors could have influenced costs associated with FFH. There was considerable attention to reduction of WC costs through initiatives such as pre-qualification of bidders as well as more rapid return to work following injury [Welch et al., 2007]. Other efforts focused specifically on reducing fall risk through changes in work practices and equipment, and some of these created unexpected hazards [McCann, 1999; Harris et al., 2010]. In Washington, the state Vertical Fall Arrest Standard went into effect in 1991; this was followed 3 years later by the Federal OSHA Standard. Both contained elements designed to decrease frequency of falls as well as potential severity of injury in the event of a fall.

MATERIALS AND METHODS

For this analysis, data from the Carpenters Trusts of Western Washington (CTWW) on union hours worked each month were linked on an individual basis to WC records obtained from the Washington State Department of Labor and Industries. Washington is one of few U.S. states with a state-run WC program, allowing us to identify reported work-related injuries and the associated payments for members of this well-defined cohort of carpenters who had worked there between 1989 and 2008. Details on the data sources and their linkage on an individual basis have been previously reported on several occasions [Lipscomb et al., 1997, 2003a] as have analyses of patterns of FFH [Lipscomb et al., 2003a,b, 2013]. Briefly, union records provided information on each worker's hours of work, age, sex, time in the union, and union local affiliation. Predominant work was based on the union local with which each carpenter was affiliated. Union carpenters in Washington State perform a wide variety of construction including heavy and light commercial work, drywall installation, piledriving, millwrighting, and residential building. Workers' compensation records included information on the injury date, coded event characteristics (including "type of event or exposure" used to identify injuries resulting from FFH and the surface from which the worker fell), and direct payments made for medical care, lost work time, or indemnity (which begins on the fourth day after the injury in Washington State), and permanent impairment associated with the event.

The Consumer Price Index (CPI) for the nation was used to adjust all costs (medical, indemnity, impairment) for inflation to the year 2011; medical costs were adjusted using the CPI for medical care. Adjusted costs were then discounted by three percent per year to account for changes over the 20-year period in the time value of money. These procedures account for differences in the values of services received or payments made at different time periods [Drummond et al., 1999] and resulted in all costs being expressed in constant dollars as of the year 2011. All WC costs were assigned to the year in which the injury occurred. In the event a WC claim was still open, projected claim reserve costs were used.

Worker' compensation payments for FFH, overall and by type of expense (medical, indemnity, impairment), were calculated for this 20-year period; the percentage of all WC payments this represented in each year was also assessed. Work hours, reported injuries from FFH, and total payments for these injuries were then stratified by categories of age, union tenure, predominant type of work, and calendar time. These stratified data were then examined using negative binomial regression to model cost means, as well as cost rates and adjusted costs rate ratios based on union hours worked (using the log of hours as an offset). Rates were expressed in terms of U.S. dollars (USD) per 200,000 hr worked.

The institutional review boards at Duke University Medical Center and the Washington State Department of Social and Health Services approved all procedures. Informed consent was not obtained; analyses involved use of de-identified secondary data.

RESULTS

Details of the 20-year carpenter cohort, their hours worked, and their injury experiences have been described recently [Lipscomb et al., 2013; McCoy et al., 2013]. Briefly, the predominantly male (97%) cohort of 24,830 union carpenters worked 192,371,021 hr in Washington State between 1989 and 2008. During that period a total of 1,511 injuries from FFH were reported accounting for 5.5% of all injuries. There were only 22 FFH among women with 3 resulting in paid lost time from work [Lipscomb et al., 2013]. Due to the limited number and the instability surrounding skewed cost data in general, cost analyses were not stratified by sex.

Workers' compensation payments for injuries sustained in FFH totalled $66,627,276 over the 20-year period, representing 15.1% of total direct WC costs. This amounts to a cost burden from FFH of thirty-five cents ($0.35) for every hour worked or nearly $700 for each fulltime carpenter per year (assuming 2,000 hr worked). Indemnity payments accounted for just over half of FFH costs (50.9%; $33.9 million) followed by payments for medical care (38.4%; $25.6 million), and permanent impairment (10.7%; $7.1

million). Proportions of indemnity, medical, and impairment payments were fairly consistent regardless of the surface from which the injured carpenter fell (Fig. 1). Falls from ladders and platforms (which would include scaffolding) contributed significantly to overall payments but almost one third were simply ascribed to "falls to a lower level" or "unspecified falls from height" in the coded WC data.

The distribution of work hours, injuries from FFH and associated payments by categories of age, time in the union and predominant work are presented in Table I. Individuals who were affiliated with locals that performed millwrighting or drywall installation had adjusted payment rates over twice as high as those in the light commercial referent group. Mean and median payments were particulary high among millwrights but this was based on only 18 events and the resulting confidence intervals are quite wide. Piledrivers had the lowest mean and median payments and payment rates. Payment rates, based on hours of work, were 20% greater among those 40 to <50 years of age than among those over age 50. Mean payments per fall increased with increasing age. While there was not a pattern of increasing mean payments or payment rates with increasing years in the union, injured carpenters with over 30 years of union tenure had the highest mean payments per fall. These workers also had high FFH payment rates, as did carpenters in their first few years as a journeyman (4 to <6 years), although, patterns for the latter did not persist when adjusting for age and predominant type of work.

The proportion of payments for medical care decreased with increasing age with corresponding increases in the proportions paid for indemnity (Table II). Mean medical costs were 1.9 times greater among those over age 50 than those under 30 years of age while mean indemnity costs were 2.6 times greater and mean impairment costs were 2.3 greater. Medical payment *rates* were highest among carpenters 40 to <50 years of age, while indemnity and impairment payment rates were highest among those under 30 years old (Fig. 2). However, when adjusting for type of work and union tenure, analyses suggest medical and indemnity cost rates of workers over age 50 are higher than those for younger carpenters (<40 years old).

To reduce some of the variability observed by year, the distribution of payments for FFH over time are presented in 2-year intervals in Table III. The percentage of payments for all WC claims that was attributable to FFH varied from a high of 23.7% in 1989–1990 to a low of 10.5% in 2007–2008. However, there was not a steady decline, but rather considerable variability by year. For example, in 2005–2006 FFH were responsible for 21.3% of total WC payments before dropping rather dramatically. Mean payments per FFH decreased from over $87,000 dollars per FFH in 1989–1990 to just under $40,000 per FFH in 2007–2008, but again this was not a monotonic decline. Of note, the pattern of mean payments per FFH over time was not confounded by age, gender, union tenure, or predominant type of work. Payment rates varied widely over time as well. However, adjusted payment ratios were over 10-fold lower in 2007–2008 than in 1989–1990. Median payments generally increased over time.

Direct payments per hour of work decreased dramatically from $0.86 per hour in 1989 to only $0.02 per hour in 2008 (Fig. 3). The decline was marked and steady through 1996. After that payments continued to vary some by year, but they remained fairly steady until 2008 when there was a very marked decrease. There were marked declines in both indemnity and medical payments between 1989 and 2006. While indemnity accounted for a third more payments overall during the 20-year period, the ratio of indemnity to medical payments fluctuated over time with payments for medical care exceeding those for paid lost time in the later years of observation. Permanent impairment payments, which accounted for a much lower percentage of payments, also decreased over time.

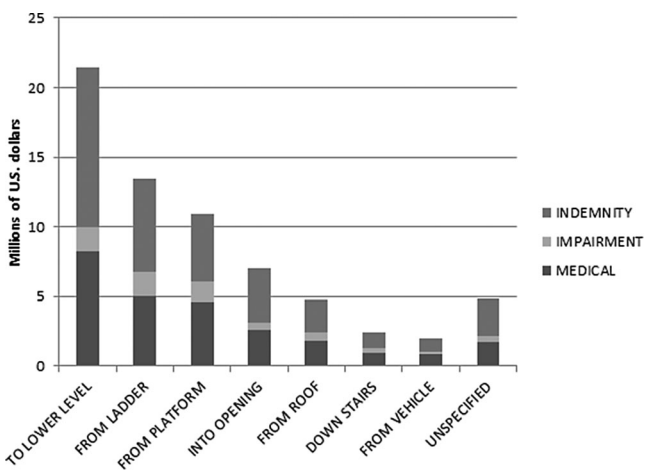

FIGURE 1. Workers' compensation payments in U.S. dollars for falls from height by surface from which the fall occurred, union carpenters in Washington State, 1989–2008.

DISCUSSION

Using combined administrative data we quantified the financial resources used to provide medical care and to estimate lost productivity, represented by payments for lost work time or impairment, for injuries sustained in FFH among a large cohort of union carpenters over 20 years. To allow comparison of payments over time, dollars were adjusted and discounted to 2011 values.

FFH are responsible for a disproportionate share of WC costs; in this cohort they accounted for 5.5% of reported injuries in the 20-year period [Lipscomb et al., 2013; McCoy et al., 2013] but over 15% of direct payments. Indemnity payments accounted for the greatest proportion of expenditures followed by payments for medical care and then permanent impairment. The distribution of these different

TABLE I. Work Hours, Falls From Height (FFH), Workers' Compensation Payment Distribution, Payment Rates (95% CI) and Adjusted Payment Rate Ratios (95% CI), Union Carpenters, Washington State 1989–2008

	Work hours	Injuries from FFH	WC payments	Median[1]	Mean (95% CI)[1]	Payment rate (95% CI)[2]	aRR (95% CI)[3]
Age							
<30	32,542,722	319	$ 8,709,340	$ 1.3	$ 40.7 (31.8–52.1)	$133.6 (94.6–188.5)	0.71 (0.41–1.2)
30 to <40	63,159,376	559	20,649,818	1.9	52.8 (44.0–63.4)	71.4 (55.4–92.0)	0.72 (0.47–1.1)
40 to <50	60,781,105	435	21,152,774	2.7	55.0 (45.8–66.2)	153.3 (122.7–191.7)	1.2 (0.83–1.8)
50+	35,415,373	197	15,730,837	4.1	93.0 (70.5–122.9)	112.8 (88.3–144.1)	1
Years in the union							
<2	25,251,790	251	8,398,675	1.5	51.8 (38.8–69.2)	44.1 (29.8–65.0)	0.29 (0.12–0.70)
2 to <4	19,336,436	186	6,280,017	1.6	51.4 (37.1–71.3)	77.4 (52.0–65.0)	0.25 (0.11–0.60)
4 to <6	16,303,299	145	6,489,003	2.0	66.2 (46.0–95.3)	326.8 (217.1–491.9)	0.48 (0.19–1.18)
6 to <8	15,121,172	118	5,086,288	2.6	56.3 (38.5–82.3)	87.6 (57.4–133.7)	0.36 (0.15–0.82)
8 to <10	13,873,415	101	3,834,635	2.9	52.6 (34.4–80.2)	212.7 (137.8–328.4)	0.70 (0.27–1.8)
10 to <12	13,156,756	118	6,058,130	2.3	83.0 (54.4–126.6)	112.3 (71.7–176.1)	0.33 (0.14–0.81)
12 to <14	11,804,564	89	3,157,838	2.1	47.1 (30.3–73.3)	57.6 (35.3–93.8)	0.23 (0.09–0.58)
14 to <16	10,983,343	79	2,125,589	1.1	33.7 (21.3–53.3)	90.7 (53.1–155.0)	0.35 (0.13–0.91)
16 to <18	10,071,783	75	3,553,902	1.5	53.8 (34.5–84.0)	149.5 (87.7–255.0)	1.9 (0.69–5.3)
18 to <20	9,011,881	62	2,125,589	2.2	53.3 (32.8–86.7)	52.6 (30.3–91.3)	0.29 (0.11–0.72)
20 to <22	8,018,472	47	3,553,902	2.9	51.1 (29.2–89.1)	58.4 (32.9–104.0)	0.14 (0.06–0.37)
22 to <24	7,413,714	48	2,931,866	1.4	63.3 (36.7–109.1)	111.7 (60.7–205.6)	0.47 (0.17–1.3)
24 to <26	6,777,007	41	2,144,341	5.4	70.7 (39.1–128.1)	64.0 (33.1–123.5)	0.23 (0.09–0.61)
26 to <28	6,226,896	45	2,786,739	7.9	69.2 (39.7–120.8)	83.4 (42.0–165.4)	0.41 (0.15–1.12)
28 to <30	5,553,414	34	2,617,854	0.9	51.7 (27.1–98.8)	61.6 (30.6–123.8)	0.13 (0.05–0.35)
30+	13,467,082	72	6,615,555	8.2	103.4 (65.8–162.3)	233.3 (115.1–473.1)	1
Predominant work							
Drywall	36,673,255	446	19,188,703	2.5	66.2 (53.4–82.0)	155.5 (107.9–224.0)	2.3 (1.3–4.0)
Residential	3,077,068	33	947,643	1.7	33.8 (17.1–67.1)	82.9 (51.8–132.9)	1.0 (0.50–2.2)
Millwright	3,497,881	18	2,023,977	32.2	112.4 (47.9–263.8)	205.2 (138.0–305.1)	2.9 (1.5–2.2)
Pile driver	11,275,835	54	1,591,629	1.5	30.6 (18.5–50.6)	16.0 (11.1–23.1)	0.18 (0.11–0.33)
Mixed commercial	43,141,929	344	14,590,180	1.8	60.8 (48.1–76.8)	116.5 (83.3–163.1)	1.7 (0.99–3.0)
Heavy commercial	39,571,780	233	10,344,155	1.5	54.2 (41.7–70.5)	264.1 (189.9–367.2)	1.7 (0.77–3.1)
Out of Washington	34,921,611	215	9,382,134	1.7	58.1 (43.7–77.2)	38.2 (27.6–52.8)	0.57(0.33–0.99)
Light commercial	18,336,177	146	7,309,346	2.3	56.6 (41.2–77.9)	96.0 (67.1–137.4)	1

[1]Medians and means expressed in $1,000's of U.S. dollars.
[2]Rates expressed as $1,000's of U.S. dollars (adjusted and discounted to 2011) per 200,000 hr of work.
[3]Adjusted for age, tenure, and predominant type of work; negative binomial regression.

payments are consistent with those reported for back injuries among this cohort through 2003 [Lipscomb et al., 2008] and as described more broadly by Schwatka et al. [2012a] among construction workers in Colorado.

Individuals involved in drywall installation had higher mean payments and payment rates associated with FFH than other carpenters, as did those who worked as millwrights. We previously documented higher injury rates for FFH among drywall installers [Lipscomb et al., 2013]. Compared to other construction occupations in the U.S., drywall installers have been described as having relatively high exposure to keeping/regaining balance at work, climbing ladders and scaffolds, and working at heights [CPWR, 2013]. While millwrights in this cohort contributed relatively few hours and few FFH, their mean payments per fall were quite high, which is consistent with our previous report of relatively high rates of paid lost days from FFH among these carpenters [Lipscomb et al., 2013]. Although, both estimates are quite unstable due to small numbers, FFH among millwrights may be different from those among other carpenters. For example, they may be more likely to fall onto concrete given their work typically involves industrial installations. Pile drivers, who exhibited the lowest mean payments and payment rates of all predominant types of work, operate in and sit in the cabs of machines that hammer pilings into the

TABLE II. Distribution of Workers' Compensation Payments in U.S. Dollars for Medical Care and Indemnity for Falls From Height By Categories of Age Among Union Carpenters, Washington State 1989–2008

Age	Sum	% Of total payments	Mean payment per FFH (95% CI)[1]	Payment rate (95% CI)[2]	aRR[3] (95% CI)
Medical payments					
<30	$ 3,808,901	43.7	$ 17.8 (14.1–22.4)	$ 35.1 (25.3–48.7)	0.66 (0.30–1.5)
30 to <40	7,885,884	38.3	20.2 (17.0–23.9)	29.4 (23.1–37.2)	0.52 (0.28–0.99)
40 to <50	7,918,912	37.3	20.6 (17.3–24.5)	75.3 (61.2–92.5)	1.1 (0.62–2.1)
50+	5,793,408	36.0	34.2 (26.5–44.4)	44.8 (35.7–56.1)	1
Indemnity payments					
<30	$ 4,089,006	47.0	$ 19.1 (12.6–12.0)	$ 78.2 (46.5–131.5)	0.49 (0.31–0.80)
30 to <40	10,445,633	50.7	26.7 (19.6–36.4)	32.1 (21.8–47.1)	0.64 (0.44–0.91)
40 to <50	10,791,179	50.9	28.1 (20.6–38.3)	68.9 (49.2–96.6)	0.91 (0.65–1.28)
50+	8,455,470	54.0	50.0 (31.3–80.0)	57.7 (39.9–83.5)	1
Permanent impairment payments					
<30	$ 811,434	9.3	$ 3.8 (2.3–6.2)	$ 19.0 (10.4–34.5)	1.2 (0.49–3.0)
30 to <40	2,318,301	11.0	5.9 (4.1–8.6)	9.3 (6.0–14.5)	1.1 (0.53–2.2)
40 to <50	2,442,683	11.8	6.4 (4.4–9.2)	8.5 (5.8–12.5)	0.96 (0.50–1.9)
50+	1,481,959	10.0	8.8 (5.0–15.3)	10.7 (7.0–16.3)	1

[1]Means expressed in $1000's of U.S. dollars; negative binomial regression.
[2]Rates expressed as $1000's of U.S. dollars (adjusted and discounted to 2011) per 200,000 hr of work.
[3]Adjusted for union tenure and type of work.

ground to support buildings, foundations, bridges, or other structures resulting in relatively low exposure to work at height.

These results provide some evidence that older carpenters have more serious falls reflected in higher mean payments per fall for both medical and indemnity. Consistent with the report of Schwatka et al. [2012b] we also saw a greater cost burden from paid lost time than from medical care with increasing age. After adjusting for union tenure and type of work, however, the risk of a higher cost claim *based on hours worked* was greater among workers over age 40 rather than being limited to the oldest age category (>50 years of age). It is likely that some of the oldest group of carpenters would have worked their way up to jobs that involve supervision and, consequently, perhaps less direct exposure to work at height. Even in the absence of a supervisory

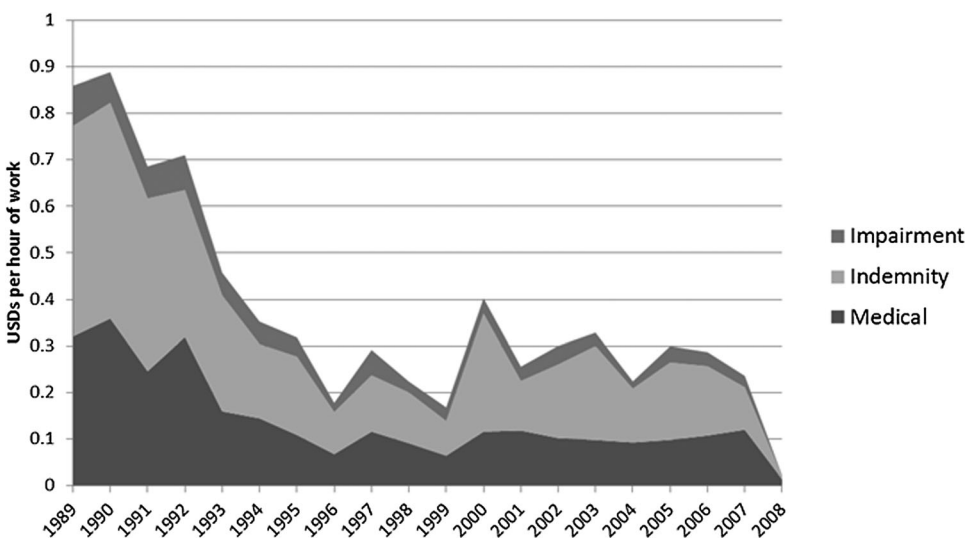

FIGURE 2. Workers' compensation payment rates by type of expenditure by age categories, union carpenters in Washington State 1989–2008.

TABLE III. Stratified Work Hours, Frequency of Falls From Height (FFH), Workers' Compensation Payments, Payment Rate (95% CI) and Adjusted Payment Rate Ratios (95% CI) by 2-Year Intervals, Union Carpenters, Washington State 1989–2008

	Work hours	Injuries from FFH	Payments for all claims	% Of payments	Median[1]	Mean (95% CI)[1]	Payment rate (95% CI)[2]	aRR (95% CI)[3]
Years								
1989–1990	14,026,008	241	$12,281,869	23.7	$ 1.6	$ 87.3 (64.3–118.4)	$ 374.8 (251.1–559.5)	10.2 (5.1–20.2)
1991–1992	17,606,872	251	12,295,096	19.8	1.9	77.1 (57.9–102.3)	186.1 (125.4–276.3)	6.4 (3.4–12.2)
1993–1994	16,530,827	182	6,720,764	12.3	1.7	51.8 (37.7–71.2)	82.3 (55.4–122.2)	3.4 (1.8–6.6)
1995–1996	16,228,556	119	4,018,831	9.5	1.5	40.0 (27.9–57.3)	39.9 (26.8–59.4)	1.6 (0.82–2.9)
1997–1998	18,010,217	142	4,620,566	14.2	2.5	40.9 (29.1–57.4)	130.7 (87.6–194.9)	4.2 (2.1–8.3)
1999–2000	22,072,030	137	6,411,288	11.8	2.1	57.2 (40.7–80.5)	181.5 (123.0–267.7)	3.2 (1.6–6.3)
2001–2002	20,367,026	134	5,642,554	13.5	2.9	49.0 (34.8–69.2)	43.4 (29.5–63.7)	2.5 (1.3–4.8)
2003–2004	18,375,432	90	5,096,818	12.6	2.5	63.7 (42.6–95.3)	37.2 (25.2–55.0)	0.85 (0.45–1.6)
2005–2006	20,619,102	106	6,035,929	21.3	2.7	66.3 (45.4–96.8)	71.9 (48.6–106.4)	3.7 (1.9–7.1)
2007–2008	28,534,951	109	3,503,560	10.5	2.3	39.8 (27.1–58.5)	60.2 (40.7–89.0)	1

[1]Medians and means expressed in $1,000's of U.S. dollars.
[2]Rates expressed as $1,000's of U.S. dollars (adjusted and discounted to 2011) per 200,000 hr of work.
[3]Adjusted for age, tenure, and predominant type of work; negative binomial regression.

position, work assignments, and consequent exposures likely differ by age- and tenure as well. it It is also possible that some of the differences observed by age reflect differences in reporting by injury severity by carpenters of different ages.

In this analysis, payment reductions over time were more pronounced for indemnity than for medical care particulary in the later years of observation. Given that all payments were adjusted and discounted, with medical payments adjusted to the CPI for medical care, the observed differences are not due to inflation or changing value of money. It is unclear from these analyses if we are getting better at getting people back to work sooner, perhaps with restrictions, or whether workers are less likely to take time off for their injuries than they were in earlier years. While it is possible that their injuries have become less severe, thus making return to work easier, given little change in mean medical payments per fall in the latter years of observation particulary, this seems somewhat unlikely.

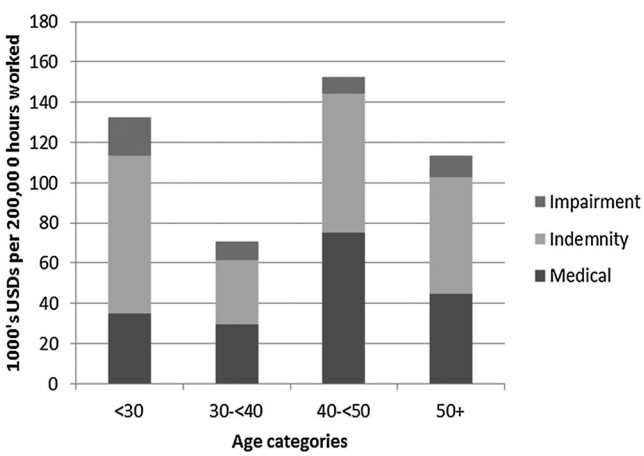

FIGURE 3. Workers' compensation payments for FFH in U.S. dollars (USDs) per hour of work, union carpenters in Washington State, 1989–2008.

Overall payments declined over the 20-year period, but not in a monotonic fashion. Furthermore, payment rates per hour of work declined in large part due to fewer falls, rather than changes in costs per fall that occurred. Mean payments per FFH fluctuated over time, but they were lower in 1995–1996 and in 2007–2008. Whether the drop we observed in 2007–2008 has been sustained or is just part of the fluctuating pattern observed is unknown but worthy of further evaluation.

These analyses have limitations, as do any observational data, but also some notable strength. We cannot explain the reasons for the observed patterns in these data. It is of note that changes were observed surrounding (both before and after) the Vertical Fall Arrest Standard (1994) that was promulgated following a record number of fatal falls in Washington in the late 1980s. We had no direct exposure information and could only broadly categorize type of work and consequently this assignment is not precise. This information does not tell us anything about exposure to work at heights or how such work might be distributed based on age or union tenure, for example. We report only on direct WC payments. We had no information on indirect costs or personal suffering which, for these events, was likely substantial [Boden and Galizzi, 1999; Boden, 2005]. It is estimated that WC covers <25% of the $250 billion annual costs associated with occupational injuries, illnesses, and fatalities [Leigh, 2011]. Even among those who initially

receive WC benefits, costs for health care and indemnity may not be absorbed in worker's compensation costs for work-related injuries [Boden, 2005; Bhattacharya and Park, 2012]. The examination of resource expenditures provides an additional dimension that may be more meaningful than count or rate data to some audiences. To us the metric of cost per hour of work, which for FFH amounted to $0.35 for every hour of carpenter work or $700 per year per fulltime carpenter, is not only meaningful but also powerful. We do not believe that public health safety efforts should be reduced to matters of dollars and cents. However, there is clearly evidence that injury severity is significantly associated with work disability and medical care costs [Friedman and Forst, 2009; Sears et al., 2014].

We have enumerated benefits of the observational data on this unique occupational cohort on a number of occasions [Lipscomb et al., 1997, 2003a,b, 2008, 2009, 2013]. The low threshold for reporting and receiving paid lost time benefits in Washington and the state-run compensation program are both strengths, as is the ability to clearly define this 20-year cohort. We were allowed access from one source to compensation records and detailed information on payments for medical care and paid time away from work after the third day for this large cohort over a long period of observation.

CONCLUSIONS

Dramatic reductions in the burden of WC payments from FFH over the 20-year period were observed with more evidence of cost containment associated with reduction in indemnity than in medical payments. However, FFH remain quite serious with the mean payment per fall in later years of observation nearly $40,000. We know that falls account for a third of fatalities in construction and remain the leading cause of mortality in the industry [BLS, 2013a,b], so continued efforts are warranted despite the direct payment reductions observed. There is also evidence from field observations that numerous fall hazards could be controlled with existing technology and best practices [Kaskutas et al., 2009]. Clearly we still need work practices and protective equipment that will protect carpenters working at height, as well as attention to ways their exposures can be reduced through design innovations that would protect workers of all ages.

Older carpenters experienced lower rates of FFH than younger carpenters [Lipscomb et al., 2013]. However, for carpenters over age 40, FFH resulted in relatively higher mean payments and payment rates for medical care and indemnity. Such patterns may reflect older carpenters experiencing more serious falls and/or being less likely than younger carpenters to report minor injuries through the WC system. In addition to highlighting the need to understand exposure to work at height by age, results of this study support the call [Schwatka et al., 2012b] to understand age-specific reporting practices.

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