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Medical care surrounding work-related back injury claims among Washington State Union Carpenters, 1989–2003

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Abstract. *Objective*: We describe medical care received through workers' compensation (WC) and union-provided insurance surrounding work-related back injuries and examine relationships between care provided and time off work among a large cohort of carpenters.
Methods and Participants: Union records identified a cohort of 20,642 carpenters working in Washington State from 1989–2003 and their private health insurance claims. These data were linked to workers' compensation files from this state-run program including records of medical care.
Results: Over 74,000 WC medical encounters resulted from 2959 work-related back injuries. Eleven percent received private care for musculoskeletal back pain within 90 days of work-related injury; this proportion increased with increasing lost days. Delay to physical therapy was more prevalent among those out of work longest. The proportion of claimants with care from both systems and from private utilization only increased after the first 90 days and, for the subset with at least one paid lost work day, after return to work.
Conclusions: Examination of medical care through both systems versus solely in workers' compensation provides a more complete understanding of back injury care while also demonstrating complexity. Differences in outcomes based upon treatment shortly after injury are worthy of further exploration.

Keywords: Private insurance, workers compensation, return to work, delays to care

1. Introduction

Work-related back injuries are responsible for significant morbidity and activity impairment. Among workers with significant manual materials handling activities such as carpenters, injuries attributed to overexertion are responsible for a large burden in health care costs and lost work days [1,2]. The relationship between physical treatments and return to work has been identified as a priority research area [3]. However, discerning the important relationships can be hampered by a number of factors. It is not uncommon for workers to see multiple providers over the course of treatment for an injury [4]. The providers, and subsequent diagnoses that people receive, may evolve overtime influencing the treatment or rehabilitation services offered or sought. For example, being referred to a specialist can be associated with delayed return to work [5,6], but this does not mean the relationship is necessarily causal.

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In the United States health care delivery for working individuals is primarily covered by two insurance systems – private insurance, most often provided through an employer or union, and workers' compensation (WC). The systems are designed to be separate, and in combination they should provide comprehensive coverage. However, there is a growing recognition of potential overlaps and gaps between them [7,8]. Surveys conducted with workers in the U.S. and Canada observed of those eligible to receive benefits, 25% to 60% filed workers' compensation claims for their work-related injury [9–11]. Barriers to reporting include fear of job loss, reporting disincentives, unable to afford time off, and the complexity of navigating the workers' compensation system [12]. In the U.S., and Canada, much of previous research on care patterns and delayed return to work has been done using workers' compensation data. In order to understand the interplay between these two systems, there is a need for studies that can examine care patterns in both systems.

An interesting example comes from a large cohort of union carpenters among whom substantial decline in the rate of work-related back injuries over a 15-year period has been documented [13]. Costs for work-related back injury per hour of work declined substantially over time due largely to declining overexertion injury rates [2]. However, these workers with union-provided health insurance also had increasing health care utilization for musculoskeletal back diagnoses through their union insurance and corresponding increases in payments and deductibles that contrasted with the marked decline in reported work-related injuries [7]. The patterns raise question about whether the health of these workers in regard to musculoskeletal back injuries and disorders is improving as well as whether some of the costs might be shifting, not just to the union insurance, but also to the worker.

In the current analyses we sought to expand upon these largely ecologic findings by: 1) describing the workers' compensation medical care visits received for work-related back injuries attributed to overexertion among these carpenters, 2) describing care for musculoskeletal back diagnoses covered through their union-provided insurance surrounding work-related back injury claims among the same individuals, and 3) examining relationships between the medical care provided and time off work.

2. Methods

This secondary data analysis used administrative records to define: 1) a cohort of union carpenters, 2) their workers' compensation injuries and associated claims for medical care, and 3) their claims for medical care received through their union-provided insurance (private utilization). Union construction workers often receive health insurance through jointly trusteed health and welfare funds established to provide benefits to workers with multiple employers. Files from the Carpenters Trusts of Western Washington (CTWW), one such fund, were used to identify a cohort of 20,642 union carpenters who worked at least three months from 1989 to 2003 in the State of Washington [13]. No restriction was placed on minimum number of hours worked per month and the three months did not have to be consecutive. Entrances and exits were allowed throughout the 15-year period. In addition, CTWW provided records of private health care utilization for non-work related injuries. The Washington State Department of Labor and Industries provided records of workers' compensation claims filed by these individuals during this period, including medical only claims, as well as those that resulted in lost work time. As a state-run program, medical claims with International Classification of Disease (ICD-9) codes that reflected medical care received for these injuries were also provided. Claims from companies that self-insure for compensation coverage are only coded in the Washington State Department of Labor and Industries system if the claim resulted in paid lost days from work and records of medical care are not fully captured. Therefore, data from employers that self-insure were excluded from these analyses.

Through the use of a unique identifier provided by the CTWW, we were able to identify and link on an individual basis all work-related back injury claims that occurred in months of union work as well as any medical care received through either insurance payment system for treatment of musculoskeletal back injury or disorder. Procedures for linking these data have been previously described [13]. All procedures were approved by the Duke University Medical Center Institutional Review Board and the Washington State Institutional Review Board, Department of Social and Health Services.

2.1. Characteristics of the cohort

Based on available variables and associations observed in previous research we included age, gender, time in the union, and history of a previous work-related back injury claim in our analyses. No race or ethnicity information was available from these data sources.

Time in the union was dichotomized at four years to separate apprentices from journeymen carpenters. Typically, an inexperienced carpenter must be in the union at least four years and complete appropriate training to reach journeyman status.

2.2. Back injury workers' compensation claim identification

All work-related back injury claims were identified by American National Standards Institute (ANSI) body part codes (back "420", trunk "400", or back and neck "600") or by International Classification of Disease (ICD-9) codes relevant to medical care for claims consistent with a back injury (i.e. lumbar sprain, spondylosis, lumbar spinal cord injury). Since the ANSI body part code identifies only cases where the back or back and neck were thought to be most severely involved at the time of the initial injury report, the use of ICD-9 codes identified back injuries and disorders for which a peripheral body part or a non-specific region (multiple, musculoskeletal, nervous, missing) were reported. Claims for which the ANSI code for body part was missing were identified as a back injury by at least two different medical encounters with an ICD-9 coded back pain diagnosis. These procedures and claims have been previously described [13].

Workers' compensation injuries of interest for this analysis were those reported to result from overexertion or bodily reaction based on ANSI mechanism of injury codes. Overexertion events included injuries resulting from actions such as pushing, pulling, lifting, and materials handling. Bodily reaction events were defined as cases involving musculoskeletal or internal injury or illness resulting from the assumption of an unnatural position or from voluntary movements like climbing, or involuntary motions induced by sudden noise, flight or efforts to recover from slips or loss of balance (not resulting in falls). Traumatic injuries, such as those resulting from falls or being struck by something, were excluded. The workers' compensation claim rather than worker was the unit of analysis; individuals with multiple claims could be found more than once during the 15 year period.

In Washington State an injured worker receives payment for lost time after three days of missed work. Number of paid lost days was categorized as follows: no paid lost days, 1 to 30 paid lost days, 31 to 90 paid lost days, and greater than 90 paid lost days. These groupings corresponded with the phases of disability described in previous studies: acute phase or first 30 days, subacute phase or 30 to 90 days, and chronic phase or $>$ 90 days [14–17].

2.3. Medical care for musculoskeletal back injury

We identified health care utilization for back injury for each carpenter through either the workers' compensation or private utilization systems. Medical providers were classified as primary care providers (osteopath, physician assistant, nurse practitioner, clinic, family medicine, internal medicine, pediatric), occupational medicine, other specialist, chiropractor, physical therapy, hospital/ER, other provider, or unknown. Care from occupational and massage therapists comprised less than 1% of all workers compensation visits and was included with physical therapy. Other included any otherwise non-classifiable provider or treatment. Utilization was defined based on one outpatient visit per day per provider. For example, a worker who saw their family medicine physician and then an orthopedist on the same day had two provider encounters: 1 specialist and 1 general. Similarly a worker who saw a chiropractor and then went to physical therapy on the same day had two provider encounters: 1 chiropractic and 1 physical therapy encounter.

2.4. Analysis

First, we described the characteristics of the injured carpenters and their work-related injuries stratified by length of time they were out of work. Next, we described the medical care received for work-related injuries through the workers' compensation system including the number of medical encounters, and the type and number of different types of medical care providers. Based on the assumption that some carpenters may circumvent or supplement the workers' compensation system and receive care from their private health care providers, private utilization within 90 days of the date of the workers' compensation injury claim was examined. Overlap between the two care systems was examined with Venn diagrams.

Descriptive frequencies and univariate statistics were calculated by provider and each covariate for claims overall and stratified by the four categories of paid lost days from work: no paid lost days, 1 to 30 days, 31 to 90 days, or $>$ 90 days. Statistical differences between ordinal column categories for the stratification variable were tested using the Mantel-Haenszel Chi-Square statistic at an alpha 0.05 level of significance. This allowed us to explore patterns and trends by time loss for providers seen (e.g. general practitioner, chiropractor, specialist, physical therapy) and specifically whether the receipt or timing of physical therapy was

Table 1
Characteristics of work-related musculoskeletal back injury claims by categories of resulting paid lost days from work, Washington State Union Carpenters, 1989 to 2003 ($n = 2959$)

	No PLD	PLD 1 to 30	PLD 31 to 90	PLD > 90	TOTAL
	n (%)	n (%)	n (%)	n (%)	n (%)
Total	**1832**	**511**	**169**	**445**	**2959**
Age					
< 30	401 (22)	101 (20)	30 (18)	58 (13)	590 (20)
30 to 44	1061 (58)	314 (61)	102 (60)	272 (61)	1749 (59)
45+	369 (20)	96 (19)	37 (22)	115 (26)	617 (21)
missing	–	–	–	–	1
Gender					
Male	1795 (98)	500 (98)	163 (97)	429 (97)	2889 (98)
Female	30 (2)	9 (2)	5 (3)	14 (3)	58 (2)
Unknown	–	–	–	–	12
Union tenure					
Apprentice	535 (29)	168 (33)	41 (24)	108 (24)	852 (29)
Journeyman	1297 (71)	343 (67)	128 (76)	337 (76)	2107 (71)
History of work-related back injury					
Yes	489 (27)	130 (25)	58 (34)	160 (36)	837 (28)
No	1343 (73)	381 (75)	111 (66)	285 (64)	2122 (72)
Body Part					
Back	1516 (83)	437 (86)	137 (81)	317 (71)	2407 (81)
Back/neck	216 (12)	47 (9)	14 (8)	34 (8)	311 (11)
Other body part*	99 (5)	27 (5)	18 (11)	94 (21)	238 (8)

PLD, paid lost days from work.
*Other body part includes: neck, chest and abdomen, trunk multiple, multiple parts, upper extremity, lower extremity.

related to paid lost days. Recognizing some overlap in the treatments provided by chiropractors and physical therapists, we stratified our analyses by receipt of chiropractic care to determine if delays in physical therapy might be due to this provision of service by a chiropractor.

3. Results

3.1. Characteristics of work-related injuries and injured workers

A total of 2959 musculoskeletal back injury claims were filed over the 15 year period by 2287 different carpenters. The majority of carpenters reported only one overexertion/bodily reaction claim (77%); 16% reported two claims, 5% reported three claims, and 2% reported four or more claims. Most work-related musculoskeletal back injuries resulted in no paid lost work days (62%); 17% had 1 to 30 work days off, 6% missed 31 to 90 work days, and 15% missed over 90 work days.

The majority of work-related musculoskeletal back injury claims were among carpenters over age 30 (80%) and those with four or more years experience (71%) carpenters (Table 1). Overall, the proportion of claims with a previous history of back injury claim increased as paid lost days increased (Table 1, $p < 0.05$). In 8% of the work-related injuries, we could identify other injured body parts besides the back; this percentage tended to increase as number of paid lost days increased (Table 1, $p < 0.05$).

3.2. Workers' compensation care for the back injury claims

Almost all overexertion/bodily reaction claims (2938/2959) received medical treatment through the workers' compensation system for a total of 74,013 back injury provider encounters. Medical encounters on first date of care ($n = 3750$) included predominantly chiropractors (31%) and general practitioners (29%) followed by specialist (12%), hospital or ER (11%), other (10%), physical therapy (2%), and occupational medicine (1%). Over the entire period of workers' compensation treatment, about half of injury claims received care from multiple providers (1617/2938). The most common combinations included: general, specialist, and physical therapy (18%); general and spe-

Table 2
Medical care surrounding workers' compensation back injury stratified by categories of resulting paid lost days from work, Washington State Union Carpenters, 1989 to 2003 (2959 claims)

	No PLD	PLD 1 to 30	PLD 31 to 90	PLD > 90	TOTAL
	n (%)	n (%)	n (%)	n (%)	n (%)
Total	**1832**	**511**	**169**	**445**	**2959**
Days to first workers' comp care*					
No comp care	16	3	2	0	23
0 days	544 (3)	144 (28)	44 (26)	95 (21)	827 (28)
1 to 7 days	956 (53)	318 (63)	92 (55)	208 (47)	1574 (54)
8 to 30 days	237 (13)	39 (8)	22 (13)	90 (20)	388 (13)
> 30 days	79 (4)	7 (1)	9 (5)	52 (12)	147 (5)
Days to first workers' comp care*					
Mean (SD)	7.6 (19.7)	3.8 (11.3)	7.9 (20.5)	21.7 (77.5)	8.5 (35.0)
Range	0 to 366	0 to 177	0 to 145	0 to 837	0 to 837
Median	1	1	2	3	2
Delay to first therapy*					
No therapy	1552 (85)	388 (76)	64 (38)	122 (27)	2125 (72)
0 to 30 days	183 (10)	99 (19)	67 (40)	131 (29)	480 (16)
> 30 days	97 (5)	24 (5)	38 (22)	192 (43)	352 (12)
Days to first therapy					
Mean (SD)	40.6 (57.8)	24.9 (47.1)	38.8 (49.3)	75.4 (82.7)	51.7 (69.4)
Range	0 to 310	0 to 313	1 to 312	0 to 362	0 to 362
Median	14.5	9	21	44	21
Overlap in care in past 1 year					
Both systems	437 (24)	130 (26)	43 (26)	146 (33)	756 (26)
Workers' comp only	1380 (76)	378 (74)	124 (74)	294 (67)	2176 (74)
Private utilization only	4 (< 1)	0 (0)	1 (1)	0 (0)	5 (< 1)
No care	13	3	1	5	22

PLD, paid lost days from work.
$*n = 2$ missing claim date.

cialist (11%); general, specialist, chiropractor, and physical therapy (10%); and general and physical therapy (10%).

For the first 30 days after the claim date, the mean number of encounters per provider type increased with increasing paid time loss category – no Paid Lost Days (PLD), 1 to 30 PLD, 31 to 90 PLD, and > 90 PLD: specialists (0.3, 0.4, 1.1, 1.4), general practitioners (0.8, 1.1, 1.7, 1.5), and physical therapy (0.4, 1.0, 2.4, 1.8). Though mean encounters were statistically different by PLD category, qualitatively these differences combined with equivalent median number of encounters for all PLD categories provide little evidence of clinical significance.

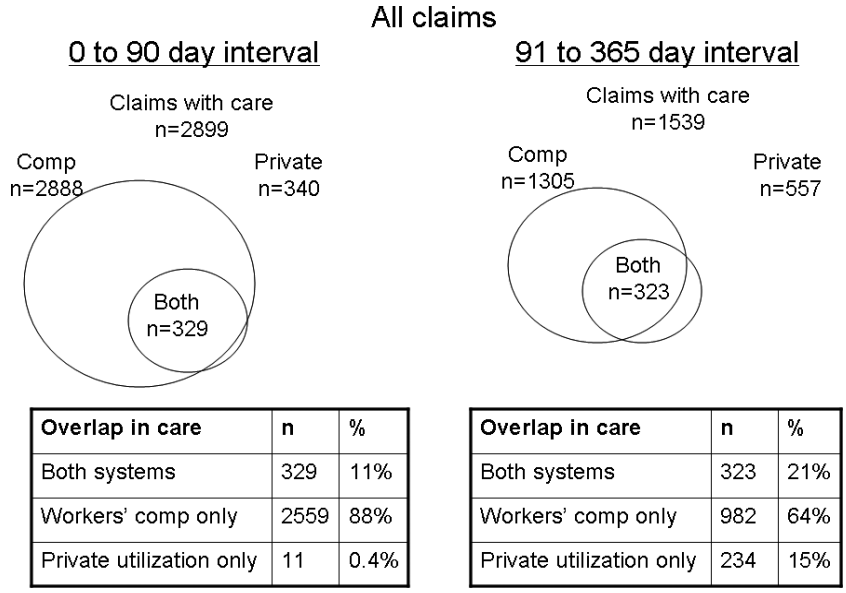
The majority of injured carpenters received treatment for work-related injury by a workers' compensation provider within 7 days (82%)–95% within 30 days. For the 5% with > 30 days to provider treatment, paid lost days tended to increase with the proportion of delayed care (Table 2, $p < 0.05$). Mean and median days to physical therapy within the first year after the injury date indicate that as the number of paid lost days increased the mean and median days to physical therapy increased (Table 2). Similarly, the proportion of claims with a delay to physical therapy increased as the amount of paid lost days increased (Table 2, $p < 0.05$). Specifically, among those out of work the longest (> 90 paid lost days), physical therapy after the first 30 days was one and a half times as prevalent as physical therapy within the first 30 days (prevalence ratio, $(43\%/29\%) = 1.5$).

A substantial number of claims never received physical therapy: 38% of claims with 31 to 90 paid lost days and 27% of claims with > 90 paid lost days. Stratified analyses were conducted to examine whether lack of or delays to physical therapy were related to the provision of similar treatments from chiropractors in the first 30 days after the claim (Table 3). Overall, we observed that chiropractic care in the first 30 days versus no chiropractic care decreased any utilization of physical therapy (22% versus 37%). Among those who received physical therapy, a > 30 day delay to physical therapy was more prevalent among those who saw a chiropractor (57%) compared to those who did not (34%). A similar pattern of increasing paid lost days with delays to physical therapy was observed among those who saw

Table 3
Physical therapy care and delays to physical therapy within the first year after the claim stratified by chiropractic care within the first 30 days after the claim among Washington State Union Carpenters, 1989 to 2003 (2959 claims)

	Chiropractic care within 30 days					No chiropractic care within 30 days				
	no PLD	1 to 30 PLD	31 to 90 PLD	> 90 PLD	TOTAL	no PLD	1 to 30 PLD	31 to 90 PLD	> 90 PLD	TOTAL
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
No therapy	775 (90)	214 (87)	25 (32)	39 (23)	**1053** (**78**)	669 (77)	150 (63)	32 (39)	48 (20)	**899** (**63**)
Therapy	84 (10)	33 (13)	54 (69)	129 (77)	**301** (**22**)	196 (23)	90 (37)	51 (61)	194 (80)	**532** (**37**)
Total claims	859	247	79	168	**1354**	865	240	83	242	**1431**
Delay to Therapy*										
0 to 30 days	30 (36)	22 (67)	34 (63)	44 (34)	**130** (**43**)	153 (78)	77 (86)	33 (65)	87 (45)	**351** (**66**)
> 30 days	54 (64)	11 (33)	20 (37)	85 (66)	**171** (**57**)	43 (22)	13 (14)	18 (35)	107 (55)	**181** (**34**)
Total claims with therapy	84	33	54	129	**301**	196	90	51	194	**532**

*Excludes those who never received physical therapy.



Overlap in care	n	%
Both systems	329	11%
Workers' comp only	2559	88%
Private utilization only	11	0.4%

Overlap in care	n	%
Both systems	323	21%
Workers' comp only	982	64%
Private utilization only	234	15%

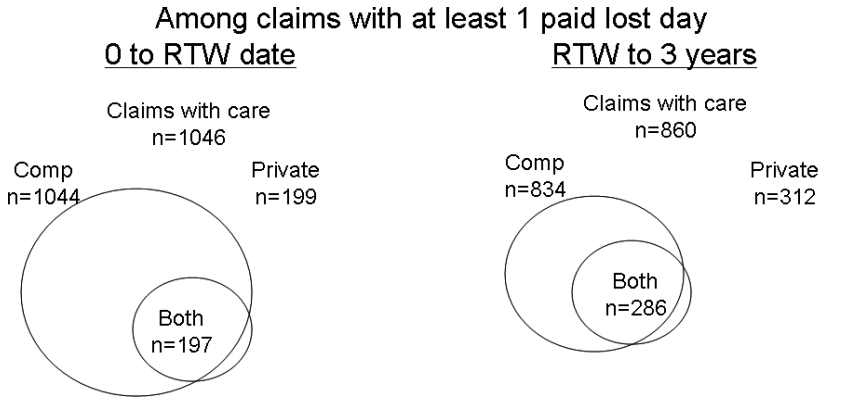
Fig. 1. Overlap in workers' compensation and private utilization care during the first year after the injury date, Washington State Union Carpenters, 1989 to 2003 (Note: Size of Venn Diagrams approximate given percentages).

a chiropractor (64% no PLD, 33% 1–30 PLD, 37% 31–90 PLD, and 66% > 90 PLD) and among those who did not (22% no PLD, 14% 1–30 PLD, 35% 31–90 PLD, and 55% > 90 PLD) (Table 3).

3.3. Private utilization for a musculoskeletal back disorder post work-related back injury claim

Eleven percent (340/2959) of claimants had a private utilization health care visit for a musculoskeletal back injury within 90 days after the claim injury date; of these, the majority had their first visit within 30 days (73%). Of the 369 initial private utilization provider encounters, most were to a chiropractor (41%), followed by general practitioners (24%), specialists (11%), hospital/ER (8%), physical therapists (1%), or other (1%) and unknown (10%). The proportion of claims with private utilization visits within 90 days increased as paid lost time increased (9% no PLD, 10% 1–30 PLD, 14% 31–90 PLD, and 22% > 90 PLD).

Venn diagrams were used to illustrate health care utilization in the two systems during the first year after the injury date. Comparing the first 90 days to the period of 91 to 365 days after the injury date, workers' compensation care *only* was more prevalent during the first 90 days (88% versus 64%) while private utilization care *only* (0.4% versus 15%) and care in *both* systems (11% versus 21%) was more prevalent after the first 90 days (Fig. 1). Overlap between care systems did not differ substantially by categories of paid lost days



Overlap in care	n	%
Both systems	197	19%
Workers' comp only	847	81%
Private utilization only	2	0.2%

Overlap in care	n	%
Both systems	286	33%
Workers' Comp only	548	64%
Private utilization only	26	3%

Fig. 2. Overlap in workers' compensation and private utilization care after return to work (RTW) among claims with at least one paid lost day from work, Washington State Union Carpenters, 1989 to 2003 (Note: Size of Venn Diagrams approximate given percentages).

except for claims with $>$ 90 days of paid lost days (Table 2). Among claims with at least one paid lost day from work, contrasting the overlap in care before and after return to work (RTW) indicates increased prevalence of private utilization care *only* and care from *both* systems after RTW (Fig. 2).

4. Discussion

Access to administrative data sources that could be linked on an individual basis allowed us to examine care received for musculoskeletal back injuries through workers' compensation, as well as care received through union-provided health insurance surrounding the work-related injury, among a large cohort of carpenters. These findings provide additional insight into the overlap in care for back injury in both systems, and illustrate the importance of examining both workers' compensation and private utilization in order to obtain a more complete picture of the care for these injuries.

Overexertion back injuries are among the most common work-related injuries among these carpenters [18]. Half of the claims received care from multiple providers even though the majority of these work-related injuries resulted in no paid lost days. The vast majority (88%) received care through the compensation system, but over 10% received care through their union insurance for similar diagnoses within a three month period. Additionally, those with $>$ 90 days of paid lost days were more likely to seek care through their union-provided insurance within 90 days of their claim (consistent with the notion that many back disorders are chronic in nature [19]). The proportion of claimants with care from both systems and only private utilization increased after the first 90 days and, for the subset with at least one paid lost work day, after return to work.

Overall, chiropractic care, whether workers' compensation or private utilization, was frequent among this group of workers which is consistent with a previous study that found skilled laborers were more likely to see chiropractors compared to service workers [20]. Specialist encounters comprised 12% of workers' compensation encounters and 11% of private utilization encounters and were more frequent as the number of paid lost days increased. Observed differences in provider care patterns by number of paid lost days is consistent with previous research where referral to specialist was associated with delayed return to work [5,6].

Of the injured carpenters who sought workers' compensation care for their claim, the majority (82%) sought care within 7 days–95% within 30 days. However, for the 5% who first sought care beyond 30 days from the claim, the proportion of claims with paid lost days tended to increase. Kominski et al. in a survey of workers' compensation injured workers reported 12% waited $>$ 3 days to seek treatment and found increased

associations with delayed RTW for those with 1 to 3 and 4 or more days between care and date of the claim [5]. Previous analyses of back injury claims in these carpenters indicated a strong association for > 30 day delay to care and delayed return to work [18]. For the first 30 days after the claim, the mean number of encounters to specialist, general practitioner, and physical therapy tended to increase with paid lost days. This suggests increased utilization in the first month after an injury for those out longest. Whether this is related to severity of injury or complexity of the diagnosis, we do not know but something is different about these claims which is evident early which could be useful to explore in clinical studies. Clinically the differences between mean number of encounters are small, but further examination of provider utilization beyond the first 30 days revealed a more striking concurrent increase in encounters with paid lost days (data not shown). Given the varied nature of work-related overexertion injuries, observational and clinical studies that can account for patient and treatment differences overtime are needed.

Mean and median days to physical therapy increased as did the proportion of claims with delays to therapy with increasing paid lost days. Of particular note, are the 38% of 31 to 90 paid lost day claims and 27% of > 90 paid lost day claims that never received physical therapy. Ehrman-Feldman et al. in their study of compensated low back pain reported that physical therapy within 30 days had a protective effect on RTW within 60 days [21]. Patients referred earlier tended to return to work sooner suggesting that timing of physical therapy was important. Delays increased among those with longer absence from work and authors postulated this could be due to physicians referring to physical therapy only after lengthy absences [21]. Infante-Rivard et al. also reported that > 30 delay to therapy was associated with delayed return to work [22].

The increasing prevalence of physical therapy visits with delayed return to work that we observed is not surprising and may reflect more care with failure to improve, or it may be due to the initial severity of the injury or other complexities. However, it is interesting that among those who utilized physical therapy within the first 30 days, the mean number of encounters in the first 30 days after injury was higher among those with delayed return to work (mean therapy encounters: 0.4, 1.0, 2.4, 1.8). This seems to indicate something different about these injuries, or carpenters, in that first month. Stratified analyses indicated that those who received chiropractic care in the first 30 days were more likely to delay physical therapy (57% vs. 34%). Potential overlap in the type of care provided by chiropractors and physical therapists may influence when physical therapy was sought. Yet this does not completely account for the delay to physical therapy since the pattern of increasing paid lost days with delays to physical therapy was present in both strata of chiropractic care (Table 3).

Reasons for delays to care and/or to physical therapy for these carpenters are unknown. With this administrative data source we do not know whether delays were due to late provider referral or deferred action by the claimant resulting from personal factors such as difficulty getting an appointment, not making the appointment in a timely manner, or failing to recognize need for immediate treatment, to name a few possibilities. We know of no reason administrative reporting differences are responsible for the observed association with delay to care. This administrative data source represents a population of workers and encompasses a large number of health care providers. We feel the results presented here are robust assuming higher variability among this group of providers when compared to smaller, and less varied, clinic-based studies and data sources.

4.1. Strengths and limitations

These data represent the injury claims and health care provider experiences among union carpenters. Application of these findings would be useful and appropriate for other working populations with access to care through workers' compensation and private insurance coverage.

As is the case with all workers' compensation data, we captured the injuries that are reported to the workers' compensation system. Carpenters have reported the ease of using their private health care system for back injuries not likely to keep them out of work [13] and our data provide some evidence for overlap in care systems for work-related back injuries. However, we cannot identify possible work-related visits that were never filed through workers' compensation.

Like other researchers, we observed that administrative data without information from injured workers or providers prevents us from identifying a predominant provider and factors leading to care from other providers. Wasiak and colleagues found claimants rarely saw only one provider over the course of treatment and method of categorization for predominant provider gave different results [4]. We refrained from identifying a predominant provider and framed our descriptive analyses to quantify number and type of

provider at certain time points (e.g., the first day of care) or time windows (e.g., 0 to 90 days, 90 to 365 days). Describing patterns of care in such a way decreases the likelihood of bias, however limits our interpretation.

Therefore, we do not attribute direction or causality to the associations reported in this analysis. Administrative data sources such as the one available for these analyses were designed for purposes other than research. We do not know if the event or delayed return to work determined receipt and type of care, or if receipt and type of care defined the event or influenced delayed return to work. These results may represent the health care experiences of injured carpenters who don't get better, and consequently, see multiple providers and receive different diagnoses. Accounting for severity of the claim beyond paid time lost and delays to care was not possible with these data. Specific to physical therapy, some injured workers may be referred to physical therapy only after prolonged absence from work. This illustrates the complex nature of provider care for work-related back injury.

Finally, it is important to note that these data come from one state. Washington State has a state sponsored workers' compensation program; therefore, this system (theoretically) captures all injuries reported to workers' compensation. This is in contrast to other states, California for example, which is not a state sponsored program, where workers' compensation providers report work-related injuries and illnesses to the state workers' compensation division. Further, workers' compensation systems work differently from state to state, approve services differently, and therefore, can result in different utilization of private insurance. Access to data from a state sponsored system enabled us to conduct these analyses; however, such variability should be considered when comparing results from previous studies and in planning future research.

5. Conclusion

Almost all of these carpenters with work-related musculoskeletal back injury claims received medical care within 30 days. Care was often received from multiple providers even though the majority had no paid time off work. Care through union-provided insurance *only* and care from both systems was more prevalent after the first 90 days following the injury overall, and likewise, after return to work for those with at least one paid lost work day. In this population utilizing care from private sources for back-related problems in close proximity to and/or in conjunction with workers' compensation care suggests several potential forces at work: incomplete recovery from, or exacerbation of, the work-related back injury, ease of care-seeking through union insurance compared to workers' compensation, or non-work-related back disorder. Delays to any care, specifically physical therapy care, were associated with delayed return to work and support findings from other studies indicating that early treatment and referral are important for timely return to work.

Examination of treatment patterns through both systems provides a more complete understanding of back injury care. It also illustrates the value of studies that capture care received from both systems around and beyond the day of the injury event and after return to work. This study was useful in describing what these union carpenters did after an overexertion back injury claim; why these carpenters did what they did is not clear. Incorporating information from the injured workers themselves, about care decisions, care received before and after return to work, and other related issues, is the next step in contextualizing the findings from administrative data studies. Differences in outcomes based upon treatment shortly after injury are worthy of further exploration.

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References

[1] *The Construction Chart Book: The U.S. Construction Industry and Its Workers*, Fourth Edition ed. Silver Spring, MD: Center to Protect Workers' Rights (CPWR), 2007.

[2] H.J. Lipscomb, J.M. Dement, B. Silverstein, W. Cameron and J.E. Glazner, Compensation costs of work-related back disorders among union carpenters, Washington State 1989–2003, *American Journal of Industrial Medicine* **52** (2009), 587–595.

[3] G.S. Pransky, R. Gatchel, S.J. Linton and P. Loisel, Improving Return to Work Research, *Journal of Occupational Rehabilitation* **15** (2005), 453–457.

[4] R. Wasiak, G.S. Pransky and S.J. Atlas, Who's in charge? Challenges in evaluating quality of primary care treatment for low back pain, *Journal of Evaluation in Clinical Practice* **14** (2008), 961–968.

[5] G.F. Kominski, N. Pourat, D.H. Roby and M.E. Cameron, Return to work and degree of recovery among injured workers in California's workers' compensation system, *Journal of Occupational and Environmental Medicine* **50** (2008), 296–305.

[6] M.A. Mahmud, B.S. Webster, T.K. Courtney, S. Matz, J.A. Tacci and D.C. Christiani, Clinical management and the duration of disability for work-related low back pain, *Journal of Occupational and Environmental Medicine* **42** (2000), 1178–1187.

[7] H.J. Lipscomb, J.M. Dement, B. Silverstein, K.L. Kucera and W. Cameron, Health care utilization for musculoskeletal back disorders, Washington State union carpenters, 1989–2003, *Journal of Occupational and Environmental Medicine* **51** (2009), 604–611.

[8] H.J. Lipscomb, J.M. Dement, B. Silverstein, W. Cameron and J.E. Glazner, Who is Paying the Bills? Health Care Costs for Musculoskeletal Back Disorders, Washington State Union Carpenters, 1989–2003, *Journal of Occupational and Environmental Medicine* **51** (2009), 1185–1192.

[9] K.D. Rosenman, J.C. Gardiner, J. Wang, J. Biddle, A. Hogan, M.J. Reilly et al., Why Most Workers With Occupational Repetitive Trauma do not File for Workers' Compensation, *Journal of Occupational & Environmental Medicine* **42** (2000), 25.

[10] H.S. Shannon and G.S. Lowe, How many injured workers do not file claims for workers' compensation benefits? *American Journal of Industrial Medicine* **42** (2002), 467–473.

[11] Z.J. Fan, D.K. Bonauto, M.P. Foley and B.A. Silverstein, Underreporting of Work-Related Injury or Illness to Workers' Compensation: Individual and Industry Factors, *Journal of Occupational & Environmental Medicine* **48** (2006), 914–922.

[12] L.S. Azaroff, C. Levenstein and D.H. Wegman, Occupational Injury and Illness Surveillance: Conceptual Filters Explain Underreporting, *Public Health Matters* **92** (2002), 1421–1429.

[13] H.J. Lipscomb, W. Cameron, B. Silverstein and J.M. Dement, Back injuries among union carpenters in Washington State, 1989–2003, *American Journal of Industrial Medicine* **51** (2008), 463–474.

[14] A. Cheadle, G. Franklin, C. Wolfhagen, J. Savarino, P. Liu, C. Salley et al., Factors influencing the duration of work-related disability: a population based study of Washington State Workers' Compensation, *American Journal of Public Health* **84** (1994), 190–196.

[15] L.K. Dasinger, N. Krause, L.J. Deegan, R.J. Brand and L. Rudolph, Duration of work disability after low back injury: A comparison of administrative and self-reported outcomes, *American Journal of Industrial Medicine* **35** (1999), 619–631.

[16] N. Krause, J.W. Frank, L.K. Dasinger, T.J. Sullivan and S.J. Sinclair, Determinants of duration of disability and return-to-work after work-related injury and illness: Challenges for future research, *American Journal of Industrial Medicine* **40** (2001), 464–484.

[17] A. Oleinick, J.V. Gluck and K.E. Guire, Factors affecting first return to work following a compensable occupational back injury, *American Journal of Industrial Medicine* **30** (1996), 540–555.

[18] K.L. Kucera, H.J. Lipscomb, B. Silverstein and W. Cameron, Predictors of delayed return to work after back injury: a case control analysis of union carpenters in Washington state, *American Journal of Industrial Medicine* **52** (2009), 821–830.

[19] T. Carey, J. Garrett, A. Jackman and N. Hadler, Recurrence and care seeking after acute back pain: results of a long-term follow-up study. North Carolina Back Pain Project, *Medical Care* **37** (1999), 157–164.

[20] P. Cote, M.L. Baldwin and W.G. Johnson, Early patterns of care for occupational back pain, *Spine* **30** (2005), 581–587.

[21] D. Ehrmann-Feldman, M. Rossignol, L. Abenhaim and D. Gobeille, Physician referral to physical therapy in a cohort of workers compensated for low back pain, *Physical Therapy* **76** (1996), 150–156.

[22] C. Infante-Rivard and M. Lortie, Prognostic factors for return to work after a first compensated episode of back pain, *Occupational & Environmental Medicine* **53** (1996), 488–494.