Health Care Utilization for Musculoskeletal Back Disorders, Washington State Union Carpenters, 1989–2003

Hester J. Lipscomb, PhD
John M. Dement, PhD
Barbara Silverstein, PhD
Kristen L. Kucera, PhD
Wilfrid Cameron, MS

Objective: *Private health care utilization rates for musculoskeletal back disorders were contrasted to rates of work-related injuries or disorders for a large cohort of union carpenters over a 15-year period.* ***Methods:*** *Yearly utilization rates were compared with rates of work-related back injuries or disorders. Negative binomial regression with generalized estimating equations was used to assess utilization rates based on age, gender, union tenure, type of work, and previous work-related back injuries.* ***Results:*** *Private utilization rates were over twice as high in 2003 as in 1989 whereas compensation rates declined substantially. Utilization was higher among carpenters with less union tenure and increased with the number of work-related injuries.* ***Conclusions:*** *Patterns of utilization across private and workers' compensation delivery systems are not independent; we need to look broadly at sources of health care coverage to better understand the health of working populations.* (J Occup Environ Med. *2009;51:604–611*)

In the United States, health care delivery for working individuals is theoretically covered by two different insurance systems—private insurance, most often provided through an employer or union, and workers' compensation (WC). Although in theory the systems are separate, and in combination they should provide comprehensive coverage, there are potential overlaps and gaps between them.

If a worker is injured on the job or has a work-related condition, he or she must submit a claim through his or her employer or WC carrier. If the claim is approved, medical care should be paid for by the compensation carrier until it is determined that the worker requires no additional care or he or she has reached a point of maximum medical improvement. In some cases, the demarcation between work-related and non–work-related conditions and care is not entirely clear, and can result in contentious situations. Some conditions, including musculoskeletal injuries or disorders, can result in continued problems for the injured worker[1] that may extend beyond the coverage for a worker's compensation claim. Compensation carriers have concerns that they may be inappropriately held responsible for care in such cases where workers do not have private insurance coverage. Conversely, to avoid paying for claims that should be the responsibility of a compensation carrier, private insurance companies routinely ask if the care for which they are being billed is related to a work-related

From the Department of Community and Family Medicine (Dr Lipscomb, Dr Dement, Dr Kucera), Division of Occupational and Environmental Medicine, Duke University Medical Center, Durham, NC; Center to Protect Workers' Rights (Mr Cameron), Silver Spring, Md; and Department of Labor and Industries (Dr Silverstein), State of Washington, Safety and Health Assessment and Research Program (SHARP), Olympia, Wash.

Address correspondence to: Hester J. Lipscomb, PhD, Box 3834, Duke University Medical Center, Durham, NC 27710; E-mail: Hester.lipscomb@duke.edu.

DOI: 10.1097/JOM.0b013e31819c561c

injury or illness. Coverage for medical care for a disputed condition may be excluded from payment by a private carrier, leaving the patient uninsured for some services.[2]

Further complicating coverage issues, additional benefits associated with WC are sometimes viewed as incentives for workers to seek care through WC. For example, WC also provides partial salary reimbursement when loss of time from work is required and payment for permanent impairment which may result from the work-related injury or illness. There is also a conflicting literature on the potential significance of cost-shifting practices on the part of providers and insurers[3–5] related to the identification of conditions as occupationally related and, consequently, to the per capita costs associated with conditions labeled work-related.

Although work-related events which result in acute injury are more likely to be recognized through the compensation system than chronic diseases or ailments that arise gradually, there is growing evidence that workers often do not file compensation claims for both acute injuries and chronic conditions for a variety of reasons[6–9] including past experiences, concerns over job security, care-giver perceptions, and convenience. The influence of all of these issues may be important in understanding the true health of a working population.

Among a large cohort of union carpenters in Washington State, we identified a significant decline (62%) in their work-related musculoskeletal back injury rates through WC between 1989 and 2003.[10] As do many members of construction trade unions, these carpenters have health insurance coverage through a jointly trusteed health and welfare fund. These funds developed through the collective bargaining process over a period of years in different local areas and in different industries and trades to provide health insurance coverage for non–work-related medical care. Access to health insurance claims data from their health care trust, in addition to their WC records,[10] allowed us to evaluate more comprehensively the health care received by these carpenters for musculoskeletal back disorders. In addition to describing their health care utilization through the trust, analyses were specifically designed to explore potential cost-shifting across insurance payment systems for this large cohort of carpenters over a 15-year period.

Materials and Methods

Data Sources

Using data from the Carpenters Trusts of Western Washington (CTWW), we identified a cohort of union carpenters who worked in the State of Washington between 1989 and 2003, their dates of birth, gender, earliest date of union activity, and their hours of union work. The CTWW also provided the records of eligibility for health care coverage through the trust each month and all claims for medical care covered through the trust. The latter included the actual line items for care including provider assigned International Classification of Diseases, ninth revision (ICD-9) diagnosis codes.

The Washington State Department of Labor and Industries (L&I) provided the WC claims for the cohort. The State of Washington has a state run worker's compensation program which captures medical only claims as well as those which result in lost work time. Claims from companies which self-insure for compensation coverage are only coded in the L&I data if they result in paid lost time from work. The L&I data include the date of injury, American National Standards Institute codes describing the events in terms of body part injured, the nature of the injury, the type of event causing the injury, and whether the claim resulted in medical costs or paid lost time from work, which occurs after the third lost day in the State of Washington. Data were extracted on August 26, 2004 allowing 8 months after the last claims were filed in 2003 for fuller development of the claims, proper identification, and capture of the self-insured claims that resulted in paid lost time.

The data were provided with a blinded unique identifier allowing us to merge the records on an individual basis without the use of personal identifiers; these methods have been previously described in detail.[11–13] No race or ethnicity information was available from these sources. Cohort membership was limited to individuals who worked at least 3 months of union hours during this 15-year period and had at least 1 month of eligibility for health insurance through CTWW.

Definitions of Outcomes and Time at Risk

The primary outcome of interest in these analyses was private outpatient health care utilization through the CTWW for musculoskeletal back diagnoses based on a primary ICD-9 code diagnosis assigned to the claim by the provider as a requirement for billing purposes. Time at risk for health care claims was based on months in which each carpenter was eligible for insurance coverage through the trust. Utilization was defined as one visit per provider in any given day. A given carpenter might see a physician and a physical therapist on the same day counting as two visits for example; however, if the carpenter saw the same provider for an examination, x-ray film, and laboratory study, the encounter was considered as only one visit. To define time at risk and events of interest on the same basis for rate calculations, visits were limited to those occurring in months of insurance eligibility.

Covariates of Interest. To explore potential shifting of care, and associated costs, across these two payment systems we wanted to contrast patterns of care for similar musculoskeletal back conditions over time. We were also interested in whether the

history of work-related back injury would influence health care utilization for back diagnoses of a musculoskeletal nature through the health care trust and whether utilization varied based on the time since the work injury. The work-related back injuries and the dates of injury were previously identified using WC records.[10]

Other covariates of interest included age and gender; both are associated with health care utilization in other populations.[14,15] We were also interested in time in the union and predominant type of work which we have found to be associated with the risk of work-related back injury in this cohort.[10] Carpenters typically spend 4 years in apprenticeship; strata were constructed to assess risk in each year of this training and at 2-year intervals afterwards. The union local affiliation was the only surrogate available for characterizing the work done by cohort members. The locals represented by the cohort members were grouped into categories based on the predominant type of carpentry work done by the locals. Assignments of predominant type of work from earlier work with this cohort[11,13] were updated through interviews with business agents for each union local. These categories included light commercial, heavy commercial, drywall, millwrighting, piledriving, residential carpentry, and a mixed category. Light commercial work involved construction on projects two to three stories. Heavy commercial work involved high-rise buildings and interstate, freeway and bridge work. Millwrights are carpenters who work in industry and are often involved in repair and maintenance of heavy machinery. Drywall carpenters in Washington State hang drywall, but they do not tape or finish, in residential or commercial settings. Some carpenters were affiliated with union locals outside of Washington State although they were working in Washington. We were unable to identify the type of work of carpenters affiliated with locals outside of the State of Washington; consequently, they were combined for the analyses.

Analyses

The frequency of diagnoses and the number of carpenters with each diagnosis were identified. Descriptive statistics were generated on age, gender, time in the union, predominant type of work, and months of insurance eligibility of the cohort. Overall private outpatient health care utilization rates for musculoskeletal back disorders were calculated per 100 person-years (or 1200 months) of insurance eligibility by year as were private outpatient utilization rates for all other diagnoses. The private utilization rates for back disorders were compared to rates of WC claims filed for back disorders by the cohort in the same 15-year period.

Time at risk and events (health care visits for back disorders in CTWW) were stratified by time before and after a work-related injury as well as by gender, categories of age and time in the union. Age, time in the union, prior work-related back injury status and calendar time since work injury were all treated as time-varying variables with time at risk accumulating in the appropriate strata over the 15-year period. All time at risk for individuals who did not file a work-related claim was assigned to the time before injury category.

The distribution of the utilization data was highly skewed due to a significant proportion of the population who never sought care. Therefore negative binomial models were used to calculate stratified rates and rate ratios.[16] To account for the correlation of health care visits within subjects generalized estimating equations were used in the multivariate modeling of these longitudinal data.[17] The initial multivariate model explored risk factors for private health care utilization based on age, gender, time in the union, and predominant type of work. We evaluated the effect of having had a prior work-related back injury and the time that transpired since that injury adjusting for the above factors. Although the number of work-related back injuries could have been treated as a time-varying covariate, the latter model excluded individuals who had multiple work-related injuries due to interpretive difficulties related to defining time before and after injuries. We did evaluate private utilization based on the number of compensation injuries during the 15-year period.

Results

Description of the Cohort

We identified a cohort of 18,768 carpenters who worked in the State of Washington between 1989 and 2003. Mean time the carpenters were observed over the 15 years was 45 months (median 23.0). The cohort was predominantly male (n = 17,879; 97.4%), and relatively young at first observation (range from 17 to 76 years, mean 35 years, median 34 years). Time in the union at first entry into the cohort ranged from less than 1 year to 48 years (mean 6.1 year; median 1 year).

Health Care Utilization for Back Disorders

Sixty percent (n = 11,217) of the cohort did not seek medical care for back disorders through either the WC system or through their private union-provided insurance (Table 1);

TABLE 1
Medical Care for Back Disorders Through Workers' Compensation and Private Insurance, Union Carpenters Washington State, 1989–2003

Source of Care	Frequency (% of Cohort)
Only workers' compensation system	1,218 (6.5)
Only private insurance system	4,514 (24.1)
Both (WC and private)	1,819 (9.7)
Neither, no care for back disorders	11,217 (59.8)

10% ($n = 1819$) sought care in both systems. Through the private health care trust 6333 carpenters (33.7%) had 120,907 different health care visits out of a total of 565,726 overall outpatient health care visits (18.1%). The most common diagnosis was "ill-defined dislocations" (ICD-9 839) (Table 2). This diagnosis code accounted for nearly half of visits and was most frequently assigned by chiropractors. This was followed by unspecified back disorders (739) and sprains and strains (846 and 847). Together these three diagnoses represented 82% of all back diagnoses assigned. Disc disorders and root lesions were relatively rare diagnoses. During the same 15-year period, 3037 (16.2%) different carpenters filed 4138 claims for work-related back injuries/disorders; these injuries have previously been described.[10]

The pattern of yearly health care utilization for back disorders of a musculoskeletal nature through their health care trust by cohort members is contrasted to their previously identified pattern of work-related back injuries of a musculoskeletal nature due to overexertion type activities (lifting, carrying, pushing, etc.) in Fig. 1.[10] Private outpatient utilization rates for all other diagnoses are presented in Fig. 2. (Of note, in both figures, the contrasting rates are presented separately on the two y axes. Work-related back injury rates are based on hours of work whereas private utilization rates are based on months of health insurance eligibility.) There was a fairly steady decline in the rate of work-related back injuries due to overexertion over time resulting in a rate that was 62% lower in 2003 compared with 1989. In contrast, private health care utilization for musculoskeletal back diagnoses increased 108% over the 15 years, most notably after 1999. Private outpatient utilization rates for other diagnoses also markedly increased, but in a different pattern than for the back diagnoses.

Utilization rates were lower among younger carpenters and women had 64% higher rates of health care utilization through the trust compared with male carpenters (Table 3). Carpenters in the first 3 years of their apprenticeship had higher utilization rates than their more seasoned peers. Particularly high rates of utilization for back disorders were observed among carpenters whose locals did predominantly residential construction.

Health care utilization for back diagnoses through private insurance coverage was higher among carpenters with more work-related back injuries (Table 4). After the first work-related back injury, private utilization rates were 36% higher (Rate Ratio 1.36; 95% CI 1.20, 1.53); rates were nearly 3 times higher (Rate Ratio 2.75; 95% CI 1.94, 3.91) among indi-

TABLE 2
Frequency of Primary Diagnoses Assigned to Private Outpatient Health Care Claims for Back Problems of a Musculoskeletal Nature, Carpenters Trusts of Western Washington, 1989–2003

Primary ICD-9 Diagnosis	Frequency (%)	Different Carpenters With Diagnosis
353 Nerve root and plexus disorders, limited to lumbosacral (353.1, 353.4)	97 (0.08)	17 (0.15)
355 Mononueritis of lower limb, limited to sciatic nerve lesions (355.0)	30 (0.02)	4 (0.04)
721 Spondylosis and allied disorders	2,872 (2.4)	225 (2.1)
722 Intervertebral disc disorders	6,805 (5.6)	1,142 (10.4)
724 Other/unspecified back disorders	20,477 (16.9)	2,728 (24.9)
738.4 Acquired spondylolisthesis	116 (0.10)	37 (0.34)
739 Nonallopathic lesions, limited to LS (739.3, 739.4)	12,227 (10.1)	938 (8.6)
839 Ill-defined dislocations (chiropractic diagnosis)	59,674 (49.3)	3,419 (31.2)
846 Sprain or strains sacroiliac region	4,882 (4.0)	659 (6.1)
847 Sprains or strains other parts of back (limited to lumbar and sacral)	13,727 (11.4)	1,801 (16.4)
Total	*120,907 (100.0)*	*6,333**

*Six thousand three hundred thirty-three different carpenters were treated for musculoskeletal back diagnoses (33.7% of cohort); some had >1 diagnosis assigned.

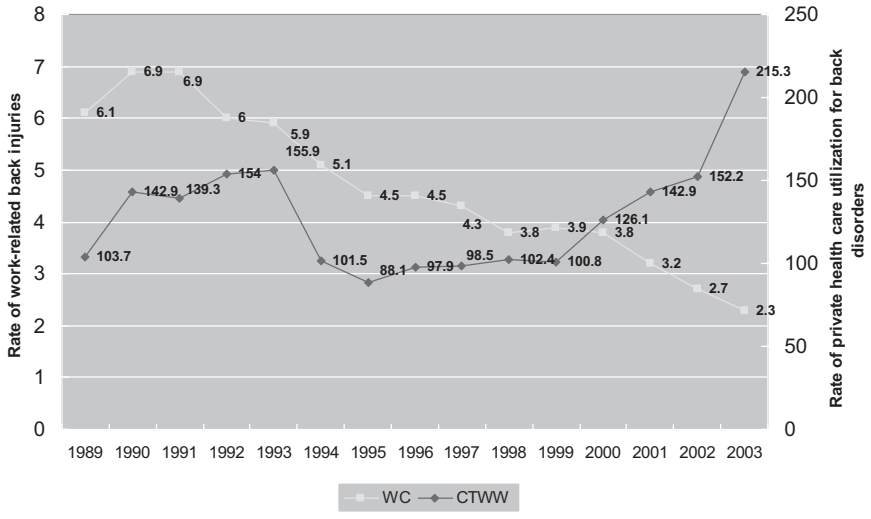

Fig. 1. Outpatient health care utilization rates for musculoskeletal back diagnoses through the Carpenters Trusts of Western Washington compared with workers' compensation injury rates for overexertion back disorders, 1989–2003. WC, overexertion injury rates per 100 person years (200,000 hours worked); HW, User rates for back care of musculoskeletal nature per 100 person-years of insurance eligibility; limited to one visit per day per person.

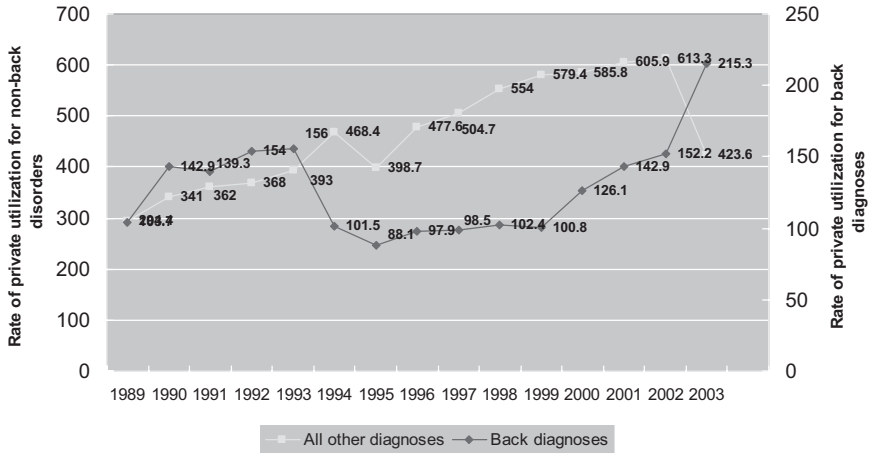

Fig. 2. Outpatient private health care utilization rates (Rates are per 100 person-years of insurance eligibility [1200 person-months].) for musculoskeletal back diagnoses and all other diagnoses, Carpenters Trusts of Western Washington, 1989–2003.

TABLE 3
Stratified Time at Risk, Health Care Visits, Utilization Rates and Adjusted Rate Ratios, Union Carpenters Washington State, 1989–2003

	Months of Insurance Eligibility	Visits	Stratified Utilization Rate (95% CI)*†	Adjusted Rate Ratios (95% CI)‡
Age				
<20	5,107	257	53.75 (42.48, 68.00)	0.36 (0.19, 0.68)
20–<30	173,565	17,529	100.66 (97.13, 104.32)	0.76 (0.60, 0.97)
30–<40	356,530	40,913	112.67 (110.06, 115.55)	0.99 (0.85, 1.15)
40–<50	311,613	35,634	115.03 (112.07, 118.07)	1.01 (0.88, 1.15)
50+	267,576	26,528	109.65 (106.46, 112.93)	1
Gender				
Female	19,594	3,171	158.69 (143.46, 175.53)	1.64 (0.86, 3.11)
Male	1,094,582	117,690	109.69 (108.15, 111.25)	1
Time in the union				
<1 yr	74,182	8,305	122.97 (115.96, 130.40)	1.16 (0.86, 1.56)
1–<2 yr	77,403	14,030	186.33 (176.90, 196.26)	1.88 (1.16, 3.03)
2–<3 yr	63,286	8,120	124.70 (117.80, 132.00)	1.25 (1.03, 1.51)
3–<4 yr	54,404	5,832	102.20 (96.10, 108.69)	1.09 (0.91, 1.30)
4–<6 yr	89,002	8,997	95.99 (91.49, 100.71)	1.02 (0.87, 1.19)
6–<8 yr	70,016	6,479	89.11 (84.37, 94.11)	0.94 (0.81, 1.08)
8–<10 yr	64,850	5,952	90.29 (85.24, 95.63)	0.94 (0.82, 1.06)
10 yr and over	624,023	63,190	106.58 (104.59, 108.60)	1
Predominant work				
Residential	14,557	4,558	324.68 (289.48, 364.16)	3.40 (1.03, 11.22)
Light commercial	131,645	13,281	101.60 (97.55, 105.83)	0.92 (0.73, 1.15)
Drywall	190,994	20,570	106.09 (102.66, 109.63)	0.96 (0.77, 1.20)
Millwright	21,371	2,141	101.14 (91.53, 111.760	0.85 (0.60, 1.22)
Pile driver	63,905	5,528	91.41 (86.12, 92.02)	0.82 (0.64, 1.07)
Mixed commercial	491,135	52,381	110.85 (108.55, 113.20)	1.01 (0.82, 1.24)
Out of Washington	18,193	1,893	100.35 (90.28, 111.56)	0.90 (0.65, 1.25)
Heavy commercial	163,058	17,878	113.26 (109.27, 117.39)	1

*Rates are per 100 person-yr of insurance eligibility.
†Negative binomial regression model.
‡Negative binomial regression model with generalized estimating equations.

viduals who experienced four or more work-related back injuries during the observation period. In analyses limited only to individuals who ever used the WC system (data not shown), the pattern was the same. Private health care utilization was highest in the first year after overexertion work injuries but highest 1 to 3 years after acute work-related back injury (Table 5).

Discussion

By combining data from a number of administrative sources and linking them on an individual basis, we were able to clearly define a cohort of union carpenters, their work-related injuries and illnesses, as well as their health care claims through their private health insurance coverage. We were also able to identify periods of eligibility for health insurance coverage and hours worked, providing reasonable measures of time at risk for use in rate calculations. Together these data provided a unique opportunity to look comprehensively and longitudinally at the health care received by these construction workers for back problems of a musculoskeletal nature.

During a period of time when work-related musculoskeletal back injuries among this cohort decreased steadily and dramatically,[10] their health care utilization rates through their private insurance followed a different pattern. Utilization rates ended in 2003 over twice as high as in 1989. This pattern of utilization raises concern that some work-related care for back disorders could have shifted to the carpenters' health care trust, particularly in later years. There was a marked increase in outpatient utilization rates through the trust for other diagnoses during this time period as well, but it followed a different pattern than those for back disorders.

Rates of utilization through the trust were increased in the first 3 to 5 years following a work-related back injury with slightly different patterns associated with a prior overexertion work injury compared with a prior back injury from acute trauma. The magnitude of the rate increase in the first year following a work injury is consistent with the report of increased health care utilization among health care workers who had experi-

TABLE 4
Private Outpatient Utilization Rates and Adjusted Rate Ratios for Musculoskeletal Back Diagnoses by the Number of Work-Related Claims, Union Carpenters Washington State, 1989–2003

Number of WC Claims	Rate of Private Utilization (95% CI)*	Adjusted Rate Ratio (95% CI)†
None	100.29 (98.68, 101.93)	1
One	129.34 (125.15, 133.68)	1.36 (1.20, 1.53)
Two	157.28 (147.97, 167.18)	1.66 (1.41, 1.95)
Three	165.05 (148.93, 182.92)	1.74 (1.37, 2.20)
Four or more	246.70 (214.13, 284.24)	2.75 (1.94, 3.91)

*Rates are per 100 person-yr of insurance eligibility.
†Adjusted for age, gender, time in the union, and predominant type of work; negative binomial regression with generalized estimating equations.

TABLE 5
Stratified Utilization Rates and Adjusted Rate Ratios Based on Calendar Time Since Work Injury and Cause of Work Injury, Union Carpenters Washington State, 1989–2003

Time Since Work Injury	Stratified Rate* of Utilization (95% CI)	Adjusted Rate Ratios (95% CI)†
Overexertion injury		
<1 yr	162.08 (154.94, 169.94)	1.53 (1.21, 1.94)
1–<3 yr	125.16 (120.07, 130.47)	1.23 (1.01, 1.50)
3–<5 yr	124.87 (118.95, 131.09)	1.24 (0.98, 1.56)
5+ yr	110.10 (105.90, 114.46)	1.11 (0.89, 1.38)
No prior work injury	102.87 (102.20, 103.94)	
Acute trauma		
<1 yr	134.47 (123.70, 146.18)	1.22 (0.85, 1.76)
1–<3 yr	157.03 (147.45, 167.23)	1.48 (1.02, 2.13)
3–<5 yr	93.32 (84.74, 102.76)	0.93 (0.62, 1.38)
5+ yr	99.48 (92.84, 106.54)	1.01 (0.66, 1.55)
No prior work injury	101.49 (100.81, 102.18)	1

*Rates are per 100 person-yr of insurance eligibility.
†Adjusted for age, gender, time in the union, and predominant type of work; negative binomial regression with generalized estimating equations.

enced a musculoskeletal work injury in British Columbia.[18] Although, we limited our before and after analyses to individuals with only one back injury, we saw a steady increase in utilization for back diagnoses through the trust as the number of work-related back injuries increased. This finding is consistent with the chronic nature of some back problems even among the employed.[18–22]

Time in union was associated with work injuries[10] and utilization through the trust; those with less union experience were at greater risk of injuries and had higher health care utilization. Individuals who were affiliated with locals who did residential carpentry had higher rates of work-related injury and utilization through the trust, particularly. These findings suggest that work-related risk factors or exposures may be playing a role in health care utilization for musculoskeletal back problems through the trust as well as in their work-related injury experiences.

In any workforce including the construction trades, it cannot be assumed that all work-related illnesses, or even injuries, will be captured in WC data.[6,8,9,20,23,24] Even after a person chooses to seek medical care, there appear to be factors which influence whether an individual chooses to seek care through the compensation system. For example, Fingar et al[25] reported that younger workers were more likely to seek emergency room care than older workers, but they were less likely to file a compensation claim. In contrast to some concerns of cost-shifting to compensation, these carpenters describe the ease of seeking care outside the compensation system for injuries that are not likely to keep them out of work. These jointly trusteed health care funds have traditionally had close alliances with the populations they serve; some report that seeking care through their private union-provided insurance is less trouble than dealing with WC.

It is important to recognize that we were studying health care utilization and reported work-related injuries. However, the data also provided information about trends in health care use among these construction workers over 15 years. We know that there was some misclassification in the identification of incident injuries based on lack of knowledge of work-related claims that occurred among cohort members before 1989 when we were able to first gain data access. Misclassification, if present, would likely have attenuated the differences in rates we observed before and after injury.

Relatively little is known about the delivery of health services to construction workers, and these analyses provide important information. Construction workers have one of the highest proportions of working individuals without private health insurance, and lack of coverage is more prevalent among non-union workers.[26] Even among union construction workers, such as these, coverage may lapse during periods of unemployment. Eligibility for benefits is typically based on having worked a required number of hours; however, workers are allowed to "bank" hours to cover eligibility requirements during periods of time when they are unable to work due to lack of available work, illness, or disability. We recognize that our findings are not

generalizable to a workforce without health insurance coverage, but the payment for work-related conditions through other sources is not limited to privately insured workers. The recent report of Dong et al[27] documented that less than half of total medical expenses for work-related injuries were paid by WC with greater disparities among Hispanic construction worker. Costs were not just borne by private insurance sources, but also through public mechanisms as well as by workers and their families.

Conclusions

Our findings demonstrate the complexity of health care use for musculoskeletal back problems among this large construction cohort with non–work-related insurance coverage. We observed evidence of changing patterns of utilization for musculoskeletal back problems in the carpenters' health care trust in concert with changes in their reported WC injury experience. However, even with the comprehensive nature of these data, these issues are difficult to clearly understand, and we cannot say one caused the other. We cannot determine whether the undefined factors contributing to overall increased health care utilization were responsible for the increase in care for back diagnoses among this large cohort of construction workers or whether it might have been related to less use of the WC system. It is noteworthy that the trajectory of increased utilization differed for musculoskeletal back diagnoses and all other outpatient claims. In any event, these findings are interesting and raise questions about whether the overall health of the population in regard to back disorders is improving or not.

These analyses provide clear evidence of interplay across two health care delivery systems for a working population. The findings add to the growing literature and demonstrate the need to look broadly at sources of health care coverage to better understand the health of working populations. Assuming the systems function independently would be naive.

Acknowledgment

We thank Norman Anderson and Larry McNutt at the Carpenters Trusts of Western Washington for their longstanding support and access to data on this carpenter cohort. We thank Barbara Trunkhill for downloading the data from the trust files and for her coordination with the Department of Labor and Industries that allowed us to secure the data with unique identifiers that did not include personal information. We also thank John Kalat and Darrin Adams at SHARP in the Department of Labor and Industries for providing the workers' compensation analysis files matched to the carpenter cohort. We are appreciative of the time of the union business agents who talked with us about type of work of the locals they represented.

Supported by NIOSH RO1 OH 008007; "Back Disorders in Union Carpenters."

References

1. Welch LS, Hunting KL, Nessel-Stephens L. Chronic symptoms in construction workers treated for musculoskeletal injuries. *Am J Ind Med*. 1999;36:532–540.
2. Ramsey S, Rosenstock L. Proposal to reimburse occupational medicine disease and injury claims through third party health insurance. *Am J Ind Med*. 1994;26: 147–154.
3. Ducatman A. Workers' compensation cost-shifting; a unique concern of providers and purchasers of prepaid health care. *J Occup Med*. 1986;28:1174–1176.
4. Zwerling C, Ryan J, Orav EJ. Workers' compensation cost shifting: an empirical study. *Am J Ind Med*. 1991;19:317–325.
5. Butler RJ, Hartwig RP, Gardner H. HMO's, moral hazard and cost shifting in workers' compensation. *J Health Econ*. 1997;16:191–206.
6. Biddle J, Roberts K, Rosenman KD, Welch EM. What percentage of workers with work-related illnesses receive workers' compensation benefits? *J Occup Environ Med*. 1998;43:325–331.
7. Rosenman KD, Gardiner JC, Wang J, et al. Why most workers with occupational repetitive trauma do not file for workers' compensation. *J Occup Environ Med*. 2000;42:25–34.
8. Shannon HS, Lowe GS. How many injured workers do not file claims for workers' compensation benefits? *Am J Ind Med*. 2002;42:467–473.
9. Fan ZJ, Bonauto DK, Foley M, Silverstein BA. Underreporting of work-related injury or illness to workers' compensation: individual and industry factors. *J Occup Environ Med*. 2006;48:914–922.
10. Lipscomb HJ, Cameron W, Silverstein B. Work-related back injuries among union carpenters in Washington State, 1989–2003. *Am J Ind Med*. 2008;51:463–474.
11. Lipscomb HJ, Dement JM, Loomis DP, Silverstein B, Kalat J. Surveillance of work-related musculoskeletal injuries among union carpenters. *Am J Ind Med*. 1997;2:629–640.
12. Lipscomb HJ, Dement JM, Gaal J, Cameron W, McDougall V. Work-related injuries in drywall installation. *Appl Occup Environ Hyg*. 2000;15:794–802.
13. Lipscomb HJ, Li L, Dement JM. Falls among union carpenters. *Am J Ind Med*. 2003;44:148–156.
14. Bertakis KD, Azari R, Helms J, Callahan EJ, Robbins JA. Gender differences in the utilization of health care services. *J Fam Pract*. 2000;49:147–152.
15. Ladwig K-H, Marten-Mittag B, Formanek B, Dammann G. Gender differences of symptoms reporting and medical care utilization in the German population. *Eur J Epidemiol*. 2000;16:511–518.
16. Byers A. Application of negative binomial modeling for discrete outcomes: a case in aging research. *J Clin Epidemiol*. 2003;56:559–564.
17. Zeger SL, Liang KY, Albert PS. Models for longitudinal data: a generalized estimating equation approach. *Biometrics*. 1988;44:1049–1060.
18. Koehorn M, Cole DC, Hertzman C, Lee H. Health care use associated with work-related musculoskeletal disorders among health care workers. *J Occup Rehabil*. 2006;16:411–424.
19. Carey TS, Garrett JM, Jackman A, Hadler N. Recurrence and care seeking after acute back pain: results of a long-term follow-up study. North Carolina back pain project. *Med Care*. 1999;37:157–164.
20. Carey TS, Garrett JM, Jackman AM. Beyond the good prognosis. Examination of an inception cohort of patients with chronic low back pain. *Spine*. 2000;25: 115–200.
21. Rosenman KD, Kalush A, Reilly MJ, Gardiner JC, Reeves M, Luo Z. How much work-related illness and injury is missed by the current national surveillance system? *J Occup Environ Med*. 2006;48:357–365.
22. Ritzwoller DP, Crounse L, Shetterley S, Rublee D. The association of comorbidities, utilization and costs for patients identified with low back pain. *BMC Musculoskelet Disord.* 2006;7:72.

23. Breslin FC, Polzer J, MacEachon E, Morrongiello B, Shannon H. Workplace injury or "part of the job?": toward a gendered understanding of injuries and complaints among young workers. *Soc Sci Med*. 2007;64:782–793.
24. Blessman JE. Differential treatment of occupational disease vs occupational injury by workers' compensation in Washington State. *J Occup Med*. 1991; 33:121–126.
25. Fingar AR, Hopkins RS, Nelson M. Work-related injuries in Athens County 1982–1986. *J Occup Med*. 1992;34: 779–787.
26. Center to Protect Workers' Rights. *The Construction Chartbook, the US Construction Industry and its Workers*. 4th ed. Silver Spring, MD: The CPWR; 2007.
27. Dong X, Ringen K, Men Y, Fujimoto A. Medical costs and sources of payment for work-related injuries among Hispanic construction workers. *J Occup Environ Med*. 2007;49:1367–1375.