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ORIGINAL ARTICLE

Patterns of sick-leave and health outcomes in injured workers with back pain

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Abstract Little is known about the sick-leave experiences of workers who make a workers' compensation claim for back pain. Our objective is to describe the 1-year patterns of sick-leave and the health outcomes of a cohort of workers who make a workers' compensation claim for back pain. We studied a cohort of 1,831 workers from five large US firms who made incident workers' compensation claims for back pain between January 1, 1999 and June 30, 2002. Injured workers were interviewed 1 month ($n = 1{,}321$), 6 months ($n = 810$) and 1 year ($n = 462$) following the onset of their pain. We described the course of back pain using four patterns of sick-leave: (1) no sick-leave, (2) returned to worked and stayed, (3) multiple episodes of sick-leave and (4) not yet returned to work. We described the health outcomes as back and/or leg pain intensity, functional limitations and health-related quality of life. We analyzed data from participants who completed all follow-up interviews ($n = 457$) to compute the probabilities of transition between patterns of sick-leave. A significant proportion of workers experienced multiple episodes of sick-leave (30.2%; 95% CI 25.0–35.1) during the 1-year follow-up. The proportion of workers who did not report sick-leave declined from 42.4% (95% CI 39.0–46.1) at 1 month to 33.6% (28.0–38.7) at 1 year. One year after the injury, 2.9% (1.6–4.9) of workers had not yet returned to work. Workers who did not report sick-leave and those who returned and stayed at work reported better health outcomes than workers who experienced multiple episodes of sick-leave or workers who had not returned to work. Almost a third of workers with an incident episode of back pain experience recurrent spells of work absenteeism during the following year. Our data suggest that stable patterns of sick-leave are associated with better health.

Keywords Low back pain · Cohort study · Prognosis · Disability · Employment

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Introduction

Back pain in workers is the most commonly compensated condition in industrialized nations [33, 39]. In the US, back pain causes an average loss of 5.3 work-hours per week [26]. Every year in the general population, 4 out of every 1,000 individuals become disabled because of back pain

[5]. Despite new disability management and clinical interventions designed to shorten work absences, reducing work disability associated with back pain remains an elusive goal. One reason for the lack of success is the continuing reliance on models that conceptualize back pain as an acute condition that follows a uni-directional path over time rather than as a chronic disorder with recurring episodes of disabling pain [5, 15].

The characterization of back pain as an acute condition is consistent with the "injury model" of disability on which workers' compensation laws were founded in the early 1900s [15]. The model assumes that the disabling effects of back pain end when an injured worker returns to work. A more recent approach is the "phases of disability model." This model assumes that patients transit through acute, sub-acute and chronic phases of back pain with an episode ending either in a return to work or permanent disability [6, 11]. Neither model permits the possibility that the disabling effects of back pain can be recurrent.

Recent research shows that the course of back pain is episodic and that a substantial minority of patients does not experience resolution of their pain and disability [5, 8, 12, 13, 21, 31, 32, 37]. A recent review of the literature shows that the rate of recurrence of work disability related to back pain depends on the definition used to measure recurrence and on the study population. In their review, Wasiak et al. report that the rate of recurrence varies form 12.1% in Quebec to 44.3% in England [37]. Two studies of workers who filed compensation claims for back pain in Ontario, Canada find that more than two-thirds of workers who returned to work experienced subsequent episodes of sick-leave related to back pain [2, 4]. To our knowledge, no study has yet described how injured workers transit in and out of work during the first year after onset of back pain.

The primary objective of this study is to describe the 1-year course of back pain among US workers in terms of their sick-leave experiences. Second, we describe associations between patterns of sick-leave and measures of pain intensity, functional limitations and health-related quality of life. Finally, we describe how workers transit between sick-leave patterns over the course of the year.

Methods

Design and study population

We conducted the *Arizona State University Healthy Back Study*, a prospective cohort study of workers who file compensation claims for back pain [7]. The study population includes nearly 200,000 workers from five US employers spread over 37 states. The employers are: America West Airlines, American Medical Response, The Earthgrains Co. (now part of Sara Lee Corporation Baking Division), Maricopa County, and Marriott International, Inc.

Participating employers notified the research team when a worker filed a compensation claim for occupational back pain. The research team contacted each worker and invited him or her to join the study. Workers who agreed to participate were contacted by telephone for the baseline interview. Follow-up interviews were conducted 1, 6 and 12 months after onset. A combined baseline and 1-month interview was administered to workers who were initially contacted more than 28 days after onset (approximately 40% of cases). Reports of back pain were confirmed by injured workers and by first "reports of injury," which include "part of body" and "nature of injury" codes. The research protocol was approved by Institutional Review Boards at Arizona State University and East Carolina University. In compliance with confidentiality agreements, the results presented here do not identify individual employers.

Study sample

Workers age 18 years and older, who filed a workers' compensation claim for back pain (with or without sciatica) between January 1, 1999 and June 30, 2002, were eligible for the study. Our study sample included all claim types: claims involving work absences that do not last longer than the state-specific waiting period ("medical only" claims); claims involving a period of absenteeism that last longer than the waiting period ("temporary total disability") and claims that result in a permanent loss or disability ("permanent partial disability").

To be interviewed, a worker had to agree to participate in the telephone survey, and confirm that he or she experienced back pain. We excluded workers with fractures (identified by "nature of injury" codes), workers whose claims were denied or litigated, and the subsequent claims of workers who submitted more than one claim during the study period.

Primary outcome

The primary outcome measure is the pattern of sick-leave experienced in the first year after onset of back pain. We measured sick-leave at each follow-up. We constructed four mutually exclusive patterns of sick-leave based on workers' responses to the following questions: (1) "Did you have to take time off from work because of your back

injury?" (2) "Have you returned to work?" (3) "Between the time you returned to work and now (time of interview) did you have to take any additional time off from work because of your back injury? The patterns are defined as follows:

- Pattern 1: No time off work associated with back pain (no sick-leave). At each follow-up interview, these workers report "no" to the question: "Did you have to take time off from work because of your back injury?"
- Pattern 2: A single episode of sick-leave associated with back pain, ending in a return to work and no subsequent episode of back pain-related sick-leave (returned and stayed at work).
- Pattern 3: A single episode of sick-leave associated with back pain, ending in a return to work; followed by one or more episodes of back pain-related sick-leave (multiple episodes).
- Pattern 4: Absent from work since the onset of back pain (not yet returned).

Patterns of sick-leave experienced at 1, 6 and 12 months represent a worker's sick-leave experience to that date. For example, a worker who experienced a single episode of work absence before the first follow-up would be classified in Pattern 2 at 1 month and again at 6 months if no other episode of work absenteeism is reported. Thus, once a worker has had one episode of sick-leave, he or she could never transition to Pattern 1 (no sick-leave). Similarly, once a worker reported multiple episodes of sick-leave (Pattern 3), he or she could never transition to another pattern.

Secondary outcomes

Our secondary outcomes include intensity of back pain, intensity of leg pain, functional limitations associated with back pain and measures of physical and mental health-related quality of life.

Back and/or leg pain intensity

Intensity of back and/or leg pain over the week prior to interview are measured on two separate numerical rating scales ranging from "0" (pain is not bothersome at all) to "100" (pain is extremely bothersome).

Functional limitations

The extent of functional disability associated with back pain is measured by the Roland–Morris Disability Scale, a 24-item instrument assessing functional abilities, such as walking, standing, climbing stairs [14, 16, 22, 27]. The internal consistency of the Roland–Morris questionnaire is well established [9, 22]. The scale has high test–retest reliability when re-administered within a 6-week period. Repeated measurements performed on the same day and at 3 weeks are highly correlated [9, 16, 22, 28]. The Roland–Morris scale has good criterion-based construct and discriminant validity and is the most responsive disability questionnaire for back pain currently available [3, 9, 10, 16, 18, 22, 27–29]. Raw scores, recorded on an integer scale ranging from 0 (no disability) to 24 (severe disability), are transformed into percentages.

Health-related quality of life

We use the SF-12 questionnaire (second revision), a short version of the SF-36, to measure physical and mental health-related quality of life [34, 36]. SF-12 scores range from 0 to 100 with higher scores indicating better health, and with population averages for a healthy population equal to 50. Both physical and mental components are predictive of the corresponding SF-36 components with r^2 values greater than 0.91 [35]. The SF-12 has good test-retest reliability measured over a 2-week period, with correlation coefficients of 0.89 for the physical component and 0.76 for the mental component [35]. Finally, the SF-12 has good internal consistency, validity and responsiveness in patients with low back pain [20].

Analysis

Our main analyses include three steps. First, we describe the 1-, 6-month, and 1-year incidence of sick-leave patterns (the number of respondents at each follow-up is the denominator). Second, we present mean severity measures stratified by sick-leave pattern. Finally, we use a sub-cohort of respondents who completed all follow-up interviews to compute the probability (incidence) of transition between the four patterns of sick-leave.

Attrition

To understand the effects of attrition, we compared the characteristics of each follow-up sample (participants to the 1-, 6-month, 1-year follow-up) with the baseline sample (full sample). Differences between the baseline and follow-up samples were used to compute sample weights to standardize our analyses to the original population.

Attrition occurs when subjects are permanently lost to follow-up and leads to missing outcome data. Attrition does not necessarily lead to bias, but it undoubtedly results in selection bias when it is dependant on the outcome [17]. Overall, attrition bias leads to spurious risk estimates of unpredictable magnitude and direction and it reduces the effective sample size for analysis.

Determining whether attrition occurs randomly or systematically is challenging. We addressed this issue by computing a propensity score for each participant [19, 23]. The propensity score is the predicted probability of individuals with particular characteristics dropping out of the study. We first identified patterns of attrition by comparing characteristics of respondents to the baseline interview to characteristics of non-respondents at each follow-up interview. We used logistic regression to estimate the probability of dropping out of the study at each follow-up period, where the independent variables in the model control for age, gender, occupation, region, employer and claim type (medical only, temporary total or permanent partial).

We used the propensity score to compute sample weights. The sample weight is the inverse of the estimated probability of non-participation scaled to sum to the number of respondents. We computed separate sample weights for each follow-up period. We used the sample weights to control for differences in characteristics between the baseline sample and those who responded to each follow-up interview [19, 23]. All analyses are weighted and conducted using SAS [25].

Course of back pain

We used a period specific approach to describe the course of back pain and computed the period specific incidence and 95% CI of sick-leave patterns. We described the health outcomes stratified by sick-leave pattern and reported back pain intensity, leg pain intensity, functional limitations, physical and mental health-related quality of life.

We formed a cohort of workers who responded to all follow-up interviews to compute the probabilities of transition (95% CI) between the four sick-leave patterns at each follow-up. We calculated the probability of transition from pattern j_t (where t is a time subscript) to pattern j_{t+1} (the following interview) by dividing the number of workers in pattern j_{t+1} by the number of workers in pattern j_t. For example, assume there are 100 workers who have not returned to work at 1 month (j_t = Pattern 4). Assume that, at 6 months, 45 have returned to work with no further sick-leave (j_{t+1} = Pattern 2), 15 have returned and experienced subsequent absences (j_{t+1} = Pattern 3) and 40 are still out of work (j_{t+1} = Pattern 4). Transition probabilities are 0.45 to Pattern 2 (returned and stayed at work), 0.15 to Pattern 3 (multiple episodes) and 0.40 to Pattern 4 (not yet returned to work). We weighted all incidence estimates with the 1-year sample weights to control for differences between the baseline cohort and the full follow-up sample.

Results

Participation

A total of 6,460 back pain claims were made to participating employers during the inception period. We received notifications of 4,901 back claims (76%). We did not receive notices for all claims because employers excluded some worksites from the study (e.g., Marriott excluded unionized hotels), and because our employer contacts sometimes failed to notify us when a back pain claim was made. Of the notifications we received, 3,626 claims (74%) were eligible for the survey. Ineligible claims included 295 non-back or non-work-related injuries; 635 refusals to release contact information; 68 denied or litigated claims; 154 notifications received more than 6 months after onset, and 123 claims for second injuries. Baseline interviews were completed for 1,836 workers (51% of eligible claims). Of those, five workers had sustained fractures and were excluded from the sample. Our baseline cohort, therefore, includes 1,831 workers. The follow-up rate was 72% at 1 month (n = 1,321), 44% at 6 months (n = 810) and 25% at 12 months (n = 462).

Characteristics of the cohort

Table 1 describes the baseline characteristics of the sample. Our baseline sample included more females than males; most workers were between the ages of 36–55 years and a higher proportion of workers were from western states. Participating workers were employed in a wide range of jobs, but over 50% worked in the services or transportation/moving sectors. Nearly two-thirds (62%) had medical only claims, a somewhat smaller proportion than the national average (78%) for all workers' compensation claims in 2000 [40].

The distribution of baseline characteristics varies slightly between the baseline and follow-up periods. Younger workers and males were more likely to be lost to follow-up than older workers and females (Table 1). At the 6- and 12-month follow-ups, dropping out of the study was slightly more common in workers who made a medical only claim than in those who made an indemnity claim. We find no important differences in baseline back pain intensity, leg pain intensity, Roland–Morris score and SF-12

Table 1 Baseline characteristics of study sample for the baseline, 1-, 6-month and 1-year interview

	Baseline (n = 1,836)	One-month follow-up Respondents (n = 1,321)	Six-month follow-up Respondents (n = 810)	One-year follow-up Respondents (n = 462)
Age group (%)				
Missing	1	1	0	0
Under 36	41	40	38	34
36–55	51	52	54	59
56 and over	7	7	7	8
Gender (%)				
Male	48	48	48	44
Female	52	52	52	56
Region (%)				
Northeast	8	8	9	8
Southeast	8	8	8	9
Midwest	26	25	25	23
West	58	59	58	61
Employer (%)				
A	4	4	4	5
B	28	28	28	28
C	15	15	16	16
D	41	39	38	38
E	12	14	14	14
Job classification (%)				
Missing	10	11	11	11
Professional/manager	5	6	5	5
Technical	12	12	13	14
Services	31	28	27	26
Sales/clerical	11	11	13	14
Skilled/semi-skilled labor	6	6	6	6
Transportation/moving	25	26	25	23
Claim type (%)				
Missing	5	5	4	5
Medical only	62	63	60	58
Indemnity	27	26	29	32
Other	6	6	6	6
Back pain, mean (S.D.)	51.3 (33.1)	51.2 (32.4)	52.0 (32.0)	52.8 (32.1)
Leg pain, mean (S.D.)	28.0 (34.4)	27.4 (34.1)	29.0 (34.3)	29.9 (34.6)
Roland–Morris (%), mean (S.D.)	45 (30)	44 (30)	45 (29)	47 (29)
Physical SF-12, mean (S.D.)	38.7 (10.6)	38.9 (10.6)	38.5 (10.5)	37.9 (10.4)
Mental SF-12; mean (S.D.)	48.4 (11.5)	48.2 (11.6)	48.3 (11.6)	47.7 (12.1)

scores between the baseline and follow-up samples of respondents.

Course of back pain

Table 2 shows the period-specific incidence of sick-leave patterns. At the 1-month follow-up, 42% of workers reported no sick-leave (Pattern 1) and 36% reported one episode of sick-leave followed by sustainable return to work (Pattern 2). Approximately one-fifth of workers reported unfavorable sick-leave outcomes: 11.9% of workers returned to work but experienced subsequent sick-leave related to their initial back pain (Pattern 3) and 9.6% had not yet returned to work (Pattern 4).

The 6-month and 1-year follow-up data confirms that back pain runs a recurrent course (Table 2). The proportion of workers who reported "multiple episodes" of sick-leave

Table 2 Period specific incidence (95% CI) of sick-leave patterns at each follow-up interview

Sick-leave pattern	One-month follow-up (n = 1,321)	Six-month follow-up (n = 810)	One-year follow-up (n = 462)
1—No sick-leave	42.4% (39.0–46.1)	35.1% (31.1–39.4)	33.6% (28.0–38.7)
2—Return and stay	36.1% (33.0–39.6)	38.6% (34.4–43.1)	33.4% (27.9–38.5)
3—Multiple episodes	11.9% (10.1–13.9)	22.6% (19.4–26.1)	30.2% (25.0–35.1)
4—Not yet returned	9.6% (8.1–11.5)	3.7% (2.5–5.3)	2.9% (1.6–4.9)

The results are weighted

increased steadily in the first year from 11.9% at 1 month to 22.6 and 30.2% at 6 months and 1 year, respectively. In contrast, the proportion of workers who reported no sick-leave decreased over time: 42.4% at 1 month, 35.1% at 6 months and 33.6% at 1 year. Still, the vast majority of workers made some attempt to return to work within 1 year. The proportion of workers who had been off work since the onset of their pain decreased from 9.6% at 1 month to 2.9% at 1 year.

Health outcomes

Table 3 presents the back pain severity measures stratified by sick-leave pattern. At each follow-up, workers who did not miss work (Pattern 1), and those who returned and stayed at work (Pattern 2), reported significantly better health outcomes than workers who experienced multiple episodes of sick-leave (Pattern 3) or workers who had not returned to work (Pattern 4). Workers in Patterns 1 and 2 reported significantly lower levels of back pain, leg pain, and functional limitations than workers in Patterns 3 or 4. Furthermore, self-reported physical and mental health-related quality of life was superior for workers in Patterns 1 and 2 at each follow-up point. Interestingly, workers in Pattern 1 (no sick-leave) consistently showed slightly worse health outcomes than those in Pattern 2 (returned and stayed at work).

The results suggest that a gradient in health outcomes exists across the patterns of sick-leave. Specifically, injured workers who did not miss work (Pattern 1), or who returned to work and stayed (Pattern 2), consistently reported the best health status, while those who had not returned to work (Pattern 4) reported the worst (Table 4). Workers who experienced multiple episodes of sick-leave reported intermediate outcomes.

Transition between patterns of sick-leave

In this section, we present the probabilities of transition between patterns of sick-leave for the 457 workers who participated in the whole study (Table 4). Results are presented for four sub-cohorts defined by the pattern of sick-leave reported 1 month after baseline.

Table 3 Weighted mean (S.D.) severity measures by period specific sick-leave pattern

Sick-leave pattern	Severity measures				
	Back pain	Leg pain	Roland–Morris (%)	Physical SF-12	Mental SF-12
One-month interview (n = 1,321)					
1—No sick-leave (n = 563)	32.9 (31.3)	19.4 (29.3)	28 (28)	44.8 (10.8)	51.7 (10.3)
2—Return and stay (n = 478)	30.4 (30.6)	16.5 (28.2)	27 (28)	45.4 (10.2)	51.7 (10.7)
3—Multiple episodes (n = 156)	54.0 (32.5)	36.1 (36.3)	53 (30)	36.2 (10.5)	45.4 (12.4)
4—Not yet returned (n = 124)	62.1 (30.2)	42.0 (38.3)	64 (27)	32.7 (9.0)	42.8 (12.9)
Six-month interview (n = 810)					
1—No sick-leave (n = 284)	26.2 (31.3)	17.3 (28.7)	20 (26)	47.8 (9.7)	51.6 (10.0)
2—Return and stay (n = 306)	22.7 (27.5)	12.3 (24.0)	17 (23)	48.3 (9.5)	53.0 (9.4)
3—Multiple episodes (n = 189)	43.1 (32.7)	33.4 (32.6)	44 (32)	39.4 (11.5)	46.1 (12.0)
4—Not yet returned (n = 31)	61.1 (29.9)	46.1 (34.6)	66 (31)	32.6 (10.0)	42.5 (13.0)
One-year interview (n = 457)					
1—No sick-leave (n = 155)	25.6 (32.2)	17.5 (28.0)	18 (24)	47.9 (9.2)	53.2 (9.1)
2—Return and stay (n = 148)	18.7 (27.2)	12.1 (25.3)	15 (22)	48.3 (9.7)	54.4 (8.1)
3—Multiple episodes (n = 145)	42.0 (31.3)	34.1 (33.5)	43 (31)	39.2 (12.0)	46.2 (12.2)
4—Not yet returned (n = 14)	59.7 (27.9)	44.9 (37.6)	62 (35)	32.8 (5.7)	37.3 (13.1)

Table 4 Weighted transition probabilities (95% CI) at each follow-up interview

One-month follow-up ($n = 457$)		Six-month follow-up ($n = 457$)		One-year follow-up ($n = 457$)		
Pattern	Transition probability	Pattern	Transition probability	Pattern	Transition probability	Cumulative transition probability (%)
1—No sick-leave	49.2% (49.0, 49.4)	1–1 No sick-leave	82.0% (81.7, 82.4)	1–1–1 No sick-leave	83.2% (82.8, 83.6)	33.3
				1–1–2 Return and stay	12.1% (11.7, 12.4)	4.2
				1–1–3 Multiple episodes	4.7% (4.5, 5.0)	2.0
		1–2 Return and stay	12.0% (11.7, 12.3)	1–2–2 Return and stay	85.5% (82.9, 88.0)	4.9
				1–2–3 Multiple episodes	14.5% (12.0, 17.1)	0.9
		1–3 Multiple episodes	6.0% (5.8, 6.2)	1–3–3 Multiple episodes	100%	2.9
2—Return and stay	29.6% (29.4, 29.8)	2–2 Return and stay	80.4% (79.9, 81.0)	2–2–2 Return and stay	83.4% (82.7, 84.0)	19.9
				2–2–3 Multiple episodes	16.6% (16.0, 17.3)	3.8
		2–3 Multiple episodes	19.6% (19.0, 20.2)	2–3–3 Multiple episodes	100%	6.0
3—Multiple episodes	11.2% (11.1, 11.4)	3–3 Multiple episodes	100%	3–3–3 Multiple episodes	100%	11.0
4—Not yet returned	10.0% (9.9, 10.1)	4–2 Return and stay	41.2% (39.1, 43.3)	4–2–2 Return and stay	71.4% (66.7, 76.1)	2.9
				4–2–3 Multiple episodes	28.6% (23.9, 33.3)	1.2
		4–3 Multiple episodes	17.7% (16.0, 19.3)	4–3–3 Multiple episodes	100%	1.8
		4–4 Not yet returned	41.2% (39.0, 43.3)	4–4–2 Return and stay	17.0% (13.1, 21.0)	7.0
				4–4–3 Multiple episodes	13.6% (10.1, 17.2)	0.6
				4–4–4 Not yet returned	69.3% (64.5, 74.2)	2.8

Sub-cohort 1—no sick-leave at 1 month

We found that just under half of workers who made an incident claim for back pain (49.2%) reported no compensated work absence at the first follow-up interview (Pattern 1). Most of these workers (82%) reported uninterrupted work experience at the 6-month follow-up as well (Pattern 1–1). However, 18% of workers in Pattern 1 had experienced at least one episode of sick-leave by the second interview (Patterns 1–2 and 1–3).

A similar pattern was observed for transitions between the 6- and 12-month interviews. Most workers (83.2%) who had no sick-leave during the first 6 months of follow-up reported no work absence because of back pain in the last 6 months of follow-up (Pattern 1–1–1). Nevertheless, 16.8% of workers who had not missed work during the first six moths had at least one episode of sick-leave during the subsequent 6 months (Patterns 1–1–2 and 1–1–3). Moreover, among those who experienced their first work absence between one and 6 months (Pattern 1–2), 14.5% reported subsequent episodes of sick-leave during the last 6 months of follow-up (Pattern 1–2–3). In summary, we observe considerable movement among sick-leave patterns even among workers with apparently low severity injuries at 1 month.

Sub-cohort 2—return and stay at 1 month

Approximately 30% of workers who had an episode of sick-leave in the first month after onset were able to return and stay at work (Pattern 2). Most of these workers (80.4%)

remained at work through the first 6 months of follow-up (Pattern 2–2) but 19.6% experienced at least one subsequent episode of sick-leave (Pattern 2–3). A similar pattern was observed during the last 6 months of follow-up. Most workers (83.4%) who returned and stayed at work following their initial episode of sick-leave (Pattern 2–2) remained at work during the last 6 months of follow-up (Pattern 2–2–2). However, 16.6% experienced at least one subsequent episode of sick-leave (Pattern 2–2–3). Again, we observe considerable movement among sick-leave patterns for workers who have returned to apparently stable sick-leave at 1 month.

Sub-cohort 3—multiple episodes at 1 month

Eleven percent of workers reported multiple episodes of sick-leave at 1 month (Pattern 3). By definition, 100% of these workers remained in the "multiple episodes" pattern.

Sub-cohort 4—not yet returned at 1 month

As shown in Table 4, 10% of workers had not returned to work 1 month after the onset of their back pain (Pattern 4). Of those, 41.2% had not made an attempt to return at 6 months (Pattern 4–4). Moreover, more than two-thirds (69.3%) of workers who had not returned to work at 6 months were still off work at the 12-month follow-up (Pattern 4–4–4).

The majority of workers (71.4%) who were not at work at 1 month, but had returned by 6 months, remained at work during the following 6 months (Pattern 4–2–2). However, recurrent episodes of sick-leave were common for workers in this sub-cohort (Table 4). For example, 28.6% of those who had returned and stayed at work at 6 months experienced at least one additional episode of sick-leave in the following 6 months (Pattern 4–2–3). Overall, we observed considerable movement within Pattern 4 (not yet returned), but the probability of a return to work diminishes as the initial episode of sick-leave lengthens.

One-year cumulative transition probability between patterns of sick-leave

The 1-year cumulative probabilities of transition (Table 4) suggest that a large proportion of workers transit in and out of sick-leave. This occurs even among those who appear to have returned to stable work at 1 month (Patterns 1 and 2). At 1 year, only one-third of workers (33.3%) had not experienced an episode of sick-leave related to their back pain (Pattern 1–1–1). Twenty-nine percent of workers reported a single episode of sick-leave (Patterns 1–1–2, 1–2–2 and 2–2–2) and 30% reported multiple spells. Finally, 2.8% had not made some attempt to return to work by the 1-year follow-up (Pattern 4–4–4).

Discussion

We conducted a cohort study to describe the patterns of sick-leave in US workers who made a workers' compensation claim for back pain. Our study adds to the literature by demonstrating that recurrent sick-leave because of back pain is a phenomenon that is not restricted to workers who experience long initial episodes of work absence. Recurrent sick-leave affects workers with prolonged, short or no episodes of work absence alike. Overall, we found that 30% of workers with back pain had two or more episodes of sick-leave in the year following onset of their pain.

The recurrence rate estimated in our study (30%) is higher than previously published figures. In New Hampshire, Wasiak et al reported that 7.9% of workers with back pain who made a workers' compensation claim had a recurrence over a 3-year period [38]. In Quebec, 36% of workers who made a claim for back pain to the provincial workers' compensation board experienced a recurrence of work disability during subsequent 3 years [1, 24]. Finally, the one and 2 year rates of recurrence for sickness absence in three industries in northwest England were 31 and 44%, respectively [30]. Although the rates of recurrence vary, they all indicate that a non-trivial proportion of workers with back pain experience recurrences. The differences in recurrence rate reported above are largely attributable to differences in source population, case definition and methods used to measure the recurrence of work disability.

Our results support the hypothesis that the substantial fraction of workers who experience recurrent episodes of sick-leave have worse health outcomes than workers who have returned and stayed at work. In fact, workers who experienced multiple episodes of sick-leave have health outcomes that are similar to those who have not returned to work. Workers who reported multiple episodes of sick-leave consistently reported clinically significant higher levels of pain, functional limitations and lower health-related quality of life compared to those who did not experience a recurrence. The results suggest that recurrent episodes may be associated with a deterioration of health.

One surprising finding is that workers who made a workers' compensation claim but did not take time off work (Pattern 1) reported slightly worse health outcomes than those who had an episode of sick-leave and subsequently returned to work (Pattern 2). Two main reasons can help explain this finding. First, it is plausible that a short

period of time off work may be helpful in promoting recovery from back pain. However, it is also possible that the small (and likely not clinically significant) observed differences may be related to attrition bias. We found that attrition was more common among workers who made a "medical only claim". A possible explanation is that injured workers who make a medical only claim may have less severe injuries. Workers with less severe injuries have a more favorable prognosis and may be less interested in continuing with the study.

The results clearly show that episodic recurrent episodes of sick-leave are not limited to workers with permanent partial disability claims. Our study emphasizes the importance of including all claim types, including "medical only" claims, in studies of the long-term course of back pain and disability in workers. We found that 18% of workers who did not initially miss work had at least one episode of sick-leave by the 6-month follow-up. Similarly, 17% of those who had not missed work in the first 6 months following the onset of their pain had at least one episode of sick-leave by the 1-year follow-up.

The main threat to the validity of our study is attrition. To understand whether attrition biased our results, we compared the baseline characteristics of the baseline sample to the baseline characteristics of participants in each follow-up interview. We found no systematic patterns of attrition at the 1- and 6-month follow-up. However, workers under the age of 36 years, males and workers with medical only claims were more likely to drop out between the 6- and 12-month follow-up. This pattern of attrition may have biased our analysis of transition probabilities because they were computed from the sub-sample of workers who participated in the whole study. This group may have included a large proportion of injured workers with poor prognosis and led to an overestimation of the probabilities of experiencing multiple episodes of sick-leave. Another limitation is the use of self-reported sick-leave which may be liable to misclassification errors particularly as more time elapses between follow-ups.

Many employers have introduced new approaches to disability management in an attempt to reduce sick-leave and losses of job productivity associated with back pain. Employers and insurers are also promoting a variety of reimbursement mechanisms, such as pay-for-performance health care, to encourage more effective treatment. Neither efforts to reduce the long term effects of back pain, nor attempts to improve the cost-effectiveness of care, can succeed, however, without an adequate understanding of the episodic and recurrent nature of the effects of back pain. Continued reliance on traditional models of back pain as an acute condition are likely to aim disability management strategies at the wrong targets and to give misleading evaluations of the outcomes of health care for back pain in workers.

A pressing challenge for researchers is to identify very early after the onset of back pain, the subgroup of workers who are at risk of experiencing long-term or recurrent sick-leave. Our analysis suggests that more than 30% of workers experienced multiple episodes of sick-leave and that about three percent had not returned to work at the 1-year follow-up. The development of prediction rules to identify these workers is needed because they are responsible for most of the cost associated with sick-leave related to back pain. The development of valid prediction rules is the first step in developing and tailoring treatment programs aimed at preventing long-term disability. Another area that needs investigation is the validation of self-reported sick-leave as an outcome in studies of work-related musculoskeletal disorders. Future studies should attempt to validate self-reported sick-leave with registry/workers' compensation data.

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