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Association between perceived union connection and upper body musculoskeletal pains among unionized construction apprentices

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Abstract

BACKGROUND—Several studies show varying associations between unionization and workers' health and wellbeing. This study investigated the association between individual worker's perceived union connection and musculoskeletal pains (MSPs).

METHODS—We conducted a cross-sectional survey of 1,757 unionized construction apprentices. Perceived union connection is a psychosocial scale measured by six questions that assessed individual worker's connection to their union (range 10 to 24) at unionized workplaces. We measured the prevalence of four MSPs (neck, shoulder, arm, and back pain) and difficulty in daily home activities, job activities, and sleeping caused by each of the four MSPs.

RESULTS—We found that a one score increase in perceived union connection was associated with 5% decreased odds of reporting neck pain (OR: 0.95, 95% CI: 0.91 ~ 1.00) and back pain (OR: 0.95, 95% CI: 0.91 ~ 0.99) after adjusting for confounders including self-reported ergonomic strain. We also found significant associations between perceived union connection and MSPs causing difficulty in daily activities. For a one score increase in perceived union connection, the odds of reporting back pain causing difficulty in home activities, job activities, and sleeping was 9% (95% CI: 0.87 ~ 0.96), 8% (95% CI: 0.88 ~ 0.96), and 7% (95% CI: 0.89 ~ 0.98) lower, respectively.

CONCLUSIONS—Although our findings are limited by the cross-sectional nature of the data, these results suggest that workers' perceived union connection can vary even within unionized workplaces, and it may be associated with the prevalence of MSPs and MSPs causing difficulty in daily activities.

Key terms

Perceived union connection; musculoskeletal symptoms; low back pain; construction workers

Introduction

According to a 2010 report from the U.S. Bureau of Labor Statistics, 14.7 million workers were union members and 16.3 million workers were represented by labor unions in the US. These figures amount to 11.9 % unionization across all workers [Bureau of Labor Statistics 2011]. Through their involvement in collective bargaining on safety and health conditions at workplaces, unions can influence workers' occupational health and safety practices [Robinson 1988, Warren-Langford, et al. 1993, Barbeau, et al. 2004].

Several empirical studies have examined the association between unionization and a wide spectrum of issues related to workers' health and wellbeing. Some studies that have compared unionized versus non-unionized workplaces and workers show that unionization is associated with increased sickness absence because of generous sick leave policies at unionized workplaces [Leigh 1981, Leigh 1984]. The latest of these studies points to the role of unions in reducing presenteeism [Veliziotis 2010]. Furthermore, Loomis and colleagues showed that states with low union density were more likely to have higher rates of fatal occupational injury after adjusting for industry and individual demographic characteristics [Loomis, et al. 2009].

Beyond collective bargaining, unions can play a role in setting the safety culture and climate at workplaces. In examining how perceived safety climate is different between union and non-union injured construction workers, Gillen and colleagues concluded that, compared to non-unionized workers, unionized workers tended to perceive that taking risks was not a part of their job and that their supervisors cared about their health and safety [Gillen, et al. 2002].

These studies of unions, however, treat unionization as a monolithic exposure. The distinction made, thus far, is a dichotomous categorization of workers as union and non-union workers. However, unionized workers could have different levels of connection to their labor union. Consequently, the impact of unions on worker's health and safety could be different. For construction apprentices, who are in the beginning of their construction career, perceptions regarding their connection to the union might be particularly important.

Construction workers have a high prevalence of musculoskeletal disorders [Holmström and Engholm 2003, Palmer, et al. 2001]. In an analysis of national data, male construction laborers had the highest prevalence of back pain among the 49 major occupations [Guo, et al. 1995]. A growing number of research studies show that psychosocial working condition could be a risk factor for these musculoskeletal disorders [Kerr, et al. 2001, Bongers, et al. 1993, Ariens 2001, Linton 2000]. Some of these studies focused specifically on the association between psychosocial work conditions and musculoskeletal disorders in construction settings [Devereux, et al. 1999, Johnston, et al. 2010]. To our knowledge, no research study has examined any union related psychosocial scale and its association with workers' health outcome.

In this study, we developed a psychosocial construct to assess the degree of workers' perceived connection to their labor union in a workplace where all workers belong to a union. Then, we examined the association between perceived union connection and

musculoskeletal pains (MSPs) among unionized construction apprentices. Specifically, our research aimed to answer the following two research questions:

1. What is the association between perceived union connection and MSPs (i.e. neck pain, shoulder pain, hand pain, and back pain) among unionized construction apprentices?
2. What is the association between perceived union connection and MSPs causing difficulty in doing daily activities (i.e. job activities, home activities, and sleeping) among unionized construction apprentices?

Materials and Methods

Study population

Our study sample participated in the MassBUILT study, which is a group randomized controlled smoking cessation intervention. A detailed description of the study design, sample and intervention results has been published elsewhere [Okechukwu, et al. 2009]. The MassBUILT study was implemented in collaboration with the Massachusetts Building Trades Council, which is a collection of unions that each manage apprenticeship training programs. Our study included ten building trade apprenticeship training programs for individuals wishing to become unionized boilermakers, bricklayers, electricians, hoisting and portable engineers, ironworkers, painters, plumbers, pipefitters, sprinkler fitters, or refrigeration workers.

The data were collected in 2005 and 2006 using self-reported questionnaire. Investigators made several efforts in order to ensure a high response rate. Trained study staff from the Dana-Farber Cancer Institute administered the survey to apprentices who were present during regularly scheduled class and meeting times. Extra questionnaires with stamped return envelopes were left with apprenticeship program coordinators at each site who then handed or mailed these questionnaires to apprentices who were absent at survey times. Overall, 1,817 apprentices (93.6%) completed the survey. After excluding those who did not answer for either an independent variable (perceived union connection) or a dependent variable (upper body MSPs) in each of the analyses, we examined the association between union connection and MSPs among construction apprentices. The sample sizes for the analysis of the different dependent variables ranged from 1202 to 1743. We obtained informed consent for all survey periods as a separate form that was distributed before the survey. The Dana-Farber Cancer Institute's Institutional Review Board approved all methods and materials used in the study. The apprentices' responses were confidential to apprentice instructors and union officials as well as to the investigators.

Perceived union connection

We developed six questions to measure workers' perceived union connection at a unionized workplace using questions based on pre-existing measures of workers' connections to their workplaces and coworkers [Barbeau, et al. 2005, Lambert and Hopkins 1995]. The questions were: (1) I am proud to tell others that I am a union apprentice. (2) I trust the information about health that I get from my union. (3) I feel the problems faced by my union are also my

problems. (4) I am treated with dignity and respect at work. (5) People I work with give me help and support. (6) People I work with are willing to listen to my work-related problems. For each question, workers could answer in four ordinal scales (1: completely disagree, 2: generally disagree, 3: generally agree, 4: completely agree). A principal components factor analysis showed that one underlying factor accounted for 49% of the total variance, with factor loading ranging from .57 to .80. The internal consistency (Cronbach's α) among the six questions was .79. The six questions were summed with a higher score indicating higher connection to union. This summed continuous score was used for all analyses. The summed score could have ranged from 6 to 24, but the actual distribution of this scale was 10 to 24 in the current study.

Prevalence of MSPs and difficulty in daily activities caused by MSPs

We assessed the prevalence of MSPs in each of four upper body parts (i.e. neck, shoulder, hand or wrist, and back) and any difficulty in daily activities (i.e. home activities, job activities, and sleeping) caused by each of those MSPs [Barbeau, et al. 2005]. To assess the prevalence of MSPs after first employment at the trade, we asked the following question: "Since starting work in your trade, have you had pain, aching, burning, stiffness, cramping, or soreness in your neck more than 3 times or that lasted more than 1 week?" Workers could answer Yes (coded as 1) or No (coded as 0).

When apprentices report pain for each of four MSPs, they were required to answer the following three questions to assess whether it caused any difficulty in daily activities (i.e. home activities, job activities, and sleeping): "Because of this neck problem, did you have any difficulty doing your home activities in your usual way?" "Because of this neck problem, did you have any difficulty doing your job activities in your usual way?" "Because of this neck problem, did you have any difficulty sleeping?" For each of the three questions, worker could answer Yes or No. In the data analyses, we classified apprentices into three categories in relation to MSPs causing difficulty in daily activities: apprentices without MSPs (coded as 0), apprentices with MSPs that did not cause difficulty in daily activities (coded as 1), and apprentice with MSPs that caused difficulty in daily activities (coded as 2). The distinction was made between MSPs that caused difficulty in daily activities and MSPs that did not cause difficulty in daily activities because those two categories would be different in terms of the pain severity.

Covariates

We modeled covariates that can be associated with both workers' relationship with union connection and MSPs among available variables: age, gender, race/ethnicity, education, income, a year of the apprenticeship program, workplace, and physical ergonomic strain. Age was categorized into four categories (18~24 years, 25~34 years, 35~ 44 years, 45 years). We collapsed race/ethnicity into Hispanic, non-Hispanic black, non-Hispanic other, and non-Hispanic white Likewise, educational attainment was collapsed from seven categories into four (less than high school, high school or GED, some college or 2 year degree, or 4 years or more). We also collapsed household income from seven \$10,000 increments of income from under \$10,000 to \$75,000 or more into four categories (< \$25,000, \$25,000–49,999, \$50,000– 74,999, and \$75,000). It takes 3 to 5 years for

apprentices to complete their training programs depending on their trade, we measured the year of the apprenticeship program workers are in (ranged from 1 to 5 years) and modeled it as a categorical variable. We controlled for year in program because it is possible that apprentices with more years of experience would be more likely to feel attached to their labor unions and to have MSPs. We also included 10 apprentices sites which represent 10 different workplaces as a categorical variable in the analyses in order to control for any effect of workplace on both the outcome and exposure.

Physical ergonomic exposure can be an important confounder of the association between perceived union connection and our outcomes. As a result, we controlled for physical ergonomic strain in the data analyses. We assessed self-reported ergonomic strain for each of four MSPs the following questions: On average, over the past 12 months, when you work a full shift, how many hours (1) do you work with your head bent forward, sideways or backwards? (ergonomic strain for neck pain) (2) do you work with your hands above your head, or your elbows above your shoulder? (ergonomic strain or shoulder pain) (3) do you repeat quick hand motions every few seconds? Examples include: hammering, driving a screw, or stapling? (ergonomic strain for hand pain) (4) do you work with your back bent forward or twisted to either side? (ergonomic strain for back pain). For each of four questions, a picture of a figure in positions of strain was provided in the questionnaire to help apprentices to understand the questions. Apprentices could answer the questions in four ordinal scale (0: almost never, 1: sometimes but for less than 1 hour, 2: 1 to 4 hours, 3: more than 4 hours). We included this ergonomic strain variable as a categorical variable in the analyses with the apprentices who answered 'almost never' as a reference.

Data analyses

We used logistic regression to assess how perceived union connection is associated with MSPs and multinomial logistic regression to examine how perceived union connection is associated with MSPs causing difficulty in daily activities (i.e. home activities, job activities, and sleeping) caused by those MSPs. All analyses were performed using STATA/SE version 11.0 (StataCorp, College Station, TX).

Multiple imputation was used to account for those missing income (n=262), race (n=116), education (n=86), gender (n =46), self-reported ergonomic strain for neck pain (n=19), shoulder pain (n=20), hand pain (n=26), and back pain (n=20). We used *mi impute mvn* command in STATA, which uses a method of multiple imputation based on Markov Chain Monte Carlo to impute data for those missing these variables. Then, *mi estimate* commands in STATA were used to combine the results of the multivariate logistic regressions from 10 imputations. All analyses controlled for age, gender, race/ethnicity, education, income, the years of apprenticeship program, apprentice sites and self-reported ergonomic strain.

Results

As indicated in Table 1, most of the construction apprentices were male (95.2 %) and under 45 years old (98%). They were mostly non-hispanic white (82.5%). Among apprentices who answered the questions regarding MSPs, back pain was most prevalent (50.6%). Perceived union connection ranged from 10 to 24 with a mean score of 21.0.

Table 2 displays the results for the analyses of the association between union connection and MSPs among construction apprentices. After adjusting for potential confounders, including self-reported ergonomic strain, we found significant associations between perceived union connection and neck pain (OR: 0.95, 95% CI: 0.91 ~ 1.00) and back pain (OR: 0.95, 95% CI: 0.91 ~ 0.99). Perceived union connection was not associated with shoulder pain in both unadjusted and adjusted analyses while the association with hand pain became non-significant after adjusting for confounders.

Table 3 displays the result of analyses examining the associations between perceived union connection and difficulty with daily activities caused by musculoskeletal pain. Because we found little difference between the unadjusted and fully adjusted models, the results from fully adjusted models are shown. A significant association was observed between perceived union connection and prevalence of neck pain and back pain causing difficulties in all of three daily activities (Table 3). For a one score increase in perceived union connection, apprentices were less likely to report their neck pain caused difficulty in doing their home activities (OR: 0.91, 95% CI: 0.85 ~ 0.97), in doing their job activities (OR: 0.91, 95% CI: 0.86 ~ 0.97), and in sleeping (OR: 0.92, 95% CI: 0.87 ~ 0.98).

Perceived union connection was only associated with shoulder pain causing difficulty in home activities (OR: 0.93, 95% CI: 0.88 ~ 0.99) and in job activities (OR: 0.94, 95% CI: 0.88 ~ 1.00). With arm pain, perceived union connection was associated with hand pain causing difficulty in home activities (OR: 0.91, 95% CI: 0.86–0.96) and in job activities (OR: 0.92, 95% CI: 0.87–0.97), but not in sleeping. Lastly, for one score increase in perceived union connection, the odds of reporting back pain causing difficulty in their home activities, job activities, and sleeping became 9% (95% CI: 0.87 ~ 0.96), 8% (95% CI: 0.88 ~ 0.96), and 7% (95% CI: 0.89 ~ 0.98) lower, respectively.

Discussion

Our study showed that there can be variability in workers' perceived union connection even at a unionized workplace. We also found that perceived union connection is associated with MSPs among unionized construction apprentices, a group that has a high prevalence of MSPs [Rosecrance, et al. 2001, Merlino, et al. 2003]. We found significant associations between perceived union connection and neck pain and back pain whereas no significant associations were observed in the adjusted analyses of shoulder pain and arm pain. Low perceived union connection was also associated with neck pain and back pain causing difficulty in three daily activities (i.e. home activities, job activities, and sleeping).

Our study makes a unique contribution to the occupational health research discourse about unions and workers' health. These results suggest that, even within a workplace where everyone is a union member, workers' perceived union connection could be a psychosocial factor that is associated with MSPs. This protective effect of unions on workers' health is consistent with previous research reports that have treated unionization as a dichotomous outcome [Loomis, et al. 2009, Gillen, et al. 2002]. Our results provide another potential pathway by which unions exert influence on workers' health.

Strong associations were observed between perceived union connection and MSPs causing difficulty in doing activities (home activities, job activities, and sleeping). These results imply that perceived union connection could influence apprentices' lives beyond the workplace. Difficulty in doing home activities could be a contributing factor to poor work-life balance among construction workers, whom studies have shown to be more vulnerable to work-life issues due to long and irregular work hours and inflexible work schedules [Lingard, et al. 2008, Lingard and Francis 2006]. Difficulty in job activities could be associated with inefficient work performance which could lead to low productivity. Difficulty in sleeping could be directly associated with insomnia. Sleep problems are particularly problematic for construction workers; many of whom have a high prevalence of sleep-related problem because their jobs require them to wake up very early in the morning [Ursin, et al. 2009, Partinen, et al. 1984].

The potential mechanisms linking perceived union connection and musculoskeletal pains may be explained in a couple of ways. Workers with higher union connection could be more embedded in their workplace community. Consequently, they could have more social support from their supervisors and co-workers than workers who reported lower perceived union connection. Social support has been linked with reduced MSPs [Eriksen, et al. 2004]. Also, the sense of coherence from feeling connected to their unions could influence workers' willingness and ability to seek elimination or control of recognized occupational hazards and modification of tasks associated with pain. This is particularly important in this case where the apprenticeship program is managed by unions and the apprentices' first line supervisors are represented by the same union [Viikari-Juntura, et al. 1991, Larsson and Kallenberg 1996].

Several limitations of this study should be noted. First, because of the cross-sectional study design, we cannot rule out the possibility of reverse causation in that apprentices with MSPs were more likely to report lower perceived union connection. This is particularly plausible when apprentices have complaints about union activities related to occupational safety that were not enough to prevent them from developing MSPs.

Second, we could not adjust for other psychosocial risk factors such as workers' control and demand, co-worker support, and supervisor support which are known to be risk factors for MSPs [Ariens 2001, Linton 2000]. Future research needs to address how these factors are related to perceived union connection and how these factors play a role in association between union connection and MSPs at a unionized workplace.

Third, because this is the first study to assess union connection as a psychosocial construct, more studies with diverse samples are needed in order to further validate the psychometric properties of the scale. Further examination could explore the mechanisms through which perceived union connection might exert influence on MSPs. Studies could also explore how union connection is related to other attachment-related workplace psychosocial factors that have been associated with health outcomes such as social capital [Kouvonen, et al. 2008, Oksanen, et al. 2010] and people-oriented culture [Amick, et al. 2000].

Finally, there was a considerable number of apprentices who did not respond to questions about neck pain and shoulder pain. Among 1757 apprentices, 545 (31.0%) and 547 (31.1%) apprentices did not answer neck pain and shoulder pain questions, respectively. These two questions were located next to one another in the questionnaire. Because skip instructions preceded these two questions, this could have confused many apprentices into skipping the questions, causing a large number of missing observations. Because this skipping pattern is expected to be at random in relation to neck pain and shoulder pain, it is unlikely that differential reporting bias caused by these missing observations can explain the significant associations observed in this study.

This study has several strengths. First, we developed a new scale to assess individual worker's perceived union connection and confirmed that six questions converge together to measure one underlying construct from confirmatory factor analysis and internal consistency measures. Second, our survey had a high response rate, which led to a large sample size particularly for the analyses of hand pain and back pain, even though it is usually difficult to gain access to construction workers. Third, we assessed the extent to which MSPs caused difficulties in three different daily activities, therefore providing a more detailed look at how perceived union connection may be associated with workers' lives beyond only the reporting of pain symptoms.

Previous studies have treated unionization as a dichotomous variable. However, this study shows that there can be variation in perceived union connections even among unionized workers and this range of perceived union connection could be associated with health outcomes. This paper suggests that perceived union connection could be an important part of psychosocial work environment, which can be considered as a domain of safety practice to reduce MSPs in conjunction with the practices such as the use of ergonomic equipments to reduce physical workplace hazards.

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Table 1Demographic characteristics of construction apprentices in the MassBUILT study (n = 1757)^a

	N	%
Gender		
Male	1,629	95.2
Female	82	4.8
Age (year)		
18~24	575	32.7
25~34	848	48.3
35~44	299	17.0
45~	35	2.0
Race		
Hispanic	63	3.8
Non-Hispanic Black	114	7.0
Non-Hispanic Others	111	6.8
Non-Hispanic White	1,353	82.5
Education		
Less than high school	21	1.3
High school or GED	849	50.8
Some college or 2 year degree	651	39.0
4 year college or more	150	9.0
Annual income (\$)		
<25,000	96	6.4
25,000–49,999	552	36.9
50,000–74,999	383	25.6
75,000	464	31.0
Apprentices sites		
Plumbers	150	8.5
Electricians	59	3.4
Bricklayers	147	8.4
Ironworkers	104	5.9
Painters & Allied Trades	115	6.6
Sprinkler fitters	77	4.4
Pipefitters	274	15.6
Electricians 2 nd group	678	38.6
Operating engineers	29	1.7
Plumbers & Pipefitters	124	7.1
Prevalence of MSPs ^b		
Neck pain ^c	480	39.6
Shoulder pain ^c	493	40.7
Hand pain	495	28.4
Back pain	887	50.6

	N	%
	<u>Mean</u>	<u>S.D.</u>
Perceived union connection	21.0	2.5

^a: Totals do not add up to the same number because values were calculated prior to imputing missing covariates

^b: Musculoskeletal pains

^c: Among 1757 apprentices, 545 (31.0%) and 547 (31.1%) apprentices did not answer the question of neck pain and shoulder pain

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Association between perceived union connection^a and upper body musculoskeletal disorders among unionized construction apprentices

Table 2

Musculoskeletal disorders	N	Unadjusted		Fully adjusted ^b	
		OR	95% CI	OR	95% CI
Neck pain	1212	0.93**	(0.89, 0.97)	0.95*	(0.91, 1.00)
Shoulder pain	1210	0.96	(0.92, 1.01)	0.97	(0.92, 1.01)
Hand pain	1743	0.93*	(0.89, 0.97)	0.96	(0.92, 1.00)
Back pain	1736	0.92***	(0.88, 0.96)	0.95*	(0.91, 0.99)

* : $P < 0.05$;

** : $P < 0.01$;

*** : $P < 0.001$

^a : perceived union connection is a continuous variable, ranged from 10 to 24

^b : adjusted for age, gender, race, education level, income, the years of apprenticeship program, apprentice site, and self-reported ergonomic strain

Table 3

Perceived union connection^a and its association with difficulty in daily activities caused by upper body musculoskeletal disorders among unionized construction apprentices in fully adjusted model^b

	Neck pain			Shoulder pain		
	N (%)	OR	95% CI	N (%)	OR	95% CI
No pain	732 (60.8%)	1	Referent	717 (59.5%)	1	Referent
Pain without difficulty in home activities	282 (23.4%)	0.99	(0.93, 1.05)	273 (22.6%)	0.99	(0.93, 1.05)
Pain causing difficulty in home activities	191 (15.9%)	0.91**	(0.85, 0.97)	216 (17.9%)	0.93*	(0.88, 0.99)
No pain	732 (60.7%)	1	Referent	717 (59.6%)	1	Referent
Pain without difficulty in job activities	245 (20.3%)	0.99	(0.93, 1.06)	234 (19.4%)	0.99	(0.93, 1.06)
Pain causing difficulty in job activities	228 (18.9%)	0.91**	(0.86, 0.97)	253 (21.0%)	0.94*	(0.88, 1.00)
No pain	732 (60.9%)	1	Referent	717 (59.5%)	1	Referent
Pain without difficulty in sleeping	216 (18.0%)	1.00	(0.93, 1.07)	244 (20.3%)	0.94	(0.88, 1.00)
Pain causing difficulty in sleeping	254 (21.1%)	0.92**	(0.87, 0.98)	244 (20.3%)	0.99	(0.93, 1.05)
	Arm pain			Back pain		
	N (%)	OR	95% CI	N (%)	OR	95% CI
No pain	1248 (71.8%)	1	Referent	858 (49.7%)	1	Referent
Pain without difficulty in home activities	245 (14.1%)	1.01	(0.95, 1.07)	359 (20.8%)	1.00	(0.95, 1.06)
Pain causing difficulty in home activities	246 (14.2%)	0.91**	(0.86, 0.96)	510 (29.5%)	0.91***	(0.87, 0.96)
No pain	1248 (71.8%)	1	Referent	858 (49.7%)	1	Referent
Pain without difficulty in job activities	230 (13.2%)	1.00	(0.94, 1.06)	346 (20.1%)	0.99	(0.94, 1.05)
Pain causing difficulty in job activities	261 (15.0%)	0.92**	(0.87, 0.97)	521 (30.2%)	0.92**	(0.88, 0.96)
No pain	1248 (71.8%)	1	Referent	858 (49.7%)	1	Referent
Pain without difficulty in sleeping	336 (19.3%)	0.96	(0.91, 1.01)	380 (22.0%)	0.97	(0.92, 1.03)
Pain causing difficulty in sleeping	154 (8.9%)	0.95	(0.88, 1.02)	487 (28.2%)	0.93**	(0.89, 0.98)

* : $P < 0.05$;

b : adjusted for age, gender, race, education level, income, the years of apprenticeship program, apprentice site and self-reported ergonomic strain
d : six-item scale perceived union connection is a continuous variable, ranged from 10 to 24

1000 > *P* < 0.0001

;1:01 > *P* < 0.01

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