Occupational Injury and Work Organization among Immigrant Latino Residential Construction Workers

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Abstract

This study sought to determine the potential health threat of work organization to immigrant Latino workers in selected trades in the residential construction industry using longitudinal data from a community-based sample (N=107). 28 participants reported one or more work-related injuries during the 3 month observation period, resulting in an injury incidence rate of 52.8 per 100 FTE. Two injuries involved two or more days away from work, resulting in an incidence rate of 3.8 injuries involving days away from work per 100 FTE. Injuries were elevated among roofers relative to framers and general construction workers. In terms of work organization, variety and control were lowest among roofers and highest among general construction workers, and roofers reported the greatest exposure to occupational hazards. Roofers also reported the lowest levels of supervisory influence over aspects of employment (both negative and positive), and their perceived safety climate was the poorest. Collectively the results suggest that work organization may contribute to elevated rates of nonfatal occupational injury among immigrant Latino residential construction workers.

Work organization is drawing increased attention as researchers attempt to understand potentially avoidable health differences among different groups of people, or health disparities. The World Health Organization recently completed a systematic review of the health disparities literature (Commission on Social Determinants of Health, 2008), and employment-related conditions were addressed in a chapter. Currently, both the World Health Organization and the National Institute for Occupational Safety and Health have commission a set of papers to summarize what is known about occupational health disparities. The fundamental argument underlying these initiatives is that vulnerable populations, like immigrant workers, are disproportionately exposed to pathogenic job designs and work characteristics, health compromising management practices, and injury-prone safety climates that contribute to an unequal and unfair burden of illness and disease.

The organization of work draws attention to the way that jobs are designed and performed (i.e., work processes), management and human resource policies, production methods, as well as labor market policies (Sauter et al., 2002). As such, the organization of work is not a single attribute that exists at a single level. Rather, work organization is a constellation of geopolitical, sociostructural, organizational, and interpersonal factors that operate at multiple levels to affect worker health (Benach et al. 2010; Muntaner et al. 2010; Sauter et al., 2002). Within this constellation, job specific or task level factors are nested within organizational-level factors, which are, in turn, nested within broader social, political and economic external contextual factors that shape and drive employment (see Benach et al. 2010; Muntaner et al. 2010).

Research focused on work organization in relation with occupational health and safety outcomes in the construction industry is underdeveloped, despite construction consistently ranking among the most dangerous occupations in terms of occupational fatality, injury, and illness. Work scheduling, an area of work organization that speaks to the temporal structure of how construction work is performed, has been linked with health and safety outcomes among construction workers (Dong, 2005; Goldenhar et al., 2003). Shimazu and de Jong (2009) documented an association between effort-reward imbalance, a measure of job stress, and greater risk for physical complaints among Japanese construction workers, and the risk for recurrent low back pain over a three-year period was elevated for scaffold workers with high levels of psychological demand and low levels of control (Elders and Burdorf, 2004). Despite the absence of previous research, systematic reviews suggest that work organization factors play an important role in safety violations (Alper and Karsh, 2009), and that construction managers recognize the importance of work organization in maintaining safety on the construction site (Törner and Pousette, 2009).

The goal of this analysis is to determine the potential health threat of work organization to immigrant Latino workers in the residential construction industry. This study focuses on Latino workers in residential construction because a sizeable and growing proportion of construction workers are Latino (BLS, 2008), many of whom are believed to be undocumented (Pew Hispanic Center, 2009), and Latinos within the industry experience higher rates of fatality, injury and illness (Dong et al., 2004; 2010). To accomplish this goal we use longitudinal data obtained from a community-based sample of Latino residential construction workers (n=107) in selected trades to: 1) document 3-month incidence of work-related injury among Latino residential construction workers, and variation in incidence by age, time in the US, country of origin, and worker classification; 2) delineate work organization characteristics of immigrant Latino residential construction workers, including variation job in structure (i.e., work hours, precariousness), job

design (i.e., skill variety, control, psychological demands, hazards exposure), supervisory practices (i.e., power, retaliation, ability to communicate) and safety climate experiences; 3) describe variation in injury risk attributed to work organization characteristics.

Methods and Materials

The data for this study are from a broader project designed to determine the feasibility of using computer-assisted telephone survey (CATS) technology to collected daily diary data from Latino residential construction workers (OH009761-01, subproject #647). The original project involved four separate data collection components: a baseline interviewer administered survey, a 21-day daily diary period using CATS technology, a debriefing interview at the end of the diary period, and a follow-up interview 3 months after completing the diary period. The current paper uses data from the baseline and the 3-month follow up interviews.

Sample

Baseline data were obtained from a non-probability sample of residential construction workers who self identified as Latino (N=119). Participants were recruited in partnership with HOLA of Wilkes County, a 501c3 non-profit organization that serves the Latino communities of Wilkes and surrounding counties in western NC. HOLA staff purposefully targeted identifying residential construction workers through a combination of techniques including known individuals within existing social networks, snowball, and referral. Study inclusion criterion were age 18 years or older, Latino (self or parents born in a Latin American country, or self-identified as "Latino" or "Hispanic"), and employment for 35 or more hours per week in construction. There were no exclusion criteria. Three-month follow-up interviews were obtained from 107 study participants (89.9%).

Data Collection

The baseline interviewer-administered interview assessed stable attributes of the individual (e.g., age, country of origin), occupational characteristics (e.g., years in construction, primary tasks performed in construction), health history (e.g., presence of chronic conditions), and multiple aspects reflecting the organization of work. The baseline interview took, on average 48 minutes to complete, and participants received a $15 incentive. The follow-up interview focused primarily on experiences of injury and changes in health during the preceding 3 month period. The follow-up interview took 24 minutes, on average, to complete, and participants received a $25 incentive. All recruitment and data collection activities were approved by a federally authorized Institutional Review Board (FWA #00001435).

The content of the baseline and follow-up interviewer-administered survey questionnaires underwent thorough translation and back-translation procedures. Content from validated Spanish instruments was used without modification where they were available. English-only instruments and items developed for this project were translated into Spanish by a native Spanish-speaker. All items were then back translated into English by a fluent Spanish-speaker. Discrepancies identified in the back translation were corrected through consensus and incorporated into both the Spanish and English versions of questionnaires (Behling & Law, 2000).

Survey questionnaire data (i.e., baseline and 3-month follow up) were collected by four trained interviewers. All interviewers were native Spanish-speakers. Training consisted of a thorough review of study purpose, screening and recruitment procedures, line-by-line review of the interviewer-administered questionnaires, and progressively more realistic practice interviews.

Measures

Dependent Variable. *Injury Incidence*, the primary dependent variable, was assessed at the three-month follow-up interview by reading a list of six statements describing specific types of injuries (i.e., sprains or strains, cut or laceration, flame or chemical burn, bruise or contusion, broken or fractured bone, dislocation, other) and asking whether the individual experienced that injury in the past 3 months while performing paid construction work. Individuals who reported one or more injuries in the past 3 months were then asked "How many days after [INSERT INJURY/your most serious injury] did you go back to work?". Response options were "same day/did not take off from work," "the day after the accident," separate response options for the second, third, and fourth "day after the accident," "the fifth day after the accident or longer" and "still off paid work". Individuals reporting returning to work on the second day after the accident or longer were classified as having experienced an injury requiring time off from work.

Work Organization. Work organization variables were organized into three categories. The first category is structural attributes of the construction job and is evaluated with two variables. The first, *long work hours*, was constructed based on the average number of hours typically worked in construction and dichotomized such that those working 45 or more hours per week were coded one, zero otherwise. The second structural characteristic of the construction work job, *precarious employment*, was measured with a single question asking "which statement best describes your work arrangement in construction" with three response options: "I am a construction contractor or subcontractor and do trades work myself," "I have worked for the same contractor or subcontractor for 3 months or longer," and "I have worked for several contractors or subcontractors during the past 3 months." Individuals who reported working for several individuals in the past 3 months were coded one for precarious employment, all others were coded zero.

The job design domain of work organization was assessed using a modified version of the Job Content Questionnaire (JCQ)(Karasek & Theorell 1990). *Control* was assessed with 3 items tapping opportunities to exert control over work (e.g., "How often are you allowed to make your own decisions about your work?"). *Variety* was assessed with 6 items tapping how jobs vary in content, location, and routine (e.g., "How often do you do a variety of different things on your job?"). *Psychological demand* was assessed with 9 items tapping the job-related stressors (e.g., "How often is your job hectic?"). Exposure to perceived hazards was assessed with 6 items asking about the frequency participants encountered environmental hazards ("How often does your job require you to work in areas where you are exposed to fire, burns, or shocks?") or dangerous equipment (e.g., "How often does your *job require* working with tools, machinery or equipment that could be dangerous?") while working in construction. Response options for each item in the modified JCQ ranged from "seldom or never=1" to "almost always=4). Each variable was constructed by summing items so that higher values indicated greater levels of the attribute. This modified instrument has been used in previous research with immigrant Latino workers where each of the subscales were the reliability of each set of items, assessed via Cronbach's alpha, ranged from a low of .72 to a high of .79, suggesting good reliability (Grzywacz et al. 2007).

The supervisory practices domain of work organization was assessed with several instruments. First, two aspects of supervision were assessed using an established scale (Tepper, 2000) that has been used in previous research with immigrant Latino workers (Grzywacz et al., 2007, 2010; Marín et al., 2009). *Powerful influence* reflects the extent to which workers' believe

their supervisor can shape or influence their opportunities on the job was assessed with 4 items (e.g., "My supervisor could….influence my getting a pay raise," or "…provide me with special benefits"). *Retaliatory supervision* was assessed with 3 items asking about the extent to which workers believe that supervisors use their authority to punish workers (e.g., "My supervisor could…. give me undesirable job assignments" or "Make things unpleasant here"). Response options ranged from "strongly disagree=1" to "strongly agree=4". Both the powerful influence and the retaliatory supervision variable were constructed by summing items so that higher values indicated greater levels of the attribute. *Poor communication* with supervisors was assessed with a single item from the JCQ asking "how well are you able to communicate with your immediate supervisor?" Possible responses were "very well," "somewhat," and "not at all;" individuals who reported "somewhat" or "not at all" were coded one for having poor communication, all others were coded zero. *Safety climate*, reflecting management's commitment to maintaining a safe worksite, was assessed using the 10-item Perceived Safety Climate Scale (Gillen et al., 2002). Items are scored such that higher values indicate greater management involvement in safety and health.

Covariates. *Age* (measured in years) and *educational attainment* assessed based upon the grading system used in Latin American countries (i.e., Primaria, Secundaria, Preparatoria, Universidad) were assessed. Multiple aspects of acculturation were assessed including *country of origin, language preference*, assessed using seven items from the Acculturation Rating Scale for Mexican-Americans-II (ARSMA-II) (Cuéllar et al., 1995), and *length of residence* in the U.S.

Analysis

Injury incidence statistics were calculated using the Bureau of Labor Statistics incidence rate calculator and comparison tool (see http://data.bls.gov/iirc/). Univariate statistics including percentages and means and standard deviations were calculated to describe the organization of construction work. Comparisons of work organization factors among framers, roofers and general construction workers were evaluated using chi-square or F-test statistics for work organization factors with discrete and continuous distributions, respectively. A series of logistic regression models were fit to explore the prospective bivariate association of each work organization factor, assessed during the baseline interview, with work injury assessed at the follow-up interview. Each bivariate model was then expanded to control for worker type and total work exposure during the observation period. All analyses were performed using SAS v9.2 (SAS Institute, Cary, NC), and used a Type I error rate of 0.05.

Results

Participants were, on average, 31.7 years of age (SD=7.6), and most had little formal education; 37.4% (n=40) of the sample reported a primary education or less (equivalent to 6th grade in the US) while 42% (n=45) reported having up to a secondary education (equivalent to 9th grade in the US). On average, participants had been in the US for 9.7 years (SD=6.0), and Spanish was the dominant language for nearly all participants (n=100, 93.5%). Nearly one-quarter of the sample (22.4%) reported having completed an apprenticeship. Most workers (n=73, 68.2%) indicated that the statement "I have worked for the same contractor or subcontractor for 3 months or longer" best characterized their connection with the construction industry, while a sizeable minority (n=29, 27.1%) indicated that that the statement "I have worked for several contractors or subcontractors during the past 3 months" described their recent construction work experiences. At the baseline survey participants worked an average of 38.3 weeks (SD=16.9) in construction in the previous year, and an average of 42 hours per week (SD=8.6). Participants reported working, on average, 7.7 weeks (SD=3.3) of the 12 week period

preceding the follow-up interviews, and typically working 34.2 hours per week (SD=12.7) during that period.

A total of 28 participants reported one or more work-related injuries during the observation period prior to the follow-up interview. The total number of hours worked by participants in the sample during the three month observation period was 26,492. The annualized total work hours would be 105,968 hours (26,492 X 4), resulting in an injury rate of 52.8 per 100 FTE. Injuries included broken or fractured bone (n=4), dislocation (n=3), sprain or strain (n=7), flame or chemical burn (n=1), as well as cuts or lacerations, and bruises or contusions. Two of the reported injuries involved two or more days away from work, resulting in a 3.8 injuries involving days away from work per 100 FTE. Injury risk among Latino residential construction workers did not differ by age, years in the US, educational attainment or country of origin (Table 1). However, injuries were more frequent among roofers than framers or general laborers, and trend-level evidence ($p < .10$) suggests that the absence of an apprenticeship may increase the risk for injury.

Several indicators of work organization differed by construction trade (Table 2). In terms of job structure, long work hours were reported least frequently by roofers and most frequently by framers. Precarious employment did not differ by trade. Turning to indicators of job design, skill variety and control were lowest among roofers and highest among general construction workers. Psychological demand was higher among general construction laborers, but differences were not statistically significant. Perceived hazards were highest among roofers and lowest among framers. In terms of supervisory practices, framers had the strongest beliefs of their supervisors' ability to influence their job opportunities, while general construction laborers had the strongest beliefs that supervisors would engage in retaliatory practices on the job site. There were no differences by trade in difficulties communicating with supervisors. Appraisals of the safety climate were poorest among roofers relative to frames and general construction workers.

Simple bivariate analyses indicated little evidence that work organization factors were associated with injury risk (Table 3). Greater perceived exposure to hazards was associated with greater injury risk (OR=1.10). After adjustment for worker type and variation in total exposure to construction during the observation period, two work organization factors were associated with greater injury risk. For every unit increase in psychological demand the odds of experiencing an injury increased by 4%. Similarly, for every unit increase in perceived hazards the odds of experiencing an injury increased by 12%.

Discussion

The goal of this study was to determine the potential health threat of work organization to immigrant Latino workers in the residential construction industry. While an understanding of how work organization contributes to occupational health within the construction industry is important onto itself (Murie, 2007; Schulte, 2006), a specific study of immigrant Latino's experiences in the industry is important because it offers insight into potential sources of occupational health disparities: evidence indicates that fatalities, injury, and illness within the construction industry are disproportionately borne by Latino workers (Dong et al., 2004; 2010). Several strands of evidence from this study suggest that work organization poses real threats to immigrant Latino worker health and safety.

Injury rates in this sample were substantial and elevated in contrast to previous reports. The estimated incidence of work-related injury observed in this sample was 52.8/100 FTE. Published injury incidence for construction is 4.2 injuries per 100 workers (BLS, 2010). Dong and colleagues (2010) reported rates of 100 to 150 injuries per 10,000 Latino workers between

2002 and 2008. Although it is widely accepted that injury rates among construction workers are likely underestimated, especially among immigrant workers (Azaroff et al., 2002; Dong et al., 2011; Schoenfisch et al., 2010), the scope of underestimation has been unknown. Our observed rate suggests a 12-fold underestimation. If estimates are limited to "major" injuries such as broken or fractured bones, dislocations and burns only, the observed injury incidence is 33.9 injuries per 100 workers: an eight-fold increase over published rates.

A unique contribution of this study is the description of several work organization factors among Latino residential construction workers. Although there is little comparative data, the overall pattern of results from this study is that the organization of construction work is relatively benign: there are few points of overt problems but there are also no points to suggest construction jobs occupied by immigrant Latinos are designed to protect much less promote worker health. For example, over 20% of workers in this sample typically worked 45 or more hours per week, and over one-quarter of the sample (27.1%) were classified as having "precarious" employment, both of which have been linked to poor occupational health outcomes (Dong, 2005; Goldenhar et al., 2003; Quinlan et al., 2001), although only long work hours has been examined in the context of construction. On the more positive side, average "variety" scores were above the midpoint of the possible range of scores suggesting that Latino construction workers are engaging in a relatively diverse set of work-related activities and are avoiding repetitive and potentially monotonous tasks. Further several variables reflecting both job design (e.g., "psychological demand" and "hazards") and supervisory practices (e.g., powerful influence, retaliatory supervision, safety climate) had average scores located at the midpoint of the possible range. Thus, while there were few areas with clear problems, there was also substantial room for improvement.

The organization of construction work systematically differs across the trades. In terms of job design characteristics, roofers reported the lowest skill variety, the lowest level of control, and the highest exposure to hazards among the trades studied. Roofers also reported the lowest average safety climate scores. However, roofers were less involved in long work hours, and they reported more favorable supervisory practices, including the lowest average powerful influence and retaliatory supervision scores. Nevertheless, consistent with previous research (Dong et al., 2010), injuries were elevated among Latino roofers relative to Latino framers or general construction laborers. Although there was little evidence in this small sample that work organization factors robustly predicted injury, the differential exposure of roofers relative to framers and general laborers to several job design features believed to undermine worker health and safety may play a role in their elevated incidence of injury (Dong et al., 2010). This is a ripe area for future research, especially given the suggestive evidence that greater psychological demands and perceived hazards may increase injury risk.

The contributions of this study must be considered in light of its limitations. First, the generalizability of study findings is unknown because the sample was small, regional, and recruited using non-probability methods. Next, the incidence of work injuries involving time away from work should be interpreted with caution because the measure used to capture work-loss time did not differentiate whether the amount of time before returning to work rested solely on the injury, the day of the week the injury occurred, or both. If a worker who typically works Monday thru Friday experienced an injury on Friday, and reported not returning to work until the second day after the injury (or later), it is possible that there was no lost work time. Finally, there was no non-Latino comparison group so it is not clear if the experiences observed in this study are specific to Latinos in residential construction, or whether they reflect experiences of workers

in this subsector more broadly. Future comparative research is needed to determine if the experiences of Latino workers in the subsector differ from other workers in the subsector.

Limitations notwithstanding, this study also has several strengths and it makes several contributions to the construction safety and health literature. A key strength is the prospective design of the study with the relatively short look-back period for reporting injury incidence which offers insight into the relative magnitude of injury under-reporting among immigrant Latino workers. This is one of the first studies to describe the organization of construction work as it is experienced by immigrant Latinos. Although there were few glaring problems, it was also imminently clear that there is room for improvement. Latino residential construction workers have little variety in their jobs, little control over their work arrangements, and the safety climate on most construction sites is (at best) moderate. Collectively the results suggest that work organization may contribute to elevated rates of nonfatal occupational injury among immigrant Latino residential construction workers. Although more research with larger probability sampling methods is needed, improving work organization may be essential to reducing occupational health disparities experienced by immigrant workers.

Table 1. Incidence of work-related injury in the past 3 months by personal characteristics.

	Injured while Working (n=28)	p-value†
Age		0.6274
< 35 years	17	
≥ 35 years	11	
Years in the US		0.4663
<10 years	15	
≥ 10 years	13	
Educational Attainment		0.3016
< Secondary (9th grade)	17	
≥ Secondary	11	
Country of Origin		0.6360
Mexico	20	
Other	8	
Worker Type		0.0187
Framer	7	
Roofer	13	
General Labor	8	
Apprenticeship		0.1042
No	19	
Yes	8	

†p-value obtained using Chi-Square test

Table 2. The organization of work among Latino residential construction workers in eastern NC.

	Sample		Worker Type Framer		Roofer		General Laborer	
Job Structure								
	N (%)	M (SD)	N(%)	M (SD)	N (%)	M (SD)	N (%)	M (SD)
Long work hours†*								
Yes	25 (21.2)		10 (8.5)		6 (5.1)		9 (7.6)	
No	93 (78.8)		16 (13.6)		28 (23.7)		49 (41.5)	
Precarious†								
Yes	31 (26.1)		9 (7.6)		8 (6.7)		14 (11.8)	
No	88 (74.0)		17 (14.3)		27 (22.7)		44 (37.0)	
Job Design								
Skill variety‡**		8.4 (2.3)		8.7 (2.1)		7.4 (1.8)		8.8(2.6)
Control‡*		6.2 (3.5)		5.5 (3.2)		5.3 (3.2)		7.1 (3.6)
Psychological demand‡		9.8 (3.1)		9.1 (2.4)		9.5 (3.4)		10.3 (3.2)
Hazards‡*		17.2 (5.1)		16.1 (5.0)		19.2 (5.1)		16.6 (4.9)
Supervisory Practices								
Powerful influence‡***		10.4 (3.2)		12.2 (3.1)		9.1 (3.5)		10.3 (2.7)
Retaliatory supervision‡*		6.9 (2.0)		6.7 (1.6)		6.3 (2.2)		7.3 (2.0)
Inability to Communicate†								
Yes	25 (21.0)		5 (4.2)		6 (5.0)		14 (11.8)	
No	94 (79.0)		21 (17.7)		29 (24.4)		44 (37.0)	
Safety Climate‡***		23.0 (5.3)		24.3 (4.8)		19.9 (5.6)		24.3 (4.7)

* $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$ (two-tailed)

†p-values obtained using a Chi Square test. ‡p-values obtained using a one-way ANOVA across worker type groups.

Table 3. Work organization and its implications for work-related injury among Latino residential construction workers eastern NC.

	Simple* OR (95% CI)	Adjusted† OR (95% CI)
Job Structure		
Long work hours (Yes vs. No)	1.52 (0.51,4.56)	1.46 (0.39,5.43)
Precarious (Yes vs. No)	0.81 (0.29,2.27)	1.12 (0.36,3.52)
Job Design		
Skill variety	1.01 (0.84,1.22)	1.09 (0.87,1.36)
Control	1.00 (0.88,1.13)	1.07 (0.93,1.24)
Psychological demand	1.01 (0.88,1.16)	1.04 (1.00,1.22)
Hazards	1.10 (1.00,1.21)	1.12 (1.00,1.25)
Supervisory Practices		
Powerful influence	0.98 (0.85,1.13)	0.99 (0.84,1.17)
Retaliatory supervision	0.90 (0.72,1.12)	0.96 (0.75,1.22)
Inability to communicate (Yes vs. No)	0.53 (0.16,1.71)	0.56 (0.16,1.93)
Safety Climate	0.95 (0.88,1.03)	0.97 (0.88,1.07)

*bivariate model with no adjustment

† model adjusts for worker type and differential exposure to construction work between baseline and 3 month follow up interviews

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