

# Results of a community-based survey of construction safety climate for Hispanic workers

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**Background:** Hispanic construction workers experience high rates of occupational injury, likely influenced by individual, organizational, and social factors.

**Objectives:** To characterize the safety climate of Hispanic construction workers using worker, contractor, and supervisor perceptions of the workplace.

**Methods:** We developed a 40-item interviewer-assisted survey with six safety climate dimensions and administered it in Spanish and English to construction workers, contractors, and supervisors. A safety climate model, comparing responses and assessing contributing factors was created based on survey responses.

**Results:** While contractors and construction supervisors' ( $n=128$ ) scores were higher, all respondents shared a negative perception of safety climate. Construction workers had statistically significantly lower safety climate scores compared to supervisors and contractors (30.6 vs 46.5%,  $P<0.05$ ). Safety climate scores were not associated with English language ability or years lived in the United States.

**Conclusions:** We found that Hispanic construction workers in this study experienced a poor safety climate. The Hispanic construction safety climate model we propose can serve as a framework to guide organizational safety interventions and evaluate safety climate improvements.

**Keywords:** Immigrant workers, Non-retaliation, Occupational injury disparities, Residential construction, Safety perception, Shared perception

## Introduction

Hispanic workers suffer disproportionately high rates of fatal and non-fatal injuries on construction sites in the United States. Thirteen percent of all construction workers are Hispanic, but they experience 28% of the fatal injuries.<sup>1-3</sup> A number of factors have been suggested to contribute to this disparity, including poor English language skills and discriminatory practices that create hazardous work environments for Hispanic workers.<sup>4,5</sup>

The construct of safety climate, proposed by Zohar, examines the importance afforded to safety in relation to other organizational priorities. Zohar proposes that safety climate be measured by assessing employees' shared perceptions and attitudes related to safety at a point in time within an organization.<sup>6-11</sup> Safety climate encompasses both environmental conditions and organizational norms that sanction or support safety-related behavior and thereby influence the likelihood of injuries.<sup>12,13</sup>

Although safety climate is a generally recognized construct, there is disagreement on how it should be operationalized and measured. Safety climate is multi-dimensional, with several scales and factors used to characterize workplaces.<sup>14</sup> Pluralist rather than unified approaches have been more widely used, with researchers tailoring variables in each dimension according to the occupational context.<sup>7</sup> Examples of safety climate dimensions include management commitment to safety, worker involvement, production pressure, supervisor support, safety systems, communication, safety training, workplace, and safety committee status.<sup>8,15-17</sup> Safety climate is a suggested antecedent on the injury causal pathway, directly affecting safety-related behaviors.<sup>7,13,18,19</sup> Unlike injury rates and lost time days, which reflect workplace safety performance retrospectively, safety climate assessment is a proactive approach for improving worksite safety.<sup>20,21</sup> Previous studies suggest that organizations with strong safety climate scores exhibit lower injury rates than organizations with weak scores.<sup>22</sup>

Although safety climate was originally studied as a predictor of behavior and injury in the manufacturing

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sector, it has since been examined in other industries including retail, health care, petrochemical and chemical, laboratories, food, transportation, and packing plants.<sup>8,21,23–33</sup> It has been extensively applied in the construction sector and we build upon our predecessors' work in this area.<sup>18,34–38</sup>

Using the safety climate construct as a theoretical framework, we investigated perceptions of work-related hazards and potential work organization and safety factors among Hispanic construction workers in Lawrence, Massachusetts. Previous research with Hispanic workers reported associations between safety climate and individual characteristics such as age, years in the US, years of working experience, and accident exposure.<sup>31,39,40</sup> Thus, age, experience in the construction industry, and length of residency were included in the survey and subsequently in the analysis to determine whether safety climate varied significantly according to participant characteristics. Additionally, given that a lack of English language skills has been identified as a risk factor for workplace injury, we explored how safety climate perception varied by respondents' English language ability.<sup>2</sup>

### Setting and approach

This work was part of a community-based participatory research (CBPR) project, *Protección en Construcción: The Lawrence Latino Safety Partnership (PenC)*. PenC was a research project conducted through collaboration of the Lawrence Mayor's Health Task Force, Laborers International Union of North America Local 175, Lawrence Community Connections, and the Department of Work Environment at the University of Massachusetts Lowell. The goals of this community–university–labor partnership were to (1) form an equitable and mutually beneficial research partnership, (2) investigate the root causes of fall hazards and silica dust exposures affecting Hispanic construction workers, and (3) design and implement an intervention to improve occupational health based on the findings.<sup>41</sup>

Known as the “Immigrant City,” Lawrence has a rich multi-ethnic and multicultural working class history with strong community networks, organizations, and small businesses. According to the U.S. Census, the Hispanic population of Lawrence, located in northeast Massachusetts, increased by 300% from 1980 to 1990. In 2012, the estimated total population was 77 326, with more than 74% of that population identifying as Hispanic.<sup>4</sup> Three-quarters of Lawrence residents speak a language other than English at home and almost two-thirds work in service, production, or construction occupations compared to one-third employed in these sectors in the state of Massachusetts.<sup>4</sup>

Community-based participatory research is a collaborative effort that utilizes the strengths,

resources, and relationships within communities to maximize the benefits of the research process through comprehensive and sustainable interventions to address identified needs.<sup>42</sup> The CBPR model is especially suited to the challenges and opportunities embedded in occupational health research with immigrant workers, and is particularly appropriate to Lawrence.<sup>43</sup> For several years, Lawrence residents, local government agencies, and community-based organizations have worked in collaboration to improve the physical environment, create jobs, foster economic development, and address the health of the community. The aim of this research was to characterize the safety climate of Hispanic construction workers, to describe differences in perception of safety climate by job position, and to identify safety climate factors that could be modified to improve conditions on construction sites and reduce injuries.

## Materials and Methods

### Survey instrument

A 40-item questionnaire was developed to measure survey respondents' characteristics and perceptions of safety climate among union and non-union construction workers, supervisors, and construction contractors in the Lawrence area. The draft was based on Jorgensen *et al.*'s work on Hispanic safety climate and findings from focus group interviews.<sup>44,45</sup> The survey was then modified after review by project staff and community members. The survey was developed in English and translated into Spanish to reflect local linguistic preferences. A 50-item was piloted ( $n=20$ ) and survey assistants (who also served as project staff in the capacity of outreach workers) noted respondents' difficulties. Subsequently, the response scale was reduced to three points and several questions were eliminated. The final 40-item instrument included 31-item safety climate questions and nine questions regarding current job title, union status, last 6 months' occupation, gender, years of experience in construction, years living in the United States, native language, English proficiency, ethnicity, and age (Table 1). From the 31 safety climate items, respondents rated 21 items on an “always,” “sometimes,” and “never” scale, while the remaining 10 questions were measured on a “agree,” “neutral,” and “disagree” scale. Participant's English fluency was self-reported using three categories (high, medium, and low).

### Sample

The eligibility criteria for survey participation were: (1) employed in the construction industry, (2) living in Lawrence, MA, (3) at least 18 years of age, and (4) self-identification as Hispanic or as a construction contractor of any ethnicity. Residential and small commercial construction contractors generally man-

age a group of workers. They are responsible for site safety, but may delegate safety duties to on-site supervisors or foremen. Using these criteria, we identified three populations. The first population was Spanish-speaking construction workers (unionized and non-unionized), supervisors, and contractors. We used strategic convenience sampling at approximately 20 sites in Lawrence chosen by community outreach team members familiar with locations frequented by construction workers.

The second sample population consisted of Spanish-speaking members of laborers' union Local. A research assistant attempted to contact all 185 workers on a list of union members with Hispanic surnames provided by the Local. The third population included contractors of any ethnicity identified from directory listings and from records of building permits from the City of Lawrence.

Survey assistants were native Spanish speakers from the community outreach team ( $n=4$ ) and Spanish-speaking graduate research assistants ( $n=2$ ). During data collection, weekly meetings were conducted with the survey assistants to monitor progress, identify recruitment barriers, calculate refusal rates, and discuss improvements.

Study participants provided oral informed consent using protocols approved by the Institutional Review Board of the University of Massachusetts Lowell. Participation was voluntary and confidential and no personal identifiers were collected. Each survey took approximately 15 minutes and respondents received a \$10 gift card for their participation.

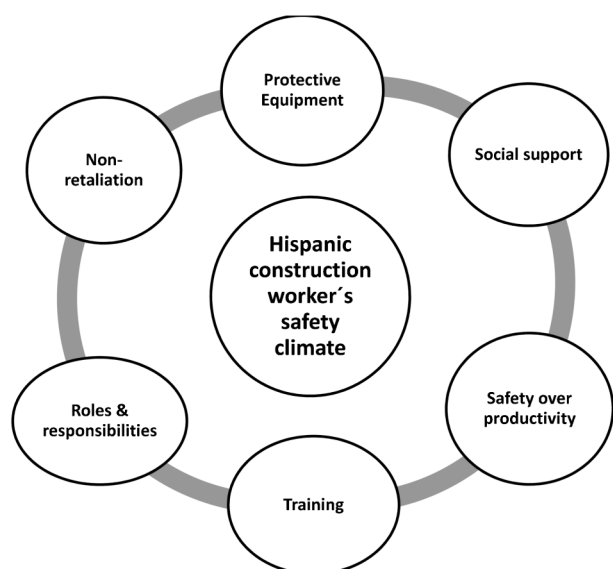
### Data collection

The survey was administered in-person and by phone between June 2010 and April 2011. At least twice per

**Table 1 Safety climate quantitative approach**

Item no.	Dimension (items)	Scoring		
		Always	Sometimes	Never
Protective equipment				
1	When working at heights, the boss provides appropriate ladders	1	0	0
2	When working at heights, the boss provides appropriate scaffolding	1	0	0
3	When working at heights, the boss provides appropriate harnesses	1	0	0
Social support				
4	Construction workers pay attention to the safety of other workers in the worksite.	1	0	0
5	Construction workers have to compete with each other in order to keep their job	0	0	1
6	Latino construction workers are treated with respect by construction supervisors	1	0	0
7	Latino construction workers are treated with respect by their co-workers	1	0	0
8	Workers who do not speak English can count on their co-workers or supervisors to translate the necessary information	1	0	0
Productivity				
9	Construction workers put themselves at risks of injuries because they take shortcuts	0	0	1
10	Safety is a priority at the construction work even when jobs run behind the schedule	1	0	0
11	Latino construction workers feel pressure to get things done quickly in order to keep their jobs	0	0	1
12	Contractors could make the construction work safer and avoid injuries but they do not do it because they want to save money.*	0	0	1
Training				
13	Latino workers say they have understood the instructions, even when they really have not understood them.	0	0	1
14	Workers who do not speak English have difficulty understanding safety rules on construction sites	0	0	1
15	Construction workers know how to use protective equipment to prevent falls, such as harnesses	1	0	0
16	Training given to workers on how to prevent falls is adequate	1	0	0
Roles and responsibilities				
17	Workers' safety is one of the most important concerns of the supervisors	1	0	0
18	Construction companies are responsible for ensuring that their construction workplace is safe.*	1	0	0
19	Construction workers who complain about the risks and hazards at the worksite are looking for excuses not to do the job.*	0	0	1
20	At the construction site, injuries happen and there is very little that can be done to prevent them.*	0	0	1
21	When Latino construction workers are injured on the job, it is generally the workers' own fault.*	0	0	1
Non-retaliation				
22	Workers who are frequently injured in the construction job may lose their jobs	0	0	1
23	Latino workers are afraid to speak when there are problems related to safety at the worksite	0	0	1
24	Construction companies exploit Latino workers because they know their urgent need for the job.*	0	0	1
25	Latino workers do whatever is asked so they can keep their jobs.*	0	0	1

\*Items measured on "agree," "neutral," and "disagree" scale.



**Figure 1** Hispanic construction workers safety climate model.

week and in pairs, the outreach team visited pre-defined recruitment locations to contact potential participants. All interviews were conducted in a private area.

Graduate research assistants conducted phone interviews with union members and contractors. Prior to the phone survey with union members, the union sent a letter to members with Hispanic surnames explaining the research and informed them that their participation was confidential and voluntary.

### *Safety climate measure*

The survey instrument measured six dimensions of safety climate relevant to Hispanic construction workers shown in the Hispanic construction safety climate model (Fig. 1). Although the concepts in Fig. 1 are not comprehensive of all safety climate dimensions, they were selected because they are measurable indicators of construction safety climate and modifiable, making them potential targets for intervention.

Not all 31 safety climate items in our instrument were included in the safety climate model. Five items related to temporary worker agencies, silica exposure, wages, and general working conditions were excluded because they were deemed too broad or not sufficiently related to the safety climate dimensions in the model. We grouped the remaining 26 survey questions into six dimensions: (1) “protective equipment” included questions about the availability of appropriate equipment for working at heights, (2) “safety over productivity” included questions about risk-taking behavior in response to job pressure, (3) “training” included items related to the effectiveness of safety training and language-related safety issues, (4) “roles and responsibilities” included workers’ perceptions of supervisors and contractors’ safety

commitment, as well as workers’ attitudes about responsibility for injuries, (5) “social support” included questions related to respectful relationships and supervisor support, and (6) “non-retaliation” questions assessed worker perception of job threats as a result of safety-related behavior. The dimensions of non-retaliation and social support have not been extensively explored previously in relation to construction safety climate. Supervisors’ potential to engage in retaliation in the workplace and to affect workers’ job opportunities is a concern among residential construction workers.<sup>39</sup>

To estimate overall safety climate perception, a safety climate score ranging from 0 to 100% was calculated for each respondent based on their answers to the survey questions. The safety climate score was calculated as the proportion of answers that suggested a positive safety climate over the total number of responses (see Appendix 1 for questions and coding). If participants responded “never” to the question regarding how often construction workers must compete with each other in order to keep their job, it was coded as 1. Other response options (always or sometimes) were coded 0, as these responses represented a less than ideal safety climate. To avoid survey-induced bias, reverse-scored items were included. Responses of “sometimes” suggest some degree of positive safety climate, but may also indicate contradictory situations that create a false sense of safety. In a strong safety climate, participants should report that they perceive consistency in tacit or explicit messages communicated by supervisors. To determine if our scoring strategy unduly influenced total safety scores, we conducted a sensitivity analysis in which a “sometimes” response was assigned a “0.5” instead of a “0.” In addition to an overall safety climate score, each respondent received scores on the individual dimensions described in our safety climate model.

### *Data analysis*

All data analysis was performed using SPSS version 19. Respondents were categorized into two groups by job position: (1) construction workers and (2) construction supervisors and contractors. Descriptive analyses were performed for demographic factors and safety scores (total and by element) using frequency tables for categorical variables (demographics) and mean, median, and quartiles for continuous variables (safety scores).

A non-parametric Kruskal–Wallis test was used to test for an association between the independent variable of job position in the construction sector (contractors and supervisors, and workers) and the safety scores. This test was selected because there was no normality and homoscedasticity of residuals. To

determine whether other demographic variables confounded the association between job position and safety score, the associations between safety scores and demographic variables were assessed. To verify internal consistency in the instrument, Cronbach’s alpha for the six dimensions was calculated to measure the proposed safety climate scale; the value of this statistic was 0.82, which is higher than the cutoff of what is generally considered good, especially for newly developed scales (0.70).<sup>46</sup>

**Results**

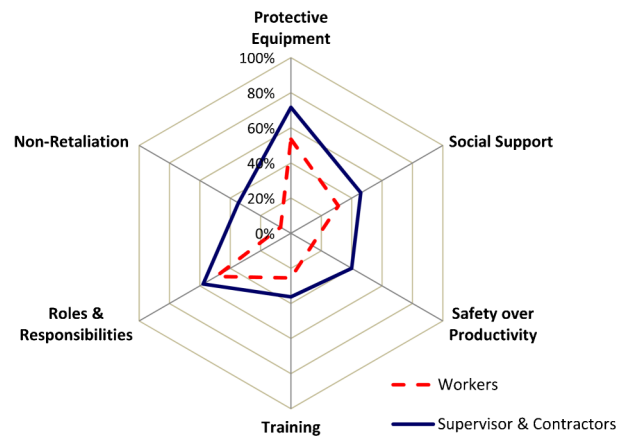
*Characteristics of participants*

A total of 128 participants completed the survey. More than 80% of the participants were construction workers, approximately three-quarters of the surveys were conducted in-person, and most were conducted in Spanish (93%). Demographic characteristics are shown in Table 2. The sample was almost entirely male (97%).

During post-survey debriefing, survey assistants reported that only a few potential participants declined to complete the in-person survey. For the telephone survey, from a list of 185 Hispanic union members provided by the Local, 133 were either a duplicate, wrong, disconnected, or non-working number; 52 members were reached; and 49 agreed to participate. From the list of 20 English-speaking contractors with telephone numbers, 11 numbers were unusable and 8 contractors completed the survey. The refusal rate was 5 and 11% for union members and contractors, respectively.

*Safety climate scores*

Safety climate scores for the six dimensions of our safety climate scale are shown in Fig. 2. Each axis represents a safety climate dimension measured from 0 to 100. Hispanic construction worker climate safety scores differed significantly by job position of the



**Figure 2** Safety climate scores by job title among Hispanic construction workers.

respondent. Construction workers had statistically significantly lower safety climate scores (30.6% ± 14.3) compared to supervisors and contractors [(46.5% ± 24.7), *P* < 0.05]. Descriptive analyses (Table 3) showed that contractors and supervisors had higher total safety climate scores compared to construction workers (47 vs 31%, respectively). Of the six safety climate dimensions, protective equipment had the highest safety climate score for contractors and supervisors (72%) and construction workers (54%), followed by roles and responsibilities (57% for contractors and supervisors). For all three respondent categories, the non-retaliation dimension received the lowest (most negatively) score in the safety climate model.

Sensitivity analysis showed no significant changes in the total and individual dimensions of safety climate scores between the two scoring strategies (“always, never” as compared to “always, sometimes, never”).

Additional statistical analyses were performed to determine whether there might be alternative explanations for the results. Kruskal–Wallis tests showed no association between English fluency, age, seniority, and years living in the US and safety climate scores in the significant range. The Kruskal–Wallis test was used to test for significant differences in the safety climate scores between construction workers by English fluency. We found no association between English fluency and safety climate scores.

**Discussion**

This study explored construction safety climate perceptions in Lawrence, Massachusetts with a focus on Hispanic construction workers. Overall, safety climate was generally rated as poor. Construction workers differed significantly from construction managers and contractors in their perception of safety climate, especially in safety climate dimensions related to the importance given to safety over

**Table 2** Characteristics of participants

	<i>n</i>	%
Total participants	128	
Construction worker	107	83.6
Contractor	11	8.6
Supervisor	10	7.8
Construction workers only	107	
Unionized worker	45	42.1
Non-unionized worker	27	25.2
Unknown	35	32.7
English fluency		
High	26	24.3
Medium	52	48.6
Low	25	23.4
	Median	Range
Age	42	19–63
Years in US	14	1–47
Experience as a construction worker in US (years)	7	1–37

productivity and in the likelihood of negative job consequences for reporting safety concerns.

Exploration of these six dimensions of construction safety climate contributes to an understanding of the meaningful components of safety climate reported by Hispanic workers such as supervisor pressure, competition for jobs, and intimidation. Non-retaliation – or workers' ability to report hazards without fear of reprisals – was the lowest-rated component of the model among all respondents. Lipscomb *et al.* looked at the job consequences of injury reporting among carpenters and also found an atmosphere of intimidation on construction sites.<sup>47</sup> In addition to non-retaliation for hazard reporting, we suggest that co-worker and supervisor social support play a critical role in safety climate for Hispanic construction workers. Previous research found that Hispanic construction workers consistently identified an absence of mutually respectful attitudes and behaviors as an impediment to safety in construction.<sup>45</sup>

### Variability in Perception of Safety Climate

Although safety climate is by definition a shared perception, researchers have found that perception may not be homogenous across organizations.<sup>48</sup> Similar to our results, previous studies have found that safety climate perception varies between management and workers irrespective of industry.<sup>18,19,40,49</sup> Despite variability by respondent job position, no scores suggested a positive perception of safety climate on construction worksites. Among Hispanic construction workers, safety climate scores had a mean of 30%. Contractors and supervisors' overall safety climates score was 47% – higher, but still low. We found that personal variables such as age, English proficiency, job experience, or years lived in the United States were not significant determinants of participants' perceptions of health and safety in construction.

Discrepancies in safety climate perceptions between employees and managers at the same worksite are attributed to differences in responsibilities, duties, and goals, to divergent management styles, and to levels of concern for safety issues.<sup>35,49</sup> Huang *et al.* suggest that discrepancies in safety perceptions

may also be explained by role differences between those responsible for implementing safety policies, procedures, or programs (middle and upper management) and those who experience these programs as implemented and directly observes them in action.<sup>50</sup> These differences may also reflect differences in safety expectations. For instance, while workers may perceive hazard reporting as positively contributing to safety conditions, supervisors might consider them to be interruptions or delay tactics.

### Safety Climate Scale and Model

Our study contributes to the definition and modeling of safety climate for the construction work environment, with a focus on dimensions of Hispanic construction worker safety climate. Researchers have used a variety of safety climate scales even within the same industry.<sup>44,51,52</sup> Zohar suggested that safety climate scales are most functional when developed specifically for a particular industry and that variability is not undesirable.<sup>7</sup> Several specific dimensions are common across safety climate scales, such as organizational priority given to safety, safety roles and responsibilities, safety training, and protective equipment.<sup>15,17,53</sup> These elements are represented in our Hispanic Construction Worker Safety Climate Model.<sup>22</sup> In construction and other sectors, co-workers play an important role in promoting a positive safety climate. Myers *et al.* highlighted the importance of co-worker connectedness to increase resources for improving safety.<sup>54</sup> When co-workers and supervisors are mutually concerned with worker safety, there will be an environment more supportive of workplace safety and safety rule compliance.<sup>55–58</sup> Positive and frequent safety messaging from supervisors has also been linked to improved workplace conditions.<sup>59,60</sup> Likewise, construction workers who perceived their worksite as less safe also perceived less supervisor and co-worker support.<sup>36</sup>

The concept of safety incorporates environmental conditions and behavior. In the construction industry, as in many other industries, productivity and safety are often viewed as conflicting.<sup>55</sup> Pressure to complete the job, rather than work safely may result in unsafe work behaviors.<sup>61,62</sup> Although, risk taking

**Table 3 Safety climate score by job title among Hispanic construction workers**

Dimensions	Safety climate score		
	Total participants % (n=128)	Construction workers % (n=107)	Supervisors and contractors % (n=21)
Total safety score	33.2 (± 17.4)	30.6 (± 14.3)	46.5 (± 24.7)
Protective equipment	56.5 (± 44.6)	53.6 (± 44.6)	71.4 (± 42.5)
Social support	33.4 (± 26.7)	31.2 (± 24.6)	44.8 (± 34.0)
Safety over productivity	17.8 (± 23.7)	13.8 (± 19.8)	38.1 (± 31.2)
Training	27.1 (± 22.4)	25.5 (± 21.4)	35.7 (± 25.7)
Roles and responsibilities	50.5 (± 17.9)	49.2 (± 17.1)	56.7 (± 20.9)
Non-retaliation	11.3 (± 23.5)	6.8 (± 15.9)	34.1 (± 38.7)

or unsafe behavior is a recognized cause of work-related injuries, social ecological theory posits that health behaviors are conditioned by environmental norms.<sup>63,64</sup> Thus, individual worker attitudes and actions related to safety and risk may follow tacit or explicit messages transmitted to workers by supervisors regarding workplace priorities.<sup>65</sup> In previous studies, workers mentioned that supervisors are sometimes given financial incentives when jobs are completed ahead of schedule, which may contribute to the prioritization of fast work over safety.<sup>45</sup> This perceived conflict between safety and production, which we defined as the *productivity over safety* dimension, suggests a need for rewarding productivity in ways that do not undermine safety. Workers, contractors, and supervisors were relatively similar in their perceptions of safety roles and responsibilities. Construction work is characterized by autonomy, and workers may view safety as primarily their own responsibility.<sup>36</sup> However, the relatively low scores among all respondents for this dimension suggests a need for role clarification and recognition of workers' limited power to achieve a positive safety climate in the absence of strong management commitment to safety.

The protective equipment dimension measured perceptions regarding availability of both personal fall protection and fall prevent equipment such as guardrails. Protective equipment was the most positively assessed dimension of the safety climate model. However, workers were less likely to report its consistent availability when compared to contractors and supervisors. Gillen *et al.* also reported that Hispanic construction workers' perception of low availability of proper equipment negatively affected perceptions of safety climate.<sup>36</sup>

Training has been found to enhance working conditions and increase safety in the workplace. Proper training to reduce gaps in safety knowledge and tailored to the construction sector can increase worker awareness, safety communication, and self-protective work practices, while reducing lost work-days.<sup>59,66,67</sup> The training dimension also assessed the extent to which training was appropriate to the workers' English proficiency and education level. Our findings are in line with previous work showing Hispanic construction workers to be at risk of experiencing inadequate safety training.<sup>2,39,68-70</sup>

The general perception among survey respondents was that there is a need for increased fall prevention equipment, safety training, and clear safety roles and responsibility definition, and that management commitment to safety is undermined by a fear of retaliation and prioritizing productivity over safety. These factors point to a poor overall construction safety climate experienced by these workers and

strong directions for improvement. For example, employers can delineate hazard-reporting protocols that encourage worker participation in identifying hazards and make clear that they will not be punished for doing so.

### Study Strengths and Limitations

We used formative research, previously utilized questions, and a community review and pilot process to assure rigor, meaning, and content validity. Researchers and construction workers who participated in the survey development and pilot agreed that the instrument measured appropriate and relevant dimensions. Our sample was a small convenience sample, and it was limited to a specific geographic location. These findings may not be applicable to Hispanic construction workers in other areas. We did not collect information regarding employer characteristics, type of construction work performed, education level, or previous injuries. We suspect that the results may not apply to large commercial construction operations with greater resources for safety than in the residential and small commercial sectors. Despite these limitations, the survey responses are comprehensive of a diverse group of respondents including workers, contractors, and supervisors.

Our research adds to the body of evidence suggesting that Hispanic construction workers face a negative safety climate that may contribute to increased injuries.<sup>36,39,45</sup> Poor safety climate has been previously linked to high injury rates in a variety of employment sectors including the construction industry. Construction contractors and supervisors have a more positive perception of safety climate than do workers and community members, but they also perceive that the key components of safety climate are not strongly perceived on their worksites. This is especially concerning given the important role of construction worker perception of management commitment to safety in normalizing safety work practices and behaviors.<sup>62,71</sup> Perception of safety climate did not significantly differ by personal variables such as English proficiency or job experience. Our findings agree with findings from our focus groups and previous investigations of Hispanic safety climate showing a need for improvement in all dimensions of safety climate including training, equipment, hazard-reporting policies, and organizational support for and prioritization of safety.<sup>2,39,45</sup>

To date, safety climate research has focused primarily on identifying and exploring potential determinants and mediators of the relationship between safety climate and safety outcomes rather than assessing the impact of safety interventions on workers' perceptions of safety. Our work highlights

the need for interventions designed to improve safety climate dimensions and address the upstream causes of poor safety conditions that lead to the higher injury rates experienced by Hispanic construction workers. Management commitment to safety and worker-supervisor relationships have been suggested as significant modifiable components of safety climate.<sup>17,30</sup> Although these dimensions can be exhibited in several different ways, worksite safety communication and leadership have been considered core elements to be addressed in safety climate interventions. An intervention focused on improving line supervisors' frequency of safety-oriented interactions with subordinates resulted in significant changes in workers' safety behavior and safety climate scores.<sup>72</sup> Similarly, the effect of increasing foreman-worker verbal safety exchanges was found positive associated with construction workers safety climate scores.<sup>73</sup> We utilized our findings from this study to develop a bi-lingual supervisor training program called "Leaders in Safe Construction," to address what we observed were deficits in safety climate on local construction worksites. The training program was approved by the Massachusetts Division of Public Safety for construction supervisor licensing continuing education credits, and included modules on building supervisor support for safety and appropriate fall prevention equipment. A report on this program, which was attended by over 100 supervisors, is forthcoming.

## Disclaimer Statements

### Contributors

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