

Brief Report

An English/Spanish Safety Climate Scale for Construction Workers

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Background Workers in the construction trades experience high rates of traumatic injury. An increasing number of workers in this industry speak only Spanish, including members of construction trade unions. This brief communication reports a dual language safety climate scale developed during a larger training intervention study.

Methods Construction workers in two unions self-completed a previously validated 6-item safety climate scale modified for the construction trades. A seventh item was developed midway through the study and incorporated into the version completed by half of the respondents. For one union with a sizeable number of Spanish-speaking members, a dual-language (Spanish/English) version was administered. Follow-up telephone interviews conducted 3 months after the self-completed survey also included the safety climate scale.

Results Cronbach's coefficient alpha was 0.85 for the 6-item scale and 0.85 for the 7-item scale. Similar coefficient alpha scores were found for the subgroup of Spanish-speakers on the 6- and 7-item scales. Spanish speakers with low education were less likely to respond to the scale when self-completing but not when it was administered by telephone in Spanish.

Conclusion This safety climate scale elicits consistent and reliable response from unionized construction workers when administered in English or in Spanish. Spanish literacy may be a consideration for the use of this scale among foreign-born Hispanic workers. *Am. J. Ind. Med.* 50:438–442, 2007. © 2007 Wiley-Liss, Inc.

KEY WORDS: construction; safety climate scale; Hispanic workers

BACKGROUND

In the U.S., construction workers have the highest absolute number and third highest rate of fatal occupational injuries and the highest rate of non-fatal occupational injuries [NIOSH, 2004]. In 2000, the proportion of self-identified Hispanic workers in construction had reached 15%, the largest proportion in any industry after agriculture. Nearly one-third of these construction workers spoke only Spanish, and the risk of fatal occupational injury was almost twice that of other construction workers [Dong and Platner, 2004]. Among all traumatic occupational fatalities reported through

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the Census of Fatal Occupational Injury between 1996 and 2001, the excess rate of fatal injury occurred only among foreign-born Hispanic workers, while U.S.-born Hispanic workers had fatal injury rates identical to the rest of the U.S. workforce [Loh and Richardson, 2004].

Safety climate is a worker's "perception about safety in their work setting" [Dedobbeleer and Beland, 1991]. Reliable measures of safety climate have been developed [Dedobbeleer and Beland, 1991; Gillen et al., 2002]. Safety climate has been associated with injury severity in construction workers [Gillen et al., 2002] and appears to be linked to incidence of any injury and illness in Latino poultry workers [Quandt et al., 2006]. Strong management commitment to safety, provision of performance feedback to employees, humanistic management style, high worker involvement in safety, and good hygiene practices constitutes aspects of workplace safety climate that have been associated with reductions in incidents of workplace exposure to blood and body fluids in healthcare settings [Gershon et al., 1995, 2000].

Union-based safety and health training programs may empower workers and improve safety climate. There is a need for reliable instruments for use among Spanish-speaking construction workers.

This study was conducted within an ongoing training evaluation research project. The aim of this component of the study is to evaluate a dual-language English-Spanish workplace safety climate scale for use with a mixed population of English-speaking and Spanish-speaking construction workers. The scale studied here is a modified version of a National Institute for Occupational Safety and Health (NIOSH) scale that was validated in relationship to workers' adherence to standardized safe work practices ("universal precautions") for the health care industry [DeJoy et al., 1995] and has been used in general industry [DeJoy et al., 2004].

METHODS

All respondents agreed to participate via informed consent using protocols approved by the Institutional Review Board of the Office to Protect Research Subjects of the University of Illinois at Chicago. The study was conducted between November 2004 and January 2006 at two sites—the Pipe Fitters' Training Center Local Union 597, Mokena, Illinois and the Joint Apprentice Training Center of the United Union of Roofers and Allied Workers Local 11 located in Indian Head Park, Illinois.

A previously validated 6-item NIOSH safety climate scale was adapted for use in construction as part of a pilot study to develop a survey instrument to evaluate safety training provided to unionized construction workers in two construction trades, roofers and pipefitters. The modified scale was translated into Spanish and presented to respon-

dents in the roofers' union in a bilingual format. Since all but two pipefitters were born in the U.S., they were given the scale in English only. It was administered by self-completion in a group setting to union members who were recruited in the classroom prior to attending a safety training class. After administering the survey to 90 respondents, a seventh item was developed in response to recommendations from the Apprentice Coordinator of the roofers' union (see Fig. 1, item seven). The expanded 7-item scale was administered to an additional 129 workers in classroom groups of approximately 30 respondents. As part of the larger study, an interviewer-administered telephone survey was conducted in English or Spanish (based on the respondent's preference) 3 months after the in-class survey for those workers who could be reached by telephone (approximately half; $n = 96$). Only the self-completed baseline survey was used for the reliability analysis.

Altogether, 219 out of a possible 291 construction workers agreed to participate in the survey, for an overall participation rate of 79%, with approximately half completing the 6-item and half completing the 7-item scale.

Exclusions

Respondents were excluded if they were missing information for country of birth ($n = 4$), were born in a non-Spanish speaking foreign country ($n = 1$), or were foreign-born pipefitters ($n = 2$). A total of 212 respondents were analyzed for completion rates. For analysis of scale reliability, 14 respondents who did not respond to every item on the scale were excluded, leaving a total of 198.

The reliability of the safety climate scale was assessed using Cronbach's coefficient alpha (α), the most commonly used approach for measuring the internal consistency of questions [Cronbach, 1951] when questions are small scales (e.g., Likert scale). Coefficients of 0.70 or greater indicate acceptable reliability. The internal consistency was measured for the 6-item scale and the 7-item scale separately. Statistical power was determined for the reliability analysis using the Power Analysis Statistical Software (PASS 2005). The power was determined by Cronbach's alpha greater than 0.7 using a one-sided F -test with a significance level of 0.05.

A total of 74 respondents completed every item on the 6-item scale. A total of 124 respondents completed every item on the 7-item scale. Since the 124 respondents to the 7-item scale completed the six items on the 6-item scale, these respondents were included in the assessment of internal reliability of the 6-item scale using the total number ($n = 198$). For the 7-item scale, the internal consistency was measured for all seven items ($n = 124$). Subsets of foreign-born Hispanic respondents ($n = 32$ for the 6-item scale; $n = 19$ for 7-item scale) and U.S.-born respondents ($n = 166$ for 6-item scale; $n = 105$ for 7-item scale) were also analyzed (see Table I).

Please indicate how much you agree or disagree with each of the following statements about safety on your most recent job. Circle one answer on the scale for each question:

Indique por favor cuánto usted esta de acuerdo en contra cada una de las siguientes declaraciones sobre la seguridad en la obra más reciente donde usted esté o haya estado trabajando. Elija la mejor respuesta para cada una de las declaraciones:

	Strongly Disagree <i>Estoy Fuertemente En Desacuerdo (SD)</i>	Disagree <i>Estoy En Desacuerdo (D)</i>	Agree <i>Estoy De Acuerdo (A)</i>	Strongly Agree <i>Estoy Fuertemente De Acuerdo (SA)</i>
1. New workers quickly learn that they are expected to follow good safety practices. <i>Los trabajadores nuevos aprenden rápidamente que se espera que sigan buenas prácticas de seguridad.</i>	SD	D	A	SA
2. There are no significant compromises or shortcuts taken when worker safety is at stake. <i>Cuando la seguridad del trabajador esta en juego, no se toma ningún riesgo que le pueda poner en peligro.</i>	SD	D	A	SA
3. Where I work, workers and supervisors work together to ensure the safest possible working conditions. <i>Donde yo trabajo, los trabajadores y los supervisores trabajan en conjunto para garantizar que las condiciones de trabajo sean lo mas seguras posibles.</i>	SD	D	A	SA
4. Workers are told when they do not follow good safety practices. <i>Los trabajadores son informados cuando no siguen buenas prácticas de seguridad.</i>	SD	D	A	SA
5. The safety of workers is a big priority with supervisors where I work. <i>Donde yo trabajo la seguridad de los trabajadores es una de las máximas prioridades de los supervisores.</i>	SD	D	A	SA
6. I feel free to report safety violations where I work. <i>Me siento libre de reportar cualquier violación de seguridad donde yo trabajo.</i>	SD	D	A	SA
7. Safety remains a priority even when the job runs behind schedule. <i>La seguridad sigue siendo prioritaria aunque el trabajo se atrase.</i>	SD	D	A	SA

FIGURE 1. Bilingual safety climate scale for construction workers. Adapted from scale provided by Dr. Lawrence R. Murphy, CDC-NIOSH, Division of Applied Research and Technology, Cincinnati, OH.

For analysis of completion rates, respondents were classified as non-completers (n = 14) if they missed any of the items on either the 6- or 7-item scale and classified as completers (n = 198) if they missed no items (Table II).

Among U.S.-born workers, 166 were completers and 7 were non-completers. Foreign-born Hispanics who were non-completers (n = 7) were compared to foreign-born Hispanics who completed the survey (n = 32) for demographic

TABLE I. Number^a of Respondents Included in the Reliability Analyses of the Safety Climate Scales by Country of Birth (n = 198).

	Respondents included in reliability analysis of 6-item scale	Respondents included in reliability analysis of 7-item scale	Number of respondents
Completed 6-item scale only	74	0	74
U.S.-born workers	61	0	61
Foreign-born Hispanic workers	13	0	13
Completed 7-item ^b scale	124	124	124
U.S.-born workers	105	105	105
Foreign-born Hispanic workers	19	19	19
Total	198	124	198
U.S.-born workers	166	105	166
Foreign-born Hispanic workers	32	19	32

^aFourteen respondents who did not complete the scale are not shown here (see Table II).

^bThe 7-item scale is the 6-item scale with an additional question (see Fig. 1) so a respondent who completed the entire 7-item scale also completed the 6-item scale.

variables using Fisher’s Exact Test for categorical variables (e.g., education) and the Wilcoxon Ranked Sums Test for continuous variables (e.g., age).

RESULTS

From all respondents who completed the safety scale, the internal consistency ($\alpha = 0.85$) indicates that the modified scale for construction is reliable for the 6-question scale. The 7-question scale yields the same value for internal consistency ($\alpha = 0.85$). Analyzed separately, U.S.-born workers who presumably speak English as their primary language produced similar values for the 6-item ($\alpha = 0.85$, n = 166) and 7-item ($\alpha = 0.84$, n = 105) scales.

Analyzed separately, the foreign-born Hispanic workers yielded similar values for reliability for both the 6-item ($\alpha = 0.85$, n = 32) and 7-item ($\alpha = 0.84$, n = 19) scales. It is assumed that these workers speak Spanish as their primary language rather than English. Statistical power was greater than 0.8 for the Cronbach’s alpha test for both U.S.-born and foreign-born Hispanic respondents for the 6-item scales and

for the U.S.-born respondents for the 7-item scale, and 0.7 for the foreign-born Hispanics taking the 7-item scale.

Evaluating non-completion rates (the proportion of respondents who were missing any of the items on the scale), differences were found between U.S.-born and foreign-born respondents (Table II). The scale was not completed by seven (4%) U.S.-born respondents (n = 173). In contrast, 18% of Spanish-speaking respondents were considered non-completers. The U.S.-born respondents were more likely to complete every item (P -value < 0.002 using the Chi-square test).

Among the Spanish-speaking respondents, the non-completers were compared to the completers for demographic variables. Non-completers had lower levels of education (range from less than high school to more than high school education; P -value = 0.02 using Fisher’s Exact Chi-square test). Of note, when the safety climate questions were read to the respondents over the telephone in the follow-up round of the study, all foreign-born Hispanic workers completed the safety scale.

DISCUSSION

This safety climate scale (Fig. 1) is reliable for unionized construction workers completing the questions in English or in Spanish. The 6-item scale is internally reliable in both languages. The 7-item scale is internally reliable in both languages, but has a lower statistical power (0.7) among foreign-born Hispanics.

The lower education level of the foreign-born workers who did not self-complete the scale but did complete it after interviewer-administration indicates that literacy in Spanish may be an issue. Alternatively, the respondents may have felt more pressure to answer questions when asked individually by phone compared to the anonymous group setting for

TABLE II. Count of Completers and Non-Completers by Country of Birth (n = 212)

	Respondents		Total
	Completers	Non-completers	
U.S.-born (%)	166 (96%)	7 (4%)	173
Foreign-born Hispanics (%)	32 (82%)	7 (18%)	39
Total	198 (93%)	14 (7%)	212

P -value < 0.002 using the Chi-square test.

self-completion. Literacy in Spanish should be a consideration in assessing safety climate and other issues for foreign-born but not for U.S.-born union members.

This report provides evidence for reliability of a self-completed safety climate scale in two of the major languages of construction workers in the U.S. The results are limited by a small number of Spanish-speaking respondents for the 7-item scale and we did not conduct additional validation of the scale.

Safety climate has had a demonstrated impact on workplace health and safety. Since U.S. construction workers face much higher rates of injury and fatality than the entire U.S. workforce and since foreign-born Hispanic construction workers are disproportionately affected, further study of the impact of safety climate in this industry is warranted. This scale may provide a useful tool for such research.

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REFERENCES

- Cronbach LJ. 1951. Coefficient alpha and the internal structure of tests. *Psychometrika* 16:297–334.
- Dedobbeleer N, Beland F. 1991. A safety climate measure for construction sites. *J Safety Res* 22:97–103.
- DeJoy DM, Murphy LR, Gershon RM. 1995. The influence of employee, job/task, and organizational factors on adherence to universal precautions among nurses. *Int J Industr Ergo* 16:43–55.
- DeJoy DM, Schaffer BS, Wilson MG, Vandenberg RJ, Butts MM. 2004. Creating safer workplaces: Assessing the determinants and role of safety climate. *J Safety Res* 35:81–90.
- Dong X, Platner JW. 2004. Occupational fatalities of Hispanic construction workers from 1992 to 2000. *Am J Industr Med* 45:45–54.
- Gershon RR, Vlahov D, Felknor SA, Vesley D, Johnson PC, Delclos GL, Murphy LR. 1995. Compliance with universal precautions among health care workers at three regional hospitals. *Am J Infect Control* 23:225–236.
- Gershon RR, Karkashian CD, Grosch JW, Murphy LR, Escamilla-Cejudo A, Flanagan PA, Bernacki E, Kasting C, Martin L. 2000. Hospital safety climate and its relationship with safe work practices and workplace exposure incidents. *Am J Infect Control* 28:211–221.
- Gillen M, Baltz D, Gassel M, Kirsch L, Vaccaro D. 2002. Perceived safety climate, job demands, and coworker support among union and nonunion injured construction workers. *J Safety Res* 3:33–51.
- Loh K, Richardson S. 2004. Foreign-born workers: Trends in fatal occupational injuries, 1996–2001. *Mon Labor Rev* Vol 127:42–53.
- National Institute for Occupational Safety and Health. Worker Health Chart Book, 2004. DHHS (NIOSH) Publication Number 2004-2146.
- Quandt SA, Grzywacz JG, Marin A, Carrillo L, Coates ML, Burke B, Arcury TA. 2006. Illnesses and injuries reported by Latino poultry workers in western North Carolina. *Am J Ind Med* 49:343–351.