



Published in final edited form as:

Saf Sci. 2018 March ; 103: 62–69. doi:10.1016/j.ssci.2017.11.011.

Differences in safety training among smaller and larger construction firms with non-native workers: Evidence of overlapping vulnerabilities

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Abstract

Collaborative efforts between the National Institute for Occupational Safety and Health (NIOSH) and the American Society of Safety Engineers (ASSE) led to a report focusing on overlapping occupational vulnerabilities, specifically small construction businesses employing young, non-native workers. Following the report, an online survey was conducted by ASSE with construction business representatives focusing on training experiences of non-native workers. Results were grouped by business size (50 or fewer employees or more than 50 employees). Smaller businesses were less likely to employ a supervisor who speaks the same language as immigrant workers ($p < .001$). Non-native workers in small businesses received fewer hours of both initial safety training ($p = .005$) and monthly ongoing safety training ($p = .042$). Immigrant workers in smaller businesses were less likely to receive every type of safety training identified in the survey (including pre-work safety orientation [$p < .001$], job-specific training [$p < .001$], OSHA 10-hour training [$p = .001$], and federal/state required training [$p < .001$]). The results highlight some of the challenges a vulnerable worker population faces in a small business, and can be used to better focus intervention efforts. Among businesses represented in this sample, there are deficits in the amount, frequency, and format of workplace safety and health training provided to non-native workers in smaller construction businesses compared to those in larger businesses. The types of training conducted for non-native workers in small business were less likely to take into account the language and literacy issues faced by these workers. The findings suggest the need for a targeted approach in providing occupational safety and health training to non-native workers employed by smaller construction businesses.

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Disclaimer

The findings and conclusions in this paper are those of the author(s) and do not necessarily represent the views of the National Institute for Occupational Safety and Health.

1. Introduction

Social structures such as race, class, and gender; employment trends such as the growth of the temporary workforce; and organizational factors such as business size can all contribute to the greater vulnerability of some workers to workplace illness or injury than others.

A worker with overlapping vulnerabilities is simultaneously a member of two or more at-risk groups, such as being an immigrant and a temporary worker, or being a young worker and employed by a small, non-union business. Each vulnerability has characteristics that add unique barriers to the worker's occupational safety and health (OSH). For example, a non-native worker may fear deportation for reporting unsafe conditions [Flynn et al., 2015] and younger workers may accept work injuries as "part of the job" because of their inexperience and lack of job control [Breslin et al., 2007]. OSH vulnerability may also intensify existing barriers to safety that are common for all workers, such as lack of training in small businesses due to financial constraints [Cunningham et al., 2014]. As these vulnerabilities are independently associated with additional risk of workplace injury or illness, the interaction between risk factors may create even more risk for groups experiencing multiple vulnerabilities than for those who experience only one risk factor. However, more work is needed to clarify how these overlapping vulnerabilities interact and may intensify the risk for occupational injury and illness and how OSH professionals can effectively reduce these risks.

In 2015, the American Society of Safety Engineers (ASSE) and the National Institute for Occupational Safety and Health (NIOSH) initiated an intervention effort to reach workers experiencing overlapping OSH vulnerabilities in small construction businesses. Their initial efforts resulted in the report *Overlapping Vulnerabilities: The Occupational Health and Safety of Young Immigrant Workers in Small Construction Firms* [NIOSH and ASSE, 2015]. This report focused on three populations that research indicates are at increased risk for adverse work-related health outcomes—Hispanic immigrants (individuals born in Latin America who currently live in the United States), employees of small businesses (firms with fewer than 20 employees), and young workers (< 25 years old)—with a specific focus on implications for the construction industry. The report explored how the combination of risk factors may result in overlapping vulnerabilities for young immigrants in small construction firms and discussed the implications for OSH professionals.

Construction fatality counts remain among the highest of all industries, accounting for nearly 20% of all workplace fatalities in 2015 (2+/day, mostly due to falls) [BLS, 2016a]. Numerous studies report a linear, inverse relationship between organization size and injury, illness, and/or fatality rates [Buckley et al., 2008; Fabiano et al., 2004; Fenn and Ashby, 2004; Mendeloff et al., 2006; Morse et al., 2004; Page, 2009; Peek-Asa et al., 1999]. In 2015, construction businesses with 11–49 employees had an average incidence rate of 4.1 per 100 full-time workers, while construction businesses with 1000 or more employees had an incidence rate of 1.3 per 100 full-time workers [BLS, 2016b].¹ According to U.S. Census data, in 2013, the total number of construction workers employed in businesses with fewer than 10 employees was almost 2 million (1,873,475) [U.S. Census Bureau, 2014]. Of the nearly 1.5 million (1,482,495) Hispanic immigrants working in construction, about 40%

(551,928) worked in firms with fewer than 10 employees. The proportion is similar for young workers. In 2013, there were over three-quarters of a million (758,613) construction workers aged 24 or younger, of whom nearly a third (221,531) worked in construction firms with fewer than 10 employees.

Young Hispanic immigrants are more likely to work for a very small business than are other racial and ethnic groups that make up much of the construction workforce. In 2013, approximately 122,000 foreign-born Hispanics employed in construction were 16–24 years of age, and from 2009 to 2013, just under half of all young Hispanic immigrants in construction worked for a very small business. Additionally, according to estimates based on the National Health Interview Survey [CDC, 2013], approximately two-thirds of Hispanic construction workers in the United States in 2013 were not citizens, a factor that has been identified as a possible contributor to occupational health disparities among immigrants [Liebman et al., 2016; Flynn et al., 2015]. These survey data also indicate nearly one quarter (23.5%) of all U.S. Hispanic construction workers have been on the job for less than a year, and nearly three quarters (70.4%) have been on the job for less than 5 years.

Among immigrants returning to Mexico from January to March 2010 ($n = 5458$), approximately 75% of respondents worked for a business with 50 or fewer employees, and those who worked for smaller establishments were less likely to get training (28% of respondents in workplaces with 50 or fewer employees received training, compared with 39% in workplaces with more than 50 employees) [CONAPO, 2010]. Additionally, those who worked for smaller establishments were less likely to sign a contract with their employer and were less likely to have benefits.

On the basis of these data, one can conclude it is likely that non-native Hispanics working in the United States face greater OSH challenges than native-born workers, not only because of the unique barriers they encounter as non-native workers but also because of the lack of OSH resources available in smaller businesses, where the majority of Hispanic immigrants are employed.

The NIOSH and ASSE report concluded with a call to business leaders, researchers and policy makers to consider the efforts needed to address and reduce the pervasive and persistent occupational health disparities experienced by vulnerable workers:

- Evaluating the potential overlap and interaction of different vulnerabilities,
- Developing interventions tailored to all relevant vulnerabilities,
- Working with organizations known to the target community, for effective dissemination and diffusion of interventions,
- Building relationships between OSH professionals and community organizations and focusing on the sustainability of interventions.

¹Many small businesses are exempt from Occupational Safety and Health Administration (OSHA) reporting regulations, which are, for the most part, not required for companies with 10 or fewer employees (with some exceptions, including in the case of a fatal incident) [OSHA, 2014]. Thus, while the inverse relationship between business size and fatality rates is detectable in data provided by the Bureau of Labor and Statistics, injury rates for the smallest size segment (1–10 employees) are likely higher than reported due to underreporting of injuries by smaller businesses [Mendeloff et al., 2006].

As a follow up, a survey was conducted by ASSE with construction business representatives intended to address the first two areas of need outlined in the ASSE/NIOSH report and results were shared with NIOSH researchers. NIOSH researchers analyzed the data collected by ASSE to further explore the training experiences of non-native workers in the construction industry and to identify needs for further research and intervention to protect vulnerable workers experiencing overlapping vulnerabilities.

2. Methods

A survey was developed consisting of 34 items that explore how workplace safety and health training differs among smaller (fewer than 50 employees) and larger (50 or more employees) construction businesses that employ non-native workers. Specifically, the survey was aimed to determine how workplace safety and health training differs between small and large construction firms that employ non-native workers in terms of:

- To whom training is provided
- The types of training provided
- How much training is provided
- How training is delivered
- How training is evaluated

To establish face validity, the survey was based on a comprehensive review of the professional and academic literature. A member of the ASSE Spanish Professionals and the Latino Workforce work group cognitively tested the survey instrument with two potential respondents to ensure the items were clearly understood. The cognitive interviews were structured and focused on eliciting participant understandings of the concept and their decision making processes in the selection of a response [Miller, 2003; Willis, 2005]. Revisions were made to the instruments based on the results of this testing, and confusing or poorly worded items were revised or eliminated.

To establish content validity, the survey was reviewed by eight experts in occupational safety and health. These experts represented various occupational safety and health leadership functions among trade, labor, and professional organizations in the construction industry. Suggested revisions and recommendations offered by the experts were incorporated into the final survey instrument.

The survey was administered online by ASSE using SurveyGizmo (<https://www.surveygizmo.com/>). Respondents were recruited via email using a snowball-sampling method: first, a list of 2907 construction business representatives were sent an email inviting them to complete the survey. That same recruitment email also requested that the recipient forward the survey invitation to additional construction business representatives. Following the initial recruitment email, the survey was available for a period of four weeks. To increase the number of small residential construction business respondents, another recruitment email was sent to 19 residential construction business representatives following initial review of the survey responses.

2.1. Data analysis

Statistical analyses of the survey data were performed using the IBM Social Package for the Social Sciences (SPSS, version 23.0). Descriptive statistics were analyzed for all response categories. Pearson's chi-square test of association were computed for categorical variables, $\alpha = 0.05$ (2-sided) to analyze response differences on survey items between small and large businesses. The survey contained several questions for which respondents could provide more than one answer. In order to conduct significance analyses for these items, each response option was made into a separate variable. Participants were coded as either answering (selecting that option) or not answering. In order to reduce type I and type II errors, multiple comparisons were corrected by means of the Benjamini-Hochberg method ($Q = 0.10$) [Benjamini and Hochberg, 1995; McDonald, 2014].

3. Results

There were a total of 268 respondents. Over half of the respondents ($n = 144$, 54.3%) represented businesses with more than 250 employees. Most respondents identified the country of origin of their non-native workers as Mexico ($n = 159$, 59.3%). The most respondents were from Texas ($n = 33$, 12.8%), California ($n = 29$, 11.3%), or New York ($n = 20$, 7.8%), with at least one respondent from 41 states and Washington, DC. The most common percentage of young workers in a company was 10–24% ($n = 93$, 36.2%). Over half of workplaces were not unionized ($n = 145$, 55.8%), and the most common specialty within construction was general commercial ($n = 70$, 26.5%).

3.1. Employee characteristics and types of employment arrangements: smaller versus larger firms

The number of employees was recoded to distinguish between smaller (2–50 employees, $n = 50$) and larger businesses (51 or more employees, $n = 215$). This dividing point between smaller and larger businesses was selected based on existing definitions of small business in OSH contexts [e.g., NIOSH, 2016; European Commission, 2003].

To assess the extent to which business in the sample hire non-native workers, a threshold of at least 25% foreign-born workforce (versus less than 25%) was selected for comparisons. This divide reflects a relatively equal distribution across the full dataset for that category. Slightly less than two-thirds of small businesses reported employing immigrant workers ($n = 31$, 62.0%), while 93% ($n = 198$) of large businesses reported employment of immigrant workers. Large businesses were significantly more likely to have a workforce that was at least 25% foreign born ($n = 74$, 38.9%) compared to small businesses ($n = 8$, 16.7%) (Pearson chi-square = 8.423, $df = 1$, $p = .004$).

To analyze the extent to which businesses in the sample employ young workers and further explore the potential overlap of vulnerable worker groups, a threshold of at least 10% (versus 10% or more) of all workers within a business was selected based on national rates of young worker representation in the U.S. workforce, where workers 24 and under comprise about 13% of the workforce [NIOSH, 2015]. As with the thresholds for non-native workers noted above, there was relatively equal distribution across the full dataset. Over half

(n = 25, 53.2%) of small businesses had some young workers (most had fewer than 10% young workers [n = 38, 80.9%]). While nearly all large businesses had some young workers (n = 203, 98.1%), large businesses most frequently had 10% or more (n = 128, 61.8%) of their workforce made up of employees under age of 25. Large businesses were significantly more likely to have a workforce that was at least 10% young workers (n = 128, 62.8%) compared to small businesses (n = 9, 19.1%) (Pearson chi-square = 28.092, df = 1, p < .001).

For both larger and smaller firms, the workplace was most commonly not unionized (small: n = 39, 81.3%; large: n = 104, 49.5%). Across the country, the rate of union membership for all wage and salary workers in 2015 was 11.1% [BLS, 2016c]. There was a significant difference in unionization between small and large businesses (Pearson chi-square = 15.922, df = 2, p < .001). The primary specialty within construction was general commercial for small businesses (n = 14, 28.6%) and heavy construction for large businesses (n = 56, 26.4%).

Respondents were asked to identify their respective workers as: full-time employees, part-time employees, temporary workers (workers supplied and paid by a staffing agency), contractors (workers employed by one firm or self-employed, but working under the direction of another, and day laborers (workers paid daily for limited periods of employment). The percentage of respondents who had workers with each employment arrangement at small and large businesses is shown in Fig. 1.

Both small and large companies most commonly provided safety training to full-time employees (See Fig. 2 for a comparison of safety training provided to different types of employees by larger v. smaller firms). Large businesses were significantly more likely than small businesses to provide safety training to full-time employees (Pearson chi-square = 7.730, df = 1, p = .005). Large businesses were also significantly more likely to provide safety training to temporary workers compared to small businesses (Pearson chi-square = 4.635, df = 1, p = .031). Both larger and smaller firms most commonly screened for previous safety training (small: n = 27, 54.0%; large: n = 100, 46.5%). There were no significant differences in what smaller and larger businesses screen for (options also included English literacy, math literacy, English speaking ability, and workers' native language literacy).

3.2. Characteristics of worker training: smaller versus larger firms

A comparison of characteristics of safety training between smaller and larger firms is presented in Table 1. Most small businesses did not employ a supervisor, foreman, or lead person who speaks the same language as immigrants working onsite, while most large businesses did. Large businesses were significantly more likely to employ a supervisor, foreman, or lead person who speaks the same language as immigrants working onsite compared to small businesses.

The most common types of safety training received by non-native workers in smaller firms was job-specific training and ongoing training, while non-native workers in larger firms most commonly received ongoing training. Non-native workers were significantly more likely to receive every type of safety training at large businesses compared to small businesses. The amount of both initial and ongoing safety training received by non-native

workers in small and large businesses differed significantly, with more hours of training generally occurring at large businesses.

Designated safety staff most commonly conducted safety training in both small and large businesses, although were significantly more likely to conduct safety training at large businesses. The most common method of delivering training to non-native workers in small businesses was hands-on training, while classroom lectures and demonstrations were more common in large businesses. Training was significantly more likely to be delivered to non-native workers in large businesses compared to small businesses through nearly all of the methods provided.

In small businesses, most respondents indicated there was no difference in the training offered to non-native workers, while the most frequently reported difference in the training offered to non-native workers in large businesses from the training given to native workers was language. The training offered to non-native workers at large businesses was significantly more likely to differ from the training given to native workers in terms of language compared to small businesses. In companies of both sizes, training was most commonly presented in the primary language of non-native workers (small: $n = 21$, 56.8%; large: $n = 126$, 61.5%).

Communicating with non-native workers about safety-related issues occurred most frequently through in-person conversations in both small and large businesses. With the exception of text messages and union representatives, every method of communicating with non-native workers was significantly more likely to be used in large businesses compared to small businesses. Communications were most frequently reported to be delivered daily, and in the primary language of non-native workers (small: $n = 26$, 70.3%; large: $n = 131$, 66.2%) in both smaller and larger firms. Significantly more large firms reported they communicated with non-native workers on a daily basis, but there was no significant difference in whether communications were delivered in the primary language of the non-native workers between smaller and larger firms.

The most common topic covered by both business sizes was fall protection/restraint (small: $n = 39$, 78.0%; large: $n = 192$, 89.3%) (see Fig. 3). The three least common topics covered in small businesses were ergonomics/safe driving ($n = 16$, 32.0%) and introduction to industrial hygiene ($n = 11$, 22.0%). The three least common topics covered in large businesses were scaffolding erection and dismantling ($n = 94$, 43.7%), demolitions ($n = 90$, 41.9%), and introduction to industrial hygiene ($n = 47$, 21.9%).

3.3. Evaluation of safety training and sources of safety information

A comparison of training evaluation and information sources between smaller and larger firms is presented in Table 2. Employee feedback was most commonly used to evaluate safety training in both small and large businesses. There was no significant difference in using employee feedback or workers' compensation insurance claims to evaluate safety training between small and large businesses. The remaining methods were all significantly more likely to be used in large businesses. Respondents from both smaller and larger firms most commonly observed improved safety culture as a benefit of their safety training. All

benefits of safety training were significantly more likely to be observed in large companies compared to small companies.

Professional and technical associations most commonly provided safety information to small and large businesses. Regardless of business size, respondents most frequently claimed no outside companies provide safety training to their non-native workers (small: $n = 22$, 44.0%; large: $n = 113$, 52.6%). The only option that was common among large businesses was unions, although less than a quarter claimed that they provide information. However, unions were significantly more likely to provide safety training to non-native workers in large businesses compared to small businesses. The least common option selected for both larger and smaller firms was faith-based organizations.

Following other specialty construction organizations ($n = 14$, 28.0%), Associated General Contractors of America (AGC) ($n = 13$, 26.0%) and the National Association of Home Builders ($n = 9$, 18.0%) were the most common organizational membership maintained by small businesses. Larger businesses were most frequently members of AGC ($n = 94$, 43.7%).

Finally, smaller businesses most frequently reported having no OSHA-recordable injuries in the last calendar year ($n = 33$, 73.3%), while large businesses most frequently reported having 10 or more ($n = 41$, 20.3%). For businesses of both sizes, language barriers were the greatest challenge faced in providing a safe workplace for non-native workers (small: $n = 16$, 42.1%; large: $n = 113$, 56.8%).

4. Discussion

The results presented in this paper suggest that, among businesses represented in the sample, there are clear deficits in the amount, frequency, and format of workplace safety and health training provided to non-native workers in smaller construction firms, compared to those working in larger firms. In particular, given that respondents indicated the majority of their immigrant employees were Hispanic, working for a smaller firm rather than a larger firm means that Hispanic immigrant employees are less likely to receive OSHA 10-hour training, pre-work safety orientation, job-specific safety training, ongoing safety training, required training due to federal/state requirements, and training required by a collective bargaining agreement. Furthermore, working for a smaller firm rather than a larger firm means that Hispanic immigrant employees are less likely to receive safety training in their native language or in a format that takes into account their literacy level. Additionally, working for a smaller firm rather than a larger firm means that Hispanic immigrant employees are likely to receive significantly less overall communication about workplace safety, and significantly fewer hours of safety training.

Many of the results reported here track similarly to findings in a recent survey report comparing safety practices among small and large construction businesses (254 total respondents) [Dodge Data and Analytics, 2016]. The most notable gap reported in the level of OSH implementation was the use of orientation training when starting work on a new site: 84% of respondents from companies with more than 100 employees report that this occurs on more than 70% of their projects, but less than half (46%) of respondents from

companies with fewer than 50 employees report the same [Dodge Data and Analytics, 2016]. These researchers suggested larger companies may have policies in place regarding site orientation, while smaller companies may have more variation depending on the project leadership. A secondary analysis of these data also revealed almost 80% of respondents at large firms (500+ employees) said they required all workers on the jobsite to have OSHA 10-hour training, while 53% of small firms (1–9 employees) said the same [Wang et al., 2016]. Additionally, almost 90% of respondents at large firms reported having measurable safety goals and objectives while 37% of small firms did. Finally, around one third of firms with fewer than 10 employees only provided training when employees were hired or when it was required. Despite differences in classifications of small and large firms, and the focus on non-native Hispanic employees in the survey results reported here, the similarities in findings among the two survey studies further highlights the need to identify and provide ways for small construction firms to effectively manage workplace safety and health issues.

The lower overall access to training for non-native workers working for smaller firms may be due to multiple factors such as lack of resources and capacity for OSH implementation in smaller firms, as well as deficits in OSH protection associated with contingent employment arrangements disproportionately experienced by Hispanic immigrants. As an example, the data reported in this study indicated larger firms were significantly more likely than smaller firms to provide safety training to temporary employees. These findings not only highlight the deficits in OSH implementation among smaller construction firms compared to larger ones, but also provide an indicator of the overlapping vulnerability to OSH risks encountered among non-native workers employed by smaller construction firms.

The findings regarding sources of safety information and training also suggest the need for a targeted approach to providing OSH assistance to smaller firms with both native and non-native workers. Insurance providers, equipment suppliers, trade associations, professional and technical associations, and government agencies were all reported as sources of safety information by more than one third of smaller business respondents. The need to channel OSH assistance diffusion efforts through intermediary organizations (organizations that are already well-connected to small business networks) has been well-documented in the OSH literature as a promising approach to improving OSH among small firms [Hasle et al., 2009; Olsen et al., 2012; Sinclair et al., 2013; Cunningham and Sinclair, 2015; Bruening et al., 2015]. As suggested by the survey data reported here certain organizational membership organizations (e.g. NAHB and AGC) may be more effective in reaching smaller firms, in addition to intermediary organizations with strong business to business relationships such as insurance companies and equipment suppliers. Given the lack of external assistance reported in providing safety training to non-native workers (e.g., no more than 4 respondents indicated any single source of external training for immigrant workers), channeling assistance efforts through intermediaries to employers may be more effective in delivering improved OSH training to non-native Hispanic construction workers.

4.1. Limitations

The survey results reported in this paper should be interpreted in light of several limitations. First, the survey yielded a relatively low response rate ($268/2926 = 9.2\%$). This is likely

partly due to the membership list used, as many of the individuals emailed may have been private consultants participating in the ASSE construction group, and the survey recruitment message was clearly directed at construction firm representatives. Second, the sample was skewed toward larger commercial construction firms. This is likely a result of the convenience sampling method used, where those construction business representatives that received the recruitment email were more likely to represent larger commercial and heavy construction firms, as those companies are more likely to employ safety and health professionals that maintain memberships in ASSE. The additional recruitment of residential builders was intended to address this limitation; however, low response rate was encountered again $7/19 = 36.8\%$. Altogether, the low response rate was not surprising given the difficulty in recruiting small businesses for OSH survey participation [Dennis, 2003], relatively long estimated survey completion time (30 min, based on cognitive testing), and the lack of a participation incentive.

Additionally, the sample is likely not representative of the construction industry in terms of levels of both non-native employment and young worker employment, as the reported levels of non-native and young worker employment does not match the census data for the construction industry cited in the introduction. Future research efforts should specifically target smaller residential firms to better represent the composition of the construction industry as a whole, and the higher proportions of immigrants, young, and new workers employed in smaller construction firms as reported based on census data.

Another limitation of this study, as well as an avenue of future research, is that this data collection did not include concrete measures of safety performance. There was only one question asking for the number of OSHA-recordable injuries in the last year, and no data regarding total labor hours were collected. Therefore, it was not possible to determine if there is a connection between safety activities (e.g., providing training or assessing employee perceptions of safety) and actual safety outcomes.

4.2. Conclusion

As recommended in the NIOSH and ASSE report, *Overlapping Vulnerabilities: The Occupational Health and Safety of Young Immigrant Workers in Small Construction Firms* [NIOSH and ASSE, 2015], it is critical to increase awareness among employers of the increased risks of occupational injury and illness among the vulnerable populations they employ and to provide employers with the appropriate resources to reduce these risks. The data reported in this study support the notion that many employers are already aware of specific challenges such as language barriers or lack of access to training, but they may benefit from additional information about the risks associated with the various vulnerability factors that may affect their workforce, as well as training on how to effectively communicate safety information. Challenges such as limited resources and reduced capacity for OSH implementation in smaller firms relative to larger ones may complicate efforts by employers to address these risk factors even if they are aware of them. In addition, OSH promotion materials and programs are often not designed to meet the needs of high risk groups such as small businesses, non-native workers or temporary workers; making them ineffective or impractical for these groups which further aggravates their elevated risk for

injury. While OSH training materials are being tailored for groups such as non-native workers [O'Connor et al., 2014], small businesses [Hung et al., 2011; Cunningham and Sinclair, 2015], and young workers [Okun et al., 2016], few exist that are tailored to the needs of two or more vulnerable groups at the same time. For example, a construction safety program that is tailored for use with Hispanic immigrants is often not designed to address the specific challenges of small construction firms. Notable exceptions include efforts to teach immigrant day laborers to serve as peer safety leaders in New York and New Jersey, and tailored offerings of the OSHA-10 hour training for Hispanic immigrants working in small construction businesses in San Francisco and Philadelphia [Scruggs and Arroyo, 2014]. However, a much greater effort is needed in developing materials that are tailored to address specific overlapping vulnerabilities such as those identified in this paper. That is, specific interventions are needed to address the deficits in OSH training received by non-native workers in small construction firms.

Acknowledgments

The authors wish to thank Bradley Evanoff and Deborah Weinstock for their thoughtful reviews of prior drafts of this manuscript.

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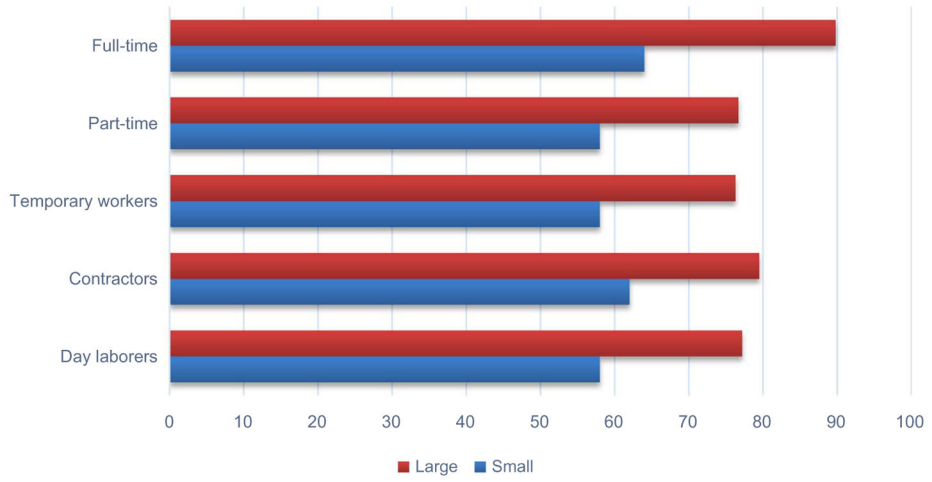


Fig. 1. Reported employment arrangements used by business size.

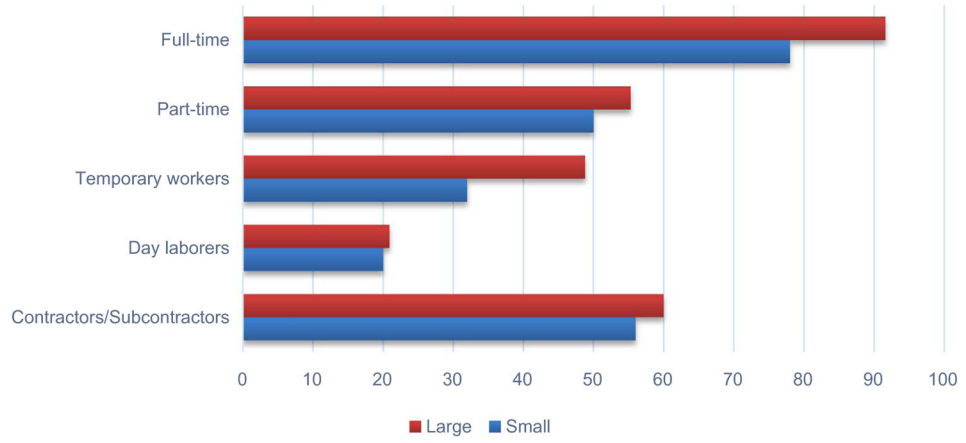


Fig. 2.
Types of employees receiving safety training by business size.

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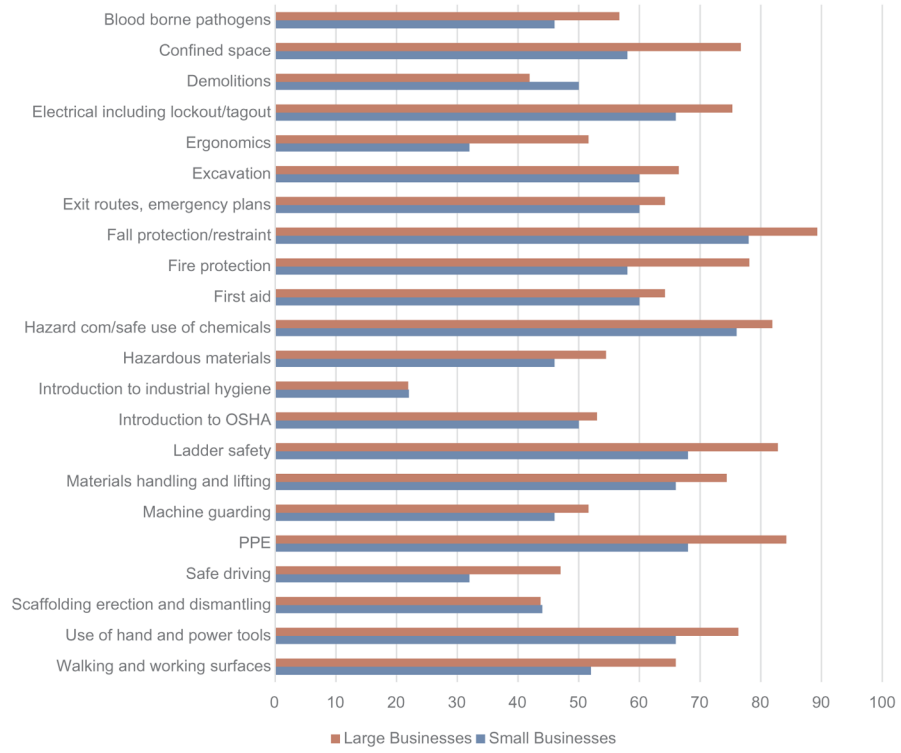


Fig. 3.
Topics covered in safety training.

Table 1

Characteristics of safety training among small and large construction firms.

Characteristics	Small		Large		Total		p-value
	n	%	n	%	n	%	
<i>Employ supervisor/foreman/lead person who speaks the same language as non-native workers</i> < 0.001 *							
Yes	18	37.5	144	68.9	162	63.0	
<i>Type of safety training non-native workers receive</i> **							
Pre-work safety orientation	25	50.0	181	84.2	206	77.7	< 0.001 */
Job-specific training	26	52.0	180	83.7	206	77.7	< 0.001 */
Ongoing training	26	52.0	185	86.0	211	79.6	< 0.001 */
OSHA 10-hour training	13	26.0	110	51.2	123	46.4	0.001 */
Required training due to federal/state requirements	20	40.0	157	73.0	177	66.8	< 0.001 */
Training required by a collective bargaining agreement	3	6.0	64	29.8	67	25.3	< 0.001 */
<i>Hours of initial safety training received by non-native workers</i> 0.012 *							
0-2	19	55.9	63	31.5	82	35.0	
3-10	13	38.2	97	48.5	110	47.0	
11+	2	5.9	40	20.0	42	17.9	
<i>Hours per month that non-native workers receive ongoing safety training</i> 0.042 *							
0-2	21	61.8	81	42.9	102	45.7	
3+	13	38.2	108	57.1	121	54.3	
<i>Who conducts the safety training</i> **							
Workers' supervisor	22	44.0	138	64.2	160	60.4	0.009 */
Third party	15	30.0	75	34.9	90	34.0	0.511
Self-administered CDs/videos	11	22.0	48	22.3	59	22.3	0.960
Union representative	4	8.0	11	5.1	15	5.7	0.494 ***
Designated safety staff	29	58.0	196	91.2	225	84.9	< 0.001 */
<i>Method of delivering training to non-native workers</i> **							
Text-based print material	20	40.0	142	66.0	162	61.1	0.001 */

Characteristics	Small		Large		Total		p-value
	n	%	n	%	n	%	
Hands-on training	28	56.0	173	80.5	201	75.8	< 0.001 ^{*,I}
Classroom lectures and demonstrations	26	52.0	176	81.9	202	76.2	< 0.001 ^{*,I}
Online training modules including webinars	11	22.0	70	32.6	81	30.6	0.144
Picture-based print material	16	32.0	102	47.4	118	44.5	0.019 ^{*,I}
Recorded video	15	30.0	104	48.4	119	44.9	0.019 ^{*,I}
Recorded audio	9	18.0	35	16.3	44	16.6	0.768
Informal talks	21	42.0	141	65.6	162	61.1	0.002 ^{*,I}
<i>How the training offered to non-native workers differs from that of native workers^{**}</i>							
Language	13	26.0	107	49.8	120	45.3	0.002 ^{*,I}
Literacy level	5	10.0	35	16.3	40	15.1	0.264
Frequency	2	4.0	11	5.1	13	4.9	1.000 ^{***}
Delivery method	9	18.0	53	24.7	62	23.4	0.317
Content	0	0.0	13	6.0	13	4.9	0.137 ^{***}
No difference	19	38.0	96	44.7	115	43.4	0.393
<i>How company communicates with non-native workers about safety-related issues^{**}</i>							
In-person conversations	36	72.0	185	86.0	221	83.4	0.016 ^{*,I}
Bulletin board	14	28.0	102	47.4	116	43.8	0.013 ^{*,I}
Email	4	8.0	44	20.5	48	18.1	0.039 ^{*,I}
Text messages	4	8.0	19	8.8	23	8.7	1.000 ^{***}
Newsletter	3	6.0	44	20.5	47	17.7	0.016 ^{*,I}
Peer-to-peer	23	46.0	134	62.3	157	59.2	0.034 ^{*,I}
Group discussions	20	40.0	153	71.2	173	65.3	< 0.001 ^{*,I}
Union representatives	3	6.0	27	12.6	30	11.3	0.187
<i>Frequency of communications with non-native workers about safety-related issues</i>							
Daily	20	51.3	140	69.3	160	66.4	0.029 [*]
Not daily	19	48.7	62	30.7	81	33.6	

* Statistically significant at $\alpha = 0.05$.

Multiple response questions, only the percentage of those who responded are reported.

Fisher's exact test (not significant).
/ Significant using the Benjamini-Hochberg procedure, $Q = 0.10$.

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Table 2

Safety training evaluation characteristics and information sources among small and large construction firms.

Characteristics	Small		Large		Total		p-value
	n	%	n	%	n	%	
<i>Method of evaluating safety training**</i>							
Employee feedback	34	68.0	171	79.5	205	77.4	0.079 [/]
Reported injuries	14	28.0	101	47.0	115	43.4	0.015 ^{*/I}
Worker perception surveys	16	32.0	102	47.4	118	44.5	0.048 ^{*/I}
Employee knowledge test and demonstration of competence	26	52.0	153	71.2	179	67.5	0.009 ^{*/I}
Workers' compensation insurance claims	11	22.0	67	31.2	78	29.4	0.200
Compliance audit/inspection	21	42.0	156	72.6	177	66.8	< 0.001 ^{*/I}
Surveys and data collection	7	14.0	75	34.9	82	30.9	0.004 ^{*/I}
Review of leading and lagging organizational indicators	7	14.0	121	56.3	128	48.3	< 0.001 ^{*/I}
<i>Observed benefits of company's safety training**</i>							
Reduced legal liability	23	46.0	96	44.7	119	44.9	0.876
Higher employee morale	24	48.0	140	65.1	164	61.9	0.025 ^{*/I}
Reduced workers' compensation claims	26	52.0	142	66.0	168	63.4	0.063
Reduced employee injuries	33	66.0	172	80.0	205	77.4	0.033 ^{*/I}
Higher employee retention	19	38.0	110	51.2	129	48.7	0.093
Higher productivity	26	52.0	120	55.8	146	55.1	0.625
Improved safety culture	34	68.0	181	84.2	215	81.1	0.008 ^{*/I}
Improved bottom line	17	34.0	98	45.6	115	43.4	0.137
Better competitiveness in the bidding process	13	26.0	95	44.2	108	40.8	0.018 ^{*/I}
No observed benefits	1	2.0	11	5.1	12	4.5	0.474 ^{***}
<i>Companies that provide business with safety information**</i>							
Insurance provider	23	46.0	127	59.1	150	56.6	0.093
Healthcare provider	8	16.0	49	22.8	57	21.5	0.293
Equipment supplier	19	38.0	116	54.0	135	50.9	0.042 [*]
Trade association	20	40.0	111	51.6	131	49.4	0.139

Characteristics	Small		Large		Total		p-value
	n	%	n	%	n	%	
Professional and technical associations	26	52.0	159	74.0	185	69.8	0.002 ^{*,/}
Government agencies	19	38.0	118	54.9	137	51.7	0.031 ^{*,/}
Unions	6	12.0	49	22.8	55	20.8	0.090
Private consultant	13	26.0	48	22.3	61	23.0	0.578
<i>Other companies that provide safety training to non-native workers at company</i> ^{**}							
Temporary staffing agencies	3	6.0	29	13.5	32	12.1	0.143
Faith-based organizations	0	0.0	6	2.8	6	2.3	0.598 ^{***}
Trade schools	4	8.0	23	10.7	27	10.2	0.570
Unions	2	4.0	48	22.3	50	18.9	0.003 ^{*,/}
Community-based organizations	2	4.0	11	5.1	13	4.9	1.000 ^{***}
None	22	44.0	113	52.6	135	50.9	0.276

* Statistically significant at $\alpha = 0.05$.

** Multiple response questions, only the percentage of those who responded are reported.

*** Fisher's exact test (not significant).

/ Significant using the Benjamini-Hochberg procedure, $Q = 0.10$.