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Change in frontline supervisors' safety leadership practices after participating in a leadership training program: Does company size matter?

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Abstract

Introduction—The majority of construction companies are small businesses and small business often lack the resources needed to ensure that their supervisors have the safety leadership skills to build and maintain a strong jobsite safety climate. The Foundations for Safety Leadership (FSL) training program was designed to provide frontline leaders in all sized companies with safety leadership skills. This paper examines the impact of the FSL training by size of business.

Methods—Leaders, defined as foremen or other frontline supervisors, from small, medium, and large construction companies were recruited to participate in a study to evaluate the degree to which the FSL changed their understanding and use of the leadership skills, safety practices and crew reporting of safety-related conditions. We used linear mixed modeling methods to analyze pre-post training survey data.

Results—Prior to the training, leaders from small and medium sized companies reported using safety leadership skills less frequently than those from large ones. After the training, regardless of business size, we observed that the FSL training improved leaders understanding of safety leadership skills from immediately before to immediately after the training. Additionally, leaders reported greater use of safety leadership skills, safety practices, and crew reporting of safety-related conditions from before to two-weeks after the training. However, those from small and medium sized companies reported the greatest improvement in their use of safety leadership skills.

Conclusions—The FSL training improves safety leadership outcomes regardless of the size company for which the leader worked. However, the FSL may be even more effective at improving the safety leadership skills of leaders working for smaller sized construction companies or those with lower baseline levels of safety leadership skills.

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Practical applications—The majority of construction companies employ a small number of employees and therefore may not have the resources to provide their frontline leaders with the leadership training they need to be effective leaders who can create a strong jobsite safety climate. The Foundations for Safety Leadership (FSL) training can help fill this gap.

Keywords

construction; transformational leadership; safety climate; occupational health and safety; small business

INTRODUCTION

In 2012, ninety-two percent of all employees in the construction industry worked for companies with fewer than 500 employees. Approximately 33% worked for firms with employee numbers ranging from 20-99 and 39% worked for firms with fewer than 20 employees (CPWR: The Center for Construction Research and Training, 2018a). Data from 2015 show that the smallest firms had the highest rate of non-fatal work-related injuries and accounted for 57% of the fatalities (CPWR: The Center for Construction Research and Training, 2018a). In a recent survey of construction contractors, the majority of respondents, regardless of the size of their company, said that strong supervisory leadership is critical for having a world-class safety program. However, compared to larger construction firms, smaller companies report having less, if any, staff positions dedicated to safety (SmartMarket Report, 2017). This fact may limit a smaller company's ability to ensure that their frontline leaders have the safety leadership skills needed to build and maintain a strong jobsite safety climate (Clarke, 2013; Hoffmeister et al., 2014).

Some researchers argue that interventions designed to improve safety in large organizations are not practical for implementation in smaller ones due to limited resources (i.e., money and time), organizational structure, and other differences (Cunningham, Sinclair, & Schulte, 2014; Legg, Olsen, Laird, & Hasle, 2015). This suggests that it might not be feasible to create a supervisory leadership training program that could be effective across companies of different sizes. To investigate this possibility, we examined data collected as part of a study designed to assess whether or not frontline supervisors' (i.e., foremen and other lead workers) safety leadership skills and safety practices improved after participating in The Foundations for Safety Leadership (FSL) training course.

The 2.5 hour Foundations for Safety Leadership (FSL) training course is an OSHA 30-hour elective as well as standalone course for the construction industry (CPWR: The Center for Construction Research and Training, 2018b). From 2014 to 2016, the authors of this paper collaborated with a 17-member curriculum development team to create the training materials and pilot them on two construction sites (Goldenhar, Schwatka, & Johnson, 2019). In the first section of the training that takes about 50-55 minutes to complete, participants learn about the direct and indirect costs of poor safety leadership and also five critical safety leadership skills needed to improve jobsite safety climate: lead by example, engage and empower team members, actively listen and practice 3-way communication, develop team members through teaching, coaching, and feedback, and recognize team members for a job

well done. In the second section that takes 85-95 minutes to go through, students apply and practice the safety leadership skills by working through real world construction job site scenarios in which job site leaders are or are not using the skills in a safety-specific situation.

There are three strengths of the FSL that increase the probability it will influence leaders' practice of safety leadership skils and other safety outcomes. First, the leadership skills taught in the training are based on transformational leadership theory, which has been linked to safety behaviors in the construction industry (Hoffmeister et al., 2014). Prior research in other industries demonstrates that transformational leadership trainings improve leader and worker safety outcomes (Mullen & Kelloway, 2009). Second, the FSL training format includes several recommended leadership training components, such as use of multiple, face-to-face delivery methods (i.e., didatics plus practice scenarios) (Lacerenza, Reyes, Marlow, Joseph, & Salas, 2017). The third reason is that from the very beginning the target audience was involved in developing the curriculum's content and teaching methods (Goldenhar et al., 2019). Indeed, we found evidence that the FSL does improve leadership outcomes in a 2016-17 effectiveness study of 20 construction sub-contractors (Schwatka et al., 2019). Compared to supervisors in the control group who had not yet received the training, those in the training group showed a statistically significant improvement in their understanding and practice of the leadership skills as well as safety practices from before to 2- and 4-weeks after the training. There were no observed changes in the crew's reported safety leadership, climate, or behavior.

Research shows that frontline leaders in smaller sized construction companies often work in environments with fewer safety activities and have less access to safety training than those working for larger construction companies (Sinclair & Cunningham, 2014; SmartMarket Report, 2017; Sørensen, Hasle, & Bach, 2007). To examine this issue further, we analyzed the data collected for the FSL evaluation study mentioned above to assess if there was any difference in training outcomes depending on whether the leader, foreman or other frontline supervisor, worked for a large, medium, or small sized construction company. Specifically, we hypothesized that while all leaders would improve their understanding and use of safety leadership skills, safety practices, and their crew's reporting of safety-related conditions from before to after the training, leaders working for small and medium sized companies would have lower pre-training scores and thus would likely show greater improvement.

Methods

Sample

The data analyzed for this article come from surveys completed by the frontline supervisors (henceforth referred to as leaders) (N = 286) who participated in the FSL training evaluation study. They worked for 20 sub-contracting companies in Colorado, West Virginia, and Massachusetts and represented a variety of trades, including drywall, electrical, labor, and mechanical, among others. More detail on the study sample can be found in Schwatka et al. (2019).

Study design and data collection

All leaders participated in the English language 2.5-hour FSL training session and completed surveys prior to and after the training (Goldenhar et al., 2019). Using a 1-5 strongly disagree to strongly agree Likert response scale, leaders rated their understanding of safety leadership skills (6 items, $\alpha = 0.88$). An example item is "In terms of safety leadership I have a thorough understanding of what it means to lead by example". They also reported on their use of leadership skills (15 items, $\alpha = 0.96$). Some of the leadership skills items used a 1 to 5 Likert response scale of strongly disagree to strongly agree (e.g., "On the jobsite I establish safety as a core value of my team"), while others used frequency scales with 'never to always' anchors (e.g., "How often do you treat team members with respect when communicating with them"). We combined Neal and Griffin's (2006) safety compliance and safety participation practices scales to measure supervisors use of safety practices (6 items, $\alpha = 0.85$, e.g., "How often do you voluntarily carry out tasks to help improve workplace safety"). Finally, again using a 5 point frequency scale, leaders' responded to questions about their crew's reporting of safety-related conditions (3 items, $\alpha = 0.85$, e.g., "How often do your team members report near misses when they occur"). All surveys were offered in English and Spanish where 12% of the leaders in the study chose to complete a Spanish language survey.

Leaders completed a pre-training survey immediately prior to the FSL training to measure all outcome variables. Then they completed a survey measuring only 'understanding safety leadership' immediately after the training to determine whether there was an increase in understanding of safety leadership skills as a result of the training. Finally, two-weeks after the training participating leaders completed a survey to measure all other outcome variables to determine whether leaders applied the leadership skills learned about in the FSL training while on the jobsite (see Table 1).

Ninety-eight percent (n=280/286) of the leaders completed both the immediate pre- and post-training surveys that we used to assess pre-post differences in 'understanding leadership skills'. We had survey data from 252 leaders (88%) to assess differences for the other three outcome variables.

Analysis

In the FSL evaluation study (Schwatka et al., 2019), participating companies were randomized into either an early or lagged training group. Leaders in the early group received the training first while the leaders in the lagged group served as controls but ultimately also received the FSL training. The two groups were not statistically different in terms of sex ($\chi^2 = 0.70(1)$, $p = 0.40$), ethnicity/race ($\chi^2 = 3.01(5)$, $p = 0.70$), union status ($\chi^2 = 3.59(1)$, $p = 0.06$), age ($F = 2.54(1)$, $p = 0.11$), or years in the construction industry ($F = 1.28(1)$, $p = 0.26$). However, there were more senior leaders ($\chi^2 = 16.51(3)$, $p < 0.01$) that had been with their company longer ($\chi^2 = 13.49(4)$, $p < 0.01$) in the lagged group than in the early group. Given these results, we were comfortable combining data from the two groups to assess the pre-training and post-training differences in study outcomes without a control group.

Companies were first categorized based on number of employees. Those with fewer than 75 employees were considered to be small (3 companies; Mean (M)=58 employees, Range=40-73 employees) Those with between 75-200 were categorized as medium (11 companies; M=137 employees, Range=80-200 employees) and those with more than 200 employees were considered large (6 companies, M=432 employees, Range=250-1050 employees).

We used linear mixed models with a random intercept for participant to evaluate the hypothesis that compared to leaders working for large construction companies' those working for small and medium companies would show a greater increase from pre- to post-FSL training in all outcome variables.

The first model tested included a binary variable representing time of survey (0 = Pre_T0, 1 = Post_T0/T+1) (Model 1). To assess if differences in outcome variables varied by company size, an interaction term between time and size of company (0 = Large, 1 = Medium, and 2 = Small) was added to the model (Model 2). For each outcome, we used a likelihood ratio test to compare the goodness of fit between the two models to determine which model to retain. If Model 2 provided the best fit to the data, then there was evidence that company size provided some explanation for the relationship between time of survey and the outcomes studied. In all models we controlled for and Spanish vs. English survey completed as well as learning goal orientation as prior research has shown it may be linked to learning in this target population in (Johnson et al., 2018). To determine whether any other demographic variables should have been controlled for, we first observed the bi-variable relationship between demographic factors and company size. The following exhibited a significant relationship with company size: position, location within the US, union status, and trade (see Table 2). There was not enough sample representation in each business and each trade category to include trade as a covariate. Second, we included each of the three other demographic variables in the models individually and evaluated whether the coefficients changed when they were included. If the coefficients changed, we included the demographic variable as a control variable. Based on this assessment, we decided to include tenure at their current company as a control variable in the understanding of safety leadership and use of safety leadership skills models. For the models on crew reporting of safety related conditions we controlled for location where the company was based in the United States and whether they were a union company.

RESULTS

Sample description

Regardless of company size, the majority of leaders in the sample were white men in their early 40's, worked in a non-union environment, and resided in the Western region of the US. They had been working in the construction industry for an average of 22 years and 75% had been with their current company for more than 4 years (see Table 2). A greater percentage of Hispanic leaders worked for medium (26%) and large (27%) sized compared to smaller ones (17%) and there was a diverse set of work roles represented across all sized companies; however, this difference was not statistically significant. Leaders from small companies were significantly more likely than those from medium or large companies to be working in the

Western region, be non-union, and hold superintendent roles. The types of trades in which these leaders worked also tended to vary by company size.

Company size comparisons

Prior to the FSL training, leaders from small companies reported significantly lower scores on their use of leadership skills (β = -0.40 (Standard error (SE) = 0.10, p <0.01)) and safety practices (β = -0.29 (SE = 0.11, p = 0.01) compared to those working in large companies (See Figures 1A – 1D). However, leaders from small companies did not have significantly different scores on understanding of leadership skills (β = -0.14 (SE = 0.11, p = 0.22)) or crew reporting of safety-related conditions (β = 0.10 (SE = 0.15, p = 0.48)) prior to the start of the training, compared to those working in large companies. Leaders from medium sized companies reported less use of leadership skills (β = -0.17 (SE = 0.06, p < 0.01)) and crew reporting of safety-related conditions (β = -0.19 (SE = 0.10, p = 0.04)) compared to leaders from large ones; however, there was no significant difference in terms of their understanding of leadership skills (β = -0.03 (SE = 0.06, p = 0.67)) or safety practices scores (β = -0.10 (SE = 0.06, p = 0.12)) (See Figures 1A – 1D).

Figures 1A and 1B show a significant increase in the understanding (β = 0.33 (SE = 0.05, p <0.01)) and use of leadership skills (β = 0.12 (SE = 0.04, p <0.01)) for leaders working for large companies. However, there was a trend for those working for small companies to report an even greater increase in these outcome variables, but this was not statisticaly significant (Understanding: β = 0.10 (SE = 0.14, p = 0.47); Use of leadership skills: β = 0.16 (SE = 0.10, p = 0.11)). Figure 1A shows that leaders working for both medium and large sized companies had a similar increase in their understanding of leadership skills (β = 0.03 (SE = 0.07, p = 0.70)). However, those from medium sized companies did have a greater increase in their use of leadership skills than leaders in large companies (β = 0.12 (SE = 0.05, p = 0.02)) (See Figure 1B).

Finally, the data showed that regardless of company size, leaders reported a significant increase in their own safety practices and also crew reported safety-related conditions. Specifically, leaders from large companies reported an increase their safety practices (β = 0.20 (SE = 0.04, p < 0.01), and leaders from small (β = 0.10 (SE = 0.10, p = 0.33) and medium (β = 0.00 (SE = 0.05, p = 0.95)) businesses reported a similar increase. Additionally, leaders from large companies reported an increase in their crew reporting of safety-related conditions (β = 0.13 (SE = 0.07, p = 0.08)). Leaders from small (β = -0.07 (SE = 0.17, p = 0.67)) and medium (β = 0.03 (SE = 0.10, p = 0.79)) businesses reported a similar increase.

The likelihood ratio tests indicated that Model 2 with time and company size effects best fit the data for the outcome variables use of leadership skills ($\chi 2$ (4) = 19.9, p < 0.01) and safety practices ($\chi 2$ (4) = 8.2, p = 0.08). However, Model 1 with only a time effect showed a better fit for understanding leadership skills ($\chi 2$ (4) = 1.5, p = 0.82) and crew-reporting of safety-related conditions ($\chi 2$ (4) = 6.2, p = 0.18). These results indicated that company size helped explain change over time for the variables use of leadership skills and safety practices, but not understanding leadership skills or crew-reporting of safety related

conditions. The reader can find detailed statistical results from Model 1 and Model 2 in supplementary material Table 1.

DISCUSSION

Most construction companies are small businesses and, although safety is equally important in all construction companies, small businesses may lack adequate safety leadership training. The findings demonstrate that regardless of company size, all construction frontline leaders who participated in the Foundations for Safety Leadership (FSL) training evaluation study improved their understanding of safety leadership skills from immediately before to after the training and their reported use of safety leadership skills, safety practices, and crew reporting of safety-related conditions from immediately before to two-weeks after the training. The data also showed that the effect of the training on leaders' use of safety leadership skills in particular, is more pronounced amongst leaders from small- and medium-sized companies, compared to leaders from large companies.

As noted above, many small construction companies do not have the resources to develop a formal safety program nor hire dedicated safety staff. Indeed, Ringen et al. (2018) reports that there is an inverse relationship between the number of employees a construction firm has and the existence of five basic safety and health procedures: job hazard analysis, near miss/accident investigation, project safety personnel, open door reporting policy, and inclusion of workers in safety process. Additionally, regardless of size, it is often the case that workers who may be very skilled at their job and perform it safely are promoted to foremen without having had any formal training on effective ways to oversee and manage their crew members. We did not ask participants if they had ever participated in training course where they were introduced to some of the topics covered in the FSL so it is possible that in the past larger companies provided their frontline leaders with safety leadership training. If they had, then it is not surprising that leaders from large companies had higher scores on the leadership skills prior to participating in the FSL training.

Consistent with Ringen et al.'s (2018) work, our data show that leaders in small and medium sized construction companies had lower scores on the use of safety leadership skills. However, we also measured their understanding of safety leadership skills and found that leaders in small and medium companies did not differ from those in large companies in that regard. This finding might suggest that the differences we see in safety leadership might stem from motivation or culture rather than knowledge. Importantly, training, like the FSL, not only targets increasing knowledge on a topic, but also impacts affective outcomes like motivation and self-efficacy (Kraiger, Ford, & Salas, 1993) . It may be that knowledge differences do not explain the safety leadership gap between small and medium companies compared to large companies. This raises the question as to whether leaders in larger organizations are more motivated to or confident in their ability to engage in safety leadership practices. In any case, our study demonstrates that the FSL may help to close this gap.

Contributions to research and practice

Hardison et al. (2014) demonstrated that construction supervisors need training in safety management and safety leadership principles. A few recent studies demonstrate that supervisor safety trainings can be successfully implemented in the construction industry (Jeschke et al., 2017) and that they are effective at improving safety knowledge, skills, and attitudes (Marín & Roelofs, 2017) as well as communication between supervisors and crew members (Kines et al., 2010). The present study contributes to this literature by being the first to demonstrate the effectiveness of a safety leadership intervention amongst construction companies of all sizes in the US. We observed that the FSL facilitates improvements in five critical safety leadership skills and that it may be particularly effective for smaller companies with fewer dedicated resources for safety.

There is a need for leadership and management interventions that can help smaller companies overcome barriers to adopting occupational health and safety practices (Tenney et al., 2019). Research has shown that these barriers include, but are not limited to management commitment and knowledge, a lack of time and resources, absent or ineffective communication/information between management and workers, lack of worker awareness of safety issues, and a general lack of focus on safety (Masi & Cagno, 2015; Ozmec, Karlsen, Kines, Andersen, & Nielsen, 2015). The findings reported here indicate that the FSL training provides leaders with the knowledge and leadership skills they need to better engage their crew and help them understand the importance of jobsite safety. The skills cover many of the aforementioned management barriers to construction job site safety, such as communication and worker empowerment and development though teaching, coaching and feeback. Furthermore, contractors from any sized firm can access the FSLtraining resources, including power points, toolbox talks a handbook and self-assessment tool and more all free of charge.

As noted earlier, the FSL was designed to be used as either a standalone course or an elective in the OSHA construction 30-hour course. The 30-hour is a trusted source by which approximately 100,000 foremen and other frontline leaders annually receive safety training (Sinclair, Cunningham, & Schulte, 2013) and which many smaller construction companies report requiring their foremen to take (SmartMarket Report, 2017). So, when paired with safety training designed to improve leaders' ability to identify and control hazards, the FSL provides additional skills for these leaders to better demonstrate management's commitment to safety (Hardison et al., 2014).

Future research

There are at least two different avenues for continued safety leadership research in smaller construction businesses. First, the FSL should be evaluated in conjunction with other safety management system interventions for small businesses to understand the impact on safety leadership practices and job site safety climate (Kines, Andersen, Andersen, Nielsen, & Pedersen, 2013; Lee, Huang, Cheung, Chen, & Shaw, 2018; Murphy, Robertson, & Carayon, 2014). Second, some small business safety research focuses on the role of the business owner in shaping the company's safety culture (Hasle, Kines, & Andersen, 2009; Legg et al., 2015; MacEachen et al., 2010). It suggests that many owners of small construction

companies say that while they value safety, they fall behind in their actions to actively promote it (Cunningham & Jacobson, 2018). Thus, future studies should investigate the impact of delivering the FSL training to small construction company owners as well as their mid-level and frontline supervisory staff together to facilitate coordinated safety leadership practices (Conchie, Moon, & Duncan, 2013).

Limitations

The strengths of this study include having a high response rate (>88%) from leaders who completed all of the pre-post surveys and a diverse sample in terms of geographic location, union participation, business size, and trade. However, there are a few limitations. First, our pre-post study design was conducted without a control group. Thus, we cannot be sure that the changes we observed by business size were due to the FSL training or other factors. Second, the survey data were self-reported. Also, we measured only short-term changes in leader practices two-weeks after the FSL training. It would have been ideal to measure changes beyond that time frame. The relatively small number of leaders in our small company size category caused the standard errors of the model estimates to be larger than for the estimates for the other business size categories. Relatedly, the small sample size in the small business category reflects a potential for selection bias. Thus, some caution should be taken when interpreting our results. It may be argued that because survey scores of leaders working for smaller companies prior to the training were lower than for those from larger, the observed greater increase in post-training scores simply reflect a regression towards the mean. The use of a linear mixed model with a random intercept for participant that accounts for random variation in baseline measurements helps to allay these concerns (Barnett, van der Pols, & Dobson, 2005). Finally, some of the leaders chose to take a Spanish language survey despite taking the FSL in English. It may be that some feel more comfortable speaking and listening to English conversationally, but not in written form. However, it is possible that the FSL-related learning for these individuals may have been lower than if they had received the training in Spanish. To address this possibility, all of the FSL materials are now available in Spanish.

Conclusions

In summary, these findings indicate that the FSL training improves front-line leaders understanding and use of safety leadership practices, safety practices, and crew-reporting of safety-related conditions regardless of company size for which they work. However, the FSL appears to be most effective at improving the safety leadership skills for those working for smaller firms. Future research is needed to further understand how the FSL, in combination with other safety management system interventions, can help small construction companies improve their safety climate and safety outcomes.

Practical applications

The majority of construction companies employ a small number of employees and therefore may not have the resources to provide their frontline leaders with the leadership training they need to be effective leaders who can create a strong jobsite safety climate. The Foundations for Safety Leadership (FSL) training can help fill this gap.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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References

Barnett AG, van der Pols JC, & Dobson AJ (2005). Regression to the mean: what it is and how to deal with it. International Journal of Epidemiology, 34(1), 215–220. doi:10.1093/ije/dyh299 [PubMed: 15333621]

Clarke S (2013). Safety leadership: A meta-analytic review of transformational and transactional leadership styles as antecedents of safety behaviours. Journal of Occupational and Organizational Psychology, 86(1), 22–49. doi:10.1111/j.2044-8325.2012.02064.x

Conchie SM, Moon S, & Duncan M (2013). Supervisors engagement in safety leadership: Factors that help and hinder. Safety Science, 51(1), 109–117. doi:10.1016/j.ssci.2012.05.020

CPWR: The Center for Construction Research and Training. (2018a). The Construction Chart Book: The U.S. construction industry and its workers (6th ed.). Silver Spring: CPWR.

CPWR: The Center for Construction Research and Training. (2018b). Foundations for Safety Leadership (FSL). Retrieved from https://www.cpwr.com/foundations-safety-leadership-fsl

Cunningham T, & Jacobson C (2018). Safety talk and safety culture: Discursive repertoires as indicators of workplace safety and health practice and readiness to change. Annals of Work Exposures and Health, 62(S1), S55–S64. [PubMed: 30212880]

Cunningham T, Sinclair R, & Schulte PA (2014). Better understanding the small business construct to advance research on delivering workplace health and safety. Small Enterprise Research, 21(2), 148–160. doi:10.1080/13215906.2014.11082084

Goldenhar LM, Schwatka NV, & Johnson S (2019). Leadership Skills for Strengthening Jobsite Safety Climate. Journal of Safety Research, 70, 263–271. [PubMed: 31848004]

Hardison D, Behm M, Hallowell MR, & Fonooni H (2014). Identifying construction supervisor competencies for effective site safety. Safety Science, 65(C), 45–53. doi:10.1016/j.ssci.2013.12.013

Hasle P, Kines P, & Andersen L (2009). Small enterprise owners' accident causation attribution and prevention. Safety Science, 47(1), 9–19. doi:10.1016/j.ssci.2007.12.005

Hoffmeister K, Gibbons AM, Johnson SK, Cigularov KP, Chen PY, & Rosecrance JC (2014). The differential effects of transformational leadership facets on employee safety. Safety Science, 62(C), 68–78. doi:10.1016/j.ssci.2013.07.004

Jeschke KC, Kines P, Rasmussen L, Andersen LPS, Dyreborg J, Ajslev J, … Andersen LL (2017). Process evaluation of a Toolbox-training program for construction foremen in Denmark. Safety Science, 94, 152–160. doi:10.1016/j.ssci.2017.01.010

Johnson S, Putter S, Reichard R, Hoffmeister K, Cigularov K, Gibbons A, & Rosecrance J (2018). Mastery goal orientation and performance affect the development of leader efficacy during leader development. Journal of Leadership and Organizational Studies, 25(1), 30–46.

Kines P, Andersen D, Andersen LP, Nielsen K, & Pedersen L (2013). Improving safety in small enterprises through an integrated safety management intervention. Journal of Safety Research, 44(1), 87–95. doi:10.1016/j.jsr.2012.08.022 [PubMed: 23398709]

Kines P, Andersen LPS, Spangenberg S, Mikkelsen KL, Dyreborg J, & Zohar D (2010). Improving construction site safety through leader-based verbal safety communication. Journal of Safety Research, 41(5), 399–406. doi:10.1016/j.jsr.2010.06.005 [PubMed: 21059457]

Kraiger K, Ford J, & Salas E (1993). Application of cognitive, skill-based, and affective theories of learning outcomes to new methods of training evaluation. Journal of Applied Psychology, 78(2), 311–328.

Lacerenza CN, Reyes DL, Marlow SL, Joseph DL, & Salas E (2017). Leadership training design, delivery, and implementation: A meta-analysis. J Appl Psychol, 102(12), 1686–1718. doi:10.1037/apl0000241 [PubMed: 28749153]

Lee J, Huang YH, Cheung JH, Chen Z, & Shaw WS (2018). A systematic review of the safety climate intervention literature: Past trends and future directions. J Occup Health Psychol. doi:10.1037/ocp0000113

Legg S, Olsen K, Laird I, & Hasle P (2015). Managing safety in small and medium enterprises. Safety Science, 71, 189–196. doi:10.1016/j.ssci.2014.11.007

MacEachen E, Kosny A, Scott-Dixon K, Facey M, Chambers L, Breslin C, … Small Business Systematic Review Team. (2010). Workplace health understandings and processes in small businesses: a systematic review of the qualitative literature. Journal of Occupational Rehabilitation, 20(2), 180–198. doi:10.1007/s10926-009-9227-7 [PubMed: 20140483]

Marín L, & Roelofs C (2017). Promoting Construction Supervisors' Safety-Efficacy to Improve Safety Climate: Training Intervention Trial. Journal of Construction Engineering and Management, 143(8). doi:10.1061/(asce)co.1943-7862.0001330

Masi D, & Cagno E (2015). Barriers to OHS interventions in Small and Medium-sized Enterprises. Safety Science, 71, 226–241. doi:10.1016/j.ssci.2014.05.020

Mullen J, & Kelloway E (2009). Safety leadership: A longitudinal study of the effects of transformational leadership on safety outcomes. Journal of Occupational and Organizational Psychology, 82(2), 253–272. doi:10.1348/096317908x325313

Murphy L, Robertson M, & Carayon P (2014). The next generation of macroergonomics: Integrating safety climate. Accident Analysis & Prevention, 68, 16–24. doi:10.1016/j.aap.2013.11.011 [PubMed: 24368052]

Neal A, & Griffin MA (2006). A study of the lagged relationships among safety climate, safety motivation, safety behavior, and accidents at the individual and group levels. Journal of Applied Psychology, 91, 946–953. doi:10.1037/0021-9010.91.4.946

Ozmec MN, Karlsen IL, Kines P, Andersen LPS, & Nielsen KJ (2015). Negotiating safety practice in small construction companies. Safety Science, 71, 275–281. doi:10.1016/j.ssci.2014.03.016

Ringen K, Dong X, Goldenhar L, & Cain C (2018). Construction safety and health in the USA: Lessons from a decade of termoil. Annals of Work Exposures and Health, 62(S1), S25–S33. [PubMed: 30212888]

Schwatka N, Goldenhar L, Johnson S, Beldon M, Tessler J, Dennerlein J, … Trieu H (2019). A training intervention to improve frontline construction leaders' safety leadership practices and overall jobsite safety climate. Journal of Safety Research, 70, 253–262. [PubMed: 31848003]

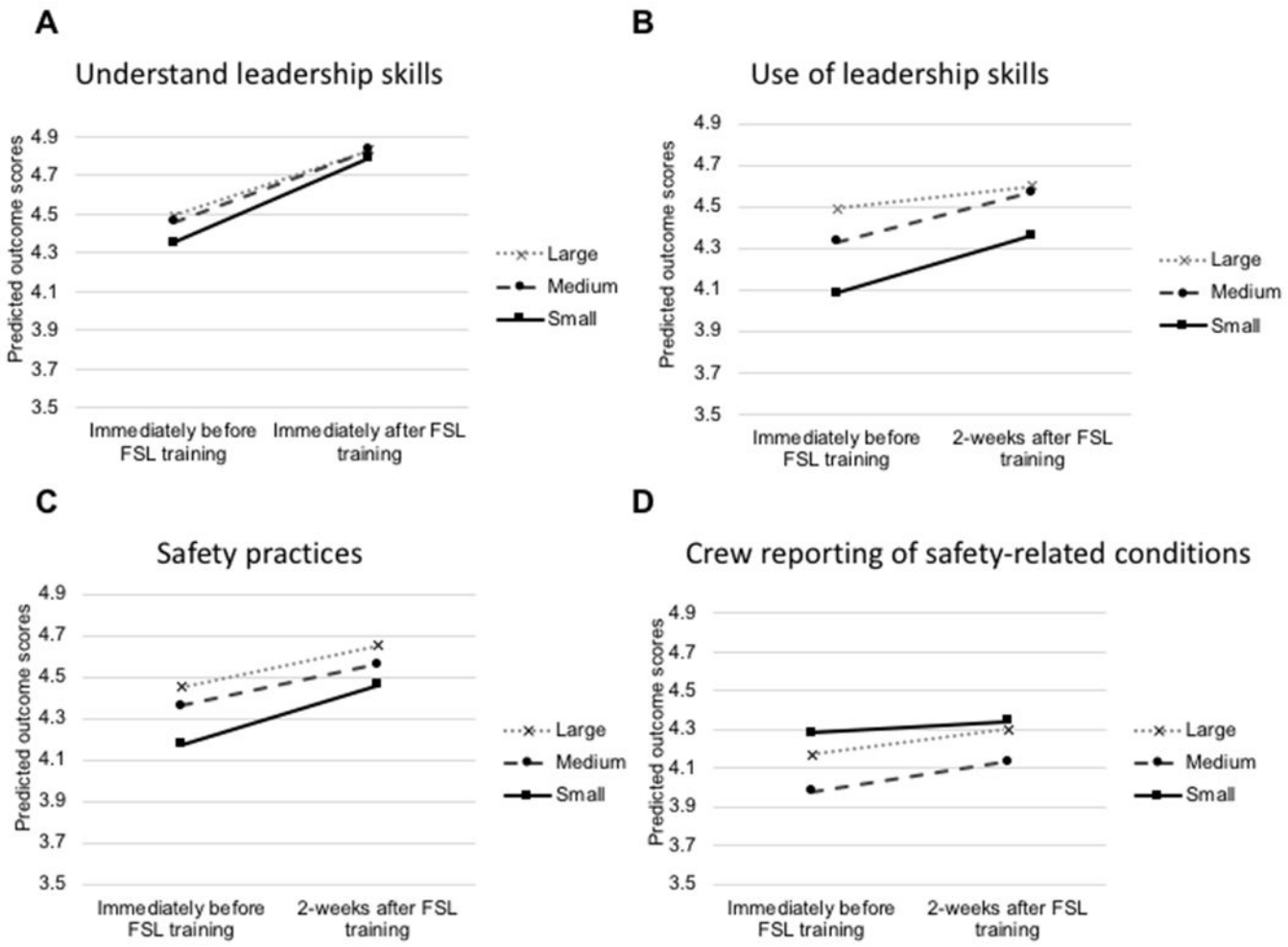
Sinclair R, & Cunningham T (2014). Safety activities in small businesses. Safety Science, 64, 32–38. doi:10.1016/j.ssci.2013.11.022 [PubMed: 26339124]

Sinclair R, Cunningham T, & Schulte P (2013). A model for occupational safety and health intervention diffusion to small businesses. American Journal of Industrial Medicine, 56(12), 1442–1451. doi:10.1002/ajim.22263 [PubMed: 24115112]

SmartMarket Report. (2017). Safety management in the construciton industry 2017. Retrieved from Dodge Data & Analytics: https://www.cpwr.com/sites/default/files/publications/Dodge_Safety_Report_2017.pdf

Sørensen O, Hasle P, & Bach E (2007). Working in small enterprises – Is there a special risk? Safety Science, 45(10), 1044–1059. doi:10.1016/j.ssci.2006.09.005

Tenney L, Fan W, Dally M, Scott J, Haan M, Rivera K, … Newman L (2019). Health LinksTM assessment of Total Worker Health practices as indicators of organizational behavior in small business. Journal of Occupational & Environmental Medicine, 61(8), 623–634. [PubMed: 31045750]



Figures 1A, 1B, 1C & 1D –.

Understanding and use of leadership skills, safety practices, and crew reporting of safety-related conditions from before to after the FSL training by company size. **Note:** In Figure 1A, the line for large business is not visible because it is behind the line for medium business.

Table 1 -

Data collection time points

Time	Outcome variables
Immediately before (Pre_T0)	•Understand leadership skills •Use leadership skills •Use safety practices •Crew reporting of safety-related conditions
FSL Training	
Immediately after (Post_T0)	•Understand leadership skills
2-weeks after (T+1)	•Use leadership skills •Use safety practices •Crew reporting of safety-related conditions

Table 2 –

Sample description by company size

	Small (n=23) n (%)	Medium (n=149) n (%)	Large(n=114) n (%)
Gender			
Male	23 (100%)	145 (99%)	110 (100%)
Female	0 (0%)	1 (1%)	0 (0%)
Age – Mean (SD)	44 (11)	44 (9)	43 (10)
Ethnicity			
White	18 (78%)	105 (70%)	72 (66%)
African American	0 (0%)	1 (1%)	3 (3%)
Hispanic	4 (17%)	38 (26%)	29 (27%)
Native American	0 (0%)	1 (1%)	1 (1%)
Mixed	1 (4%)	3 (2%)	3 (3%)
Other	0 (0%)	0 (0%)	1 (1%)
Years in construction – Mean (SD)	21 (8)	22 (10)	22 (9)
Current position *			
Supervisor/manager	2 (9%)	17 (12%)	5 (5%)
Superintendent	7 (30%)	17 (12%)	12 (11%)
Foreman/lead person	14 (61%)	105 (74%)	93 (88%)
Other	0 (0%)	3 (2%)	0 (0%)
Tenure with company			
<1 year	2 (11%)	13 (9%)	10 (9%)
1-3 years	3 (16%)	25 (18%)	15 (14%)
4-6 years	5 (26%)	24 (17%)	19 (18%)
7-10 years	3 (16%)	18 (13%)	18 (17%)
10+ years	6 (32%)	62 (44%)	46 (43%)
Location in the US **			
West	23 (100%)	90 (60%)	97 (85%)
Mid-west	0 (0%)	15 (10%)	17 (15%)
Northeast	0 (0%)	44 (30%)	0 (0%)
Union Status **			
Non-Union	17 (74%)	81 (54%)	79 (79%)
Union	6 (26%)	68 (46%)	35 (31%)
Trade(s) **			
Electrical	0 (0%)	28 (19%)	18 (16%)
Heavy civil	0 (0%)	31 (21%)	34 (30%)
Structural steel and precast concrete	6 (26%)	0 (0%)	12 (11%)
Mechanical	17 (74%)	15 (10%)	0 (0%)
Roofing	0 (0%)	24 (16%)	0 (0%)

	Small (n=23) n (%)	Medium (n=149) n (%)	Large(n=114) n (%)
Drywall	0 (0%)	27 (18%)	0 (0%)
Labor, Pipelayer, Welding	0 (0%)	15 (10%)	0 (0%)
Carpentry, Painting, Labor	0 (0%)	0 (0%)	5 (4%)
Carpentry, Masonry, Labor	0 (0%)	0 (0%)	12 (11%)
Drywall, Structural/Framing/Plaster	0 (0%)	9 (6%)	0 (0%)
Drywall, Painting, Acoustical finish, Scaffold	0 (0%)	0 (0%)	33 (29%)

** p<0.01;

* p<0.05

Note. The numbers do not add up to the total sample size for each column due to missing data.