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Saf Sci. Author manuscript; available in PMC 2015 September 01.

Published in final edited form as:

Saf Sci. 2014 April ; 64: 32–38. doi:10.1016/j.ssci.2013.11.022.

Safety activities in small businesses

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Abstract

Background—Workplace injuries occur at higher rates in smaller firms than in larger firms, and the number of workplace safety activities appear to be inversely associated with those rates. Predictors of safety activities are rarely studied.

Methods—This study uses data from a national random survey of firms (n = 722) with less than 250 employees conducted in 2002.

Results—We found that, regardless of firm size or industry, safety activities were more common in 2002 than they were in a similar 1983 study. Having had an OSHA inspection in the last five years and firm size were stronger predictors of safety activities than industry hazardousness and manager's perceptions of hazardousness. All four variables were significant predictors (β range .19 to .28; R^2 = .27).

Conclusions—Further progress in the prevention of injuries in small firms will require attention to factors likely subsumed within the firm size variable, especially the relative lack of slack resources that might be devoted to safety activities.

Keywords

Small business; Workplace monitoring; Safety practices; Work-related injuries

1. Introduction

Small businesses are burdened with higher occupational injury and fatality rates than larger businesses. (Buckley et al., 2008; Fabiano et al., 2004; Fenn and Ashby, 2004; Hinze and Gambatese, 2003; Jeong, 1998; Mendeloff et al., 2006; Morse et al., 2004; Page, 2009) Efforts to prevent those injuries and fatalities are important because of the human loss, but also because they may threaten the survival of small businesses which are viewed as engines of job creation and economic growth. A study of business survival rates of new, presumably smaller businesses in Canada found that those that survived for at least five years had less than half the rate of occupational injuries in their first year of operation as those that survived for only one to two years (Holizki et al., 2006).

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One of the ways employers prevent occupational injuries and fatalities is by engaging in safety activities. Activities such as regular safety meetings with employees, job descriptions that include safety duties, regular management communications about safety issues, and employee involvement are associated with fewer injuries and fatalities (Shannon et al., 1997; Mearns et al., 2003). While most smaller firms engage in some safety activities (Barbeau et al., 2004; Champoux and Brun, 2003), they engage in fewer safety activities than larger firms (de Kok, 2005; Dennis, 2002; Lentz et al., 2001; Lentz and Wenzl, 2006). Reasons for that disparity include less slack resources, greater time demands on managers, poorer manager attitudes about safety, and fewer employees to engage in activities such as safety committees (Hasle and Limborg, 2006; Parker et al., 2007).

Evidence about the relative importance of those reasons is sparse. In the only study of its kind that we found, Sims (2008) took an important step beyond descriptive studies by evaluating a number of predictors of safety activities using regression analysis. Using data from a 1983 survey of a random sample of members of the National Federation of Independent Businesses (NFIB) that was stratified by size and industry, he found that the following factors were associated with more safety activities in a firm:

- A loss prevention inspection by a workers' compensation organization (external variable).
- An OSHA inspection (external).
- Greater business size (organization).
- Greater hazardousness of the business sector (organization).
- Employee safety being an element of collective bargaining activity (organization).
- Presence of a production foreman (organization).
- Presence of designated safety personnel (organization).
- Perceived lack of difficulty in persuading employees to act safely (manager perception).
- Perception that safety and health was a serious concern (manager perception).

However, when the organizational predictive factors were added to the overall regression model, business size, industry sector, and OSHA or workers' compensation inspection experience no longer explained significant amounts of variance in the outcome. Sims concluded that much of the predictive value of these variables was explained by manager perceptions and the other organizational variables. These results are at odds with more recent findings that a primary reason for finding fewer safety activities in smaller businesses is lack of resources to devote to non production-related activities – a condition most-related to business size (Page, 2009; Champoux and Brun, 2003; Hasle and Limborg, 2006; Jones, 1999). The Sims study also had to drop consideration of less-hazardous industries due to the low number of safety activities reported in those industries, restricting the gereralizability of his results.

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The study described in this paper is a partial replication of the Sims study using more recent data from a second survey of smaller U.S. businesses that was conducted by the same organization almost twenty years after the first survey. The 2002 survey report from NFIB included only analysis of bivariate relationships of all survey questions by firm size (Dennis, 2002). The additional analyses of the 2002 data reported here allowed us to address three research questions: First, was there a change in the number of reported safety activities in smaller businesses between 1983 and 2002? Second, what is the relative importance of business size, industry hazardousness, OSHA inspection, and manager perception variables in predicting safety activities of smaller businesses? The relative importance of these predictors might change over time. Is Sims' finding that OSHA inspections are a weak predictor of safety activities true 19 years later? Finally, this study goes beyond the earlier study by using data from small businesses from all industry sectors (not just the most hazardous ones). Thus we were able to evaluate the extent to which predictors of safety activities were similar for all industries in the U.S. economy. A thorough background on predictor and outcome variables may be found in (Sims, 2008), but a brief explanation is provided here before sections on methods, results, discussion and conclusions.

1.1. Firm size and industrial sector

Smaller businesses have been found to have fewer safety activities than larger businesses. (Dennis, 2002) In addition, industries that are more hazardous have been found to engage in a greater number of safety activities than those in other industries. For example, participation in a safety committee program offered by a workers' compensation agency was positively related to business size and the hazardousness of the participant's industry (as measured by injury rate) (Liu et al., 2010). Firms with more than 100 employees were 100 times more likely to participate than firms with less than 20 employees. Firms in construction or manufacturing were more likely to participate than firms in service sectors.

1.2. OSHA inspections

OSHA inspections have been shown to be related to reduced subsequent workplace injury experience by analysis at both the industry-level (Bartel and Thomas, 1985; Viscusi, 1979, 1983) and enterprise-level (Baggs et al., 2003; Gray and Mendeloff, 2005; Gray and Scholz, 1993; Mendeloff and Gray, 2005; Scholz and Gray, 1990; Weil, 1996). However, the relationship between inspections and safety activities has received less attention. Sometimes the inspection-activities relationship is presumed in investigations of the inspection-injury relationship. Using types of injuries experienced by employers after an OSHA inspection as a dependent variable, Mendeloff and Gray (2005) found support for their proposal that inspections motivated both a focused employer response pattern ("detection/correction" – specific cited hazards reduced and injuries specific to the hazard subsequently reduced) and a general response pattern ("behavioral shock" – overall greater emphasis on safety and a broader range of hazards and injuries reduced). They found evidence that the shock effect was stronger than the detection/correction effect. Thus, we expect that inspections will be related to a range of safety activities across all industries.

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1.3. Manager perceptions of relative risk

Research focusing on top level managers suggests that their attitudes or perceptions play a significant role in their organization's occupational safety performance (Rundmo and Hale, 2003; Sawacha et al., 1999). Additionally, small business managers' and employees' perceptions of the work environment including safety training, employee-management cooperation, resources for safety, safety programs, and the presence of a safety committee strongly predicted safety performance (Parker et al., 2007). Safety activities in smaller enterprises are likely related to perceptions and motivations of their managers. Hasle and Limborg's review (2006) found evidence that small business owners often have low motivation to consult outside resources which may leave them at a disadvantage when they face technical issues such as safety and health, leaving them less likely to take preventive action. They also may be less motivated than managers in larger firms because they see workplace injuries less frequently.

2. Data and methods

2.1. Sample

This is a secondary analysis of data that were collected for a 2002 survey called *Workplace Safety*. It was conducted at the direction of the National Federation of Independent Businesses Research Foundation by the executive interviewing group of the Gallup Organization. The methods used to collect the data and descriptive findings are in the NFIB report on the survey (Dennis, 2002). A national random sample of businesses was drawn from the files of the Dun & Bradstreet Corporation. The sample was stratified to oversample for larger businesses since most U.S. businesses employ one to four people. The final sample that was surveyed (by telephone) included 351 businesses with 1 to 9 employees (46%), 200 with 10 to 19 (27%), and 201 with 20 to 249 employees (27%). Without stratification, in 2002 those percentages of the population would have been 79%, 11%, and 10% (Dennis, 2002). Respondents were the business owner or operator. Response rate and non-responder bias data were neither reported by nor available from the primary research groups.

2.2. Analysis variables

2.2.1. Firm size and industrial sector—The number of employees (firm size) was extracted from Dunn & Bradstreet. Respondents were asked to specify their "primary business activity" and given nine categories from which to choose: Construction, manufacturing, wholesale, retail, services, transportation, communication, financial services, and agriculture/forestry/fishing. Data from the U.S. Department of Labor's Bureau of Labor Statistics (BLS) were used to rank these categories on their overall injury and illness rates in 2002 (BLS, 2003). Those ranks were collapsed to two for analysis: "high injury/illness rates" (>3.0 injuries per 100 FTE per year – manufacturing, transportation, construction, agriculture/forestry/fishing, and wholesale trade) or "low injury/illness rates" (<3.0 – retail trade, services, communications, and financial services). Incidence rate data were nonfatal occupational injuries and illnesses involving days away from work, job transfer, or restriction of activities, by quartile distribution and employment size group, private industry, 2002.

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2.2.2. OSHA inspections—Responses to a single survey question were used to measure inspection experience: “Within the last five years, has your business been inspected by OSHA or its state equivalent?”.

2.2.3. Perceived dangerousness of firm’s industry—Respondents were asked this question: “Compared to other industries, is your industry a relatively dangerous industry to work in, a relatively safe industry to work in, or about average?” We collapsed “relatively safe” and “average” categories for the regression analysis. This measure is similar to the measure of safety and health as a “serious concern” in the 1983 survey.

2.2.4. Safety activities—Respondents were asked six questions that tapped this construct. The items are broadly representative of three of the four elements of a small business safety program. OSHA recommends that such a program have: training for employees, supervisors, and managers (questions 1, 2, and 3); worksite analysis (question 4); management commitment and employee involvement (questions 5 and 6); hazard prevention and control (question 6, but only slightly) (OSHA, 2005). We summed the “yes” responses to these questions to form a composite measure of safety activities. Table 1 shows a comparison of the wording of these items to the items used in the 1983 NFIB survey. That survey used 12 items to measure safety activities (Sims, 2008). Our categorization of those items is: manager/employee involvement: 1; worksite analysis: 5; hazard control and prevention: 5; training: 1.

For the multiple regression analysis, three control variables were developed from three other questions in the survey. Those variables were respondents’ age in years, education level (collapsed to dichotomous – *college diploma or higher* or *less than college diploma*), and years of experience with current business.

3. Results

There were 751 questionnaires available. Of those, 722 answered all of the questions that form the variables for this study and did not refuse the question or answer “don’t know.” Those were used for the analysis. Firms with less than 10 employees represented 47% of the sample (337). Six hundred and 94 businesses (96%) had fewer than 100 employees. About 17% of the sample reported that the business was operated primarily from the home (including outbuildings). Twenty-three percent of the sample reported having owned or operated the business for less than six years, 19% said six to ten years, 27% said 11–20 years, and 31% said 21 years or more. Respondents reported that their primary business activity was services (33%), retail (23%), manufacturing (12%), construction (10%), financial services (5%), agriculture, forestry or fishing (5%), wholesale (7%), transportation (3%), or communication (2%). The sample was distributed somewhat evenly across the country: East (16%), South (23%), Midwest (23%), Central (19%) and West (18%).

3.1. Safety activities

The most commonly-reported safety activity was conducting periodic safety inspections. Eighty-two percent (592) of respondents said that either he/she or an employee conducted periodic safety inspections. Sixty-six percent reported that safety training or safety

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awareness was part of a new employee's job orientation. The same percentage reported that their organization had safety rules or policies. The other safety activities were reported less often: Respondent personally attended safety training in the last 12 months (23%), there is an employee safety committee in the business (18%), and respondent sent an employee to safety training in the last 12 months (9%). No one reported having done all six of the activities, but 30% (225) reported four or five of them. Fortyfive percent reported two or three of the safety activities, and 89% reported at least one activity.

Comparison of the frequency tables from Sims (2008) and Dennis (2002) reveals that between the surveys, across all industries surveyed, the portion of firms that reported having written safety and health rules and procedures grew from 24% to 32% over time, and the portion reporting safety committees grew from 62% to 85%. Similar-sized changes were found for all firm size categories.

3.2. Firm size and industry sector

In the current study, firms with less than 10 employees reported fewer safety activities than firms with 10 to 19 employees, and those firms reported fewer safety activities than larger firms ($F = 68.39_{(2,719)}$, $p < .0001$) (Table 2). In follow-up comparisons, each of three group means was different from the other two. Frequency tables for these firm size categories by individual safety activities (including the ones used in this analysis) are provided in the NFIB survey report. For each safety activity, businesses in a larger size category were more likely to carry out the safety activity than businesses in a smaller size category.

The mean number of safety activities for firms in the "high" injury incidence rate industries was higher than the mean for the "low" group ($t = 6.1$ [720]), $p < .0001$; Table 2). The mean industry-level injury rates and the mean number of safety activities by industry and by firm size within industry are reported in Table 3. The range in mean safety activities across industries was 1.5 (financial sector) to 3.6 (manufacturing). The numerical order of the industry mean safety activity rates does not exactly match the order of the industry-level mean injury rates, but the pattern is close (Table 3). The safety activity means for firm size by industry generally parallel the ordering of the industry means.

The difference in safety activities in less-hazardous industry sectors between 1983 and 2002 was substantial. In the Sims study, so many of the low-risk firms reported zero safety activities (41%) that all low-risk firms were dropped from the regression analysis (more than half the sample). In this study, only 13% of the low-risk firms reported zero safety activities, and almost half of them reported three to five safety activities. The respondents to the 1983 survey were asked to self-report over a longer period of time (two years retrospective versus either present practice or one year retrospective in the 2002 survey) and were given twice as many items (12 versus 6 items) about which to report. It appears that firms in the less-hazardous sectors were more engaged in preventive practices in 2002 than was a similar group in 1983.

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3.3. Manager perceptions and OSHA inspections

Like the quantitative measure of industry dangerousness (injury rates), owner/operators' perceptions of his or her firm's industry dangerousness was related to self-reports of safety activities in the firm. The group that estimated that their firm's industry was "a relatively dangerous industry" had more safety activities than those who rated the firm as relatively safe or about average ($t = 3.5$ [720]), $p < .001$; Table 2). Even though the means were apparently different, the difference was relatively small, and only about 10% of the sample perceived their firm to be relatively dangerous.

The mean reported safety activities for respondents who had been inspected by OSHA was higher than the mean for others ($t = 11.35$ [720]), $p < .0001$). Those who had an inspection averaged about one more safety activity than others (3.4 versus 2.2). Among those who had been inspected, 80% reported three to five activities, while only 44% of those who had not been inspected reported that level of activity. Only 3% of those inspected reported no activities, while 15% of those uninspected had no activities.

3.4. Multivariate analysis

Using multiple regression, safety activity scores were regressed on the linear combination of firm size, inspection by OSHA, mean sector injury rate, perception of dangerousness, and owner/operator's age, education, and years of ownership experience. The equation containing these variables accounted for 27% of the variance in safety activities, $F_{(7,714)} = 39.56$, $p < .0001$, adjusted $R^2 = .27$. Beta weights (standardized multiple regression coefficients) and uniqueness indices were reviewed to assess the relative importance of the variables. The uniqueness index for a variable is the percentage of variance in the criterion accounted for by that variable, beyond the variance accounted for by the other predictor variables (Table 4). Paralleling the bivariate results, inspection by OSHA, firm size, sector injury rate, and perception of dangerousness were the only variables with significant beta weights (.27, .26, .19, and .12 respectively, all $p < .001$). OSHA inspections and firm size were the best predictors of safety activities. The owner/operator characteristic variables had non-significant beta weights under .06. Uniqueness indices showed the same pattern as the beta weights for all variables.

4. Discussion

Studies about safety and health in small businesses are mostly limited to small, single-industry, convenient samples. We undertook this secondary analysis of relatively old data partly because the opportunity to examine a random national sample of U.S. small businesses on this topic is rare.

We found that having had an OSHA inspection and size of the firm were the strongest predictors of engagement in safety activities, and that each accounted for variance in the outcome variable independently of other variables. Industry-level injury rate and manager's perception of dangerousness of the industry were also significant independent but less-important predictors. We found this in a national sample of all industries, a finding that was

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made possible by an apparent overall increase in safety activities in all smaller businesses between 1983 and 2002 that allowed us to include all industries in the regression analysis.

There can be little doubt that the firm size variable subsumes a number of other factors. Other researchers found that the positive firm size/safety activities relationship occurs because of barriers in smaller businesses including (in descending order of importance) costs of safety activities, paperwork, lack of training, priority to production and lack of time in descending order (Champoux and Brun, 2003). We had no way in this study to evaluate the hypothesis that lack of resources in smaller firms is related to safety activities and more consideration of that relationship in future studies is warranted. Additional operationalizations of the size construct are needed to do so. Publicly available financial data that might be used to capture a firm's slack resources have been proposed, e.g., retained earnings, dividend payout, working capital as a percent of sales, credit rating, and price/earnings ratio (Bourgeois, 1981). Such alternatives might explain more of the variance in safety activities in smaller firms than number of employees and should be high priorities for investigator consideration. If resources are the real issue, then external, intermediary organizations may have sufficient interest in smaller enterprises to provide assistance that will help overcome these conditions and public health agencies and practitioners should cultivate partnerships with them (Hasle and Limborg, 2006; Hasle et al., 2010).

Our finding that industry-level injury rate predicted safety activities at the firm level cannot be compared to Sims because in 1983 the frequency of safety activities in the low-injury industry group was so low that it was not used in Sims's analysis. By 2002, even the lowest injury industry, the financial sector, reported an average of 1.5 activities per firm. It is likely that the capacity for safety activities and the interest in same has grown in all industries in the two decades between the surveys and perhaps even more since then. This study confirms that a firm's industry sector predicts firm behavior. Given that firms participate in trade associations and other industry-centered relationships and activities, and that processes within industries vary less than across industries, our results confirm that industry-specific prevention efforts within small businesses must be an ongoing consideration.

Industry-level annual injury rate was a stronger predictor of firm-level safety activities than owner/operators' perceptions of the relative dangerousness of the firm's sector. The data from the survey report revealed that owner/operators frequently underestimated the relative dangerousness of their sector (Dennis, 2002). Our analysis indicates that industry-level injury experience data was a better predictor of action than manager's perceptions about their industry's relative dangerousness. It may be that standard industry safety and health practices are observed by employers due to normative behavior influences independently of their personal estimation of the need for such precautions. Additionally, manager perceptions about dangerousness may be subject to bias due to a tendency to base perceptions on frequency of injury incidents rather than incidence rates. Managers of the smallest firms which likely experience the lowest injury frequencies may be most subject to this bias. Another study found that small firm managers were likely to see workplace accidents as due to factors outside their control, undermining their estimation of the value of prevention activities such as training (Hasle et al., 2009).

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Our finding that OSHA inspections were an important influence on safety activities differs from Sims's analysis which found them to be less influential. One reason for that may be that the OSHA inspection variable picked up some of the variance in dangerousness within the industry categories that formed the rough measure of industry dangerousness we used. OSHA is likely to inspect establishments in more dangerous subsectors within the broad industry categories that were the offered categories in the survey. Nevertheless, our finding fits with the research that links inspections, especially inspections with penalties, to subsequent reduced injury rates in inspected firms (Baggs et al., 2003; Gray and Mendeloff, 2005; Mendeloff and Gray, 2005; Weil, 1996; Haviland et al., 2010). Given the broad range of safety activities used as the criterion variable, this study provides partial support for the effect of inspections on the general response pattern proposed by Mendeloff and Gray. There are likely to be positive organizational effects of OSHA inspections beyond any particular foci of those inspections. Similar results have been found about employee behavior. Some individual safety behaviors covary rather consistently, and response generalization occurs when non-targeted behaviors increase as a result of intervening to increase a targeted behavior (Ludwig and Geller, 1997). While our study fills a gap by linking level of safety activities with inspection experience, it lacks the specificity of cited hazards linked with particular safety activities. Further research is needed to demonstrate a general response pattern, or response generalization at the employer/organizational level.

One of the many contributions of Sims's study that we were unable to replicate is the finding that workers' compensation loss control inspections were significant predictors of safety activities, even stronger than OSHA inspections. Given the expected role of external organizations in assisting small businesses with safety and health activities (Hasle and Limborg, 2006; Eakin et al., 2010), the relative influence of different inspection processes needs to be studied further. Other types of organizations that either do or might inspect small businesses include state and local health departments, small business development centers, and consultant service organizations. Comparisons of the effects of inspection-related costs and benefits (e.g., fines and premium discounts) warrant further study. The framework of behavioral economics has demonstrated loss aversion to be a stronger influence than incentives in several contexts (Kahneman, 2003). Inspections provided by non-fining entities are likely to be perceived as less threatening; however, the injury prevention effects are not as strong (Gray and Mendeloff, 2005).

Sims's (2008) study found that respondent's perception "that safety and health was a serious concern" was the best predictor of safety activities and that firm size and OSHA inspection were lesser or non-significant contributors when that perception and other internal factors were considered. In contrast, in the current study the manager's perception about the dangerousness of the firm's industry was the weakest predictor in the multivariate analysis. Although not identical, the two measures of managers' perceptions are similar. These results indicate that the importance of firm size and inspections should not be discounted (de Kok, 2005; Lentz et al., 2001; Lentz and Wenzl, 2006).

The sample for this study is unusual because it includes a substantial number of firms with less than 10 employees (46% of the sample). This study confirms that the smallest firms have the fewest activities, a finding that fits with studies that have found the most workplace

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injuries and fatalities in such firms. Other studies diverge on the extent to which the smallest of firms are included. For example, Haviland and colleagues omitted businesses with less than 10 employees because they are exempt from OSHA programmed inspections (Haviland et al., 2010). The lack of consistency of business size categories across studies has hampered progress. For example, overall, the Haviland study excluded firms with less than 19 employees from their analysis because they found no relationship between size and injuries in that group. However, another study included such firms and concluded that firms with less than 100 employees were associated with greater injury rates than larger enterprises (Gray and Mendeloff, 2005). Whenever possible, interval level workforce size data from employers should be collected and analyzed.

This study has several limitations. As a secondary analysis, it had limited capability to operationalize variables. This investigation was able to use only four predictor and three control variables. Future investigations of organizational OSH behavior should consider a greater range of variables in all categories in order to tap all the relevant dimensions of each construct. Similarly, the outcome measure of safety activities did not adequately tap all dimensions of recommended safety programs, and was particularly deficient on the essential element of hazard control. It also did not take into account the fact that a safety activity may have required a great deal more resources to accomplish in one firm than in another. Being cross-sectional, this study could not account for the variety of time differences between predictor events and outcome events that certainly influenced correlations. On the independent variable side for example, manager's perceptions about the dangerousness of the industry might have changed to the measured perception from a different perception at the time a measured safety activity was started. Similarly, safety activities at a firm may have been started and then stopped *after* an OSHA safety inspection but *before* the time of the survey.

Further, the broadness of the industrial sector categories makes our operationalization of the industry dangerousness variable a rough estimate of a firm's actual hazardousness. There are more- and less-dangerous subsectors within each category, a factor that could have biased the results in one direction or another. And of course, the regression analysis cannot provide evidence about causal relationships. Further, the variables are not grounded in a theory of organizational OSH behavior, which is sorely needed for the field.

A puzzling finding of the NFIB 2002 survey report was the percentage of firms that reported having had an inspection by OSHA or its state equivalent within the last five years: nearly 35%. Almost 22% of the firms with less than 10 employees reported having been inspected as did over half of the firms with more than 20 employees. Given normal inspection rates, OSHA may be expected to inspect less than 10% of all establishments within five years (Mendeloff et al., 2006). In addition, OSHA exempts some low-hazard firms with less than 11 employees from regular "programmed" safety inspections, although not from complaint-driven ones or accident investigations. While the over-sampling of larger firms might have increased the rate of inspection slightly, any effect would likely be small. Further, the current study may have actually undercounted inspections due to multiple inspections at one firm being represented as a single "yes" response. Hence, the reported number of inspections seem high, and the results of the survey should be viewed with caution. More research is

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needed to understand how inspection activity is perceived by managers and how it is best measured and used as a predictor variable.

Another limitation is that the data were collected some time ago, and just as owner/operator reports of safety practices reported in 2002 were apparently substantially greater than in 1983, practices may have varied in quality over that same time period. Additionally, safety practices today likely differ in quantity and quality from 2002, making comparisons difficult. The influence of historical factors cannot be ruled out. Regular surveys of the safety activities of small firms would allow for control of such factors.

The data were collected using a survey, self-report method that may be subject to bias. This is more likely to be a problem when reporting business activities that have humanitarian or consumer appeal such as ones meant to contribute to the safety of a firm's workers or to activities required by government regulations. A more comprehensive research design may include injury rates at least as an indicator of the quality of safety activities, if not to also further demonstrate the relationship between safety activities and injury reduction. Finally, no response rate or non-response bias information was available for this secondary analysis, further limiting conclusions that can be drawn.

5. Conclusion

While it appears that progress was made in increasing safety activities in small firms between this survey and its progenitor, there is room for further progress, particularly among the smallest of small firms. Although there are known business methods to control the human and financial costs of workplace injuries, this analysis shows that use of those methods are influenced chiefly by firm characteristics (size and industry) and external pressures (OSHA inspections) and not as much by the internal factor of managers' perceptions. Further, it shows that firm size is one of the most important of those aspects for businesses with less than 250 employees, including firms with less than 10 employees. With resources scarce, motivation to conduct safety activities low, and a strong culture of independence from outside connections in smaller firms, research should continue to better-understand the important influences on their OSH behavior. Research should also better-identify ways that external, intermediary organizations can contribute to their hazard control efforts. Future research should focus particular attention on the smallest businesses. It may be that safety program recommendations should be substantially different for those organizations. For example, it may not be credible or practical to recommend safety committee formation to a firm with less than five employees. Costs, in terms of time and materials, must be low so as to make a coherent safety program achievable. It may be necessary to explore means of providing more resources to small businesses to invest in injury prevention and to find ways to motivate busy, isolated managers of the smallest enterprises.

Acknowledgements

The authors thank the National Federation of Independent Businesses for generously sharing their 2002 survey data. They also thank Wayne Gray and John Mendeloff for their comments on a previous draft.

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Table 1

Comparison of safety activities measures.

1983 Sims (2008)	2002 (current study)
In the past two years, has your firm taken any actions to reduce health and safety hazards? (Please check all that apply)	
Employee training	1. “Within the last 12 months, have you sent an employee to attend a seminar, conference session, or training on workplace safety, reducing accidents, etc.?”
	2. “Is safety training or safety awareness part of a new employee’s job orientation?”
	3. “Within the last 12 months, have you personally attended a seminar, conference session, or training on workplace safety or reducing accidents?”
Self inspection programs	4. “Do you personally conduct or do you have someone else conduct periodic safety inspections of your workplace(s)?”
Safety committees	5. “Do you have an employee safety committee in your business?”
[Non matching items]	[Non matching item]
Screening of workers for sensitivity to hazards	6. “Do you have written safety rules or policies?”
Personal protective equipment	
Engineered controls for production equipment	
Use less hazardous materials	
Reduce worker exposure (e.g. through work rotation)	
Stop making/carrying a hazardous product	
Use OSHA consulting service	
Use trade association for advice	
Hire private safety consultant	

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Table 2

Mean number of reported safety activities by groups.

Variable	Groups	Mean safety activities[a] (s.d.)	*n*
Number of employees	1–9	2.00 (1.40)[b]	337
	10–19	2.94 (1.32)[b]	193
	20–249	3.36 (1.35)[b]	192
Industry injury rate group[c]	High	3.05 (1.42)[d]	265
	Low	2.37 (1.47)[d]	457
OSHA inspection	Yes	3.41 (1.23)[d]	250
	No	2.19 (1.44)[d]	472
Perceived dangerousness of industry	More dangerous	3.19 (1.37)[d]	72
	About average or Safer	2.55 (1.49)[d]	650

[a] Maximum =6.

[b] $p < .05$ Each mean is significantly different from the other two in this block (Tukey's HSD test).

[c] Based on annual injury incidence case rates by industry sector for nonfatal occupational injuries and illnesses involving days away from work, job transfer, or restriction for 2002; high: >3.0 per hundred FTE, low: <3.0 per 100 FTE.

[d] $p < .001$.

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Table 3

Mean number of safety activities by industry and firm size.

Sector	Mean illness injury rate[a]	General safety activities mean (s.d., n)[b]	General safety activities mean by firm size (s.d., n)		
			1–9	10–19	20–249
Manufacturing	4.1	3.60 (1.25, 84)	2.39 (1.34, 23)	3.80 (0.81, 25)	4.22 (0.86, 36)
Transportation	4.0	3.09 (1.41, 22)	2.13 (1.46, 8)	3.40 (1.14, 5)	3.78 (1.09, 9)
Construction	3.8	3.04 (1.24, 75)	2.67 (1.17, 34)	3.17 (1.31, 29)	3.75 (0.87, 12)
Agriculture	3.3	2.51 (1.71, 39)	1.88 (1.62, 27)	3.6 (1.14, 5)	4.14 (0.69, 7)
Wholesale	3.1	2.44 (1.36, 50)	2.15 (1.40, 26)	2.57 (1.16, 14)	3.0 (1.41, 10)
Communication	2.5	2.82 (1.78, 11)	2.00 (2.00, 3)	1.75 (1.26, 4)	4.50 (0.58, 4)
Services	2.2	2.45 (1.51, 254)	2.02 (1.50, 127)	2.83 (1.43, 65)	2.95 (1.36, 62)
Retail	2.0	2.44 (1.34, 176)	2.01 (1.22, 80)	2.60 (1.21, 45)	2.98 (1.44, 51)
Financial services	0.8	1.55 (1.37, 40)	0.87 (0.97, 23)	2.50 (1.41, 8)	2.44 (1.33, 9)

[a] Average incidence rates for nonfatal occupational injuries and illnesses involving days away from work, job transfer, or restriction per 100 full-time workers by industry (BLS, 2003).

[b] Maximum = 6.

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Table 4

Regression beta weights and uniqueness indices for predictor variables.

Predictor	Beta weights		Uniqueness indices	
	Beta	*t*	Uniqueness index	*F*
Size (# employees)	.28	8.08**	.070	70**
OSHA inspection experience last 5 years (Y/N)	.27	7.76**	.065	65**
Sector injury rate[a]	.19	5.4**	.031	31**
Hazard perceptions[b]	.12	3.45*	.013	11*
Respondent age (# years)	−.02	−0.63	.001	1
Education[c]	.02	0.72	.001	1
Experience with current business (# years)	.02	0.50	.000	0

[a]Continuous: incidence rates by industry sector for nonfatal occupational injuries and illnesses involving days away from work and by selected events exposures leading or to injury or illness, 2002 (BLS, 2003).

[b]Dichotomous: relatively dangerous/about average or relatively safe.

[c]Dichotomous: college diploma or more/less than diploma.

*$p < .001$.

**$p < .0001$.