



## A comparison of workplace safety perceptions among financial decision-makers of medium- vs. large-size companies

Yueng-Hsiang Huang<sup>a,\*</sup>, Tom B. Leamon<sup>b</sup>, Theodore K. Courtney<sup>a,b</sup>, Peter Y. Chen<sup>c</sup>, Sarah DeArmond<sup>d</sup>

<sup>a</sup> Liberty Mutual Research Institute for Safety, 71 Frankland Road, Hopkinton, MA 01748, USA

<sup>b</sup> Department of Environmental Health, Harvard School of Public Health, Boston, MA 02115, USA

<sup>c</sup> Department of Psychology, Colorado State University, Fort Collins, CO 80523, USA

<sup>d</sup> College of Business, University of Wisconsin Oshkosh, Oshkosh, WI 54901, USA

### ARTICLE INFO

#### Article history:

Received 25 November 2008

Received in revised form 24 July 2009

Accepted 21 September 2009

#### Keywords:

Corporate financial decision-maker

Company size

Workplace safety

### ABSTRACT

This study, through a random national survey in the U.S., explored how corporate financial decision-makers perceive important workplace safety issues as a function of the size of the company for which they worked (medium- vs. large-size companies). Telephone surveys were conducted with 404 U.S. corporate financial decision-makers: 203 from medium-size companies and 201 from large companies. Results showed that the patterns of responding for participants from medium- and large-size companies were somewhat similar. The top-rated safety priorities in resource allocation reported by participants from both groups were overexertion, repetitive motion, and bodily reaction. They believed that there were direct and indirect costs associated with workplace injuries and for every dollar spent improving workplace safety, more than four dollars would be returned. They perceived the top benefits of an effective safety program to be predominately financial in nature – increased productivity and reduced costs – and the safety modification participants mentioned most often was to have more/better safety-focused training. However, more participants from large- than medium-size companies reported that “falling on the same level” was the major cause of workers’ compensation loss, which is in line with industry loss data. Participants from large companies were more likely to see their safety programs as better than those of other companies in their industries, and those of medium-size companies were more likely to mention that there were no improvements needed for their companies.

© 2009 Elsevier Ltd. All rights reserved.

### 1. Introduction

Occupational injury continues to be a great concern in the workplace. The U.S. Bureau of Labor Statistics (2008) reported that in 2006 there were around 4.1 million nonfatal workplace injuries and illnesses, which means that there were 4.4 nonfatal injuries and illnesses for every one hundred full-time equivalent U.S. workers. In addition, about 5840 fatal occupational injuries occurred in private industry in the U.S. in the same year. These statistics show that there is reason for continued concern about the safety of the U.S. workforce, especially in light of a recent study that indicated that the BLS’s system for recording work-related injuries and illnesses undercounts the total number of injuries associated with chronic or acute conditions (Rosenman et al., 2006). These statistics illustrate the continuing need to identify ways to reduce workplace accidents and injuries and to improve overall workplace safety.

Prior research suggests that management commitment to health and safety, a key aspect of safety climate, has a significant impact on a variety of safety outcomes (Barling et al., 2002; Cohen, 1977; Cooper and Phillips, 2004; Cree and Kelloway, 1997; Glendon and Litherland, 2001; Ilgen, 1990; Marsh et al., 1998; Siu et al., 2004; Zohar, 2002; Zohar and Luria, 2005). It should be noted, however, that management is a broad term. There are different levels of management (e.g., executives, middle managers, front-line supervisors) within organizations, and research suggests there is a need to differentiate among these levels (e.g., Zohar and Luria, 2005; Zohar, 2008). For example, Zohar (2008) argued that current definitions and measures of safety climate fail to make a distinction between the priorities of senior-level managers and front-line supervisors.

Managers play a significant role in shaping an organization’s safety outcomes. For instance, management commitment to health and safety has been shown to have a significant link to a variety of safety outcomes (Barling et al., 2002; Cohen, 1977; Cooper and Phillips, 2004; Cree and Kelloway, 1997; Glendon and Litherland, 2001; Ilgen, 1990; Marsh et al., 1998; Siu et al., 2004; Zohar, 2002; Zohar and Luria, 2005). While there has been a fair amount of

\* Corresponding author. Tel.: +1 508 497 0208; fax: +1 508 435 0482.

E-mail address: [Yueng-hsiang.Huang@Libertymutual.com](mailto:Yueng-hsiang.Huang@Libertymutual.com) (Y.H. Huang).

occupational safety research which has explored the role that managers play in occupational safety, most of this research has focused on lower level management. For example, Barling et al. (2002) documented relationships between the characteristics of front-line supervisors, safety climate, and safety outcomes. While there might be a variety of practical issues which lead to more research being done on samples of lower level managers (e.g., total numbers of lower level managers, access to lower level managers), this is likely a significant shortcoming of the existing occupational safety research literature. Since upper level management can set priorities and have a greater impact on organizational strategy, there is a need for more research on these individuals.

Huang et al. (2007)'s study attempted to address this need by focusing on the upper level managers' attitudes and perceptions of occupational safety. That study, which used a randomized national survey approach, explored how senior financial executives or managers (those who determined high-level budget, resource allocation, and corporate priorities) of medium-to-large companies perceive important workplace safety issues. The three top-rated safety priorities in resource allocation reported by the participants (overexertion, repetitive motion, and bodily reaction) were consistent with the top three perceived causes of workers' compensation losses. The greatest single safety concerns reported were overexertion, repetitive motion, highway accidents, falling on the same level and bodily reaction. A majority of participants believed that the indirect costs associated with workplace injury were higher than the direct costs. The participants believed that money spent improving workplace safety would have significant returns. The perceived top benefits of an effective workplace safety program were increased productivity, reduced cost, retention, and increased satisfaction among employees. The perceived most important safety modification was safety training. The top reasons senior financial executives gave for believing their safety programs were better than those at other companies were that their companies paid more attention to and emphasized safety, they had better classes and training focused on safety, and they had teams/individuals focused specifically on safety.

Some researchers have suggested that smaller companies might have greater safety problems than larger companies (Holmes, 1999; Wilson and Koehn, 2000). This is thought to be due to inferior management of risk (Holmes, 1999). In particular, it seems that small business employers have a tendency to think that risk control is the responsibility of individual employees rather than the employer or the company management system (Eakins, 1992). Further, smaller companies may have fewer resources for designing and managing safety programs (Wilson and Koehn, 2000). The research which has noted this issue has been largely industry-specific (e.g., a great deal of it has taken place in the construction industry), and much of it has taken place outside of the U.S.

Huang et al. (2007) studied American companies without consideration for the potential impact of company size. Extending from this prior study, the current study utilized the same protocols to collect additional data by size class in order to explore and compare top financial decision-makers' perceptions of safety as a function of the size of managers' companies (medium- vs. large-size companies in the U.S.). Corporate financial decision-makers were chosen because they make decisions about high-level budgets, resource allocations, and corporate priorities. Medium-to-large-size companies (100+ employees) were targeted because they are more likely than small companies to have an individual dedicated to corporate finances who is distinct from the head of the enterprise.

## 2. Methodology

### 2.1. Participants and procedure

Telephone surveys were conducted to explore our research questions. The data used in Huang et al. (2007) are included in the current study and merged with additional survey data collected from large-size companies.

In the earlier study, a consulting firm was hired to conduct the telephone interviews using a Computer Assisted Telephone Interviewing (CATI) lab. Four thousand randomly selected telephone numbers from the 48 continental U.S. were obtained from a vendor's database commonly used by researchers to obtain representative samples of American businesses (Chen and Huang, 2005). Several procedures were used to ensure a high response rate which included: sending a pre-notification letter to potential respondents indicating the survey sponsor and purpose of the survey; using a team of experienced telephone interviewers; making call backs on different days and at different times of the day; calling back "refusals" to enlist their cooperation; offering a final report to participants for completing the survey; and assuring our participants that all the individual information would be kept confidential and that only aggregate information would be reported. Experienced telephone interviewers contacted the most senior executive or manager responsible for making decisions about property and casualty risk management or insurance-related services for their organizations (e.g., CFO, Director of Finance). A total of 10,819 calls (including no answer, call back, refusal, completed interview, etc.) were made in the process. A total of 231 respondents agreed to participate in the interview, with a 20% response rate. The response rate was calculated by number of completed responses out of total number of completed responses and rejections. Of these respondents, 203 were from medium-size companies and 28 from large-size companies. Medium-size companies were defined as those which had between 100 and 2000 employees, and large companies as those with 2000+ employees. These definitions are consistent with those used in the insurance industry. For more information regarding the participants and procedures in the former study, please see Huang et al. (2007).

As only 28 respondents in the earlier study came from large-size companies, an additional stage of data collection was conducted to recruit large-size companies to permit comparison of responses by company size for the current study. Applying the data collection protocols used in the earlier study, an additional 3200 phone numbers from large-size companies were purchased from the same vendor. A total of 21,217 phone calls (including no answer, call back, refusal, completed interview, etc.) were made to recruit respondents. In this stage of data collection, 173 respondents from large-size companies participated in the survey, with a 10% response rate. When these interviews were added to the original dataset, there were a total of 404 corporate financial decision-makers represented: 203 participants worked for medium-size companies (100–1999 employees) and 201 worked for large-size companies (2000+). The project was approved by the Liberty Mutual Research Institute for Safety Institutional Review Board.

### 2.2. Survey topics

The new participants were asked the same survey questions as in the prior study (see Appendix A). The questions relevant to this report focused on three topics: (1) corporate financial decision-makers' perceptions of the leading safety concerns and workers' compensation losses in their companies and their future priorities in terms of organizational resources and efforts for addressing different occupational injury causes; (2) their perceptions of the direct and indirect costs of workplace injuries and return on

**Table 1**  
Descriptive information of respondents and their companies.

	Medium-size companies Number (percentage)	Large-size companies Number (percentage)
<b>Job title</b>		
Chief Financial Officer	98 (48.8%)	94 (46.8%)
Controller	35 (17.3%)*	5 (2.5%)*
Vice President	21 (10.5%)	17 (8.5%)
Director of Finance	17 (8.4%)	9 (4.5%)
Chief Operating Officer	7 (3.5%)	1 (0.5%)
Other (e.g., Treasure, Finance Manager, Safety Manager, Risk Manager, Human Resources Manager)	24 (11.9%)	75 (37.3%)
Total participants	202 (missing 1)	201
<b>Gender</b>		
Male	164 (80.8%)	166 (82.6%)
Female	39 (19.2%)	35 (17.4%)
Total participants	203	201
<b>Industry type</b>		
Manufacturing	47 (23.2%)	39 (20.2%)
Health care and social assistance	27 (13.3%)	40 (20.7%)
Finance and insurance	21 (10.3%)*	9 (4.7%)*
Construction	15 (7.4%)*	6 (3.1%)*
Wholesale trade	18 (8.9%)*	3 (1.6%)*
Educational services	15 (7.4%)	18 (9.3%)
Retail trade	15 (7.4%)	16 (8.3%)
Transportation and warehousing	11 (5.4%)	10 (5.2%)
Other	34 (16.8%)	52 (27.0%)
Total participants	203	193 (missing 8)
<b>Number of employees</b>		
100–249 employees	101 (50.0%)	
250–499 employees	59 (29.2%)	
500–999 employees	31 (15.3%)	
1000–1999 employees	11 (5.4%)	
2000 or more employees		201 (100%)
Total participants	202 (missing 1)	201
<b>Approximate annual revenue</b>		
Under 10 million	19 (11.0%)	9 (5.2%)
10–24.9 million	39 (22.5%)	2 (1.1%)
25–74.9 million	72 (41.6%)	4 (2.3%)
75–199.9 million	27 (15.6%)	24 (13.8%)
200–499.9 million	13 (7.5%)	37 (21.3%)
1 billion or more	1 (0.6%)	66 (37.9%)
Total participants	173 (missing 30)	174 (missing 27)

Note: A Chi-square test was used to examine whether there were significant differences between the characteristics of respondents (i.e., job type, gender, and industry type) for medium vs. large-size companies.

\* Significant difference between the two groups.

investment of improving workplace safety; and (3) senior financial decision-makers' perceptions of the benefits of safety programs and interventions. Participants were asked to compare their companies' safety programs to those of other companies in the same industry. Those who reported their companies' safety programs were better than average were asked why they felt that way.

### 2.3. Data reduction and analysis

Newly collected data from large-size companies (from 173 participants) were merged with the data collected for the Huang et al. (2007) study (231 participants) for a total dataset of 404 for the current study, hereafter referred to as the "combined sample" or "sample." Participants' responses to the open-ended questions in the new data were content analyzed by three members of the project team and sorted into the categories already established in Huang et al. (2007). Any discrepancy was discussed among the project team members, and consensus was reached. Background information for the participants were classified the same way as in the Huang et al. (2007) study. For industry class, specifically, categories were taken from the North American Industrial Classification

System. Descriptive statistics were calculated for the questions answered on Likert scales. Repeated measures ANOVA was used to test the differences in the top three mean levels of priority placed by participants for these two study groups on the different causes of occupational injuries (for Question 1). A Chi-square ( $\chi^2$ ) test and independent *t*-test were used to examine whether there were significant differences between the responses of corporate financial decision-makers from medium- and large-size companies.

### 3. Results

Table 1 displays information about the demographic characteristics of the combined sample (job titles, gender, industry type, number of employees, and approximate annual revenue). The demographic characteristics of the participants from medium- and large-size companies were compared, and the two groups were quite similar except for the job titles of participants and industries. There were more controllers among the participants from large companies. There were more people working in the industries of finance and insurance, construction, and wholesale trades from medium-size companies than large companies.

**Table 2**  
Means (*M*), standard deviation (*SD*), and number of respondents answering (*n*), of 5-point Likert scale responses and independent *t*-test results to Question 1 on survey (see Appendix A) regarding the top safety priorities for resource allocation for participants from medium- vs. large-size companies.

Causes of occupational injuries listed on survey	Medium-size companies Mean (SD) Number of participants	Large-size companies Mean (SD) Number of participants	Mean differences between medium- and large-size companies
(1) Overexertion from lifting, pushing, pulling, holding, carrying, or throwing of an object	3.26(1.28) <i>n</i> = 199	3.68(1.24) <i>n</i> = 198	<i>t</i> = -3.32***
(2) Repetitive motion (such as injuries due to repeated stress or strain)	3.13(1.15) <i>n</i> = 200	3.40(1.14) <i>n</i> = 200	<i>t</i> = -2.31*
(3) Bodily reaction (such as injuries due to bending, climbing, slipping or tripping without falling)	3.13(1.23) <i>n</i> = 202	3.51(1.13) <i>n</i> = 199	<i>t</i> = -3.21**
(4) Exposure to harmful substances or environment	2.60(1.45) <i>n</i> = 195	2.87(1.44) <i>n</i> = 194	<i>t</i> = -1.85
(5) Falling on the same level	2.55(1.28) <i>n</i> = 201	3.14(1.28) <i>n</i> = 200	<i>t</i> = -4.60***
(6) Highway accidents	2.29(1.43) <i>n</i> = 191	2.70(1.44) <i>n</i> = 190	<i>t</i> = -2.81**
(7) Being caught in or compressed by equipment or objects	2.28(1.40) <i>n</i> = 190	2.61(1.41) <i>n</i> = 189	<i>t</i> = -2.28*
(8) Being struck by an object (such as a tool falling on a worker from above)	2.24(1.31) <i>n</i> = 197	2.55(1.25) <i>n</i> = 195	<i>t</i> = -2.40*
(9) Workplace violence	2.27(1.26) <i>n</i> = 199	2.51(1.30) <i>n</i> = 196	<i>t</i> = -1.81
(10) Falling from heights	2.18(1.37) <i>n</i> = 196	2.45(1.37) <i>n</i> = 194	<i>t</i> = -1.91
(11) Striking against an object (such as an employee walking into a door frame)	2.14(1.12) <i>n</i> = 201	2.41(1.13) <i>n</i> = 197	<i>t</i> = -2.36*
(12) Contact with high/low temperature	1.87(1.14) <i>n</i> = 188	2.18(1.22) <i>n</i> = 186	<i>t</i> = -2.50*

Note: Independent *t*-test was used to test if there were any significant differences between medium- vs. large-size companies for the same causes of occupational injuries.

\* *p* < .05.  
\*\* *p* < .01.  
\*\*\* *p* < .001.

### 3.1. Topic 1: perceived leading safety priorities, losses and concerns

In the first question, the corporate financial decision-makers were asked to rate their top safety priorities for resource allocation for the upcoming year from a list of the twelve major causes of occupational injuries. A relative rating scale with skewed rating anchors (i.e., 1 as “Below Average” priority, 2 as “Average” priority, 3 as “Above Average” priority, 4 as “Well Above Average” priority, and 5 as “One of the Highest” priorities) was used to increase variability in responses, discriminability, and quality (e.g., Bernardin and Beatty, 1984; Huang et al., 2007). The results are shown in Table 2.

As can be seen, the top three safety priorities reported for participants from the medium-size companies were “overexertion from lifting, pushing, pulling, holding, carrying, or throwing of an object” (*M* = 3.26), “repetitive motion such as injuries due to repeated stress or strain” (*M* = 3.13), and “bodily reaction such as injuries due to bending, climbing, slipping or tripping without falling” (*M* = 3.13). A repeated measures ANOVA indicated that the mean scores of these top three safety priorities did not differ statistically [ $F(2, 394) = 1.33, p > .05$ ].

For participants from the large-size companies, the order of the top three safety priorities was somewhat different from that of medium-size companies. Based on the result from a repeated measures ANOVA [ $F(2, 388) = 5.14, p < .01$ ] for the top three priorities, overexertion was also the number one priority (*M* = 3.68) but it was rated significantly higher than the rest of the categories. Bodily

reaction had a higher mean value (*M* = 3.51) than repetitive motion (*M* = 3.40); however, this difference was not statistically significant. Falling on the same level (*M* = 3.14) had the fourth highest priority mean value.

The responses of participants between medium- and large-size companies were compared via a series of independent *t*-tests. The results showed that participants from the large-size companies gave higher mean priority ratings to all 12 causes of occupational injury (statistically, 9 out of the 12 were significantly higher than those of medium-size companies).

The second question asked participants to name the number one cause of their company’s workers’ compensation losses (Question 2). As can be seen in Table 3, for medium-size companies, the most frequently reported causes were: overexertion (36.8%), followed by repetitive motion (12.6%), and bodily reaction (10.5%). A few participants (2.6%) reported that their organizations had not had any recent losses/claims. For the large-size companies, the order differed. Overexertion (32.1%) was the most commonly cited cause of their companies’ workers’ compensation losses also; however, falling on the same level (16.8%) was rated as the number one cause by more respondents than was repetitive motion (13.7%) or bodily reaction (10.0%). No participants from large-size companies reported that they “had not had any losses/claims” the previous year. There were significantly more respondents from the large-size companies choosing falling on the same level as the number one cause of workers’ compensation losses than respondents from the medium-size companies.

**Table 3**

Frequency and valid percent for responses of participants from medium- vs. large-size companies to Question 2 regarding what they perceive to be the number one cause of workers' compensation losses in their company.

	Medium-size Frequency (%)	Large-size Frequency (%)
Overexertion	70 (36.8%)	61 (32.1%)
Repetitive motion	24 (12.6%)	26 (13.7%)
Bodily reaction	20 (10.5%)	19 (10.0%)
Falling on the same level	17 (8.9%)*	32 (16.8%)*
Highway accidents	8 (4.2%)	11 (5.8%)
Falling from heights	5 (2.6%)	5 (2.6%)
Being struck by an object	5 (2.6%)	2 (1.1%)
Being caught in or compressed by equipment or objects	5 (2.6%)	5 (2.6%)
Carelessness, not paying attention	5 (2.6%)	4 (2.1%)
Cuts, abrasions, lacerations	5 (2.6%)	5 (2.6%)
Back injuries	4 (2.1%)	4 (2.1%)
Exposure to harmful substances or environment	2 (1.1%)	1 (0.5%)
Employees not adhering to safety regulations/policies	1 (0.5%)	1 (0.5%)
Bites, scratches	2 (1.1%)	2 (1.1%)
Contact with high/low temperature	1 (0.5%)	0 (0.0%)
We have not had any losses/claims for a while	5 (2.6%)	0 (0.0%)
Fraudulent claims	3 (1.6%)	2 (1.1%)
Other (e.g., knee injury, cumulative trauma disorder)	8 (4.2%)	10 (5.3%)
# Responses to item	190	190
# No response	13	11
Total participants	203	201

Note: A Chi-square test was used to examine whether there were significant differences between the responses for medium- vs. large-size companies.

\* Significant difference between the two groups.

An open-ended question (Question 3) was asked regarding the single greatest workplace safety concern for our participants' companies. The results are shown in Table 4. The most frequently reported single greatest concern named by participants from the medium-size companies, was: (1) overexertion (22.0%); (2) repetitive motion (14.5%); (3) highway accidents (12.9%); (4) falling on the same level (8.6%); and (5) bodily reaction (5.4%). A few participants (1.5%) reported that there were no safety concerns for their companies. For the large-size companies, the order differed somewhat. Overexertion (24.5%) and repetitive motion (16.7%) were also the most frequently mentioned as the single greatest workplace safety concern; however, falling on the same level (13.5%) was mentioned by more participants than highway accidents (9.9%) or bodily reaction (7.3%). None of the participants from large com-

panies reported "having no safety concerns." There was a small but significantly larger number of respondents from the medium-size companies (3.8%) than large-size companies (0.5%) who chose "employee carelessness or lack of focus" as the single greatest workplace safety concern.

### 3.2. Topic 2: perceived financial impact of safety

The participants were asked in Question 4 to estimate the ratio of indirect costs to direct costs associated with workplace injuries and what they think is the biggest cause of indirect costs. As described in Table 5, the mean score for the ratio for participants from the medium-size companies was \$2.1 (SD = 1.9). The median ratio was \$2:\$1; 51.1% of the participants from medium-size com-

**Table 4**

Frequency and percent for responses of participants from medium- vs. large-size companies to Question 3 regarding their single greatest workplace safety concern.

	Medium-size Frequency (%)	Large-size Frequency (%)
Overexertion	41 (22%)	47 (24.5%)
Repetitive motion	27 (14.5%)	32 (16.7%)
Highway accidents	24 (12.9%)	19 (9.9%)
Falling on the same level	16 (8.6%)	26 (13.5%)
Bodily reaction	10 (5.4%)	14 (7.3%)
Being caught in or compressed by equipment or objects	9 (4.8%)	7 (3.6%)
Exposure to harmful substances or environment	8 (4.3%)	8 (4.2%)
Falling from heights	6 (3.2%)	10 (5.2%)
Employee carelessness or lack of focus	7 (3.8%)*	1 (0.5%)
Flu, disease, viruses, bacteria, infection	5 (2.7%)	1 (0.5%)
Creating a safe work environment	4 (2.2%)	1 (0.5%)
Cuts, abrasions, lacerations from needles, knives, or sharp object	4 (2.2%)	3 (1.6%)
Striking against an object	2 (1.1%)	1 (0.5%)
Workplace violence	3 (1.6%)	5 (2.6%)
Not having good safety education and training	3 (1.6%)	3 (1.6%)
Being struck by an object	2 (1.1%)	2 (1.0%)
Contact with high voltage/electricity	2 (1.1%)	1 (0.5%)
Contact with high/low temperature	1 (0.5%)	0 (0%)
All concerns are equally important	2 (1.1%)	0 (0%)
No concerns	3 (1.5%)	0 (0%)
Other	7 (3.8%)	11 (5.7%)
# Responses to item	186	192
# No responses	17	9
Total participants	203	201

Note: A Chi-square test was used to examine whether there were significant differences between the responses for medium vs. large-size companies.

\* Significant difference between the two groups.

**Table 5**

Frequency and percentage for responses of participants from medium- vs. large-size companies to Question 4a regarding the ratio of indirect costs to direct costs in their company due to workplace injuries.

Dollars of indirect cost	Medium-size Frequency (%)	Large-size Frequency (%)
0–.99	27 (19.7%)	31 (19.5%)
1–1.99	40 (29.2%)	36 (22.6%)
2–2.99	25 (18.2%)	43 (27.1%)
3–3.99	24 (17.5%)	29 (18.2%)
4–4.99	7 (5.1%)	9 (5.7%)
5–5.99	10 (7.3%)	9 (5.7%)
6–6.99	0 (0%)	0 (0%)
7–7.99	1 (0.7%)	0 (0%)
8–8.99	0 (0%)	2 (1.3%)
9–9.99	0 (0%)	0 (0%)
10–10.99	2 (1.5%)	0 (0%)
11	1 (0.7%)	0 (0%)
# Responses to item	137	159
# No response	66	42
Total participants	203	201

Note: For participants from the medium-size companies, min=0, max=11, mean = 2.1, SD = 1.9, and median = 2; for participants from the large-size companies, min = 0, max = 8, mean = 2.0, SD = 1.5, and median = 2.

panies believed that at least two dollars would be spent on indirect costs for every dollar spent on direct costs. Similar to the participants from the medium-size companies, the mean score for the ratio for participants from large-size companies was \$2.0 (SD = 1.5). The median ratio was \$2:\$1; 57.9% of participants believed that at least two dollars would be spent on indirect costs for every dollar spent on direct costs. Results from the independent *t*-test showed that there were no significant differences between the two groups on this question.

Results from Table 6 show that the leading causes of indirect costs identified by medium- and large-size companies were: (1) workplace disruption, downtime, loss of productivity (33.1% for medium-size companies and 36.8% for large-size companies); (2) worker replacement, training new employees (22.1% and 23.7%, respectively); and (3) worker's compensation, increased insurance premiums, attorney fees (16.9% and 14.7%, respectively). The top three responses were consistent between the groups.

The second question under this topic (Question 5) asked our participants to estimate how many dollars would be returned for each dollar spent improving workplace safety. Table 7 shows that for participants from the medium-size companies, the mean score was \$4.83 (SD = 13.0). Participants believed that for every dollar spent improving workplace safety, more than four dollars would be returned. The median score was \$2. A few participants reported high figures which moved the average mean above the median. For

**Table 6**

Frequency and percent for responses of participants from medium- vs. large-size companies to Question 4b regarding the biggest cause of indirect costs in their company due to workplace injuries.

	Medium-size Frequency (%)	Large-size Frequency (%)
Workplace disruption, downtime, loss of productivity	57 (33.1%)	70 (36.8%)
Worker replacement, training for new employees	38 (22.1%)	45 (23.7%)
Worker compensation, increased insurance premiums, attorney fees	29 (16.9%)	28 (14.7%)
Absentees, vacation time	15 (8.7%)	12 (6.3%)
Unsafe acts by employees	7 (4.1%)	5 (2.6%)
Overtime/extra/high wages	6 (3.5%)	10 (5.3%)
Administrative costs	5 (2.9%)	5 (2.6%)
Poor management	2 (1.2%)	7 (3.7%)
Not an issue, not applicable, we have no costs	3 (1.7%)	0 (0.0%)
Other	10 (5.8%)	8 (4.2%)
# Responses to this item	172	190
# No response	31	11
Total participants	203	201

Note: A Chi-square test was used to examine whether there were significant differences between the responses for medium vs. large-size companies. No significant differences were found between the two groups.

**Table 7**

Frequency and percentage for responses of participants from medium- vs. large-size companies to Question 5 regarding ratio of dollars spent improving workplace safety vs. dollars returned.

Dollars returned	Medium-size Frequency (%)	Large-size Frequency (%)
0–.99	17 (11.6%)	15 (9.7%)
1–1.99	40 (27.4%)	18 (11.6%)
2.00	38 (26.0%)	43 (27.9%)
3.00	19 (13.0%)	31 (20.1%)
4.00	4 (2.7%)	15 (9.7%)
5.00	12 (8.2%)	22 (14.3%)
8.0	0 (0%)	1 (0.6%)
10.00	9 (6.2%)	8 (5.2%)
15.00	1 (0.7%)	0 (0%)
20.00	1 (0.7%)	0 (0%)
25.00	1 (0.7%)	0 (0%)
50.00	2 (1.4%)	0 (0%)
100.00	2 (1.4%)	0 (0%)
200	0 (0%)	1 (0.6%)
# Responses to item	146	154
# No response	57	47
Total # participants	203	201

Note: For participants from the medium-size companies, min=0, max=100, mean = 4.83, SD = 13.0 and median = 2; for participants from the large-size companies, min = 0, max = 200, mean = 4.29, SD = 16.0, and median = 3.

participants from large-size companies, the mean score was \$4.29 (SD = 16.0). The median score was \$3. Results from the independent *t*-test showed that there were no significant differences between the two groups on the mean scores.

### 3.3. Topic 3: issues regarding safety programs

The top benefits of an effective workplace safety program reported from open-ended Question 6, as shown in Table 8, for the medium- and large-size companies were believed to be (1) increased productivity (43.4% and 38.4%, respectively); (2) reduced costs (26.3% and 34.8%, respectively); and (3) retention (7.6% and 7.1%, respectively). Results from Chi-square test showed that there were no significant differences between the two groups.

In terms of participants' responses to open-ended Question 7, "if you could make one modification to significantly improve the workplace safety of your company, what would that be?" the intervention mentioned most frequently by participants from both medium- and large-size companies, as shown in Table 9, was to have "more/better safety-focused training" (27.9% and 28.6%, respectively). All other potential modifications (e.g., more safety management, better equipment and workspace, safer and cleaner environment, enforcement of policies and procedures, removal of hazards, and additional personnel to monitor safety) were each

**Table 8**

Frequency and percent for responses of participants from medium- vs. large-size companies to Question 6 regarding what they see as the top benefit of an effective safety program.

	Medium-size Frequency (%)	Large-size Frequency (%)
Productivity	86 (43.4%)	76 (38.4%)
Cost	52 (26.3%)	69 (34.8%)
Retention	15 (7.6%)	14 (7.1%)
Employee/company morale, satisfaction among employees	11 (5.6%)	10 (5.1%)
Preventing injury/fewer injuries	7 (3.5%)	3 (1.5%)
Concern for employee health and well-being	9 (4.5%)	7 (3.5%)
Workplace safety	4 (2%)	1 (0.5%)
Fewer Injury	5 (2.5%)	5 (2.5%)
Reduced premiums	5 (2.5%)	2 (1%)
Turnover	2 (1%)	8 (4%)
Other	2 (1%)	3 (1.5%)
# Responses to item	198	198
# No response	5	3
Total participants	203	201

Note: A Chi-square test was used to examine whether there were significant differences between the responses for medium vs. large-size companies. No significant differences were found between the two groups.

**Table 9**

Frequency and percent for responses of participants from medium- vs. large-size companies to Question 7 regarding one modification to significantly improve their company's workplace safety.

	Medium-size Frequency (%)	Large-size Frequency (%)
More/better safety-focused training	46 (27.9%)	53 (28.6%)
Safer/better/updated equipment and workspace	11 (6.7%)	13 (7.0%)
More safety management	9 (5.5%)	18 (9.7%)
More enforcement of policies and procedures	11 (6.7%)	11 (5.9%)
Improvements made to create a safer and cleaner environment	10 (6.1%)	13 (7.0%)
Remove hazards	9 (5.5%)	9 (4.9%)
Additional personnel present at all times to monitor safety	6 (3.6%) <sup>*</sup>	16 (8.6%) <sup>*</sup>
Screening of applicants, testing of current employees	3 (1.8%)	8 (4.3%)
More resources devoted to safety programs and prevention	1 (0.6%)	1 (0.5%)
No improvements needed	41 (24.8%) <sup>*</sup>	22 (11.9%) <sup>*</sup>
Other	18 (10.9%)	21 (11.4%)
# Responses to item	165	185
# No response	38	16
Total participants	203	201

Note: A Chi-square test was used to examine whether there were significant differences between the responses for medium vs. large-size companies.

<sup>\*</sup> Significant difference between the two groups.

mentioned by fewer than 10% of those responding to this question. More respondents from the large-size companies (8.6%) mentioned "having additional personnel present at all times to monitor safety" than medium-size companies (3.6%) as the number one modification for their companies. Interestingly, results showed that 24.8% of the participants from medium-size companies mentioned that there were no improvements needed for their companies as compared to 11.9% from large-size companies, which a Chi-square test showed was a significant difference.

**Table 10**

Frequency and percent for responses of participants from medium- vs. large-size companies to Question 8a "How do your company's workplace Safety Programs compare to other companies in your industry?"

	Medium-size Frequency (%)	Large-size Frequency (%)
(1) Not as good	5(2.8%)	9(4.9%)
(2) The same	86(47.5%) <sup>*</sup>	59(32.1%) <sup>*</sup>
(3) Better	90(49.7%) <sup>*</sup>	116(63.0%) <sup>*</sup>
# Responses to this item	181	184
# No response	22	17
Total participants	203	201

Note: A Chi-square test was used to examine whether there were significant differences between the responses for medium vs. large-size companies.

<sup>\*</sup> Significant difference between the two groups.

Results from Question 8 (see Tables 10 and 11) showed that, among participants from the medium-size companies, 49.7% reported that their safety programs were better than those of other companies in their industries (47.5% reported "the same," and 2.8% reported "not as good"). For those who thought their companies were better, the top three reasons given were that they believed (1) their companies paid more attention to and emphasized safety (23.6%); (2) they had better classes and training focused on safety (21.3%), and (3) they had teams/individuals focused specifically on safety (10.1%).

For participants from the large-size companies, 63.0% reported that their safety programs were better than those of other companies in their industries (32.1% reported "the same," and 4.9% reported "not as good"). For those who thought their companies were better, the same top three reasons were given as those given by the participants from medium companies: (1) their companies paid more attention to and emphasized safety (27.1%); (2) they had better classes and training focused on safety (20.6%), and (3) they had teams/individuals focused specifically on safety (9.3%).

Results showed that significantly more respondents from the large-size companies than the medium-size companies reported that their safety programs were "better" compared to other companies in the same industry. More respondents from the medium-size companies than large-size companies reported that their safety

**Table 11**

Frequency and percent for responses of participants from medium- vs. large-size companies to Question 8b regarding why safety programs are better (from those who think their safety programs are better for Question 8a).

	Medium-size Frequency (%)	Large-size Frequency (%)
We paid more attention to and emphasized safety	21 (23.6%)	29 (27.1%)
We have better classes/training focused on safety	19 (21.3%)	22 (20.6%)
We have teams/individuals focused specifically on safe	9 (10.1%)	10 (9.3%)
We have a lower accident rate	8 (9%)	5 (4.7%)
We have a clean/safe work environment	7 (7.9%)	3 (2.8%)
We are used as a benchmark in the industry	5 (5.6%)	5 (4.7%)
We devote a lot of resources/time to safety awareness	5 (5.6%)	6 (5.6%)
We have incentive programs geared toward improving safety	4 (4.5%)	1 (0.9%)
We have compared ourselves to others statistically	4 (4.5%)	9 (8.4%)
We have low insurance premiums	2 (2.2%)	4 (3.7%)
We have tracked our progress and have seen improvements	0 (0%)	1 (0.9%)
Other	5 (5.6%)	12 (11.2%)
# Responses to this item	89	107
# No response	1	9
Total participants	90	116

Note: A Chi-square test was used to examine whether there were significant differences between the responses for medium vs. large-size companies. No significant differences were found between the two groups.

programs were “the same” compared to other companies in the same industry.

#### 4. Discussion

The current study explored whether the perceptions of workplace safety issues of top financial decision-makers (those who determine high-level budgets, resource allocation, and corporate priorities) varied as a function of company size (medium- vs. large-size companies). In general, the patterns of responding for participants from medium- and large-size companies were similar. However, there was evidence that perceptions did vary on some issues as a function of size.

Regarding perceived leading safety priorities, losses and concerns, the three top-rated safety priorities in resource allocation for the coming year reported by participants from both medium- and large-size companies were overexertion, repetitive motion, and bodily reaction. Priorities in resource allocation for participants from medium-size companies were consistent with the three top reasons given as their company's greatest cause of workers' compensation losses. Interestingly, more participants from large-size companies named “falling on the same level” as the number one cause of workers' compensation losses than “repetitive motion” and “bodily reaction;” however, they rated it as a lower priority for resources for the coming year than these other two types of injuries. For participants from medium-size companies, the greatest safety concerns reported were overexertion, repetitive motion, highway accidents, falling on the same level and bodily reaction. For large-size companies, they reported that falling on the same level was a greater concern than highway accidents.

Participants' priorities in resource allocation for safety were further compared to the results from the Liberty Mutual Workplace Safety Index (LMWSI) (2006). The LMWSI reported the 10 leading causes of serious workplace injuries (which accounted for 88.1% of the direct worker's compensation costs) in 2004. The 10 leading causes of workplace injury cited in the Safety Index, in order, were: overexertion, falls on same level, bodily reaction, falls to lower level, struck by object, highway incidents, repetitive motion, struck against object, caught in or compressed by equipment, and assaults and violent acts. In a comparison of LMWSI facts with participant perceptions, participants from both medium- and large-size companies indicated “overexertion” as first for resource allocation, which was consistent with the leading actual cause of loss reported by the LMWSI. However, while participants from both size companies chose “repetitive motion” as a high priority for resource

allocation (second for medium-size companies and third for large-size companies), it was only seventh on the LMWSI, counting for only 2.5% of the direct cost of disabling workplace injuries in 2004. Furthermore, falls on the same level (the second leading category for the LMWSI) and falls to lower levels (the fourth) were both higher cost injury events in 2004 (LMWSI, 2006). However, participants from neither medium- nor large-size companies reported them as higher than fourth level priorities for resource allocation. Future studies should explore this discrepancy between financial decision-makers' choices for resource allocation and the reported costs of different workplace injury causes.

It is curious that falling on the same level was not one of the top three priorities of resources allocation for either group. According to LMWSI (2006), “falling on the same level” was the second leading cause of workplace injury in 2004, the year the participants had just experienced before the survey data were collected. It seems that “falling on the same level” has not received the attention from financial decision-makers that it deserves. Data in the current study suggest that participants from medium-size companies might not understand the relative scale of national losses from falls; therefore, they may have considered it as a lower priority for resources and rated it as less of a safety concern. Surprisingly, although “falling on the same level” rated second as the number one cause of workers' compensation losses by participants from large-size companies, and was considered as a great concern, it still rated as a low priority for resource allocation in the coming year. Without collecting further qualitative data (e.g., interviewing participants for reasons behind the answers), we do not know why financial decision-makers do not give falls on the same level higher priority for resources. Future studies should try to better understand financial decision-makers' perceptions of falls.

Regarding the perceived financial impact of safety, results showed that these corporate financial decision-makers recognized that there were direct and indirect costs associated with workplace injuries and that they believed the ratio of indirect to direct costs to be about 2:1. A prior study by the Health and Safety Executive of the United Kingdom estimated that indirect costs typically range between 3 and 30 times the direct (Health and Safety Executive, 1993). In New Zealand, the indirect to direct cost ratio of work injuries and diseases was estimated to be 0.34:1 (Head and Harcourt, 1998). One study (Leigh et al., 1997) estimated that the ratio of indirect to direct costs associated with occupational injuries and illnesses in the U.S. in 1992 was 1.63:1. It is good to see that participants from both medium- and large-size companies estimated that indirect costs of worker injuries were greater than



the direct costs. However, we do not know whether their estimated ratios of indirect to direct costs reflect the actual experience of their companies, an investigation of which could be included in a future study.

In terms of dollars spent and dollars returned, results of the current study showed that financial decision-makers from both medium- and large-size companies believed that for every dollar spent improving workplace safety, more than four dollars would be returned. The American Society of Safety Engineers has concluded that there is a direct, positive correlation between investment in safety, health, and the environment and its subsequent return on investment (ASSE, 2002). The U.S. Occupational Safety and Health Administration (OSHA) (2007) asserts from its own evidence that companies implementing effective safety and health programs can reduce injury and illness rates by 20% or more and generate a return of \$4 to \$6 for every \$1 invested. OSHA reported that employers investing in workplace safety and health can expect to reduce fatalities, injuries, and illnesses. This could result in cost savings in a variety of areas, such as lowering workers' compensation costs and medical expenses, avoiding OSHA penalties, and reducing costs to train replacement employees and conduct accident investigations. In addition, employers often find that changes made to improve workplace safety and health can result in significant improvements to their organization's productivity and financial performance. The results of the current study appear to show that financial decision-makers do recognize the potential for return on the money spent improving workplace safety. It is possible, however, as discussed in our earlier report, that the results could also suggest that these decision-makers have an expectation of return on investment if they choose to direct resources toward a given issue. In this sense the results could be viewed as the minimum return such decision-makers would expect in order to make a particular investment in safety. Future research could explore the basis for these estimates and whether these views actually translate into behaviors.

It should be noted that quite a few participants did not provide answers to these two items on perceived financial impact of safety: 108 out of the 404 participants (26.7%) did not answer the question on the ratio of direct costs to indirect costs, and 104 out of the 404 participants (25.7%) did not answer the question on dollars spent vs. dollars returned on improving safety. As the participants of the current project were the most senior executives or managers responsible for making decisions about property and casualty risk management or insurance-related services for their organizations, it was a surprise that such a high number of participants were not able to or decided not to answer these two questions. It would be important for future study to investigate the reasons behind these missing responses.

Similar to the results from Huang et al. (2007), for Topic 3, financial decision-makers from both medium and large companies perceived the top benefits of an effective workplace safety program to be predominately financial in nature – increased productivity and reduced costs – and the safety modification participants mentioned most often was to have more/better safety-focused training. Most participants, especially those from large-size companies, thought their companies' safety programs were better than other companies in their industry. Participants from both company sizes saw that there were improvements still to be made; however, while almost 90% of the participants from large-size companies reported that improvements are still needed for their companies, those of medium-size companies were more likely to mention that there were no improvements needed for their companies (about one-fourth) and a few reported that they had not had any losses/claims for a while.

There are several limitations in the current study. Due to practical constraints, this study only explored self-reported perceptions of corporate financial decision-makers. This is problematic in two

ways. First, there can be problems with self-reported data (e.g., social desirability effects). We do not have the actual loss data for these individual companies or the population data for these two study groups in terms of injury information; therefore, we are not able to provide an analysis between perceived and actual loss. We suggest that future research examine the perception vs. reality issues and collect specific objective data (e.g., company injury records, population injury data, analyses of actual direct and indirect costs of injury) to examine whether there is consistency between financial decision-makers' perceptions and reality, and explore potential interventions if there is a gap between the two. Second, it would also be important and interesting to compare whether financial decision-makers' opinions on safety are similar to or different from those of other top-level managers, middle managers, line supervisors, or company employees.

In the Huang et al. (2007) study, the distribution of our sample of participants was comparable to that of U.S. companies as a whole. The present study extended and enlarged the earlier dataset using the same methodology as that used in the prior study. However, in this case larger companies were deliberately over-sampled in order to meet the study objective of comparing and contrasting medium- and large-sized company financial decision-makers.

In terms of the definition of company size used, based on the authors' understanding, there is no standardized approach in the literature for defining medium- and large-size companies. For example, the BLS divides the size of enterprises into firms with 1–4 employees, 5–9 employees, 10–19 employees, all the way to firms with 10,000 employees or more. In the current study, the defining of medium- and large-size companies was based on definitions already in use by the insurance industry, instead of artificially combining groups from published data. In this case, the results may best reflect the experience of financial decision-makers in companies in the size classes evaluated.

Although this study focused solely on financial representatives who are not often included in occupational safety research, it should be noted that targeting high-level management with this stringent sampling procedure resulted in a somewhat low response rate. Although there does not appear to be respondent/non-respondent bias (Huang et al., 2007) occurring on examined demographic variables, it is speculated that there may be other respondent/non-respondent bias such as the value of safety or safety climate for these companies. Caution should be used when generalizing the results to the whole population.

The current study explored how corporate financial decision-makers perceive important workplace safety issues as a function of the size of the participant's company. Since it is clear that different industries have different injury rates and injury risks (e.g., BLS, 2008), it is possible that financial decision-makers from different industries have different opinions on safety issues. Due to our focus on comparing company size and having limited sample sizes for the industries involved, we are not able to test differences between different industries or provide specific industry information. Future studies should consider collecting data to examine between industry group differences.

Finally, the study did not explore in-depth information on all the reasons behind the executives' choices. For example, we do not know why financial decision-makers do not set a higher degree of priority on falls, which are the second most expensive workplace injury. Future qualitative research should investigate potential explanations for these types of discrepancies.

In conclusion, this study explored how corporate financial decision-makers perceive important workplace safety issues as a function of the size of managers' company. Results showed that the patterns of responding for participants from medium- and large-size companies were somewhat similar. This study suggested that financial decision-makers in general, whether from medium-size

or large-size companies, focus on the financial aspects when they view safety, and may not be fully aware of the actual nature of workplace injury and safety. More participants from large- than medium-size companies reported that “falling on the same level” was the major cause of workers’ compensation loss in their companies, which is in line with industry loss data; however, both groups rated it as a low priority for resource allocation. Participants from large companies were more likely to see their safety programs as better than those of other companies in their industries, and those of medium-size companies were more likely to mention that there were no improvements needed for their companies.

## Appendix A.

### A.1. Topic 1: Perceived leading safety priorities, losses and concerns

**Question 1:** The following series of questions deal with causes of occupational injuries, and your priority of addressing them in the next 12 months. Now I’d like to ask you to use your professional judgment to rate and differentiate those work hazards on a 5-point scale, with 1 as “Below Average” priority, 2 as “Average” priority, 3 as “Above Average” priority, 4 as “Well Above Average” priority, and 5 as “One of the Highest” priorities. In the next 12 months, what priority for organizational resources and efforts will you and/or your company give to the occupational injuries caused by (12 injury causes—see Table 2 for list)?”

**Question 2:** What is the number one cause of workers’ compensation losses in your company?

**Question 3:** What is the single greatest workplace safety concern for your company in the coming 12 months?

### A.2. Topic 2: Perceived financial impact of safety

**Question 4a:** There are direct costs (such as payments to medical providers and the injured employee) and indirect costs (such as lost productivity and worker replacement costs) associated with the workplace injuries. Based on your professional experience with both types of costs, for each dollar of direct cost, how many dollars are spent on indirect costs?

**Question 4b:** What do you think is the biggest cause of indirect costs?

**Question 5:** In your professional opinion, for each dollar spent improving workplace safety, how many dollars are returned? We are asking for the ratio of dollars spent vs. dollars returned.

### A.3. Topic 3: Issues regarding safety programs

**Question 6:** What is the top benefit of an effective workplace safety program?

**Question 7:** If you could make one modification to significantly improve the workplace safety of your company, what would that be?

**Question 8a:** How do your company’s workplace Safety Programs compare to other companies in your industry? (1) Not as good, (2) the same, (3) better.

**Question 8b (for those who say (3) better on Q8a):** Why do you think your company’s Safety Programs are better compared to other companies in your industry?

*Note:* This appendix with the survey items was published in Huang et al. (2007) and used by permission of the publisher.

## References

- American Society of Safety Engineers (ASSE), 2002. <http://www.asse.org/professionallaffairs/govtaffairs/ngposi10.php>.
- Barling, J., Loughlin, C., Kelloway, K., 2002. Development and test of a model linking safety-specific transformational leadership and occupational safety. *Journal of Applied Psychology* 87, 488–496.
- Bernardin, H.J., Beatty, R.W., 1984. *Performance Appraisal: Assessing Human Behavior at Work*. Kent Publishing Co., Boston, MA.
- Bureau of Labor Statistics, 2008. *Census of Fatal Occupational Injuries (CFOI)—Current and Revised Data*. <http://www.bls.gov/iif/oshcfoi1.htm>.
- Chen, P.Y., Huang, Y.H., 2005. Conducting telephone surveys. In: Leong, F., Austin, J. (Eds.), *Psychology Research Handbook: A Guide for Graduate Students and Research Assistants*. Sage Publications, CA.
- Cohen, A., 1977. Factors in successful occupational safety programs. *Journal of Safety Research* 9, 168–178.
- Cooper, M.D., Phillips, R.A., 2004. Exploratory analysis of the safety climate and safety behavior relationship. *Journal of Safety Research* 35 (5), 497–512.
- Cree, T., Kelloway, E.K., 1997. Responses to occupational hazards exit and participation. *Journal of Occupational Health Psychology* 2, 304–311.
- Eakins, J., 1992. Leaving it up to the workers: sociological perspectives on the management of health and safety in small workplaces. *International Journal of Health Services* 22 (4), 689–704.
- Glendon, A.I., Litherland, D.K., 2001. Safety climate factors, group differences and safety behavior in road construction. *Safety Science*, 39157–39188.
- Head, L., Harcourt, M., 1998. The direct and indirect costs of work injuries and diseases in New Zealand. *Asia Pacific Journal of Human Resources* 36 (2), 46–58.
- Health and Safety Executive, 1993. *The Costs of Accidents at Work (HS(G)96)*. HMSO, London.
- Holmes, N., 1999. An exploratory study of meanings of risk control for long term and acute effect occupational health and safety risk in small business construction firms. *Journal of Safety Research* 30, 61–71.
- Huang, Y.H., Leamon, T.B., Courtney, T.K., Chen, P.Y., DeArmond, S., 2007. Corporate financial decision-makers’ perceptions of workplace safety. *Accident Analysis and Prevention* 39, 767–775.
- Ilgen, D.R., 1990. Health issues at work: opportunity for industrial/organizational psychology. *American Psychologist* 45, 272–283.
- Leigh, J.P., Markowitz, S.B., Fahs, M., Shin, C., Landrigan, P.J., 1997. Occupational injury and illness in the United States: estimates of costs, morbidity, and mortality. *Archives of Internal Medicine* 157 (14), 1557–1568.
- Liberty Mutual Institute for Safety, 2006. 2004 Workplace Safety Index. Accessed at <http://www.libertymutual.com/omapps/ContentServer?cid=1138344114861&pagename=ResearchCenter%2FDocument%2FShowDoc&c=Document>.
- Marsh, T., Davies, R., Phillips, R.A., Duff, R., Robertson, I.T., Weyman, A., Cooper, M.D., 1998. The role of management commitment in determining the success of a behavioural safety intervention. *Journal of the Institution of Occupational Safety and Health* 2, 45–56.
- Occupational Safety and Health Administration (OSHA), 2007. *Safety and Health Management Systems eTool. Module 1—Safety and Health Payoffs, Helpful Statistics*. <http://www.osha.gov/SLTC/etools/safetyhealth/helpfulstatistics.html> (page last updated: 11/12/2007).
- Rosenman, K.D., Kalush, A., Reilly, M.J., Gardiner, J.C., Reeves, M., Luo, Z., 2006. How much work-related injury and illness is missed by the current national surveillance system? *Journal of Occupational and Environmental Medicine* 48 (4), 357–365.
- Siu, O., Phillips, D.R., Leung, T., 2004. Safety climate and safety performance among construction workers in Hong Kong: the role of psychological strains as mediators. *Accident Analysis and Prevention* 36 (3), 359–366.
- Wilson, J., Koehn, E., 2000. Safety management: problems encountered and recommended solutions. *Journal of Construction Engineering and Management* 126, 77–79.
- Zohar, D., 2002. The effects of leadership dimensions, safety climate, and assigned priorities on minor injuries in work groups. *Journal of Organizational Behavior* 23, 75–92.
- Zohar, D., Luria, G., 2005. A multilevel model of safety climate: cross-level relationships between organization and group-level climates. *Journal of Applied Psychology* 90, 616–628.
- Zohar, D., 2008. Safety climate and beyond: a multi-level multi-climate framework. *Safety Science* 46, 376–387.