HHS Public Access

Author manuscript

Saf Sci. Author manuscript; available in PMC 2022 September 21.

Published in final edited form as:

Saf Sci. 2017 March ; 93: 70–75. doi:10.1016/j.ssci.2016.11.015.

The impact of job control on employee perception of management commitment to safety

Clint Pinion[a], **Shelley Brewer**[c], **David Douphrate**[b], **Lawrence Whitehead**[b], **Jami DelliFraine**[d], **Wendell C. Taylor**[b], **Jim Klyza**[a]

[a]Eastern Kentucky University, College of Health Sciences, Department of Environmental Health Science, 521 Lancaster Avenue, Richmond, KY 40475, United States

[b]The University of Texas, School of Public Health, 1200 Pressler Street, Houston, TX 77030, United States

[c]Brewer Consulting Solutions, Inc., 167 South Arrow Canyon Circle, The Woodlands, TX 77389, United States

[d]Medical University of South Carolina, College of Health Professions, 151-B Rutledge Avenue, MSC 962, Charleston, SC 29425, United States

Abstract

Background: Employees self-reporting low job control may perceive management as not being committed to employee safety.

Objective: Assess the relationship between self-reported job control and management commitment to safety while controlling for categorical variables.

Method: A 31-item survey was used in a cross-sectional study to assess the relationship between self-reported job control scores (JCS) and management commitment to safety scores (MCS). Descriptive statistics (means and frequencies), and an ANACOVA (analysis of covariance) were performed on a saturated model.

Results: Study had 71 percent response rate. Results indicate a statistically significant association between MCS and JCS when controlling for job position [$F(5, 690) = 206.97$, $p < 0.0001$, adjusted R-square = 0.60].

Conclusion: Employees with low job control have poor perceptions of management's commitment to safety when controlling for job position.

Keywords

Safety climate; Construction

1. Introduction

Construction work is a hazardous occupation in the United States (Schoenfisch et al., 2010, Waehrer et al., 2007, Zohar, 2010). Construction workers sustain various injury types with different degrees of severity. Work-related injuries and illnesses disproportionately affect the construction industry (Waehrer et al., 2007), causing adverse consequences for the injured

employee, the employer, and the general population (Brewer, 2007). Occupational fatalities cost the United States' construction industry more than ten billion US dollars during a four year period from 1999 to 2002 (NIOSH, 2013).

Construction industry injury prevention programs are developed and implemented to mitigate employee injuries. As Brewer illustrates, construction injury prevention programs are implemented to protect employees, reduce adverse work injury consequences, manage cost, and meet regulatory requirements (Brewer, 2007). Lagging indicators, which are statistics from past injuries or incidents, such as fatality and injury rates, were historically used to design and implement injury prevention programs; however, the construction industry shifted safety focus from lagging to leading indicators. Leading indicators are statistics used to predict future incidents that may cause an injury or illness; they provide a more current organizational snapshot of safety, while focusing on human, managerial, and organization factors that may lead to an incident (Flinn et al., 2000).

Safety climate surveys are considered a leading indicator. Safety Climate is a shared perception of safety within an organization, and examines work practices and policies imposed on employees (Yule, 2003). Safety climate begins with an employee's perception but can become a shared perception among co-workers (Zohar, 2010). Therefore, an individual's perception of safety climate can materialize into a group-level perception. The emergence of individual perception of safety climate into a shared perception occurs through supervisory leadership and symbolic interactionism (Zohar, 2010). Essentially, employees will seek to understand their work environment (e.g. how important is safety), and will find their answer through co-worker interactions and observations of workplace procedures, practices and events (Zohar, 2010). Employees will often look to management for safety cues (Zohar, 2010). Management commitment, the most important construct of safety climate, measures employee perception of management's behavior and attitude toward safety. Through management's actions, behaviors, and communication (aspects of management commitment), employees begin to form a perception of 'what is important' to their work organization, and determine their safety citizenship (Employee participation in activities aimed at improving workplace safety). Thus, employees will perceive safety as a priority if supervisors not only communicate the importance of safety behaviors, practices, and procedures, but also allow the employee to allocate time for safety citizenship (e.g. behavior based safety observation programs, safety inspections, etc).

Management commitment to safety affects employee safety citizenship, safety performance, and injury rates (Michael et al., 2005). Bailey (1989) reported perception of management commitment among employees was positive in plants that had low injury rates. Additionally, Bailey (1989) reported perception of management commitment among employees was negative in plants that had high injury rates (O'Toole, 2002). Simonds and Shafari-Sahrai (1977) reported injury frequency rates were lower in companies that had upper management involvement in workplace safety (O'Toole, 2002). Parker et al. report that when management coach their employees and show compassion, employees will engage in working safely (e.g. participate in safety activities).

A lack of management commitment to safety might be perceived by employees if they are not allotted time for safety citizenship. It should be noted that job demands can affect employee safety citizenship; however, the design of work can provide employees with opportunity to prevent or manage job demands, such as in the form of job control (Turner et al., 2012). Job control is an employee's capacity to control work tasks, work environment, and work task outcomes (Snyder et al., 2008). Job control is important when discussing safety citizenship, as employees must allocate time to participate in safety activities. High job control is correlated with positive safety citizenship, or in other words, high employee involvement in activities aimed at improving workplace safety (Snyder et al., 2008). High job demand and low job control are associated with negative or low safety citizenship (Turner et al., 2012).

Job control is a predictor of employees safely working when management shows commitment to employee safety (Parker et al., 2001). Literature suggests that employee safety citizenship can be increased when managers show commitment and allow employees to have more job control (also known as job autonomy in literature). Based upon literature, we can ask the following: if employees have low job control, will they have a poor perception of management commitment to safety? For example, if an employee's schedule is restrictive and they cannot allocate time for safety activities, they may be more likely to perceive that management isn't committed to employee safety. When employees have poor perceptions of management commitment they may be less likely to participate in safety activities, their safety performance may decline, and they may experience higher injury rates (Michael et al., 2005).

Few studies have examined the relationship between job control and management commitment to safety, despite literature demonstrating a positive relationship between job control and management commitment, and the relationship between job control and outcomes such as employees working safely and employees participating in safety activities (Turner et al., 2012, Parker et al., 2001). This study uses a safety climate survey to capture an employee perception of management commitment and self-reported job control within the construction industry. This study adds crucial knowledge to the construction safety literature by evaluating leading indicator variables. Of great importance to public health, this study aids environmental, health, and safety professionals as they plan and implement injury prevention programs, to prevent injuries to construction workers. The objectives of this study include the following:

1. Assess the relationship between self-reported job control and management commitment to safety.
2. Analyze whether the relationship between job control and management commitment are affected by demographic variables.

We hypothesize that:

1. Self-reported job control and perceptions of management commitment to safety will be positively related and that demographic variables will not affect the relationship. For example, low job control employees will be more likely to have an unfavorable perception of management commitment to safety.

2. Methods

2.1. Instrument

This exploratory cross-sectional study used a 38-item employee perception survey to examine the impact job control has on employee perception of management commitment to safety and general safety climate. The survey measured (1) management commitment to safety (15 questions adapted from the Western Australian Mining Industry Safety Behavior Survey (MOSHAB, 2002)) and (2) job control (16 questions adapted from the Control Scale listed in the NIOSH Generic Job Stress Questionnaire (NIOSH, 1991)) as shown in Table 1. The reliability and psychometric properties of the survey instrument have not been tested. Study participants could respond to each survey question with the following responses: (a) strongly disagree, (b) disagree, (c) neutral, (d) agree, and (e) strongly agree. The survey included the following demographic information: (a) age, (b) sex, (c) education level, (d) region of origin, (e) job position, (f) years worked in construction industry, and (g) years worked with company. Age was divided age into four categories: (1) ⩽24, (2) 25–34, (3) 35–49, and (4) ⩾50. Five categories for education were included: (1) some high school, (2) high school or GED diploma, (3) some college, (4) college degree, and (5) graduate degree. Job positions are categorized based on the Engineering, Procurement, and Construction (EPC) Company's hierarchal structure. Five categories were included for job position: (1) laborer/tradesperson, (2) foreman, (3) superintendent/supervisor, (4) technical support/engineering/HSE/quality, and (5) construction management/project management. Region of origin options included: (1) Canada, (2) United States, (3) Central America, (4) South America, (5) Africa, (6) Western Europe, (7) Eastern Europe, (8) Asia Pacific, and (9) Australia. Options for years worked in the construction industry and years worked with company both included: (1) <1, (2) 1–5, (3) 6–10, (4) 11–15, and (5) ⩾16.

2.2. Inclusion and exclusion criteria

Inclusion criteria for this study were: (1) Individual employed with the EPC Company, (2) Individual able to read and comprehend the informed consent form and survey that is written in English, (3) Individual signs an informed consent form, and (4) Individual completes all sections of the survey. Exclusion criteria for this study included: (1) Individual declined to participate in the study (2) Individual declined to sign an informed consent form, and (3) Individual unable to read and comprehend the informed consent form and survey which are written in English.

2.3. Recruitment and consent

EPC Company employees, from seven sites, meeting the inclusion criteria were invited to participate in this study. The seven sites were located in the following areas: Texas (n = 3), Iowa (n = 1), Alberta (n = 2), and West Virginia (n = 1). The industrial activity of the EPC sites were as follows: one (1) steel plate fabrication shop, two (2) modular fabrication/construction sites and four (4) active construction sites constructing steel plate containment vessels and pipe racks. The employees were recruited during regularly scheduled company safety meetings. During these meetings, supervisors were asked to not be present as the principal investigator explained the study purpose. Employees were reminded that they had the option of not participating in the study. Individuals opting not to participate were

allowed to remain at the meeting, ensuring the anonymity of each employee's decision. EPC employees choosing to participate were given an informed consent form to read and sign. The employees were administered the survey in paper format upon completion of the informed consent form.

2.4. Hypothesis

To test the hypothesis, a job control score (JCS) and a management commitment score (MCS) were calculated for each participant. The survey included sixteen job control items and fifteen management commitment items. Participants rated each question between 1 and 5. A total of 80 points were possible for job control and 75 points were possible for management commitment. The job control scores (JCS) and management commitment scores (MCS) were a summation of scores assigned to each item, divided by the total points possible, expressed as a percent. SAS 9.3 statistical package (SAS Institute, Cary, NC) was used for all data analysis (SAS statistical package, 2016). Descriptive statistics (means and frequencies), and an ANACOVA (analysis of covariance) were performed on a saturated model. The backwards elimination method was then used to reach to the most parsimonious model with an a priori alpha of $p < 0.05$. In this process, the covariate with the highest p-value was removed from the model. This modified model was then rerun for significance of the covariates. The same elimination method was repeated until all remaining covariates were statistically significant.

The Least Squares Difference (LSD), Tukey's Studentized Range (HSD), and Scheffe's Test were simultaneously used with the ANACOVA to better ascertain the differences in pairwise comparisons of the categorical covariate (job position). A power analysis was performed to determine how well the model controlled for type II error (false negatives). In addition, the assumptions of the model, including normality of residuals, collinearity, and homogeneity of variance, were tested. Power was estimated to be greater than 99%. Bartlett's test was used to test homogeneity of the variance for the categorical variable (job position). Bartlett's test can be inaccurate if distribution is non-normal (Box, 1953). The initial saturated model was as follows:

$$Y = \beta 0 + \beta 1(JCS) + \beta 2(\ AGE - CATEGORICAL) + \beta 3(\ GENDER\ ) + \beta 4(\ EDUCATION\ ) + \beta 5(\ JOB\ POSITION\ ) + \beta 6(\ YEARS\ WITH\ \ EMPLOYER) + E$$

where MCS = Management Commitment to Safety Score, JCS = Job Control Score, AGE-CATEGORICAL = Age of Study Participant, GENDER = Self-identified gender of Study Participant, EDUCATION = Highest level of education completed by Study Participant, JOB POSITION = Job position of Study Participant, and YEARS WITH EMPLOYER = Number of years Study Participant worked with EPC company.

The final model was as follows: $Y = \beta_0 + \beta_1(\text{JCS}) + \beta_2(\text{ JOB POSITION}) + E$. Where: MCS = Management Commitment to Safety Score, JCS = Job Control Score, and JOB POSITION = Job positon of Study Participant.

3. Results

3.1. Response rate

A total of 981 EPC employees were invited to participate in this study at the seven sites. Of the total invited, 696 surveys were completed for a response rate of 71%. The completed 699 surveys were included in the analysis for this study.

3.2. Participant demographics

The participants were predominantly male (n = 660, 95%), and were from the United States (n = 493, 71%) and Canada (n = 154, 22%). The majority of participants completed a high school diploma or greater (n = 559, 91%). Only seventeen percent of participants completed a college degree (n = 117). The pool of participants was predominantly comprised of laborers or tradespeople (n = 510, 73%). The majority of participants had worked in the construction industry for more than six years (n = 528, 76%). However, the majority of participants had worked for the EPC company for less than 5 years (n = 501, 72%).

3.3. Overall perceptions of MCS and JCS

An unstratified mean score was calculated for the discrete variables. As Table 2 illustrates, the mean Management Commitment to Safety score (MCS) for all participants was 0.79 (SD = 0.13). The mean Job Control score (JCS) for all participants was 0.70 (SD = 0.13).

3.4. Hypothesis

As Table 3 illustrates, the final ANACOVA results showed a statistically significant association between MCS and JCS when controlling for job position, $F(5, 690) = 206.97$, $p < 0.0001$. The adjusted R-square was 0.599968.

4. Discussion

4.1. JCS, MCS, and Implication on safety citizenship

This study's purpose was to (1) assess the relationship between self-reported job control scores and management commitment to safety scores and (2) to determine if demographic variables modify employee's perception of management commitment to safety. A statistically significant association between MCS and JCS was found when controlling for job position. Thus, employee perception of management commitment to safety scores increased as self-reported job control scores rose. The results of this study imply that employees reporting lower job control are more likely to perceive management as not being committed to employee safety.

This finding has implications on implementing injury and incident prevention programs. High job demand and low job control are associated with low safety citizenship (Turner et al., 2012). Therefore, employees with low job control will be less likely to participate in injury and incident prevention programs. The lack of safety citizenship may be linked to a restrictive schedule that places pressure on employees to perform assigned tasks within a given time frame (e.g. 8 h work shift). Literature suggests that employees with high job

control will be more likely to participate in injury and incident prevention program; high job control is correlated with positive safety citizenship (Snyder et al., 2008).

Intuitively, a positive increase in perception of management commitment to safety would occur as employees perceived that they had more job control. Specifically, if an employee has more job control they may feel that they can control when they take breaks, how they perform job tasks, or even their level of safety citizenship. Ford and Tetrick (2011) offered that employees feeling empowered or having more job control were more likely to perform safety behaviors (e.g. safety citizenship), to be more involved in safety management, and to attempt to influence coworker safety behavior (Ford and Tetrick, 2011). If management allows employees to have more job control, employees will have increased safety citizenship and ultimately have better perceptions of management commitment to safety.

Workplaces with greater job autonomy (job control) will have fewer occupational accidents (Jitwasinkul and Hadikusumo, 2011). Positive employee perceptions of management commitment to safety is considered a catalyst for employee safety performance and increased safety citizenship (Michael et al., 2005). Employees with low job control may not feel they can have high safety citizenship and may be more vulnerable to workplace injuries and incidents. Employees may perceive that they can prevent workplace incidents or control experiencing injuries at work if they feel the environment in which they work is supportive of or committed to their safety (Snyder et al., 2008). Employees may feel more capable of controlling whether or not they experience work injuries if they perceive that management is committed to their safety.

4.2. Job position and management commitment to safety

This study identified significant differences in mean Management Commitment to Safety Scores (MCS) between job position categories. Specifically, individuals self-identifying in job types with more managerial responsibilities (e.g. project management) reported higher mean MCS than job types with less managerial experience (e.g. laborers and tradesperson). No significant difference in mean MCS was identified between categories of the remaining variables: age, region of origin, education level, years worked in the construction industry, and years worked with the EPC Company.

These findings strengthen and support current research that reports mixed results concerning the influence of demographics on safety climate measures, such as perception of management commitment to safety. For example, Fang et al. (2006) reports that age and education level are not related to perception of safety climate. In the same study, gender, work experience in the construction industry, and work experience with the company did not influence participant’s perceptions of safety climate. The significant difference in mean MCS among job positions was expected in this study, as different levels of employees participated in the study (e.g. laborers, foreman, engineers, project management, etc.). Site situational conditions and work activities play a more important role in conducting climate research than demographic variables. Site situational conditions and work activities would be expected to affect climate research, because safety climate focuses on employees’ perception of practices, behaviors, and procedures regarding safety at their job site (Zohar, 2010).

Huang et al. (2006) pointed out that employees have different safety responsibilities based on job title. Employees who are laborers or tradesmen typically are the target of safety programming and training; however, management, such as project managers, foremen, and supervisors typically administer safety programming. Therefore, different safety experiences based on job type will result in employees having various perceptions of management commitment to safety. Differences in safety climate perception based on job type have been reported in literature, with management having a more positive safety climate perception (Huang et al., 2012).

4.3. Limitations

A major limitation of this study is mono-method bias, as the study relied on a single cross-sectional survey tool using self-reporting. All variables in the study were measured using self-report measures, and were collected at one point in time. Although limiting, self-report surveys are a useful tool in assessing employee's perceptions on safety climate and management commitment to safety and are widely used. This study could be enhanced if it were longitudinal, with the survey being administered to the same participants at different times.

4.4. Strengths

This study has several strengths. Previous research has not examined the association between job control and employees' perception of management commitment to safety. This study shows a positive relationship between job control and management commitment to safety. The finding may guide future injury and incident prevention programs in the construction industry. Specifically, this study suggests that focus should be given on ensuring employees have adequate support (management commitment) and the ability to make time for safety citizenship through increased job control. Second, this study strengthens literature focusing on the relationship between employee demographics and employee perception of management commitment to safety. This study's findings regarding demographic characteristics and safety climate surveys are consistent with existing studies (e.g. demographic characteristics have minimal impact on safety climate survey outcomes).

5. Conclusions

The findings of this study have implications for practice. The findings imply that employees with low job control will have poor perceptions of management commitment; poor perceptions of management commitment are linked to decreased safety citizenship, poor safety performance, and higher employee injury rates (Michael et al., 2005). Thus, employees with low job control are more likely to be involved in a workplace injury or incident. This study suggests Health, Safety, and Environmental practitioners consider employee job control when designing injury and incident prevention programs. Individuals having more control over their work activities will be able to allot time for safety citizenship, and will have positive perceptions of management commitment to safety.

Demographic variables, with the exception of job control, are not important in understanding the impact of job control on employee perceptions of management commitment to safety.

This study implies that Health, Safety, and Environmental practitioners place focus on employees based on job position when implementing injury and incident prevention programs, giving specific attention to employees with low job control (e.g. laborers in the construction industry).

This study also illustrates the need to further examine the relationship between self-reported job control and perception of management commitment to safety. Specifically, future studies should further examine if employee perception of management commitment and job control affect employee safety participation and safety performance.

References

Bailey C. Using perception surveys to assess safety system effectiveness Profess. Safety, 2 (1989), pp. 22–26

Box GEP Non-normality and tests on variance Biometrika, 40 (1953), pp. 318–335

Brewer S. Workplace Injury/illness Prevention and Loss Control Programs: A Series of Systematic Reviews Dr.PH Dissertation University of Texas School of Public Health, Houston (2007)

Fang D, Chen Y, Wong L. Safety climate in construction industry: a case study in Hong Kong J. Constr. Eng. Manag, 132 (6) (2006), pp. 573–584

Flinn R, Mearns K, O'Connor P, Bryden R. Measuring safety climate: identifying the common features Saf. Sci, 34 (2000), pp. 177–192

Ford M, Tetrick L. Relations among occupational hazards, attitudes and safety performance J. Occup. Health Psychol, 16 (1) (2011), pp. 48–66 [PubMed: 21280944]

Huang Y, Ho M, Smith G, Chen Safety climate P. and self-reported injury: assessing the mediating role of employee safety control Accid. Anal. Prev, 38 (2006), pp. 425–433 [PubMed: 16442068]

Huang Y, Verma S, Chang W, Courtney T, Lombardi D, Brennan M, Perry M. Management commitment to safety vs. employee perceived safety training and association with future injury Accid. Anal. Prevent, 47 (2012), pp. 94–101

Jitwasinkul B, Hadikusumo B. Identification of important organizational factors influencing safety work behaviors in construction projects J. Civil Eng. Manag, 17 (4) (2011), pp. 520–528

Michael J, Evans D, Jansen K, Haight J. Management commitment to safety as organizational support: relationships with non-safety outcomes in wodd manufacturing employees J. Saf. Res, 36 (2005), pp. 171–179

Mines Occupational Safety and Health Board (MOSHAB), 2002. Safety Behavior Survey of the Western Australian mining industry.

National Institute for Occupational Safety and Health (NIOSH), 1991. Generic Job Stress Questionnaire.

National Institute of Occupational Safety and Health, 2013. NIOSH Fatal Occupation Injury Cost Fact Sheet: Construction. Available from: <http://www.cdc.gov/niosh/docs/2006-153/>.

O'Toole M. The relationship between employees' perceptions of safety and organizational culture J. Saf. Res, 33 (2002), pp. 231–243

Parker S, Axtell C, Turner N. Designing a safer workplace: importance of job autonomy, communication quality, and supportive supervisors J. Occup. Health Psychol., 6 (3) (2001), pp. 211–228 [PubMed: 11482633]

SAS statistical package [computer program], 2016. Version 9.3. SAS Institute: Cary, North Carolina.

Schoenfisch A, Lipscomb H, Shislov K, Myers D. Nonfatal construction industry-related injuries treated in hospital emergency departments in the United States, 1998–2005 Am. J. Ind. Med, 53 (2010), pp. 570–580 [PubMed: 20506460]

Simonds RH, Shafari-Sahrai Y. Factors apparently affecting injury frequency in eleven matched pairs of companies J. Saf. Res, 9 (1977), pp. 120–127

Snyder L, Krauss A, Chen P, Finlinson S, Huang Occupational safety Y: application of the job demand-control-support model Accid. Anal. Prev, 40 (2008), pp. 1713–1723 [PubMed: 18760100]

Turner N, Stride C, Carter A, McCaughey D, Carroll A. Job demands-control-support model and employee safety performance Accid. Anal. Prev, 45 (2012), pp. 81–817

Waehrer G, Dong X, Miller T, Haile E, Men Y. Costs of occupational injuries in construction in the United States Accid. Anal. Prev, 39 (2007), pp. 1258–1266 [PubMed: 17920850]

Yule S. Senior Management Influence on Safety Performance in the UK and US Energy Sectors Doctoral thesis University of Aberdeen, Scotland (2003)

Zohar D. Thirty years of safety climate research: reflections and future directions Accid. Anal. Prev, 42 (2010), pp. 1517–1522 [PubMed: 20538108]

Table 1.

Management commitment to safety and job control survey questions.

Management commitment to safety questions
1. Management provides positive feedback for following safe work practices
2. Employees are encouraged to report or bring safety issues to the attention of management
3. Employees are encouraged by management to stop unsafe work
4. Management actively discourages unsafe behavior
5. Management provides up to date safe work procedures that are available at site
6. Employees get feedback from management in incident/accident investigations
7. Management spend adequate time talking with employees about safety
8. Management provides recognition for employees working safely and not taking risks
9. Management provides employees with proper training to safely perform their job tasks
10. Risk, short cuts or unsafe behavior are unacceptable to management
11. Management provides safety bulletins and safety incident reports that are readily available for you to read
12. Management is skilled and competent to ensure the safety of their workers
13. Management provides easy access to safe work procedures
14. Employees are provided with adequate safety information relevant to their work
15. Management reacts constructively to safety issues that are raised
Job control questions
16. Employees are routinely involved in the development of safe work procedures
17. Employees have influence over the variety of tasks they perform
18. Employees influence the policies, procedures, and performance concerning their work
19. Employees have influence over the availability of supplies and equipment they need to do their work
20. Employees are properly trained by management in the use of writing safe work procedures
21. Employees have influence over the amount of work they do
22. Employees have influence over the training of other employees in their unit
23. Employees have influence over the quality of work that they do
24. Employees have influence over the decisions as to when things will be done in their work unit
25. In general, employees have influence over their work and work related factors
26. Employees have influence over the order in which they perform tasks at work
27. Employees have influence over the pace of their work
28. Employees have influence over the decisions concerning which individuals they work with
29. Employees have influence over the hours or schedule that they work
30. Employees have influence over the availability of materials they need to do their work
31. Employees have influence on when they work ahead and take short rest breaks during work hours

Table 2.

Means of continuous variables (unstratified).

Variable	N	N Miss	Mean	Minimum	Maximum	Standard deviation
MCS	696	0	0.79	0.12	1.00	0.13
JCS	696	0	0.70	0.19	1.00	0.13

Table 3.

ANACOVA Final Model: the GLM procedure (dependent variable – MCS).

Source	DF	Sum of squares	Mean square	F value	Pr>F
Model	5	6.61	1.32	206.97	<0.0001
Error	690	4.41	0.01		
Corrected Total	695	11.02			

R-Square	Coeff Var	Root MSE	MCS Mean
0.60	10.05	0.08	0.79

Source	DF	Type I SS	Mean square	F value	Pr>F
JCS	1	6.50	6.50	1017.75	<0.0001
JOB_POSITION	4	0.11	0.03	4.28	0.0020

Parameter	Estimate	Standard error	t value	Pr>t
Intercept	0.326 B	0.012	17.20	<0.0001
JCS	0.713	0.023	31.63	<0.0001
JOB_POSITION FOREMAN	−0.024 B	0.014	−1.79	0.0733
JOB_POSITION LABORER[A]	−0.033 B	0.011	−3.02	0.0026
JOB_POSITION PROJ MGMT[B]	0.033 B	0.024	1.37	0.1719
JOB_POSITION SUPERVISORS[C]	−0.021 B	0.017	−1.25	0.2106
JOB_POSITION TECHNICAL[D]	0.000 B			

[A]Included employees self-identifying as laborer or tradesperson.

[B]Included employees self-identifying as construction management or project management.

[C]Included employees self-identifying as supervisors or superintendents.

[D]Included employees self-identifying as technical support, engineering, HSE professionals or quality. Table 4 shows difference between means and significance of pairwise comparisons for the categorical variable job position. Comparisons that are significant are denoted with asterisks.

Table 4.

t Tests: Least Significant Difference (LSD) for MCS.

Alpha	0.050
Error Degrees of Freedom	690
Error Mean Square	0.006
Critical Value of t	1.96

JOB_POSITION	Difference between means	95% Confidence limits	Comparison
PROJ MGMT[B] – FOREMAN	0.064	0.017	0.111***
PROJ MGMT[B] – SUPERVISOR[C]	0.072	0.020	0.123***
PROJ MGMT[B] – LABORER[A]	0.086	0.042	0.130***
TECHNICAL[D] – LABORER[A]	0.046	0.025	0.067***
FOREMAN – LABORER[A]	0.022	0.002	0.041 ***

[A] Included employees self-identifying as laborer or tradesperson.

[B] Included employees self-identifying as construction management or project management.

[C] Included employees self-identifying as supervisors or superintendents.

[D] Included employees self-identifying as technical support, engineering, HSE professionals or quality.

*** Comparisons significant at the 0.05 level.