

This article was downloaded by: [University of Alberta]

On: 19 July 2010

Access details: Access Details: [subscription number 920763647]

Publisher Taylor & Francis

Informa Ltd Registered in England and Wales Registered Number: 1072954 Registered office: Mortimer House, 37-41 Mortimer Street, London W1T 3JH, UK



International Journal of Environmental Health Research

Publication details, including instructions for authors and subscription information:

<http://www.informaworld.com/smpp/title~content=t713425582>

Obtaining compliance with occupational health and safety regulations: a multilevel study using self-determination theory

Igor Burstyn^a; Lorraine Jonasi^a; T. Cameron Wild^a

^a School of Public Health, University of Alberta, Edmonton, Alberta, Canada

Online publication date: 19 July 2010

To cite this Article Burstyn, Igor, Jonasi, Lorraine and Wild, T. Cameron (2010) 'Obtaining compliance with occupational health and safety regulations: a multilevel study using self-determination theory', International Journal of Environmental Health Research, 20: 4, 271 – 287

To link to this Article: DOI: 10.1080/09603121003663461

URL: <http://dx.doi.org/10.1080/09603121003663461>

PLEASE SCROLL DOWN FOR ARTICLE

Full terms and conditions of use: <http://www.informaworld.com/terms-and-conditions-of-access.pdf>

This article may be used for research, teaching and private study purposes. Any substantial or systematic reproduction, re-distribution, re-selling, loan or sub-licensing, systematic supply or distribution in any form to anyone is expressly forbidden.

The publisher does not give any warranty express or implied or make any representation that the contents will be complete or accurate or up to date. The accuracy of any instructions, formulae and drug doses should be independently verified with primary sources. The publisher shall not be liable for any loss, actions, claims, proceedings, demand or costs or damages whatsoever or howsoever caused arising directly or indirectly in connection with or arising out of the use of this material.

Obtaining compliance with occupational health and safety regulations: a multilevel study using self-determination theory

Igor Burstyn, Lorraine Jonasi and T. Cameron Wild*

School of Public Health, University of Alberta, Edmonton, Alberta, Canada

(Received 6 August 2009; final version received 23 December 2009)

It was hypothesized that occupational health and safety (OHS) inspectors who prefer to use autonomy supportive tactics to resolve workplace conflicts (e.g. providing rationale, choices) would be more effective in resolving industry non-compliance with OHS regulations, compared to inspectors who prefer to use coercive tactics (e.g. deadlines, pressure). Preferences for resolving work conflicts were collected from 39 Canadian OHS inspectors and were linked to administrative records documenting 17,960 industry inspection episodes and 29,451 compliance orders issued by those inspectors from 2003–2006. Multilevel Poisson and negative binomial regression models examined associations between inspector autonomy-supportiveness and compliance outcomes, adjusting for covariates at the inspector level (e.g. job experience, number of inspection episodes) and at the worksite level (e.g. workplace safety record). Relative to coercive inspectors, autonomy-supportive inspectors issued fewer severe compliance orders and achieved compliance after fewer worksite visits. Use of autonomy-supportive approaches may reduce exposure to preventable injuries at non-compliant worksites.

Keywords: workplace safety; compliance; psychosocial factors

Introduction

In many jurisdictions around the world, workplace inspections are used to facilitate adherence to occupational health and safety (OHS) regulations. Compliance orders issued to worksites as a result of OHS inspections are designed to reduce or eliminate risks of occupational injuries and exposure to health hazards. Research shows that greater frequency and severity of penalties issued as a result of non-compliance to health and safety regulations are associated with reduced risk of employee injuries at large US manufacturing plants (Viscusi 1986; Gray and Scholz 1993). In a similar Canadian study, Lanoie (1992) reported that a 1% increase in occupational health and safety inspection rates was associated with a 0.2–0.3% decrease in frequency of individual workplace injuries. A Canadian study of construction industries predicted lost-time claims for workplace injuries from inspection intensity, prior workplace convictions for safety violations, job turnover, compensation payments, unemployment, and a time trend. Results demonstrated that inspections had no effect on risk

*Corresponding author. Email: cam.wild@ualberta.ca

of employee injuries, but were associated with reduced risk of work-related fatalities (Auld et al. 2001).

These studies and, we would argue, most approaches to OHS inspections, implicitly assume that quality and effectiveness of the inspection process is invariant across inspection episodes and that non-compliance with health and safety regulations is resolved by *administrative* and *organizational* variables such as severity of infractions, number of compliance orders and/or penalties issued to remedy those infractions, safety record of the worksite being inspected, and so on. However, this assumption can be questioned in the light of other studies showing that *psychosocial* variables also influence occupational health and safety outcomes. For example, a growing body of research suggests that workplace safety climate (i.e. shared perceptions of employees about organizational policies, procedures, and practices that promote workplace safety) are also important determinants of workplace health and safety outcomes (Griffin and Neal 2000; Zohar 2000; Hofmann et al. 2003; Smith et al. 2006; and for a recent review, see Christian et al. 2009). One line of research has emphasized interpersonal factors within organizations. Clarke and Ward (2006) compared transformative versus transactional leadership styles with respect to employee participation in safety initiatives and concluded that a combination of tactics, including rational arguments, involvement in decision making, and generating enthusiasm for safety can all influence employee compliance with workplace safety initiatives and policies.

These psychosocial studies have focused on interpersonal variables in relation to OHS initiatives and policies from an intraorganizational perspective, i.e. within organizations and workplaces. However, there has been little attempt to examine whether interpersonal variables might play a similarly important role in shaping compliance to OHS regulations from an interorganizational perspective. This issue is particularly important to address with respect to OHS inspections, given that they essentially involve interorganizational (i.e. government, industry) and interpersonal (i.e. inspector, worksite representative) relationships. Thus, in this study we explored whether differences in the tactics that inspectors might use to handle interactions with company representatives (e.g. adopting a “hard line” versus an empathic, educational approach) influence the process of resolving workplace non-compliance with health and safety regulations. The present research examined this issue using a multilevel approach in which compliance outcomes related to health and safety inspections (i.e. administrative outcomes generated from the inspection process) were predicted from differences in inspectors’ preferred approaches for resolving work conflicts and motivating subordinates.

Theoretical perspective and hypothesis

Although administrative and organizational variables such as inspection rates and workplace safety records are undeniably associated with compliance outcomes, we suggest that there is value in conceptualizing inspections as highly negotiated social events occurring between dissimilar social actors. In this study, we assumed that inspectors possess the requisite technical competence to detect violations of OHS regulations and to issue appropriate compliance orders, but that a superior-subordinate interpersonal relationship exists, i.e. inspectors have coercive legislative power that they can apply at their discretion to influence employers to comply with OHS regulations, with worksite representatives being aware of

this power imbalance. Within this context, we propose that health and safety inspectors differ with respect to the interpersonal tactics and strategies that they prefer to use to motivate worksite representatives to be compliant with health and safety regulations, and that differences across inspectors in beliefs about the value of adopting a coercive, authoritarian approach versus an empathic, educational approach would be manifested in administrative outcomes of inspections across worksites.

Self-determination theory (SDT; Deci and Ryan 1985, 2002) provides a useful theoretical framework for understanding this hypothetical sequence of events, since this theory addresses how social environments influence motivational processes underlying compliance and other forms of individual and organizational behavior change. SDT characterizes motivation to engage in activities on a continuum, ranging from activities that are completely initiated and controlled by external social forces, to activities that are fully self-determined. According to SDT, people have fundamental psychological needs for autonomy, relatedness, and competence. When social events promote perceptions of being coerced, intrinsic motivation for engaging in activities is undermined. A large body of research indicates that when people use coercive tactics to change others' behavior (e.g. by using deadlines, pressuring people to achieve outcomes, using surveillance and other social controls), interest, engagement, and persistence in target activities is reduced (Deci and Ryan 2002). Conversely, when people use autonomy-supportive tactics to change others' behavior (e.g. by providing choices about how to proceed, empathy, and informative rationale for decisions), interest, engagement, and persistence in target activities is enhanced (Deci and Ryan 2002).

These basic predictions from SDT have been supported by an extensive body of applied research. For example, intraorganizational research using SDT shows that in comparison to coercive work environments, autonomy-supportive work environments are associated with more positive employee outcomes (for a review, see Gagne and Deci 2005; Van den Broek et al. 2008). Deci et al. (1989) reported that autonomy supportive interpersonal tactics adopted by managers (i.e. acknowledging subordinates' perspectives, providing relevant information to them in a non-controlling way, offering choice, and encouraging self-initiation rather than pressuring them to behave in specified ways) was associated with greater job satisfaction and higher level of trust in corporate management. Similar findings were reported in two studies using employees in the financial industry, with individual differences in managerial autonomy support positively predicting employees' psychological adjustment to work and more favorable performance evaluation ratings (Baard et al. 2004). Gagne et al. (2000) reported that perceived managerial autonomy support longitudinally predicted acceptance of organizational change among employees of a Canadian telecommunications company. Importantly, positive effects of autonomy support have been replicated and are therefore transferable to a variety of applied research contexts that also involve superior-subordinate relationships. For example, patients who perceive that their physician is autonomy-supportive exhibit greater compliance to medical regimens, compared to patients who perceive their health provider as controlling or coercive (Williams et al. 1998, 2007; see Williams 2002 for a review). Similarly, interest in learning and persistence in educational activities are enhanced when students are exposed to educators who use autonomy-supportive, rather than controlling and coercive teaching styles (see Reeve 2002; Niemiec and Ryan 2009; Pelletier and Sharp 2009; for reviews).

The preceding studies are consistent with the general notion that superiors (i.e. managers, physicians, teachers) are more successful in motivating subordinates (i.e. employees, patients, students) when they use autonomy-supportive (rather than controlling) social influence tactics. However, no research to date has attempted to replicate these findings in the occupational health and safety area, nor has this psychosocial issue been investigated in an interorganizational context. Building on previous findings using SDT showing that autonomy supportive superiors foster greater trust in management (Deci et al. 1989), it is reasonable to posit that autonomy supportiveness exhibited by OHS inspectors would facilitate greater interorganizational trust and openness to organizational learning during inspection episodes. If so, government inspectors who prefer to use autonomy-supportive tactics to resolve workplace problems (e.g. by providing rationale, choices, and empathy) should be more effective in resolving non-compliance with OHS regulations than inspectors who prefer to use coercive tactics (e.g. deadlines, pressure, and surveillance). The present research tested this general prediction using a combination of primary and administrative data on OHS inspections. Because this is the first study to our knowledge attempting to apply SDT to an industrial OHS context, our analytic approach was merely designed to establish whether or not inspectors' autonomy-supportiveness was associated with worksite compliance outcomes, taking into account the effects of a number of inspector covariates (e.g. work experience, educational attainment, rates with which inspectors issue compliance orders generally) and workplace covariates (e.g. severity of violations of health and safety regulations, worksite history of OHS problems). If such an association was observed, this would: (a) justify conducting further research on the mechanisms by which autonomy-supportive inspectors enhance compliance outcomes, and (b) support the general idea that industrial health and safety research may benefit from investigating the impact of interpersonal variables from an interorganizational perspective.

Methods

Study setting

The study was conducted in the regulatory environment of Alberta, a Canadian province that employs about 1.7 million workers in over 110,000 workplaces. The provincial government employs approximately 80 occupational health and safety inspectors who interact with worksites to identify and resolve non-compliance with health and safety regulations. Inspectors engage in two types of activities: *proactive* inspections (i.e. employer education and prevention of workplace health hazards) and *reactive* inspections (i.e. targeted investigation of worksites in response to reported OHS incidents and/or complaints). In either type of inspection, when inspectors detect non-compliance with regulatory health and safety requirements, several outcomes are possible. In some cases, inspectors are legally obliged to issue stop-use or stop-work orders (e.g. for reactive inspections involving fatalities). For less serious violations of health and safety regulations, inspectors are able to use their discretion in handling non-compliance. At the time this study was conducted¹ when inspectors observed workplace non-compliance with health and safety regulations, they were able to use discretion to issue either *voluntary* compliance orders (i.e. informal warnings, with the expectation that the worksite will correct the violation with no further scrutiny by the inspector), or *formal* compliance orders (i.e. serious warnings, with the expectation that the inspector will put the worksite under

surveillance and actively follow up to ensure that compliance orders are acted upon). As well, inspectors could exercise discretion with respect to the *number* of compliance orders issued as a result of initial and subsequent worksite inspections. Finally, for either formal or voluntary compliance situations, inspectors could exercise discretion in scheduling follow-up inspections with worksites to determine whether compliance with OHS codes has been achieved. Each inspection episode is logged into an administrative database, with codes indicating the type of compliance order issued, and if appropriate, whether or workplaces successfully resolved non-compliance with health and safety violations.

Procedure

Inspector survey

In January 2007, all 82 provincial government occupational health and safety inspectors were mailed a self-completed survey containing socio-demographic information, as well as an instrument to assess individual differences in the use of autonomy-supportive or coercive interpersonal tactics to deal with workplace problems exhibited by a subordinate. To enhance response rates, a second survey was mailed four weeks after the initial mailing.

Administrative data and linkage

We identified all workplace inspection episodes from 2002–2006 using the Alberta Government's Worksite Inspection Tracking System (WITS). In order to derive worksite covariates, we linked the WITS database to the Worker's Compensation Board (WCB) database using the employer's WCB account and an industry code. Inspected worksites were identified using a combination of WCB identification number and WCB industrial classification. A total of 53,943 inspections were conducted from 2003–2006 by 130 different inspectors, with 56,195 compliance orders issued over the same time period. To identify inspection episodes specifically conducted by OHS officers who responded to our inspector survey, the WITS and inspector survey datasets were linked using first and last names of each inspector.

Measures

Inspector covariates

The survey assessed each inspector's age, their highest level of educational achievement (college or university degree versus lesser educational attainment), length of tenure as an inspector (in years), and previous work experience in the occupational health and safety field (i.e. whether or not respondents were previously employed in the private sector as a health and safety consultant prior to their current position).

Independent variable

The *Problems at Work* questionnaire is widely-used, reliable and valid instrument assessing individual differences in the use of autonomy supportiveness in workplace

settings (Deci et al. 1989). This measure does not specifically assess health and safety inspections per se, but instead presents a series of eight hypothetical scenarios depicting problems that respondents typically encounter in the workplace, such as poor job performance of subordinates, changes in workload among employees, and complaints about work environments (e.g. “Harry, who manages the parts department, seems to be creating something of a bottleneck. Important parts are often ‘on order’ and not in stock, and he often is slow in meeting short notice demands and ‘emergency’ situations. The best thing for his supervisor to do is: . . .”). Following each scenario, respondents were given four possible ways to respond to each scenario. Two of the tactics refer to an autonomy supportive approach (e.g. “Find out from Harry what he thinks is wrong and see if you can help him figure out how to better organize his operation”). The other two tactics refer to a coercive approach (e.g. “Insist that the orders be done within a specified time limit, and check to be sure he is meeting the deadlines”). Inspectors rated the appropriateness of engaging in each tactic for each of the eight scenarios on a 7-point scale (1 = very inappropriate; 4 = moderately appropriate; 7 = very appropriate). As in other studies using this measure (Deci et al. 1989; Gagne and Deci 2005) we assumed that respondent ratings on the hypothetical items assess preferences that are applicable to a variety of work settings. As such, we computed a single autonomy supportiveness score for each inspector across the eight scenarios by weighting the appropriateness ratings for highly controlling tactics with a score of -2 , moderately controlling tactics with a -1 ; moderately autonomy supportive tactics with $+1$; and the highly autonomy supportive tactics with $+2$ (Deci et al. 1989). The algebraic sum of the ratings across scenarios assessed differences in inspectors’ preferences with higher scores reflecting inspectors’ endorsement of more autonomy-supportive tactics and lower scores reflecting their endorsement of more coercive tactics. For our analyses we split this composite score at the median (6.43), with inspectors scoring below the median classified as being coercive and inspectors scoring above the median classified as being autonomy supportive. Two arguments supported our decision to dichotomize our primary independent variable. First, with respect to disseminating study results back to the OHS inspection community, groundwork conducted for this study indicated that inspectors could understand the premise of our study when the focal independent variable were treated as a categorical between-subject variable, i.e. by categorizing respondents as autonomy supportive versus coercive inspectors, rather than as a continuous scale measure. Second, from a statistical perspective, while dichotomization of the independent variable was associated with loss of information, any gain in statistical power afforded to our analyses by treating inspector autonomy supportiveness as a continuous measure would be negligible, given the very large sample of inspection events in our main analyses.

Worksite covariates

Linked administrative data were used to operationalize a number of inspection and worksite covariates. At the level of inspection episodes, we created variables assessing the year that each inspection episode was conducted and the type of inspection conducted during each episode (proactive or reactive). For each inspection episode, we computed the number of compliance orders (of all types) issued to the worksite; these data were aggregated also across inspectors within each study year. Worksite variables included geographic region of each inspected worksite

(northern or southern Alberta), each inspected worksite's history of violations of health and safety regulations (i.e. number of previous OHS violations recorded in the administrative database), and worksite safety record, i.e. lost time claim rates, operationalized as the number of WCB claims divided by the size of the worksite's payroll (an estimate of workforce size).

Outcome variables

Our study hypothesis was tested using three proxy measures of inspector effectiveness. First, we calculated *severity* of the inspection outcome, i.e. whether voluntary or formal compliance orders were issued as a result of inspections. High severity outcomes were defined as inspection episodes that resulted in a formal compliance order being issued to the employer. Low severity outcomes were defined as either no compliance order or a voluntary compliance order being issued to the employer. Second, we calculated the *number of compliance orders issued* after first inspection episodes, without regard for severity of the order. Finally, we used a proxy measure of *time to achieve compliance*, which was derived by counting the number of worksite visits required by each inspector to change the status of non-compliant worksites from high to low severity, as defined earlier.

Statistical analyses

Individual differences in inspector autonomy-supportiveness would only be expected among inspection episodes for which it was possible for OHS inspectors to use discretion in handling and negotiating outcomes of the inspection process. Consequently, we excluded fatality inspections and all other inspection for which inspectors were legally obligated to issue stop-use or stop-work compliance orders from our analyses. Thus, we analyzed 17,960 first inspection episodes not repeated at the same workplace and 29,451 compliance orders issued as a result of these inspection episodes by the 39 surveyed inspectors who had complete survey data and to workplaces that had a valid WCB accounts. We analyzed a multilevel data structure, with inspection severity and time to achieve compliance each nested within worksites and inspectors. Three statistical models were estimated for these discretionary inspections: (i) predicting severity of compliance orders issued during first inspection episodes; (ii) predicting the number of compliance orders issued after initial inspection episodes; and (iii) predicting the number of inspector visits required to achieve compliance with a given compliance order. For each outcome, our dichotomized inspector autonomy-supportiveness measure was included in models that also included the inspector, inspection, and worksite covariates described earlier. One year lagged variables were constructed for each workplace's history of safety records and inspections. Thus, all primary analyses were restricted to inspections conducted between the years 2003 and 2006, to allow the use of 2002 data to construct lagged variables for outcomes observed in 2003.

Modified Poisson regression with robust error variance (Zou 2004) was used to predict severity of compliance order(s) issued by inspectors in the first inspection episode (high versus low severity) from inspector autonomy supportiveness and the study covariates. Negative binomial regression was used to predict the number of orders written on the first inspection episode (a count variable) from inspector autonomy-supportiveness. The negative binomial model was chosen to correct for

over-dispersion. Finally, modified Poisson regression which adjusted for under-dispersion (by scaling deviance) was used to predict the number of inspector visits required to achieve compliance for a given order from inspector autonomy supportiveness and the study covariates. For the second and third analyses, generalized estimating equations (GEE) were used to account for the clustered nature of the data, i.e. dependency among compliance orders for given inspection episodes.

For each analysis, we adopted the same model-building strategy. First, we entered main effect terms for the hypothesized independent variable of interest (inspector autonomy supportiveness) and study covariates, and interactions between the independent variable and the study covariates. Second, we removed all non-significant interaction terms ($p > 0.05$) from each model. Finally, we removed all non-significant main effects if they were not involved in a significant interaction from each model. The remaining effects were retained in final models for interpretive purposes. All statistical analyses were implemented using PROC GENMOD of SAS Version 9 (SAS Institute, Cary, NC, USA).

Results

Inspectors and inspection episodes: descriptive results

Forty-five inspectors completed the survey (21 and 24 from the north and south administrative regions, respectively, with four refusals; response rate = 55%). Descriptive analyses indicated that the M age of respondents was 44 (SD = 11). Most (87%) respondents had a college or university degree, were employed as a government inspector for an average of 4.4 years (SD = 7.5 years). Most (72%) respondents indicated that they had “considerable” experience in the OHS field. Almost a half of the respondents (41%) also had some experience as private consultants in the OHS field. Among the 45 respondents, complete survey data was only available for 39 inspectors who were evenly split between northern (19) and southern (20) administrative study regions. Respondents with complete data on the survey were very similar to all respondents, except that they were slightly younger ($M = 43.8$ vs. 44.2 years) and had a slightly shorter tenure in their job ($M = 6.4$ vs. 6.8 years).

Most inspections (72%) did not result in a compliance order being issued, but the remaining inspection episodes issued up to 28 compliance orders, with an average of three compliance orders issued per initial inspection. Bivariate analyses indicated that coercive inspectors issued severe compliance orders slightly more often than autonomy-supportive inspectors (26% vs. 24% of inspection episodes, respectively). In general, workplace non-compliance was resolved quickly, with 97–99% of cases being resolved within no more than two return visits by inspectors. The remaining cases required up to six return visits to achieve compliance. Inspectors from the two geographical regions under study contributed approximately equal number of compliance orders and inspections for the study.

Predicting inspection outcomes

Severity of compliance orders issued

As shown in Table 1, study covariates associated with an *increase* in the relative risk (RR) for issuing severe compliance orders included: compliance orders written after

Table 1. Multilevel Poisson regression predicting severity of compliance order issued after first inspections: final model.

| Predictor | Count | Relative risk (RR) | 95% Confidence interval (CI) |
|--|--------|--------------------|------------------------------|
| Main effects – inspectors | | | |
| Autonomy supportiveness | 17,758 | 0.78 | 0.71–0.86 |
| Years of employment (<5 years vs. 5+ years) | 14,289 | 0.88 | 0.84–0.92 |
| Prior experience in OHS (considerable vs. little) | 19,535 | 0.66 | 0.63–0.69 |
| Main effect – type of inspection | | | |
| Geographic location of Inspection (north vs. south) | 17,814 | 5.09 | 4.74–5.47 |
| Proactive | 14,251 | Reference = 1 | – |
| Reactive | 8,692 | 1.57 | 1.46–1.97 |
| Other | 6,508 | 1.72 | 1.60–1.86 |
| Main effect – inspection year | | | |
| 2003 | 6,317 | 0.55 | 0.50–0.60 |
| 2004 | 7,108 | 0.70 | 0.64–0.76 |
| 2005 | 8,109 | 0.92 | 0.86–0.99 |
| 2006 | 7,917 | Reference = 1 | – |
| Interactions | | | |
| Inspector autonomy supportiveness × reactive inspection | | 0.88 | 0.76–0.97 |
| Inspector autonomy supportiveness × other inspection | | 0.73 | 0.66–0.81 |

Note: RR estimates whose CIs do not cross 1.0 are statistically significant, $p < 0.01$.

reactive and other inspections (versus proactive inspections), as well as compliance orders written for companies located in the northern (vs. southern) administrative region of the Province. Covariate effects associated with a *decrease* in the RR for issuing severe compliance orders included prior OHS work experience, and length of tenure as an inspector. As well, there was a temporal trend towards issuing orders of increasingly higher severity over the study period. In addition to these effects, autonomy supportive inspectors were significantly less likely than coercive inspectors to write severe compliance orders (RR = 0.78, 95% confidence interval [CI] = 0.71, 0.86). This main effect of inspector autonomy-supportiveness was qualified by a significant interaction with inspection type. As shown in Figure 1, autonomy-supportive inspectors were more likely than coercive inspectors to write severe compliance orders for formal and other inspections, compared to proactive inspections.

Number of compliance orders issued

As shown in Table 2, a number of study covariates were associated with an increase in the RR for issuing multiple compliance orders, including: college education of inspectors (vs. high school), reactive (vs. proactive) inspection types, and the number of compliance orders issued per year. Other covariates that were associated with a decrease in the RR for writing multiple compliance orders were: number of

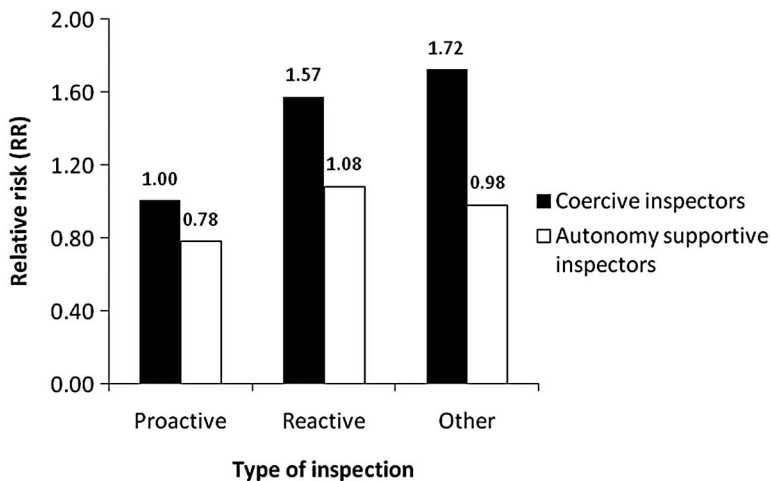


Figure 1. Interaction between inspector autonomy supportiveness and inspection type on relative risk of issuing severe compliance orders (2003–2006).

Table 2. Number of orders issued on first inspection: multiple negative binomial regression predicting the number of orders issued on first inspection: final model.

| Predictor | Count or inter-quartile range | Relative risk (RR) | 95% Confidence interval |
|--|-------------------------------|--------------------|-------------------------|
| Main effects – inspectors | | | |
| Autonomy supportiveness | 10,873 | 1.17 | 1.06–1.29 |
| Education (college vs. high school or less) | 15,947 | 1.17 | 1.04–1.31 |
| Prior experience as a private OHS consultant | 8,071 | 1.11 | 0.99–1.25 |
| Number of compliance orders issued that year | 120–260 | 1.005 | 1.005–1.006 |
| Number of inspections conducted in that year | 177–281 | 0.995 | 0.995–0.996 |
| Main effect – type of inspection | | | |
| Proactive | 4,767 | Reference = 1 | – |
| Reactive | 8,786 | 1.32 | 1.21–1.44 |
| Other inspections | 4,407 | 1.01 | 0.92–1.11 |
| Main effect – year of inspection: | | | |
| 2003 | 3,575 | 1.13 | 1.01–1.26 |
| 2004 | 4,117 | 1.15 | 1.03–1.28 |
| 2005 | 5,041 | 1.05 | 0.95–1.16 |
| 2006 | 5,227 | Reference = 1 | – |
| Main effect – employer history | | | |
| Compliance orders received in previous year | 0–0.7 (max. 18) | 0.88 | 0.85–0.91 |
| Interaction | | | |
| Inspector autonomy supportiveness × inspector prior experience as a private OHS consultant | | 0.79 | 0.68–0.92 |

Notes: RR estimates whose CIs do not cross 1.0 are statistically significant, $p < 0.01$.

inspections conducted per study year and the number of compliance orders issued to the inspected worksite in the previous year. Contrary to predictions, autonomy supportive inspectors on average wrote more orders during initial inspections, compared to coercive inspectors (RR = 1.17, 95% CI = 1.06, 1.29). However, this main effect was qualified by a significant interaction between private consulting experience and autonomy supportiveness of inspectors, as displayed in Figure 2. Specifically, coercive inspectors tended to issue more compliance orders if they had previous experience as private consultants prior to working as government inspectors, whereas autonomy supportive inspectors issued more orders if they did not work as private consultants prior to becoming inspectors.

Time to achieve compliance

Not surprisingly, the more compliance orders issued following any given inspection episode, the more worksite visits were required to resolve non-compliance (RR: 1.090, 95% CI: 1.084, 1.095). However, as hypothesized and shown in Table 3, in addition to this effect and regional differences, autonomy supportive inspectors required fewer worksite visits to resolve non-compliance (RR: 0.986, 95% CI: 0.977,

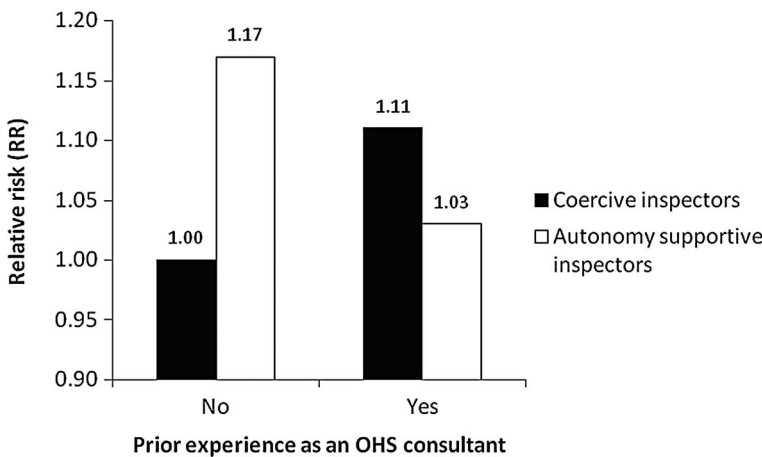


Figure 2. Interaction between inspector autonomy supportiveness and type of prior employment experience on relative risk (RR) of issuing more compliance orders (2003–2006).

Table 3. Multilevel Poisson regression (with scaled deviance parameter) predicting number of inspector visits needed to resolve worksite non-compliance: final model.

| Predictor | Count or interquartile range | Rate ratio | 95% Confidence interval |
|--|------------------------------|------------|-------------------------|
| Main effects – inspectors | | | |
| Autonomy supportiveness | 16,775 | 0.986 | 0.977–0.995 |
| Total number of compliance orders issued | 0–4 | 1.091 | 1.086–1.097 |
| Geographic location | 16,086 | 0.951 | 0.943–0.959 |

Notes: RR estimates whose CIs do not cross 1.0 are statistically significant, $p < 0.01$.

0.995). Note that there are no longer any lagged variables in the model in Table 3. Therefore, we were able to expand the dataset to also include additional observations from 2002 for a total of 28,717 compliance orders. In doing so, we obtained a more statistically robust test of our main hypothesis. The final model resulting from that analysis was virtually identical to that shown in Table 3 (not shown). Compliance order severity could not be included in the model in Table 3 as it was collinear with the number of orders issued per inspection episode variable (Spearman's $RHO = 0.53$, $p < 0.0001$). Also, the effect of this variable was also not statistically significant and was therefore rejected during our a priori defined model building strategy.

Discussion

Organizational and interpersonal factors (e.g. safety culture) influence uptake and effectiveness of workplace health and safety policies (Zohar 2000; Griffin and Neal 2000; Hoffman et al. 2003; Clarke and Ward 2006; Smith et al. 2006). However, little research has examined whether interpersonal factors are associated with variations in OHS compliance outcomes after taking into consideration effects of administrative and organizational variables such as inspection rates and worksite OHS records. This study was the first investigation designed to explore whether differences in occupational health and safety inspectors' preferences for resolving work conflicts is associated with workplace compliance with health and safety regulations. Self-Determination Theory (SDT) (Deci and Ryan 1985, 2002) suggests that inspectors who prefer to use autonomy supportive tactics (e.g. by providing rationale, choices, and empathy) would more effective in resolving industry non-compliance with OHS legislation, compared to inspectors who endorse coercive tactics (e.g. deadlines, pressure, and surveillance). This general prediction was tested by predicting how effective government inspectors were in resolving non-compliance in a sample of workplace inspection episodes over which inspectors could use their discretion about how punitive they should be with respect to resolving OHS violations.

We observed that in first inspection episodes where discretion was possible (i.e. when not legally obligated because of a fatality or an egregious OHS violation to issue stop-work or stop-use compliance orders) autonomy supportive inspectors were less likely than coercive inspectors to issue punitive, formal compliance orders. These results are consistent with the idea that when not legally obligated to shut down a worksite, autonomy supportive inspectors set a more cooperative tone with inspected worksites, compared to coercive inspectors. This effect was least pronounced for proactive (educational, prevention-oriented) inspection episodes, and was more pronounced for reactive and other types of inspections. Thus, especially in reactive situations where inspectors have already been made aware of violations of regulatory health and safety codes, autonomy-supportive inspectors appear to be less willing than coercive inspectors to conclude the inspection process by issuing formal compliance orders to worksite representatives. Because reactive inspections are predicated on the expectation that it will be necessary to issue a compliance order, it is not surprising that coercive inspectors would be more likely to reinforce the message that derelict employers should make a greater effort to comply with health and safety regulations by issuing a formal compliance order. Our results suggest that autonomy supportive inspectors prefer to treat reactive inspection episodes initiated by pre-existing health and safety violations as opportunities to

educate employers, rather than an opportunity to “throw the book at them” by issuing what are typically perceived as punitive, formal compliance orders. If this interpretation is valid, the present study supports the notion that autonomy supportive inspectors are more likely than coercive inspectors to set a cooperative tone during the inspection process. In addition to this hypothesized effect of inspector autonomy supportiveness, we observed marked geographical differences in severity of compliance orders in relation to geographic area, with worksites located in the northern part of the province being much more likely to receive severe compliance orders than worksites in the southern part of the study setting. These results probably reflect differences in the types of workplaces inspected, i.e. northern Alberta has a higher concentration of hazardous oil, gas, and other resource-based industries compared to other areas of the province. Alternatively, these findings may reflect managerial differences in directives given to the officers in the two regions; these possibilities should be disentangled in future research.

The interaction between inspectors’ autonomy supportiveness and history of private consulting experience on the number of compliance orders issued during the inspection process deserves closer scrutiny, as it suggests that inexperienced autonomy supportive inspectors may be attempting to document their efforts to encourage compliance through writing comparatively more low severity orders, whereas experienced autonomy-supportive inspectors tend to rely on informal means to active the same goal. More experienced and educated inspectors tended to write a greater number of compliance orders after initial workplace inspections, and were less likely to issue severe compliance orders when that option was available to them, even after adjusting for their preferences for using autonomy-supportive versus controlling tactics to resolve work problems. This finding suggests that experienced and more highly educated officers tend to assume a role of educators during inspections and use the compliance process as an opportunity to inform workplaces about opportunities to improve occupational health and safety outcomes, rather than coerce workplaces into complying with existing regulations.

Finally, we found that in comparison to coercive inspectors, autonomy supportive inspectors took fewer visits to resolve worksite non-compliance with OHS regulations. These results suggest that employees at workplaces inspected by autonomy supportive officers spent less time at risk for injuries due to non-compliance with health and safety regulations. Because each workplace visit is associated with considerable time commitment from an inspector (at least half of a work-day) and associated administrative burden (for both the government and the employer), it is reasonable to speculate that autonomy supportive officers achieve compliance at a lower overall cost.

There were several strengths associated with the present research. First, our findings were obtained across a variety of different Canadian workplaces and industries, which suggests that the positive impact of autonomy supportive tactics on resolution of industry non-compliance is generalizable across worksites. Second, effects of inspector autonomy-supportiveness were observed in analyses that adjusted for a number of other inspector and worksite covariates. Our analyses thus demonstrated the predictive capacity of a psychosocial variable (inspector autonomy supportiveness), taking into account the effects of administrative and organizational variables that are more traditionally thought to influence the process of resolving non-compliance to OHS regulations. Third, our results are unlikely to have been influenced by self-report biases, since (a) measurement of autonomy

supportiveness was not specifically tailored to inspection activities, but rather to individual differences in the use of autonomy supportive or coercive tactics to resolve work problems in general, and (b) the study hypotheses were tested with administrative data collected for different purposes than ascertaining inspector effectiveness in resolving non-compliance issues at worksites. Fourth, the analytic approach used in this study was well suited to reflect how OHS inspections actually work in the field, with inspection episode data (and compliance outcomes) nested in between-subjects variables, such as inspector training and autonomy supportiveness. Finally, from a theoretical perspective, the results from this study suggest that SDT provides a useful framework with which to understand the role of interpersonal factors as determinants of compliance processes. Specifically, we found general support for our prediction that inspectors' endorsement of autonomy supportive tactics to manage work problems would be associated with greater effectiveness in resolving non-compliance with health and safety regulations. These results are consistent with a large literature derived from SDT indicating that autonomy support is positively associated with enhanced uptake of recommended behavior changes.

Limitations and future directions

Notwithstanding these strengths, there are also several important limitations of the present study, all of which set limits on interpretation of our results while also providing directions for pursuing further work in this area. First, generalizability of our findings is limited because of the relatively low recruitment rate of inspectors for the study, and because the research was conducted within a single Canadian provincial jurisdiction. Further research is required to replicate our findings in a manner that minimizes potential for selection bias of inspectors, and to determine whether effects of autonomy supportiveness are obtained among representative samples of OHS inspectors employed in other jurisdictions. Second, the present study used a retrospective design, i.e. inspector autonomy supportiveness was assessed and historical administrative data generated by inspectors was analyzed to test our study hypothesis. This strategy implicitly assumes that differences in inspector autonomy supportiveness are stable across time. Future research should examine the impact of this variable prospectively. Third, there were several measurement limitations in the present work. For example, our analysis only examined a proxy measure for time to achieve compliance, i.e. the number of worksite visits required to resolve non-compliance with health and safety regulations. Although the administrative data available to us precluded this possibility, further research would benefit from using a more sensitive temporal measure of time to compliance using time- and date-stamped administrative outcomes. Measurement in this study was also limited with respect to assessing severity and complexity of OHS infractions. Fourth, although our data analytic strategy assumed randomness in assigning inspectors to worksites, it is possible that autonomy-supportive officers were not randomly assigned to inspections, but are preferentially assigned by their managers to handle "difficult" worksites and inspection situations.² This would result in an underestimate of the benefit derived from adopting autonomy-supportive, rather than coercive, tactics in achieving compliance. On the other hand, if coercive officers are delegated to deal with complex situations where violations are more likely, than effects of adopting

autonomy-supportive, rather than coercive, tactics in achieving compliance might be inflated. Future research should also incorporate additional variables reflecting the process by which inspectors are assigned to conduct inspections at different worksites. Finally, although we observed an association between inspector autonomy supportiveness and effectiveness with which inspectors resolved industry non-compliance, data on how inspectors approached this task in the field was not collected. The present results would therefore be bolstered by observational research that provided direct assessment of how autonomy-supportive and coercive inspectors actually negotiate compliance outcomes in the field. Such research would focus on mediational mechanisms underlying this association. For example, further research using SDT could examine whether autonomy-supportive inspectors use interpersonal tactics in a manner that supports employers' psychological need for relatedness, and in turn, whether such need satisfaction enhances trust between inspectors and worksite representatives and promotes openness to organizational learning in the process of obtaining compliance with health and safety regulations (cf. Deci et al. 1989).

Despite these limitations, the present study confirmed our prediction that autonomy supportive inspectors would achieve compliance with OHS laws more effectively than coercive inspectors. These results are consistent with predictions made by SDT, and more generally, are consistent with an emerging body of literature demonstrating that psychosocial and behavioral factors play a key role in shaping organizational responses to regulatory systems designed to protect human health (Gilling et al. 2001; Ball et al. 2009). Because autonomy-supportive interpersonal tactics can be taught (Deci et al. 1989), it is reasonable to speculate that OHS inspectors can learn to adopt an interpersonal style that, in this study, was associated with efficiency in the process of resolving non-compliance to industrial health and safety regulations. As such, results from this exploratory study may help to inform the development and testing of psychosocial interventions designed to minimize employee exposure to workplace hazards. For example, beyond informing and educating OHS inspectors about the importance of generating enthusiasm for workplace safety initiatives and policies (e.g. Clarke and Ward 2006), the present study suggests that educational interventions designed to enhance inspectors' skills in adopting autonomy supportive interpersonal styles in their interactions with worksite representatives (e.g. acknowledging their perspectives, providing feedback to them in a non-controlling way, offering choice, and encouraging self-initiation rather than pressuring them to conform to OHS regulations) could enhance effectiveness of occupational health and safety inspections. Further research should therefore examine whether training programs specifically attempting to enhance inspectors' autonomy supportiveness results in objective changes in the amount of time workplaces expose employees to health and safety hazards.

Notes

1. Subsequent to this study, the distinction between "voluntary compliance" and "compliance" orders was eliminated because stakeholders in this jurisdiction it is believed that it is undesirable for employers to perceive some compliance orders as less important or critical than others.
2. We have no objective data to verify non-randomness in assignment of inspectors to an inspection is associated with the extent to which an inspector exhibits autonomy-supportive approach to eliciting compliance.

References

- Auld MC, Emery JCH, Gordon DV, McClintock D. 2001. The efficacy of construction site safety inspections. *J Lab Econom.* 19(4):900–921.
- Baard PP, Deci EL, Ryan RM. 2004. Intrinsic need satisfaction: A motivational basis of performance and well-being in two work settings. *J Appl Soc Psychol.* 34:2045–2068.
- Ball B, Wilcock A, Aung M. 2009. Factors influencing workers to follow food safety management systems in meat plants in Ontario, Canada. *Int J Environ Health Res.* 19:201–218.
- Christian MS, Bradley JC, Wallace JC, Burke MJ. 2009. Workplace safety: A meta-analysis of the roles of person and situation factors. *J Appl Psychol.* 94:1103–1127.
- Clarke S, Ward K. 2006. The role of leader influence tactics and safety climate in engaging employees' safety participation. *Risk Anal.* 26(5):1175–1185.
- Deci EL, Ryan RM. 1985. *Intrinsic motivation and self-determination in human behavior.* New York: Plenum Press.
- Deci EL, Ryan RM, editors. 2002. *Handbook of self-determination research.* Rochester: University of Rochester Press.
- Deci EL, Connell JP, Ryan RM. 1989. Self-determination in a work organization. *J Appl Psychol.* 74(4):580–590.
- Gagné M, Deci EL. 2005. Self-determination theory and work motivation. *J Org Behav.* 26(4): 331–362.
- Gagné M, Koestner R, Zuckerman M. 2000. Facilitating acceptance of organizational change: The importance of self-determination. *J Appl Soc Psychol.* 30:1843–1852.
- Gilling SJ, Taylor EA, Kane K, Taylor JZ. 2001. Successful hazard analysis critical control point implementation in the United Kingdom: Understanding the barriers using a behavioral adherence model. *J Food Protect.* 64:710–715.
- Gray WB, Scholz JT. 1993. Does regulatory enforcement work? A panel analysis of OSHA enforcement. *Law Soc Rev.* 27(1):177–213.
- Griffin MA, Neal A. 2000. Perceptions of safety at work: A framework for linking safety climate to safety performance, knowledge, and motivation. *J Occupat Health Psychol.* 5(3):347–358.
- Hofmann DA, Morgeson FP, Gerras SJ. 2003. Climate as a moderator of the relationship between leader-member exchange and content specific citizenship: Safety climate as an exemplar. *J Appl Psychol.* 88(1):170–178.
- Lanoie P. 1992. The impact of occupational safety and health regulation on the risk of workplace accidents: Quebec, 1983–87. *J Hum Resources.* 27(4):643–660.
- Niemiec CP, Ryan RM. 2009. Autonomy, competence, and relatedness in the classroom: Applying self-determination theory to educational practice. *Theory Res Educat.* 7:133–144.
- Pelletier LG, Sharp EG. 2009. Administrative pressures and teachers' interpersonal behavior in the classroom. *Theory Res Educat.* 7:174–183.
- Reeve JM. 2002. Self-determination theory applied to educational settings. In: Deci EL, Ryan RM, editors. *Handbook of self-determination research.* Rochester (NY): University of Rochester Press. p. 183–203.
- Smith GS, Huang YH, Ho M, Chen PY. 2006. The relationship between safety climate and injury rates across industries: The need to adjust for injury hazards. *Accid Anal Prevent.* 38(3):556–562.
- Van den Broek A, Vansteenkiste M, De Witte H. 2008. Self-determination theory: A theoretical and empirical overview in occupational health psychology. In: Houdmont J, Leka S, editors. *Occupational health psychology: European perspectives on research, education, and practice.* Nottingham: Nottingham University Press. p. 63–88.
- Viscusi WK. 1986. The impact of occupational safety and health regulations, 1973–1983. *RAND J Econom.* 17(4):567–580.
- Williams GC. 2002. Improving patients' health through supporting the autonomy of patients and providers. In: Deci EL, Ryan RM, editors. *Handbook of self-determination research.* Rochester (NY): University Of Rochester Press. p. 233–254.

- Williams GC, Lynch MF, Glasgow RE. 2007. Computer-assisted intervention improves patient-centered diabetes care by increasing autonomy support. *Health Psychol.* 26:728–734.
- Williams GC, Rodin GC, Ryan RM, Grolnick WS, Deci EL. 1998. Autonomous regulation and adherence to long-term medical regimens in adult outpatients. *Health Psychol.* 17:269–276.
- Zohar D. 2000. A group-level model of safety climate: Testing the effect of group climate on microaccidents in manufacturing jobs. *J Appl Psychol.* 85(4):587–596.
- Zou GA. 2004. A modified Poisson regression approach to prospective studies with binary data. *Am J Epidemiol.* 159(7):702–706.