Assessing Employee Safety Motivation

May, 2012

Principle Investigator: Mark Fleming PhD

Co-applicants: Natasha Scott PhD(c)

Project # RS2010-DG08

Acknowledgements

This research is supported with funds from WorkSafeBC and the Workers' Compensation Board of Nova Scotia through the FOCUS ON TOMORROW program.

Table of Contents

SUMMARY

- This research project developed and pilot tested the Self-Determined Safety Motivation (SDSM) scale. This study is the first step towards the development of an assessment tool for evaluating employees motivation to work safely

- The creation of the SDSM scale was based on the theoretical framework of Self-determination theory (Deci & Ryan, 1985)

- The SDSM scale is designed to assess five different types of safety motivation (i.e., amotivation, external, introjected, identified, and intrinsic)

- The SDSM scale was evaluated using two samples of employees, one sample consisted of contract construction employees in Ontario, the other a random sample of employees in Nova Scotia

- The results of this research provide initial information about the validity and reliability of the SDSM scale and we conclude that further revision and evaluation of the instrument is required

- The results provide preliminary evidence that autonomous forms of motivation (i.e., identified and intrinsic) may be particularly important for employee motivation

EXECUTIVE SUMMARY

Keywords: *Safety motivation, Safety behaviours, Self-determination theory, Scale development, Safety climate*

There are two main psychological approaches to improving workplace safety; (1) behavioural-based safety initiatives and (2) safety culture strategies (Dejoy, 2005). Both approaches aim to enhance employee safety motivation and encourage employee's to work safely; however, these two approaches are based on different philosophies about the best way to motivate employees to work safely. Behavioural-based safety programs largely focuses on motivating employees through contingencies (e.g., rewards), whereas developing a positive safety culture is more value-based and focuses on encouraging employees to internalize the value of safety (Dejoy, 2005). As both approaches have been found to be effective at enhancing workplace safety, it can be concluded that there are different types of safety motivation, one type of safety motivation that is driven by external reward (or punishment) and a second that is based on the relative value employees place on safety.

Currently, very few assessment tools for evaluating employees' motivation to work safely exist. Understanding what motivates employees to work safely is an important part of changing unsafe behaviour and increasing employees' participation in safety activities at work. The goal of this research was to develop and pilot test a survey instrument that can be used to assess employee's safety motivation and provide preliminary information about the reliability and validity of the instrument.

Instrument Development Process

The development of the safety motivation instrument was based on a popular psychological theory of human motivation and behaviour (i.e., self-determination theory), which

outlines five types of motivation. To create the safety motivation scale, we developed items to assess these five types of safety motivation using best practices in instrument development. The instrument was subsequently labeled the Self-Determined Safety Motivation (SDSM) scale.

Process For Evaluating the SDSM Instrument

The SDSM scale was completed by two different samples of employees. One sample consisted of contract construction employees in the petrochemical and energy industries in Ontario. The second sample consisted of random sample of employees from across Nova Scotia. Various statistical analyses were conducted to evaluate the reliability and validity of the SDSM scale.

Key Research Findings

The SDSM scale assesses the five types of employee safety motivation it was developed to measure. Initial evaluation of the instrument supports the argument that there is merit in conducting further research into the refinement and evaluation of the SDSM scale. The SDSM scale is still at the prototype stage and it is not at a stage where we can recommend organizations use the scale as a safety motivation assessment tool. The results do provide additional information about the nature of employee safety motivation and the factors that influence their engagement in both safety compliance and safety participation behaviours. Finally, the results also provide evidence that autonomous (self-directed) safety motivation, which is based on personal safety values, may influence the level of employee safety motivation and their self-report proactive safety activities.

Main Outcomes and Application of Research

The main outcome of this research project was the pilot 16-item Self-Determined Safety Motivation (SDSM) scale. The current instrument can be used as the starting point for future

research into the refinement of an instrument to assess employee safety motivation based on self-determination theory.

INTRODUCTION

The focus over the past 150 years has been on the technical aspects of engineering systems to improve safety (Lee, 1998). These efforts have been very successful as large improvements in workplace safety have been achieved through improved hardware and design, and through improved safety management systems and procedures. This success can be seen in the low accident rates in the majority of safety critical industries, but it does appear that they have reached a plateau (Lee, 1998). Since the frequency of technological failures in industry has diminished, the role of human behaviour has become more apparent. Safety experts estimate that 80-90% of all industrial accidents are attributable to 'human factors' (Hoyos, 1995). It seems likely that the most effective way to reduce workplace injury and accident rates even further and improve hazard management is to address the social and organizational factors that have an impact on safety (Lee, 1995). This recognition of the importance of organizational and social factors in improving workplace safety is demonstrated by increased efforts to improve safety leadership, safety culture/climate, and employee safety behaviours.

There is good research evidence that employee self-reported safety behaviours are associated with fewer injuries and accidents (Clarke, 2006; Neal & Griffin, 2006; Probst & Brubaker, 2001; Sinclair, Martin, & Sears, 2010). Furthermore, there is a growing body of literature demonstrating that employee safety behaviours are largely influenced by their motivation to work safely (Christian, Bradley, Wallace, & Burke, 2009; Griffin & Neal, 2000; Neal & Griffin, 2006; Neal, Griffin, & Hart, 2000). Accordingly, an important component of addressing the social and organizational factors that influence workplace safety includes understanding why employees are motivated to work safely. Therefore, the purpose of this project was to develop and provide preliminary information on the reliability and validity of a

safety motivation scale designed to assess and understand the reasons why employees are motivated to work safely.

Employee Safety Motivation

Although the importance of employee safety motivation has been recognized since the beginning of the twentieth century (Heinrich, 1931), it has only been recently that researchers have began systematically studying employee safety motivation. This research largely focuses on how motivated employees are to work safely, assessing the level or amount of safety motivation. Research consistently concludes that employees who report higher levels of safety motivation also report engaging in more safety compliance behaviours (i.e., core safety activities that are part of the formal work procedures) and participation behaviours (i.e., informal safety activities that help to create a safe work environment) (Christian et al., 2009; Neal & Griffin, 2006; Neal et al., 2000; Sinclair et al., 2010; Vinodkumar & Bhasi, 2010).

There are two dominant psychological approaches to safety improvement, namely behaviour-based safety and the promotion of a safety culture (Dejoy, 2005). These two approaches are different from each other and in many ways have opposing views about how to motivate employees to work safely. Although these two approaches propose very different strategies for organizations to enhance safety, there is evidence supporting the effectiveness of both behaviour-based (McAfee and Winn, 1989) and safety culture (Guldenmund, 2010) interventions.

Behaviour-based safety is founded on behaviour modification theory (Skinner, 1938), which has extensive evidence of efficacy in a wide range of settings. Behaviour-based safety proposes that employee behaviour is dependent on contingencies and behaviour can be controlled by altering these contingencies (Dejoy, 2005). Thus, behaviour-based safety aims to

control employee behaviour by introducing specific reinforcements in order to motivate employees to adopt specific safety behaviours.

Alternatively, safety culture improvement interventions target the shared values within the organization in order to enhance the value placed on safety (Dejoy, 2005). Safety culture interventions focus on leader behaviour, specifically leaders' behaviours demonstrating their commitment to safety and encouraging their subordinates to value safety above other competing goals (e.g., production targets). For example, Mullen and Kelloway (2009) demonstrated that safety leadership training produce changes in subordinate perceptions about the relative priority of safety (i.e., safety climate). Furthermore, Zohar (2002) has also demonstrated that promoting specific supervisory leadership behaviours can reduce injury rates.

Research conducted to date highlights the importance of considering the influence of employee safety motivation on occupational safety outcomes and demonstrates that organizations can influence employee safety behaviours both directly and indirectly by influencing employees' motivation to work safely (Christian et al., 2009; Neal & Griffin, 2006). Neal & Griffin, (2006) demonstrated that safety climate influences employee level of safety motivation, which in turn influences their safety behaviour (compliance and participation). However, one of the shortfalls of current safety motivation research is that it focuses solely on the level of employee safety motivation, without differentiating type of motivation. Evidence of the effectiveness of both behaviour-based and safety culture strategies for motivating employees to work safely support the argument that there are different types of safety motivation, one type of safety motivation that is driven by external reward (or punishment) and a second that is based on the relative value employees place on safety. In addition to assessing how motivated

employees are to work safely, it is important to investigate the reasons why people are motivated to work safely so that we can better understand the mechanisms that drive behaviour change.

As no measure of the reasons (i.e., external, internal) why employees are motivated to work safely currently exists, the development of such a measure is a worthwhile aim. Thus, the goal of this project is to develop a safety motivation scale, which assesses the reasons why employees are motivated to work safely and which is based on a strong theoretical framework. Self-determination theory (Deci & Ryan, 1985) is particularly relevant to understanding why employees are motivated to work safely and provides the strong theoretical structure to base the development of a safety motivation scale instrument designed to assess the different reasons why employees are motivated to work safety.

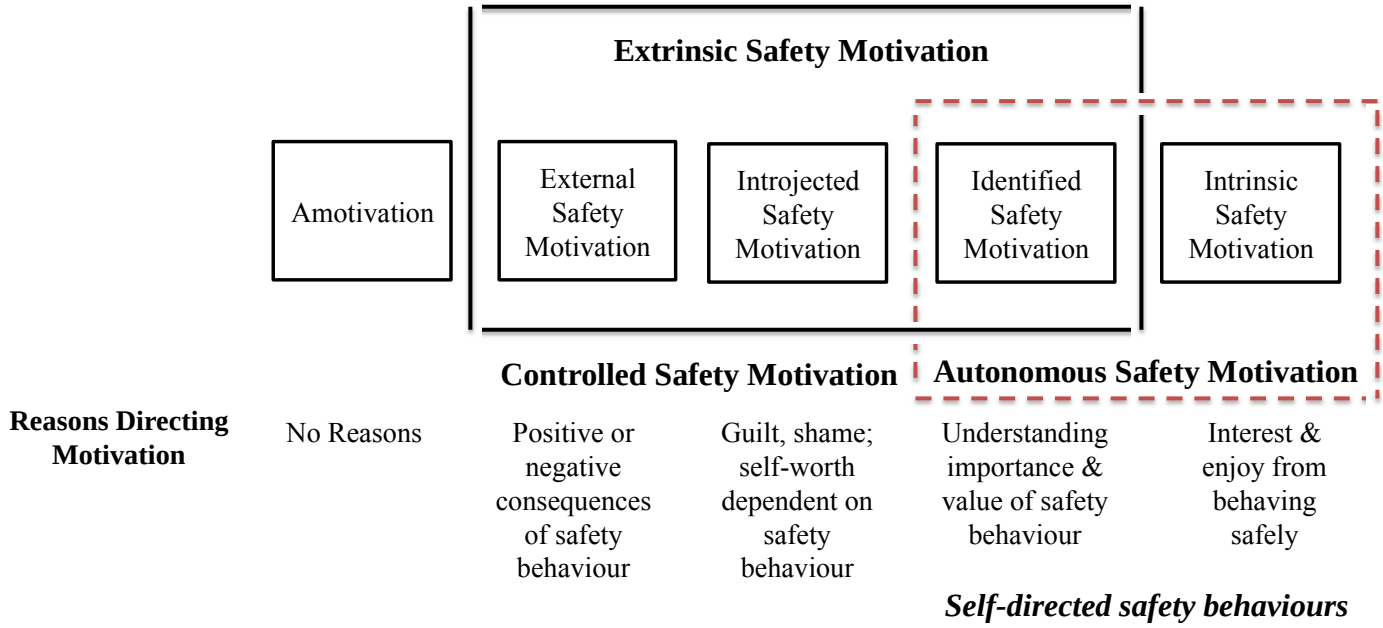
Self-Determination Theory

Self-determination theory (Deci & Ryan, 1985) asserts that individuals are motivated to perform behaviours for a variety of reasons and classifies different types of motivation according to these reasons. Furthermore, self-determination theory also posits that different types of motivation vary in the degree to which they result in self-directed (i.e., autonomous) behaviour, specifying that some types of motivation are internalized by the individual while other types are not (Deci & Ryan, 1985; 2000; 2002; Gagné & Deci, 2005). When the motivation has not been internalized, some type of external contingency will be required to direct the performance of individuals' behaviour. Therefore, self-determination theory views motivation as a multi-dimensional construct and recognizes the importance of understanding both the *level* and the *type* of motivation when attempting to explain an individual's behaviour (Ryan & Deci, 2002).

At the most basic level, SDT recognizes there are both intrinsic reasons and extrinsic reasons that determine how an individual behaves. Extrinsic reasons include receiving an

outcome that is contingent upon the performance of the behaviour. Conversely, intrinsic reasons include experiencing enjoyment and pleasure from performing the behaviour itself. These different reasons for our behaviour reflect different types of motivation (i.e., extrinsic and intrinsic motivation; Deci & Ryan, 1985). Thus, when individuals are extrinsically motivated, the outcome resulting from the behaviour is the underlying reason the behaviour occurs. However, these outcomes can differ in how they regulate behaviour, depending on how closely the outcome reflects or aligns with the individuals' values and goals. In other words, individuals internalize the motivation for performing different behaviours to varying degrees (Gagné, et al., 2010; Ryan & Deci, 2002). Different degrees of internalizing extrinsic reasons for behaviour further distinguish different types of extrinsic motivation (i.e., external, introjected, identified, integrated) (see Figure 1 below).

Figure 1: Self-determined safety motivation framework



According to SDT, an individual can internalize the outcomes associated with performing behaviours to the extent that these extrinsic reasons become personal values of the individual. When this occurs, the extrinsic motivation will result in autonomous, self-directed behaviour, and will not require the presence of the extrinsic contingency to motivate the individual. Therefore, instead of identifying employee safety motivation as either extrinsic or intrinsic, it is more important to distinguish between controlled and autonomous types of safety motivation. Controlled types of safety motivation result in contingent-based behaviours, whereas autonomous types of safety motivation result in internally, self-directed behaviour (Ryan & Deci, 2002). SDT also argues that employees can be amotivated to work safely. In other words, in addition to classifying employee safety motivation into controlled and autonomous forms, SDT also takes into account employees who lack any type of motivation to work safely (see Figure 1).

Controlled Safety Motivation

Controlled safety motivation represents feelings of *having* to or thinking that you *should* work safely (Gagné & Deci, 2005). Therefore, safety behaviours that occur from controlled motivation are performed because the employee feels pressured to do so. The pressure to perform safety behaviours can come from another person (e.g., supervisor, coworker), a group (e.g., the organization), society (e.g., the occupational health and safety act), or from the individual themselves. Therefore, controlled safety motivation can be classified as external pressure (i.e., external safety motivation) or internal pressure (i.e., introjected safety motivation) to behave safely.

External safety motivation. External safety motivation represents the most controlling form of motivation (Deci & Ryan, 1985; 2000). Externally motivated safety behaviours require the presence of a stimulus in order for the behaviours to occur. The stimulus is typically in the

form of a reward for performing work safely or a negative consequence when work is not performed safely (Gagné & Deci, 2005; Ryan & Deci, 2002). Examples of external reasons for performing safety behaviours include receiving a bonus for good safety performance, or the threat of being laid off because of unsafe behaviours. Behaviour-based safety approaches most commonly focus on increasing employee's external safety motivation.

Introjected safety motivation. Classified as slightly less controlling than external safety motivation (Gagné & Deci, 2005), introjected safety motivation still entails performing safety activities because there is pressure to do so; however the pressure comes from within the employee as opposed to from another person or group. Internal pressure to behave safely is most commonly experienced as guilt or shame (Ryan & Deci, 2002). For example, an employee may be motivated to wear and attach their safety harness when they work at height, not because they will receive a reward or praise for doing so, but because the employee would feel guilty and ashamed if they did not wear the safety harness. Employees may also be introjectedly motivated to perform safety activities because their self-worth is contingent upon being a safe worker (Deci & Ryan, 2000).

Autonomous Safety Motivation

Autonomous safety motivation can result from both extrinsic and intrinsic reasons for working safely. Employees who are autonomously motivated to work safely take ownership over performing safety activities because they view these activities as being consistent with their own personal values and interests (Ryan & Deci, 2002). As a result, autonomously motivated safety behaviours are self-directed and therefore, should be consistently performed.

Identified safety motivation. Identified safety motivation represents employees who are motivated to engage in safety activities because they believe a safe work environment is

important and accept that performing safety activities are necessary to achieve that goal. For example, a group of employees who show up to a new worksite and immediately begin conducting a hazard assessment before starting the job may do so because they believe hazard assessments provide useful information to make the jobsite a safer place to work. If the employees conduct the hazard assessment because they value the information they obtained from the activity, their motivation is still extrinsically driven because they are performing the activity to obtain an outcome (i.e., the information it provides); however, the employees have internalized the value of the outcome; therefore, the behaviour will be autonomous and self-directed.

Intrinsic safety motivation. Intrinsic safety motivation is characterized as performing safety activities (e.g., volunteering for the joint occupational health and safety committee; following rules and procedures) because the employee finds these activities pleasurable, satisfying, or interesting. Intrinsic safety motivation represents the fullest form of autonomous safety motivation, as the reason for engaging in the safety activity is completely volitional.

In describing motivation in terms of different forms of controlled and autonomous motivation, self-determination theory provides a theoretical framework, which explains the different reasons why employees are motivated to work safely. The first objective of this research was to develop a Self-Determined Safety Motivation (SDSM) scale that measured the five types of motivation described above (i.e., amotivation, external, introjected, identified, and intrinsic). The second objective of this research was to evaluate the reliability and the validity of the SDSM scale.

Specifically, we hypothesized that the SDSM scale would demonstrate good construct validity in measuring the five types of safety motivation (as determined by factor analytic

results) and that each subscale would demonstrate high internal reliability (as determined by cronbach's alpha). Furthermore, we hypothesized that the SDSM scale would predict employee safety behaviours (i.e., compliance and participation behaviours) above and beyond both safety climate and a general measure of safety motivation (i.e., predictive validity). In addition, since employees have more freedom to choose to engage in safety participation behaviours we hypothesized that autonomous forms of motivation (i.e. internal and identified) will be more strongly associated with participation than controlled forms of motivation.

METHODOLOGY

Scale Development Process

We followed the test construction process outlined by Crocker and Algina (1986) to develop the SDSM scale. The initial stage of the scale development process included reviews of both the self-determination theory literature and of the occupational safety literature. To develop items, we consulted the definitions of each of the five different types of motivation to be measured. In addition, when possible, we adapted items from previously developed motivation scales from other domains (e.g., education: Ryan & Connell, 1989; healthcare: Ryan, Plant, & O'Malley, 1995). In addition, we drew on preliminary SDT safety motivation scale development that we had conducted with subject matter experts and tested on a student sample (see Scott & Fleming, in press). All items were developed to correspond to the item stem *"Why do you put effort into working safely?"*.

From the initial item writing stage, four individuals with expertise in scale development and who were familiar with self-determination theory independently completed an item-sorting task in which they sorted all initial items into the five types of motivation. Afterwards, the four individuals met to discuss their responses. During this meeting, discrepancies in responses were

discussed and resolved. Items that were interpreted as belonging to multiple types of motivation, or that were identified as being poorly worded were deleted. Based on the results of the scale development process a 21-item SDSM scale was created.

Study 1 (Reliability and Validity of the SDSM Scale)

Participants

Participants consisted of 492 employees from contracting construction companies working in the petrochemical and energy industries in Ontario, Canada. Occupations represented in the sample included; piperfitters and welders (11.8%), carpenters (10.3%) electricians (9.9%) boilmakers (9.0%), laborers (8.3%), millwrights (4.7%), steamfitters (4.7%), and insulators (3.8%), among others. Participants worked an average of 39.7 hours per week (SD = 5.9) and were employed at their current job for an average of 5.6 years (SD = 8.2). Less than one third of participants held a management or supervisory position (27.2%) and the majority of respondents were males (96.6%).

Procedure

Employees were informed about this research and were given the survey packages to complete during mandatory safety meetings or training events. Each survey package included a cover letter describing the purpose of the research, the measures described below, and an envelope. Workers were instructed to seal their completed surveys in the envelope provided, which were collected by a company representative whom mailed the completed surveys to the researchers in Nova Scotia.

Measures

Demographic information. Participants were asked to indicate their job title, whether they currently held a supervisory or management position, the number of years employed in their present job, average hours worked per week, and their gender.

Safety motivation scale. Participants completed the 21-item SDSM scale developed for this project. This scale assesses five theorized types of safety motivation: (1) Intrinsic (e.g., *"Because I enjoy working safely"*); (2) Identified (e.g., *"Because putting effort into working safely is important to me"*); (3) Introjected (e.g., *"Because otherwise I will feel guilty"*); (4) External (e.g. *"In order to avoid being criticized by others"*); and (5) Amotivation (e.g., *"I don't because safety is not a priority in my workplace"*). Participants responded to each item using a 5-point scale (1 = Not at all for this reason; 5 = Exactly for this reason). Information on the factor structure and scale reliabilities is presented in the results section.

Safety motivation. Participants also completed a 3-item general safety motivation scale from Neal and Griffin (2006) using a 5-point scale (1 = strongly disagree; 5 = strongly agree). The reliability of the scale was α = .89.

Safety climate. Safety climate was measured using the 16-item group level safety climate scale developed by Zohar and Luria (2005). Participants indicated the extent to which they agreed with each statement using a 5-point scale (1 = strongly disagree; 5 = strongly agree). The safety climate scale had good internal reliability (α = .95).

Safety behaviours. Safety behaviours were assessed using a scale developed by Neal et al. (2000). Respondents used a 5-point scale (1 = strongly disagree; 5 = strongly agree) to indicate if they engaged in two types of safety behaviours (i.e., compliance and participation behaviours). Three items assessed participant's safety compliance behaviours (e.g., *"I use the correct safety*

procedures for carrying out my job") and three items assessed safety participation behaviours (e.g., *"I promote the safety program within the organization"*). Both subscales had good reliability, α = .90 (compliance) and α = .86 (participation).

Results

To begin, a series of item analyses were conducted to clean and screen for data entry errors and data irregularities. During the initial item-level analysis, one item from the SDSM scale (*"In order to avoid injury"*) was deemed unacceptable for further analysis due to poor item properties (e.g., inter-item correlations) and was deleted from all further analyses.

Exploratory Structural Equation Modeling Analysis

To assess the construct validity of the SDSM scale we examined the extent to which each item represented the type of motivation it was intended to measure through an exploratory structural equation modeling analysis (ESEM; Asparouhov & Muthén, 2009; Marsh, Lüdtke, Muthén, Asparouhov, Morin, Trautwein, & Nagengast, 2010; Marsh, Muthén, Asparouhov, Lüdtke, Robitzsch, Morin, & Trautwein, 2009). ESEM is a hybrid analysis using aspects of both exploratory and confirmatory factor analysis. This analysis is particularly well suited for situations in which a scale has strong theoretical support, but has limited validity evidence available due to early stages of scale development.

An ESEM was performed using Mplus 5.2 (Muthén & Muthén, 1998-2010) in which a five-factor structure was estimated allowing all 20 items to load on each of the five factors. The five-factor structure was assessed using model fit indices. In addition, each item parameter estimate was assessed for statistical significance. The five-factor structure provided a good fit to the data (χ^2 (100) = 230.00; CFI = .97; RMSEA = .05, [C.I. = .04 - .06, ns]). Standardized parameter estimates are presented in Table 1. As shown in Table 1, although there were some

significant cross-loadings, all but one item significantly loaded on its intended factor. Specifically, the item *"Because I take pride in working safely"* was designed to represent introjected safety motivation, however it only loaded significantly on the identified safety motivation factor. Due to the non-significant parameter estimate of this item on its intended factor, the item was removed from the SDSM scale. Removal of this item did not substantially change the remaining parameter estimates reported in Table 1. Although the hypothesized five-factor model demonstrated a good fit to the data, we also tested alternative models to determine if other plausible models of SDSM produced equal or better fit to the data. Specifically, we compared this five factor model with a three factor model which included an amotivation factor, collapsed external and introjected forms of safety motivation to form a controlled motivation factor, and collapsed identified and intrinsic motivation to form an autonomous motivation factor. We also examined the fit of an overall safety motivation model in which all items loaded on one factor. As can be seen in table 2 the five-factor model was the best fit..

Four out of the five subscales achieved a Cronbach's alpha of at least .70, indicating good internal reliability (Intrinsic, α = .80; Identified, α = .84; External, α = .72; and Amotivation, α = .86). Consistent with the results of the exploratory structural equation model, the introjected safety motivation subscale had the lowest internal reliability (α = .65). Reliability estimates, along with variable means, standard deviations, and correlations are presented in Table 3. In addition, we tested the extent that SDSM factors were distinct from other safety variables in the study using SEM. We estimated the fit of a model containing the five SDSM factors (as estimated the ESEM technique), safety climate, general safety motivation, safety compliance and safety behaviour variables. This model demonstrated good fit (χ^2 = 1501.6, df(849), p < .001; CFI = .95; TLI = .94; RMSEA = .04 (C.I. = .03 - .04, ns)).

Incremental Variance of SDSM

In order to examine whether the SDSM scale was able to account for additional variance and significantly predict employee self-reported safety behaviours after controlling for factors that previous research has identified as influencing safety behaviours (i.e., safety motivation and safety climate), a hierarchical regression was conducted for each of the two types of safety behaviours (i.e., compliance and participation behaviours). In each regression, safety climate was entered into the first step, Neal and Griffin's (2006) general measure of safety motivation was entered into the second step, and with the five types of safety motivation assessed with the SDSM scale entered into the third and final step of the equation (see Table 4).

As expected, safety climate accounted for a significant amount of variance in safety compliance ($R^2 = .16, p < .001$) and participation behaviours ($R^2 = .12, p < .001$), as did the general measure of safety motivation ($R^2 = .38, p < .001$; $R^2 = .18, p < .001$, respectfully). Even after, allowing safety climate and general safety motivation to account for the variance in safety behaviours, the SDSM scale still accounted for a significant increase in the variance explained in both safety compliance behaviours ($R^2 = .04, p < .001$) and safety participation behaviours ($R^2 = .11, p < .001$). Specifically, identified safety motivation was a unique predictor of safety compliance behaviours ($\beta = .20, p < .001$) and safety participation behaviours ($\beta = .29, p < .001$). In addition, intrinsic safety motivation was also a unique significant predictor of safety participation behaviours ($\beta = .17, p < .001$).

Discussion

This study provides an initial test of the validity and reliability of an SDSM scale based on self-determination theory. The five-factor safety motivation model demonstrated good fit. Although all but one introjected item loaded on their intended factor, there were a number of

significant cross loadings. These cross loadings provide evidence that some of the items are complex and not ideal as they are not solely associated with their intended dimension. Four out of the five subscales demonstrated acceptable reliability (above .70). The reliability of the introjected dimension was 0.65, which is generally considered be below acceptable levels. Identified motivation did explain a small amount (4%) of incremental variance in compliance behaviours, but this is too small to be meaningful in practice. Intrinsic and Introjected SDSM scales added a moderate incremental prediction of employee self-reported participation behaviours above two commonly used predictors of employee safety behaviours (i.e., a general measure of safety motivation and safety climate). Results from the incremental validity analysis provide evidence that autonomous forms of motivation in particular significantly influence participation behaviours. These results do not allow us to conclude that our hypotheses were supported, as the ESEM analysis identified a number of cross loading items and one of the factors had a suboptimal reliability. In addition, the incremental validity analysis did not support our hypothesis.

The results of study one also point to several aspects of the SDSM scale that could be refined and improved. As indicated above, the measure of introjected safety motivation is weak. Specifically, one item that was intended to represent this factor failed reach a significant parameter estimate and this subscale had a substandard reliability estimate. Furthermore, although the majority of items significantly loaded onto their intended factor, several items cross-loaded onto another factor indicating that these items measure aspects of multiple types of safety motivation. Ideally, each item should only measure aspects of one type of motivation. As it currently stands, each type of safety motivation measured in the SDSM scale contained few items (between 4-5 per subscale). Although this results in a concise measure of safety

motivation, it does leave little room to refine problematic areas of the scale and improve the overall reliability and validity. Therefore, a second study was performed in which the number of items was increased to 26 with the intention of finding a unique subset of items that demonstrates high internal reliability for each type of safety motivation.

Study 2 (SDSM Scale Refinement and Evaluation)

Participants

Participants consisted of 446 employees from across Nova Scotia, Canada. Participants worked in a variety of industries including; Healthcare (19.8%), Construction (7.1), Retail (6.0%), Manufacturing (5.6), Food service/accommodations (5.6%), Transportation/warehouse (4.9%), Education (4.0%), among others. Participants worked an average of 40.1 hours per week (SD = 12.3) and were employed at their current job for an average of 10.2 years (SD = 8.45). Approximately one third of participants held a management or supervisory position (34.5%). The sample included similar numbers of males (41%) and females (45.4%) (3.6% did not indicate their gender), and participants ranged in age from 18 – 69 years old (Mean = 44.2; SD = 10.3)

Procedure and Measures

A marketing firm was hired to collect a random sample of employees working in Nova Scotia, Canada. Each participant was emailed a web link to an online survey, which included the revised 26-item SDSM scale.

Results

An ESEM was conducted in which a five-factor model was specified and in which the 26 items were allowed to load on each of the five factors. Although this model demonstrated good fit (χ^2 *(205) = 411.29; CFI = .96; RMSEA = .05, [C.I. = .04 - .05, ns]*) and all but one item (*"Because I get satisfaction from working safely"*) significantly loaded on it's intended factor,

there were still several cross-loading items that were deemed problematic. As the goal of this second study was to reduce the number of complex items a series of ESEM analyses were conducted in which items were deleted one at a time, starting with the most complex items (i.e., items that loaded more highly on a factor it was not designed to measure or items with approximately equal parameter estimates on two or more items). This process resulted in the removal of ten items. The final version of the SDSM scale is shown in Table 4.

This final version of the SDSM scale contains sixteen items measuring five types of safety motivation (i.e., amotivation, external, introjected, identified, intrinsic). This model achieved excellent fit (χ^2 *(50) = 69.96; CFI = .99; RMSEA = .03, [C.I. = .00 - .05, ns]*). In addition, as can be seen by comparing the results from the two studies (see Tables 1 and 4), the number of complex items was reduced by half (twelve in study one, six in study two). Furthermore, the five subscales of safety motivation demonstrated acceptable internal reliabilities (Intrinsic, α = .79; Identified, α = .78; Introjected, α = .74 External, α = .79; and Amotivation, α = .69).

PROJECT FINDINGS/OUTCOMES

The main goals of this study were to (1) develop an instrument to assess employee safety motivation and (2) to evaluate the reliability and validity of this newly developed measure. These goals were accomplished through a scale development process and by conducting two separate studies to evaluate the psychometric properties of the Self-Determined Safety Motivation (SDSM) scale. The findings from this project provide evidence that safety motivation is a multi-dimensional construct, capturing different types of motivation. The pilot SDSM scale developed for this project provides an initial measure of the five types of employee safety motivation. Specifically, (1) Amotivation- a lack of motivation for working safely, (2) External safety

motivation- contingency-based motivation influenced by others in the environment, (3) Introjected safety motivation- internal pressure to work safely, (4) Identified safety motivation- personal value-based motivation, and (5) Intrinsic safety motivation- personal interest and enjoyment in safety activities.

The 16 item pilot SDSM scale provides a starting point for future research using SDT as a theoretical framework. Specifically, future research should focus on confirming the factor structure and evaluating the outcome validity of this scale. Although the SDSM scale only explained a small amount of unique variance in employee safety behaviour it is interesting that that autonomous forms of safety motivation (i.e., identified and intrinsic safety motivation) explained the same amount of variance in participation behaviours as safety climate.

IMPLICATIONS FOR FUTURE OCCUPATIONAL HEALTH RESEARCH

The findings from this research project reveal several short and long-term future occupational safety research initiatives that should be explored. Specifically, short-term research initiatives should include both refinement and further evaluation of the SDSM scale, and a more comprehensive examination of the antecedents and consequences (e.g., employee safety behaviours) of different types of employee safety motivation. In terms of scale refinement and further evaluation, future research initiatives should aim to eliminate all complex items and to confirm the reliability and validity of such refinements across different samples of employees. Short-term future research initiatives should also aim to explore if and how different types of employee safety motivation influence employee safety behaviours. Initial findings from this research provide evidence that autonomous forms of safety motivation (i.e., identified and intrinsic) may influence employee engagement in safety participation behaviours to a greater extent than controlled forms of safety motivation (i.e., external and introjected). Future research

should conduct a more in-depth examination of these relationships. Furthermore, future research should also examine what situational factors (e.g., safety climate, transformational safety leadership etc.) promote autonomous and controlled forms of employee safety motivation.

The short-term future research initiatives mentioned above will direct more long-term research initiatives. Long-term research initiatives should include developing and evaluating safety initiatives and training programs designed to promote specific types of employee safety motivation that are associated with positive safety behaviours. Furthermore, long-term research initiatives should also use longitudinal research designs to provide evidence that specific types of safety motivation influence other important safety outcomes besides employee behaviour, such as a reduction in employee injuries and company WCB premium costs.

APPLICATIONS FOR POLICY AND PREVENTION

Given the limitations of the SDSM scale revealed by this research it is premature to make recommendations for policy. The research provides some support for the argument that further research focused on the refinement of the SDSM scale is warranted.

KNOWLEDGE TRANSLATION AND EXCHANGE

Several knowledge translation activities were initiated upon completion of this research. First, a detailed report and presentation, which included a summary of the research results and recommendations for improving employee safety motivation and behaviour were provided to each area that participated in the study one. Safety personnel from locations participating in this research continue to have on-going discussions with the researchers regarding continued measurement and improvement of workplace safety. We also plan to conduct knowledge translation activities with the academic community by preparing academic publications reporting the result of this research project. The results of this research will also be presented at industry

and safety association conferences in Canada to increase awareness of the results of this research and the importance of safety motivation. Finally, the results of this research will also be used to help design new safety improvement interventions aimed at increasing employees safety motivation and behaviour. Such interventions will be implemented and evaluated during future research initiatives with company partners.

REFERENCES

Asparouhov, T. & Muthén, B. (2009). Exploratory structural equation modeling. *Structural Equation Modeling, 16*, 397-438.

Christian, M. S., Bradley, J. C., Wallace, J. C., & Burke, M. J. (2009). Workplace safety: A meta-analysis of the roles of person and situation factors. *Journal of Applied Psychology, 94*, 1103-1127.

Clarke, S. (2006). The relationship between safety climate and safety performance: A meta-analytic review. *Journal of Occupational Health Psychology*, *11,* 315-327.

Crocker, L. & Algina, J. (1986). *Introduction to classical and modern test theory*. Orlando, FL: Harcourt Brace Jovanovich, Inc.

Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior*. New York: Plenum.

Deci, E. L., & Ryan, R. M. (2000). The "What" and "Why" of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry, 11*, 227-268.

Deci, E. L., & Ryan, R. M. (2002). *Handbook of Self-Determination Research*. Rochester, NY: The University of Rochester Press.

Dejoy, D. M. (2005). Behavior change versus culture change: Divergent approaches to managing workplace safety. *Safety Science, 43*, 105-129.

Gagné, M. & Deci, E. L. (2005). Self-determination theory and work motivation. *Journal of Organizational Behavior*, *26*, 331-362.

Gagné, M., Forest, J., Gilbert, M. H., Aubé, C., Morin, E., & Malorni, A. (2010). The motivation at work scale: Validation evidence in two languages. *Educational and Psychological Measurement*, *70*, 628-646.

Griffin, M. A., & Neal, A. (2000). Perceptions of safety at work: A framework for linking safety climate to safety performance, knowledge, and motivation. *Journal of Occupational Health Psychology*, *5*, 347-358.

Guldenmund, F. W. (2000). The nature of safety culture: A review of theory and research. *Safety Science*, *34*, 215-257.

Heinrich, H. (1931). *Industrial accident prevention: A scientific approach.* 1st Ed. London: McGraw-Hill Publishing Co. Ltd.

Hoyos, C. G. (1995). Occupational safety: Progress in understanding the basic aspects of safe and unsafe behaviours. Applied Psychology: An International Review, 44, 233- 250.

Lee, T. R. (1995). The role of attitudes in the safety culture and how to change them. *Paper presented at the Conference on 'Understanding Risk Perception'*. Aberdeen: Offshore Management Centre, The Robert Gordon University.

Lee, T. (1998). Assessment of safety culture at a nuclear reprocessing plant. *Work and Stress, 12*, 217-237.

Marsh, H. W., Lüdtke, O., Muthén, B., Asparouhov, T., Morin, A. J. S., Trautwein, U. & Nagengast, B. (2010). A new look at the big-five factor structure through exploratory structural equation modeling. *Psychological Assessment, 22*, 471-491.

Marsh, H.W., Muthén, B., Asparouhov, A., Lüdtke, O., Robitzsch, A., Morin, A.J.S., & Trautwein, U. (2009). Exploratory Structural Equation Modeling, Integrating CFA and EFA: Application to Students' Evaluations of University Teaching. *Structural Equation Modeling, 16*, 439-476.

McAfee, R. B., & Winn, A. R. (1989). The use of incentives/feedback to enhance workplace safety: A critique of the literature. *Journal of Safety Research, 20*, 7-19.

Mullen, J. & Kelloway, E. K., (2009). Safety leadership: A longitudinal study of the effects of transformational leadership on safety outcomes. *Journal of Occupational and Organizational Psychology, 20*, 253-272.

Muthén, L. K., & Muthén, B. O. (1998-2010). Mplus User's Guide. Sixth Edition. Los Angeles, CA.

Neal, A. & Griffin, M. A. (2006). A study of the lagged relationships among safety climate, safety motivation, safety behaviour, and accidents at the individual and group levels. *Journal of Applied Psychology*, *91*, 946-953.

Neal, A., Griffin, M.A., & Hart, P.M. (2000). The impact of organizational climate on Safety climate and individual behaviour. *Safety Science*, *34*, 99-109.

Probst, T. M., & Brubaker, T. L. (2001). The effects of job insecurity on employee safety outcomes: Cross-sectional and longitudinal explorations. *Journal of Occupational Health Psychology, 6,* 139–159.

Ryan, R. M., & Connell, J. P. (1989). Perceived locus of causality and internalization: Examining reasons for acting in two domains. *Journal of Personality and Social Psychology, 57*, 749-761.

Ryan, R. M., & Deci, E. L. (2002). An overview of self-determination theory: An organismic-dialectical perspective. In E. L. Deci & R. M. Ryan (Eds.), *Handbook of Self-Determination Research* (pp. 3-36). Rochester, NY: The University of Rochester Press.

Ryan, R. M., Plant, R. W., & O'Malley, S. (1995). Initial motivations for alcohol treatment: Relations with patient characteristics, treatment involvement and dropout. *Addictive Behaviors, 20*, 279-297.

Sinclair, R. R., Martin, J. E., & Sears, L. E. (2010). Labor unions and safety climate: Perceived union safety values and retail employee safety outcomes. *Accident Analysis and Prevention, 42*, 1477-1487.

Skinner, B. F. (1938). *The behavior of organisms: An experimental analysis*. New York: Appleton-Century-Crofts.

Vinodkumar, M. N., & Bhasi, M. (2010). Safety management practices and safety behaviour: assessing the mediating role of safety knowledge and motivation. *Accident Analysis and Prevention, 42*, 2082-2093.

Zohar, D. (2002). Modifying supervisory practices to improve subunit safety: A leadership-based intervention model. Journal of Applied Psychology, 87, 156-163.

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.

Table 1: Study 1 results from the exploratory structural equation modeling analysis

	Amotivation	External	Introjected	Identified	Intrinsic
Item *Why do you put effort into working safely?*					
Because I have fun while working safely					**.69*** **
Because it makes me happy		.09*			**.77*** **
Because I enjoy working safely				.44***	**.41*** **
Because safety interests me	.13**			.56***	**.27*** **
Because I personally value safety			-.20**	**.64*** **	
Because I value working in a safe environment			-.27***	**.65*** **	.13*
Because putting effort into working safely is important to me				**.85*** **	
Because I believe it is important to put effort into working safely				**.84*** **	
Because I take pride in working safely				.72***	
Because otherwise I will feel guilty		.53***	**.14* **		
Because I feel bad about myself when I don't work safely		.28***	**.31*** **	.43***	
Because I feel good about myself when I work safely			**.42*** **	.70***	
Because I risk losing my job if I don't		**.55*** **	-.25***		
In order to avoid being criticized by others (e.g., supervisors, colleagues, family, clients…)		**.77*** **			
In order to get approval from others' (e.g., supervisors, colleagues, family, clients…)		**.75*** **			
In order to get a reward	.25***	**.42*** **			
I don't because it doesn't make a difference whether I work safely or not	**.65*** **			-.14**	
I don't because safety is not a priority in my workplace	**.84*** **				
I don't, because safety is not a priority for me	**.81*** **				-.11*
I don't, because working safely is not worth the effort	**.77*** **				

Notes: parameter significant at ***p < .0001; **p < .01, *p < .05. Loadings corresponding to hypothesis are in bold and underlined.
N = 446

Table 2: Competing Alternative Factor Structures for Sample 1

	χ^2	df	*p*	CFI	TLI	RMSEA	95% CI RMSEA	AIC
1 Factor Model	2219.6	170	.000	.51	.46	.16	(.15 - .16)	27653.5
3 Factor Model	536.5	133	.000	.90	.86	.08	(.07 - .09)	26046.5
5 Factor Model	230.0	100	.000	.97	.94	.05	(.04 - .06)	25814.9

Table 3: Means, standard deviations, correlations, and reliabilities of study 1 variables

	Mean	*SD*	Amotivation	External	Introjected	Identified	Intrinsic	General Motivation	Safety Compliance	Safety Participation	Safety Climate
Amotivation	**1.45**	**.87**	(.86)								
External	**2.70**	**1.01**	.353**	(.72)							
Introjected	**3.19**	**1.01**	.161**	.409**	(.65)						
Identified	**4.38**	**.70**	-.132**	.101*	.456**	(.84)					
Intrinsic	**3.47**	**.99**	.147**	.216**	.547**	.588**	(.80)				
General Motivation	**4.56**	**.56**	-.235**	-.014	.231**	.527**	.304**	(.89)			
Safety Compliance	**4.37**	**.62**	-.119*	.016	.227**	.541**	.355**	.713**	(.90)		
Safety Participation	**4.15**	**.71**	-.094	.059	.257**	.545**	.411**	.513**	.669**	(.86)	
Safety Climate	**3.93**	**.66**	-.018	.071	.196**	.239**	.153**	.327**	.402**	.342**	(.95)

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).
Listwise N=420; Cronbach alpha for each scale presented in parenthesis along the diagonal

Table 4: Incremental variance of SDSM scale beyond safety climate and general safety motivation

	Compliance Behaviours		**Participation Behaviours**	
	β	**ΔR^2**	**β**	**ΔR^2**
Step 1:		.16***		.12***
Safety Climate	.40***		.34***	
Step 2:		.38***		.18***
General Safety Motivation	.65***		.45***	
Step 2: Safety Motivation Types		.04***		.11***
Intrinsic Safety Motivation	.08		.17***	
Identified Safety Motivation	.20***		.29***	
Introjected Safety Motivation	-.07		-.07	
External Safety Motivation	-.01		.02	
Amotivation	.05		-.01	
Total R^2		**.58*** **		**.41*** **

Notes: ***p < .001

Table 5: Final study 2 results from the exploratory structural equation modeling analysis

	Amotivation	External	Introjected	Identified	Intrinsic
Item *Why do you put effort into working safely?*					
Because I have fun while working safely					**.83*** **
Because it makes me happy					**.78*** **
Because I enjoy working safely				.43***	**.46*** **
Because putting effort into working safely is important to me				***.76*** **	
Because I believe it is important to put effort into working safely				***.70*** **	
Because working safely aligns with my personal values			.18**	***.72*** **	
Because otherwise I will feel guilty	-.11*	.22**	**.66*** **		
Because I feel bad about myself when I don't work safely			**.72*** **		
Because I would be ashamed of myself if I didn't work safely			**.52*** **	.39***	
In order to avoid being criticized by others (e.g., supervisors, colleagues, family, clients…)		**.78*** **			
In order to get approval from others' (e.g., supervisors, colleagues, family, clients…)		**.62*** **	.23**		
Because other people (e.g., supervisors, colleagues, family, clients…) pressure me to work safely		**.75*** **			
I don't because it doesn't make a difference whether I work safely or not	**.57*** **			-.13*	.15**
I don't because safety is not a priority in my workplace	**.70*** **				
I don't, because safety is not a priority for me	**.85*** **				
I don't, because working safely is not worth the effort	**.37*** **				

Notes: parameter significant at ***p < .0001; **p < .01, *p < .05. Loadings corresponding to hypothesis are in bold and underlined.
N = 490