A cross-sectional study exploring the effect of work place stressors on individual psychological and behavioural indicators of safety.

Maria MATTHEWS [1], James I MORGAN [1] and Stuart WEBSTER-SPRIGGS [2]

Leeds Beckett University [1] and VolkerRail Ltd [2], United Kingdom

Abstract. The role of stress and well-being in the workplace has attracted growing interest in the field of occupational psychology, yet its potential role in accident risk is less explored. Although stress has been linked to safety behaviours, the underlying mechanisms behind this are unclear. This current research proposes that workplace stressors are associated with safety related behaviour through a mediating relationship with safety motivation. Implications and avenues for future research are discussed.

Keywords. Stress, well-being, safety, behaviour.

1. Introduction

Fatal worker injuries in the UK Rail Industry have remained consistently low over recent years as demonstrated by the UK Network Rail workforce safety statistics; with zero workforce fatalities in 15/16 and an average of 3 fatalities a year since 2002 (45 in total). This decline since the 1990's is likely due to legislation and improved safeguarding practices, with the industry taking a "systems" approach to safety (Reason, 1995). Whilst fatal worker injury rates are considered low, non-fatal injuries remain a common occurrence with 6597 workforce injuries reported to Network Rail in 15/16. Despite an overall decline since the 1990's, non-fatal injuries in recent years have remained similar annually (6380 in 13/14 and 6311 in 15/16).

The industry often describes this as an accident "plateau" (Morgan and Webster-Spriggs, 2015), a point at which traditional health and safety assurances have exhausted their value. Further reduction of work-related accidents may therefore require the manipulation of individual psychological and behavioural factors. It is therefore important to explore what particular role these factors play in their contribution to accident rates. Despite this, studies exploring the relationship between psychological factors and safety outcomes are quite scarce (Laurent, Chmiel & Hansez, 2016). One such area to explore is the role of workplace stress, which has attracted much attention in Occupational Psychology but has been less explored for its potential role in accident risk.

Workplace stress has attracted much interest in numerous fields of applied research due to its links with performance, productivity and occupational health as demonstrated in organizational and behavioural studies (Banatunde, 2013), with organisations introducing initiatives and interventions to identify, manage and reduce workplace stressors. For example, in the UK the Health and Safety Executive (HSE) have developed a tool to help businesses evaluate employee perceptions of workplace stressors across a number of domains and have also provided a set of recommended measures if the presence of stressors is found to be high (Health and Safety Executive, 2007). Despite the growing interest in the impact of stressors and the importance of

work related well-being, the role of stress in accident risk is less established. Although poor well-being and stress has been tentatively linked to the risk of negative safety outcomes (e.g., Morgan, Abbott, Furness, & Ramsay, 2016), the literature is somewhat confused by inconsistencies in the definition of stress, and gaps in our understanding of the ways in which stressors may influence safety.

1.1 Defining stress

Stress is commonly defined as a psychological and/or physiological response that occurs within the individual (Banatunde, 2013). There have been a number of studies in the safety literature that link stress with safety behaviour using this definition. For example, poor emotional states have been proposed to interfere with an individual's ability to focus on safety processes and behaviours (Zohar, 2000). Excessive stress leading to burnout or exhaustion has also been linked to poorer individual safety performance, for example, Nahrgang, Morgeson and Hofmann (2011) reported employee burnout to be associated with unsafe behaviours.

However, an alternative way to measure work-related stress, often adopted in occupational health research is to measure stress as a stimulus, as opposed to a response, considering characteristics of the environment that could be considered as stress inducing. Although this is the approach taken by the HSE in their stress management tool, few studies have examined the link between stressor prevalence, measured in this way, and individual and behavioural safety outcomes. Investigating perceived workplace stressors and ways in which they might influence safety, as opposed to stress responses, may prove to be more useful for the purpose of developing interventions, as this enables the source of potential psychological stress to be identified and manipulated.

1.2 Reflective processes vs automatic processes

Inconsistencies in the definition and measurement of stress also contribute to gaps in our understanding of the mechanics of the stress-safety relationship. It is likely that stress as a stimulus may affect behaviour via a different set of processes compared to stress as a response. For example, stress has been implicated in accident risk through cognitive failure leading to human error (Day, Brasher and Bridger 2012), but there is little research exploring how stressors may impact more reflective processes involving attitudes and intentions.

In safety climate research, it is proposed that 'Safety Motivation' is a reflective mechanism important in determining safety behaviour. In particular, Neal, Griffin and Hart (2000) have demonstrated a relationship between safety motivation and safety compliance and safety participation. Safety motivation refers to "an individual's willingness to exert effort to enact safety behaviours and the valence associated with those behaviours" Safety compliance concerns the enactment of such safety related behaviours whereas safety participation reflects proactive safety behaviours that extend beyond compliance, such as voluntarily participating in safety related activities and training (Neal & Griffin, 2006, p. 947). A positive relationship between safety motivation and compliance and safety motivation and participation has been long established (Neal et al, 2000). It is therefore expected that safety related behaviours may stem from both reflective and automatic processes.

In the area of stress however, this has not been applied, with most research focusing on what could be deemed automatic processes. For example, such as how stress can increase human error.

These approaches do not consider how workplace stressors may influence safety motivation and attitudes and therefore safety behaviours through intentions and reflective processes. Neal et al (2000) argue that if one perceives the organization to be supportive of their well-being and welfare they may be more likely to hold the view that the organization values their safety as a priority. If this assumption is the case, then the presence of stressors may influence these perceptions and would be likely to be associated with safety behaviours through safety motivation.

We therefore propose that:

Hypothesis 1: More percieved workplace stressors will be associated with lower safety motivation, safety compliance and safety participation.

And that:

Hypothesis 2: Motivation will mediate the association between workplace stressors and safety compliance/participation.

2. Methods

We invited all safety critical site based staff of a specialist railway infrastructure services company in the UK to participate in this study. Using online, in-person and mail-based data collection a total of 381 employees participated out of an invited population of 630 employees (a 60.48% response rate). The majority of the sample was male (93.3%) with a median age of 39 years and have been working in their current role for a mean average of 4.5 years (SD = 5.26). Employees had spent a mean average of 12.9 years (SD=10.52) working in the rail industry.

2.1 Measures

2.1.1 Safety motivation and safety behaviour (compliance and participation).

Safety motivation, compliance and participation was assessed using 3 scales from the Neal et al safety climate survey (2000). These were a four-item safety motivation scale; one sample item being “I believe that workplace health and safety is an important issue.” A four item safety compliance scale; one sample item being “I use the correct safety procedures for carrying out my job”, and a four-item safety participation scale; one sample item being “I voluntarily perform tasks that help improve workplace safety.” These were measured on a 5 point likert scale ranging from strongly disagree (1) to strongly agree (5) and were coded such that higher scores reflected higher levels of each construct.

2.1.2 Workplace stressors

Indicators of work related stressors were assessed with the HSE management standards work related stress indicator tool (Health and Safety Executive, 2007). The tool consists of 35-items that assess the frequency of which the respondent experiences certain work conditions relating to six key areas of work design; Demands (this includes issues such as workload, work patterns and the work environment), control (how much say the person has in the way they do their work),

support (this includes the encouragement, sponsorship and resources provided by the organisation, line management and colleagues), relationships (this includes promoting positive working to avoid conflict and dealing with unacceptable behaviour), role (whether people understand their role within the organisation and whether the organisation ensures that they do not have conflicting roles), and change (how organisational change (large or small) is managed and communicated in the organisation). Participants respond on a 5 point scale ranging from Never (1) to Always (5). Data was prepared following HSE convention so that higher scores on the scale represent a more positive work environment (fewer perceived stressors) with negatively framed questions reverse scored prior to analysis.

3. Results

Table 1 presents the descriptive statistics and intercorrelations of the variables measured in this study. In support of hypothesis 1, safety motivation was correlated with all 6 domains of stressors apart from demands. These stressors were also correlated with compliance and participation (aside from demands which was correlated with compliance only) suggesting a mediating relationship through motivation may exist in support of hypothesis 2. Motivation, compliance and participation were highly correlated with each other as would be expected based on findings from previous research.

Table 1: Descriptive statistics and intercorrelations of study variables

	N	M	SD	Stressor total	Stressor/ROLE	Stressor/CHANGE	Stressor/RELATIONSHIPS	Stressor/SUPPORT	Stressor/CONTROL	Stressor/DEMANDS	Motivation	Compliance	Participation
Stressor total	376	3.70	0.50										
Stressor/ROLE	376	4.20	0.58	.590**									
Stressor/CHANGE	376	3.32	0.76	.748**	.517**								
Stressor/RELATIONSHIPS	376	3.94	0.65	.780**	.302**	.497**							
Stressor/SUPPORT	376	3.72	0.70	.812**	.429**	.612**	.628**						
Stressor/CONTROL	376	3.47	0.71	.796**	.389**	.565**	.556**	.549**					
Stressor/DEMANDS	376	3.32	0.63	.595**	.198**	.339**	.393**	.351**	.256**				
Motivation	354	4.77	0.55	.215**	.199**	.135*	.180**	.134*	.191**	0.078			
Compliance	354	4.63	0.60	.249**	.233**	.142**	.175**	.152**	.205**	.155**	.683**		
Participation	355	4.20	0.75	.205**	.299**	.219**	.127*	.143**	.180**	0.006	.554**	.578**	

** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).

In order to evaluate the relationship between workplace stressors and safety outcomes whilst accounting for type 1 error, we ran a multivariate multiple regression controlling for sample characteristics (age, gender, time in industry, time in role and weekly hours). The results of this analysis are presented in table 3. Providing addition support for hypothesis 1 we found that work

place stressors predicted poorer motivation, compliance and participation.

We also used regression analysis to investigate hypothesis 2 that safety motivation mediates the effect of workplace stressors on compliance and participation. Results indicated that workplace stressors were a significant predictor of motivation and that motivation was a significant predictor of compliance and participation. The effect of workplace stressors on compliance and participation was significantly reduced after controlling for the mediator, motivation, consistent with partial mediation. The results are presented in Table 3.

Table 2: Multivariate multiple regression analysis.

Step and variable	Dependent variable		
	Motivation	Compliance	Participation
Step 1	(dfs=5,209)	(dfs=5,209)	(dfs=5,209)
Gender	0.179	0.309	0.269
Age	0.013	0.013	0.031
Years in industry	-0.004	0.004	-0.007
Years in role	0.002	-0.016	-0.016
Total hours	0.001	0.001	0.012
R squared	0.069	0.088	0.182
F	4.481***	5.125***	10.525***
Step 2	(dfs=6,208)	(dfs=6,208)	(dfs=6,208)
Workplace stressors	0.237	0.217	0.288
Adjusted R squared	0.141	0.117	0.216
F	6.851***	5.744***	10.811***

* p < .05. ** p < .01. *** p < .00

Table 3: Mediation analysis.

	Compliance (Y)	Participation (Y)
X (stressors) predict Y (path C)	F(1,349)=23.23, p<0.001, R2=0.0624 B=.3, t(349)=15.45, p<0.001	F(1,350)=15.251, p<0.001, R2=0.0418 b=0.3062, t(350) = 3.905, p<0.001
X predicts M (motivation) (path A)	F(1,349)=21.22, p<0.001, R2 = 0.0573 b= 0.247, t(349) = 4.6062, p<0.001	F(1,350) = 17.186, p<0.001, R2 = 0.0468 b= 0.2383, t(350) = 4.1456, p<0.001
X and M together predict Y	F(2,348)=156.46, p<0.001, r2 = 0.4735	F(2,349)=79.89, p<0.001, r2 = 0.3141

M predicts Y	b=0.7673, t(348)=16.48,p<0.001	b=0.7271, t(349)=11.77,p<0.001
X no longer predicts Y or effect is lessened	b=0.1100, t(348)=2.289, p<0.05	b=0.1329, t(349)=1.9535, p=0.05
Sobel Test	Z=4.429, p<0.001	Z=3.898, p<0.001

4. Discussion and Conclusion

4.1 Discussion

The purpose of this study was to begin to explore whether workplace stressors were associated with safety compliance and safety participation behaviours via a mediated relationship with safety motivation. We found a small but significant effect of work place stressors on safety compliance and participation and evidence that this relationship is partially mediated through safety motivation. This is a novel contribution as previous research has tended to focus on how stress might affect safety behaviours through more automatic processes related to human error, with stress being considered to increase accident risk through cognitive failure (Day et al 2012). Exploration of the link between stress and safety involving reflective processes and measures of attitudes such as safety motivation (as in this study) are less prevalent. Although we did not directly measure intentional behaviours vs unintentional behaviours, the partial mediating association through safety motivation provides some evidence that workplace stressors may impact on how motivated an individual is to behave safely.

Alternatively, in the context of social exchange theory (Blau, 1964) a more positive work environment with a low level of stressors could encourage reciprocation behaviours, in this case, engaging in what is deemed as desirable behaviour by the organization through a reciprocation process. It is argued that as a result of a good quality relationship with their organization employees may feel obliged to reciprocate and behaving in a safe manner can be one such way to do this (Chmiel, Fraccaroli and Sverke, 2017). Participation behaviours in-particular may be viewed as reciprocal behaviours since it is going above and beyond what is expected in terms of rules and proceedures. In this current study, the relationship between workplace stressors and participation was slightly stronger than the relationship between either motivation or compliance, providing some support for this possibility.

4.2 Implications and conclusion.

Our present study explored the association between stressors and two safety behaviours; compliance and participation. We found that this relationship is partially mediated through a third measure, safety motivation. Companies may therefore benefit from measuring workplace stressors alongside other organizational level measures of safety (such as safety climate), not

only for the purpose of employee well-being and psychological health, but also since they are likely to be implicated in accident risk through safety motivation, safety compliance and safety participation. Further research should aim to disentangle the effect of stressors from stress responses as they may impact on safety behaviours and outcomes through different mechanisms. Furthermore, future research may benefit from exploring the role of stressors interact with organizational levels of safety such as safety climate.

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