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Relationship Between Work-Related Stress and Accidents: Moderating Role of Safety Factors

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Abstract

Work-related stress has been identified as a risk factor for accidents according to the inadaptability theory of accident causation. The same theory says that increasing adaptability can reduce accidents. So, safety culture can be expected to be a moderator in the relationship between work-related stress and errors or accidents (as a composite construct). A survey was conducted among 431 employees from various industries using the job stress index, safety culture scale, and workplace error-accident history scale with the aim of testing if safety culture mitigates the relationship between workplace stress and errors/accidents. Work-related stress and errors/accidents correlated significantly, $r=.18$, $p<.01$. However, safety culture was not found to moderate their relationship. The conclusion is that a safety culture may not reduce the accidents caused because of work-related stress, and alternatives need to be sought. However, other studies with more methodological rigor or more objective data are needed to verify this conclusion.

Keywords: safety climate, safety compliance, inadaptability theory, errors, accidents

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Introduction

Safety culture includes many things like management commitment, necessary infrastructure, and behavioral issues such as compliance with safety guidelines. It has three major components: employees' behaviors, their cognition, and environmental factors like safety mechanisms (Mathis et al., 2017, p. 564). A Nepalese study (Adhikari, 2021) indicated that a safety culture should be created with supportive management by improving working conditions. Supervisors should be careful to foster a climate of safety by establishing a good communication system. They should also encourage compliance with safety rules (Dessler, 2014, p. 416). A believer in safety culture emphasizes safety in their organizational culture and fosters safety practices at organizational, design, and individual levels (Mathis & Jackson, 2008, p. 469). Safety culture includes communication openness, welcoming response to errors, and management support among others. The safety culture can be made with the help of commitment to safety goals (Turner, 2000) and open discussion about safety hazards including minor ones. Accidents occur because of human and system errors (Adhikari, 2015). Safety training is essential to reduce accidents and is predictive of safety knowledge, motivation, compliance, and participation (Vinodkumar & Bhasi, 2010). In addition to commitment from management, continuous improvement should be the norm. The employees should get a chance to report the incidents and hazards without the fear of punishment because reporting is a valuable source of data based on which desirable interventions can be designed (Johnson, 2003). Culture is created by the collective habits of people regarding speech, communication, dressing, eating, and other behaviors. Likewise, safety culture refers to individual, group, and organizational habits to think about, react to, and communicate about hazards and safety issues.

Safety culture is significantly correlated with stress (Asefzadeh et al., 2017) which is the bodily reaction when the unpredictable and uncontrollable environmental demands exceed the natural regulatory capacity (Koolhaas et al., 2011). The people who experienced more accidents comply less with safety culture (Milczarek & Najmiec, 2004). Safety climate, the shared value perceived and placed by an organization and its members on safety (Griffin & Curcuruto, 2016), affects the well-being of the construction workers (Chen et al., 2017). A higher number of safety climate problems are associated with more accidents (Ajslev et al., 2017). The commitment of management, workers' knowledge, and their participation are significantly related to the

accidents (Vinodkumar & Bhasi, 2009). Safety behavior is the predictor of safety outcomes (Panuwatwanich et al., 2017). In short, errors or accidents are constantly shown to be associated with stress including work-related stress.

Stress is a person's response to threatening or challenging stimuli (Feldman, 2019). Job stress work-related stress or occupational stress mean the same thing and refer to the stress created because of various aspects of a job, work, or occupation. Job stress is theorized to be caused by environmental factors such as financial/political uncertainty, organizational factors such as role ambiguity, and personal factors such as family problems (Robbins & Judge, 2022, p.631). It is supposed to result in physiological strain such as headache, psychological strain such as anxiety, and behavioral strain such as high absenteeism (p.631). Stress as a risk factor might trigger errors and accidents among employees. A study is needed to explore this relationship. The safety culture (say safety climate, motivation, compliance, and participation) is expected to moderate the relationship. Research is needed in that direction too. For this study, safety culture has been defined as made up of safety climate, safety motivation, and safety behaviors (Neal & Griffin, 2006).

The inadaptability theory of accident causation posits that inadaptability, which is contributed by individual factors like stress, sleep deprivation, and distraction, and system factors like degrading road conditions, and corroding machines are the causes of accidents (Adhikari, 2017). The factors created by the interaction of both humans and the system may also contribute to inadaptability or adaptability. The very theory posits that increasing adaptability can reduce errors-accidents. So, factors like safety culture, situational awareness, attention, alertness, and mindfulness are expected to be helpful in reducing errors and accidents and enhancing safety according to this theoretical framework. In this study, a hypothesis has been tested: the safety culture weakens the relationship between work-related stress and errors or accidents. Likewise, the other hypotheses are related to the three components of safety culture.

Method: Participants

There were 431 participants taken by convenient sampling. Most of the participants were young (M_{age}=29.18, SD=7.40) with an average experience of 3.67 years and average daily working hours of 8.51 hours. More than half participants (57.9%) were male and 42.1% were female. The following table represents the industry they belonged to:

Table 1: The industry related to participants

Industry	Frequency	Percentage
Automobile	29	6.73
Construction	65	15.08
E-commerce	30	6.96
Service	118	27.38
IT	65	15.08
Manufacturing	30	6.96
Medical	94	21.81
Total	431	100

Source: Survey, 2022

Measures

The job stress index (Bernas & Major, 2000) was used to measure work-related stress. It has 12 items on a Likert scale to be rated from “Strongly disagree” through “Strongly agree”. A higher score means more work-related stress. The safety culture scale used in a study to measure safety climate, motivation, and behaviors (Neal et al., 2000; Neal & Griffin, 2006) was used to measure safety culture. In other words, safety culture is assumed to be made up of safety climate, safety motivation, and safety behaviors. Safety behaviors had two components: safety compliance and safety participation. Each safety component had three items to be rated on a 5-point Likert scale (“Strongly Disagree” through “Strongly Agree”), and more scores in each meant more value in each. A scale with 5 items was developed to measure workplace error and accident history (WEAH). This Likert scale had five response options ranging from “Never” to “Almost always”. Its items were related to errors and accidents that occurred in the workplace during the last 12 months. A higher score meant more errors and accidents at the workplace. The WEAH scale had the following items:

1. You have committed minor errors
2. You have committed serious errors
3. You have fallen into minor accidents
4. You have fallen into serious accidents
5. Your coworker has fallen into serious accidents

Cronbach's alpha in this sample was .86 for the job stress index. It was .89 for the safety culture scale and .82 for WEAH. These are acceptable reliabilities.

Procedure

The survey was administered to the participants with the help of research assistants who were students in a graduate college of Industrial and Organizational Psychology program in Kathmandu. The participants were approached while they worked in their workplace. They were requested to fill out the survey. The white-collar workers were asked questions in English but the illiterate and blue-collar workers were approached with their Nepali translation.

Data Analysis

Data was organized in Excel and imported to SPSS. The moderated regression analyses were carried out. Six models were tested. In addition, some descriptive statistics were computed.

Results

The summary of work-related stress, safety climate, and errors-accidents are given in Table 1.

Table 2: Descriptive statistics of the three main variables

	M	SD	Q_1	M_d	Q_3
Work-related stress	31.72	8.524	26.00	31.00	36.00
Safety culture (consisting of safety climate, motivation, and behaviors)	44.10	7.567	39.00	45.00	49.00
Errors and Accidents	6.49	4.071	3.00	6.00	9.00

Source: Survey, 2022

The correlations between the variables of the study are given in Table 3. All safety factors are positively and significantly correlated. The safety culture did not correlate significantly with errors and accidents. However, work-related stress and errors-accidents have correlated significantly.

Table 3: Correlation matrix

		1	2	3	4	5	6	7	8	9	10
1	Age										
2	Work hours/day	-0.02									
3	Experience (years)	.54**	0.10								
4	Work-related Stress	-0.01	0.05	0.04							
5	Safety culture	-.17**	.15**	-0.02	0.03						
6	Errors & accidents	-0.06	0	.21**	.18**	0.06					
7	Safety climate	-0.06	-0.07	-.26**	-.13**	.13**	-0.06				
8	Safety Motivation	-0.04	-0.06	-.24**	-.11*	.16**	-0.06	.95**			
9	Safety compliance	-0.04	-0.07	-.23**	-.12*	.15**	-0.06	.95**	.95**		
10	Safety participation	-.12*	-0.04	-.25**	-.13**	.17**	-0.05	.94**	.94**	.94**	
11	Safety behavior	-0.08	-0.06	-.25**	-.12*	.16**	-0.05	.96**	.96**	.99**	.99**

Note. * Means significant at .05 and ** significant at .01 levels.

Source: Survey, 2022

The moderation model showed that a 3.6% variance in error accidents is explained by predictor variables: work-related stress and safety culture. However, they could not predict errors-accidents significantly. The interaction term was not significant as shown in the table below. Similarly, no other safety factors moderated this relationship.

Model	Interaction term	b	LLCI	ULCI	% of variance explained by the predictors
1	Stress x Safety Culture	.001	-.005	.007	3.6
2	Stress x Safety Climate	.0002	-.007	.007	3.4
3	Stress x Safety Motivation	-.001	-.009	.006	3.5
4	Stress x Safety Compliance	-.0005	-.008	.007	3.5
5	Stress x Safety Participation	-.0003	-.008	.007	3.3
6	Stress x Safety Behavior	-.0002	-.004	.004	3.4

Despite the lack of statistical significance, a graph was created in three levels of safety culture and the following pattern (refer to Figure 1) was seen. Figure 1 shows that safety culture seems to have no effect on errors and accidents.

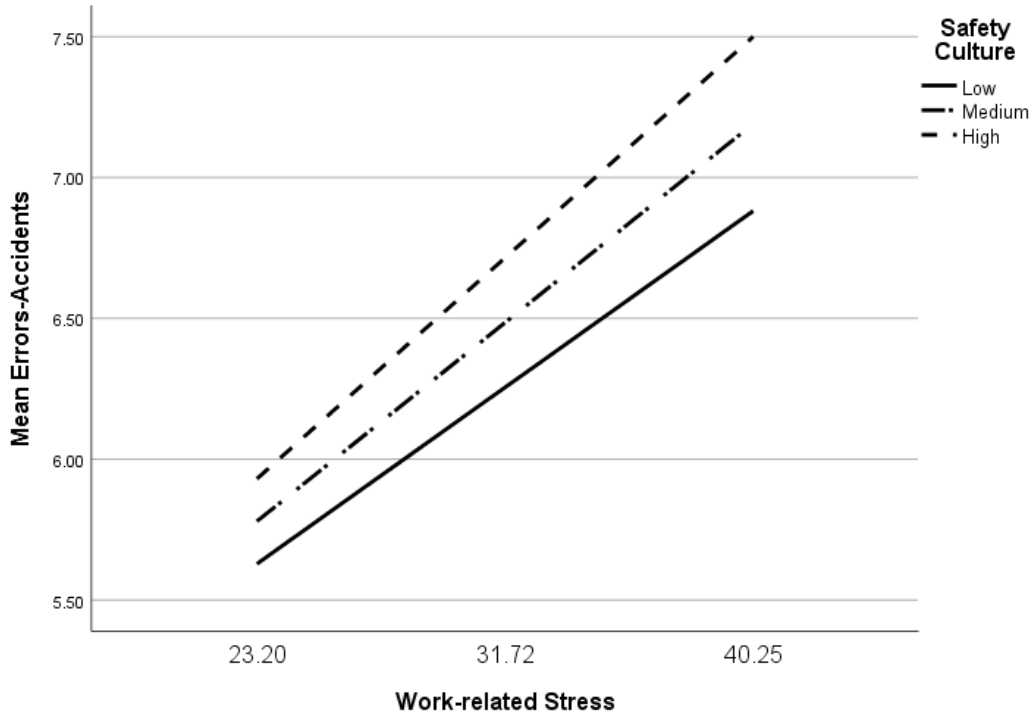

Figure 1. The figure shows that errors-accidents increase as stress increases at work, and safety culture appears to have no effect on the levels of accidents

Discussion

Stress, such as acute stress and that related to life events, increases accidents (Green, 1985). This study also showed a significant positive correlation between work-related stress and errors/accidents. This study did not support the idea that a safety culture is helpful in reducing errors and accidents. Confidence in the inadaptability theory of accident causation (Adhikari, 2017) was not provided. The findings in this study are consistent with Neal and Griffin's (2006) which showed no significant correlation between safety climate or behavior with accidents. The moderation models were not found significant. So, a safety culture may not mitigate accidents caused because of work-related stress.

The possible cause of the failure of safety culture in placating the errors-accidents caused by stress is the overemphasis on behavioral aspects. There are only three items for climate and nine items for behaviors in the test to measure the safety culture used in this study. Situational factors may also be responsible for errors and accidents. The questionnaire used does not include situational factors like work pressure, safety systems, and job risk (Christian et al., 2009).

Implications

The inadaptability theory of accident causation did not gain support in this study. However, methodological flaws may be to blame and new studies should test this theory using objective data, rather than subjective or self-reported data. Organizations and factories should focus less on safety culture as a strategy to reduce errors and accidents. Stress is a risk factor but safety climate, motivation, compliance, and participation may not be the protective factors for errors and accidents at the workplace. This study has contributed a new and briefer version of error-accident history. The longer version (Adhikari, 2022) had six items. Regarding the validity of this briefer version, a significant correlation with stress establishes some extent of convergent validity because we can intuitively predict that stressful persons are prone to errors and accidents.

The alternative ways to lessen the accidents are to modify the behaviors of employees, improve the design of the workplace, and change the way employees interact with the system. There are options to alter the environment, training, selection, equipment, task, or organization design (Lee et al., 2017, p.6). Employee/job features, tools, and physical/psychological environment make up the work system (p.518).

As in a previous study (Adhikari, 2022), the inadaptability theory could not garner confidence. However, the problem may be a methodological issue as pointed out in it. Self-reported data about accidents may not be accurate. Questionnaires face criticisms for methodological inadequacy (Strauch, 2015) in investigating safety culture and accidents. This research could have lacked methodological rigor such as quality control of the research assistants. The relationship can be replicated increasing the rigor. Stressors such as schedule pressure are known to contribute to errors or accidents (Pereira et al., 2020). In this study, the composite score of errors and accidents was used as a dependent variable. The disparate scores could have been used. Convenient sampling may have impaired the generalizability of the findings. Moreover, stress is not always negative but this study deals it as one. Distress is the harmful stress. Eustress is not harmful and can be considered challenging and hence performance-boosting.

This study was carried out among the various professionals. So, a focused study can be conducted in the future, taking the participants who work in error- and accident-prone occupations. Other risk factors like violations (de Winter & Dodou, 2010), and protective factors

like awareness or training (Adhikari, 2015) can be tested in future studies. The objective data are desirable. The same research problem can be examined with objective data such as those maintained by organizations. Moreover, a future study may be conducted to establish other psychometric characteristics of the WEAH scale.

Work-related stress may not directly lead to accidents. Stress occupies the mind and leads to distraction or lack of attention, situational awareness, and concentration. So, these constructs and mindfulness can be tested as mediators in the relationship between stress and errors/accidents. If these prove to be mediational, the interventions can be designed to enhance mindfulness, attention, concentration, and situational awareness and lessen distraction, ultimately reducing errors and accidents at the workplace. Stress should not be limited to work-related, to cause incidents (including both errors and accidents). Since the stress caused in personal life lingers, such stress may also lead to unwanted incidents. Hence, stress can be studied in broader delimitation.

Conclusion

The safety culture globally, and safety motivation, safety behaviors (and safety compliance, safety, and participation), and safety motivation separately could not moderate the relationship between stress and error-accidents. Stress and errors or accidents are significantly correlated. Rather than focusing on safety climate, behavior, and motivation, managers should seek alternative ways to reduce errors and accidents. However, these conclusions should be considered with caution because the self-reported incidents of errors or accidents may not be accurate. So, verification of this conclusion demands organizationally maintained objective data on incidents.

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