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Safety climate and safety performance among construction workers in Hong Kong The role of psychological strains as mediators

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Abstract

This paper examines relations among safety climate (safety attitudes and communication), psychological strains (psychological distress and job satisfaction), and safety performance (self-reported accident rates and occupational injuries). A questionnaire was administered to construction workers from 27 construction sites in Hong Kong (N = 374, M = 366, F = 8, mean age =36.68 years). Data were collected by in-depth interviews and a survey from February to May 2000. A path analysis using the EQS-5 was employed to test the hypothesized model relating safety climate, safety performance, and psychological strains. The results provide partial support for the model, in that safety attitudes predict occupational injuries, and psychological distress predicts accident rates. Furthermore, psychological distress was found to be a mediator of the relationship between safety attitudes and accident rates. The implications of these results for psychological interventions in the construction industry are discussed.

Keywords

Safety attitudes; Safety climate; Psychological strains; Safety performance; Mediators

1. Introduction

As in many countries, safety has always been a major issue and often a problem in the construction industry in Hong Kong. Thousands of people are killed annually in industrial accidents in Hong Kong, and the number of disabling injuries is also a staggering figure. For example, from 1998 to March 1999, there were 35,986 cases of industrial accidents in all industrial undertakings in Hong Kong. Construction employees in Hong Kong incurred approximately 46% annual injury of all occupational injuries. The annual accident rate per 1000 workers in the construction industry was 248.6 and 199.1 in 1998 and 1999, respectively (Hong Kong Annual Digest of Statistics, 1998 and Hong Kong Annual Digest of Statistics, 1999).

1.1. Safety attitudes and safety climate

Donald and Canter (1993) developed the Safety Attitude Questionnaire (SAQ) to measure attitude, which comprised of 16 scales. The rationale was that surveying workers' safety attitudes, using

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questionnaires as measurement instruments, appear to be similar to management safety audits. The Safety Attitude Questionnaire was used in safety research in more than 40 companies over 6 years, and found to be a valid and reliable instrument in predicting safety performance. The implication of these results is that, if a department's safety attitudes are surveyed, it is possible to predict the likely accident rates within that department and to take proactive corrective action.

Donald and Canter (1994) noted that organizational climate is a useful related concept in considering the organizational factors associated with risk and accidents. Climate may also refer to a particular area of organizational functioning, one of which is safety. Cheyne et al. (1998) used structural equation modeling to examine the architecture of the relationships between components of organizational safety climate, and reported that employees' attitudes to safety issues explained levels of safety activity. They argued that employee attitudes are the most important indices of safety climate, since these attitudes are often framed as a result of all other contributory features of the working environment.

1.2. Communication and safety climate

Cheyne et al. (1998) incorporated communication (about safety issues discussed in meetings) as one of the components of safety climate, and concluded that employees differed in communication did report differences in their perceptions of workplace hazards. Furthermore, Hoffmann and Stetzer (1998) concluded that safety climate and communication (an open, free-flowing exchange about safety-related issues) significantly influenced accident attributions. As reported in previous studies, communication is one of the dimensions of psychological climate (e.g. Koys and DeCotiis, 1991). Therefore, besides safety attitudes, communication (an open, free-flowing exchange with management about issues within department/company) is also included as one-dimension of safety climate in the present study.

1.3. Psychological strains and safety performance

Job strains are related to employee safety (Hoffmann and Stetzer, 1996). According to Spector's work (Spector and Jex, 1998 and Spector and O'Connell, 1994), job strains are adverse reactions that employees have to job stressors, one of which is psychological strain (Jex and Beehr, 1991). Psychological strains are affective reactions including attitudes (job dissatisfaction) or emotions (anxiety or frustration).

The results obtained from psychological strains and safety performance are inconclusive. Some studies reported a positive relation between job dissatisfaction and work-related accidents and injuries (e.g. Cooper and Sutherland, 1987 and Holcom et al., 1993). Dunbar (1993) reported that safety compliance could be predicted by affect, anxiety, and depression. Based on the results of a cross-sectional survey in a chemical processing plant, Hoffmann and Stetzer (1996) concluded that

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a perception of high role overload (an indication of perceived work pressure) was associated with an increased tendency to engage in unsafe acts. The main reason was that workers who perceived a high degree of performance pressure would focus their attention on completing the work and less on the safety of their work procedures. Furthermore, Murray et al. (1997) revealed that the fishermen who reported more anxiety reported more injuries and took fewer safety precautions. However, Mearns et al. (1998) did not find any difference in work pressure between accident and non-accident groups among workers in offshore oil and gas industry.

1.4. Causal models linking safety climate and safety performance

Research on safety climate began in early 1980s (Zohar, 1980). Zohar (1980) mainly addressed the role of management, rather than the worker, affects safety in organizations. Guastello and co-workers (Guastello, 1989, Guastello, 1991 and Guastello et al., 1999) applied the non-linear dynamic catastrophe model, in particular, the cusp model, to include individual characteristics to study the occurrence of occupational accidents and stress-related medical disorders in different occupational settings. For instance, Guastello (1991) reported that injuries occurred among transit operators in a climate of elevated stress and anxiety, which might have hampered the operators' ability to respond effectively to potentially dangerous situations. Guastello et al. (1999) concluded that depression symptoms and shift work are the two variables, which predisposed the health care worker to a greater accident risk.

Recently, there has been growing interest in research looking at mediators in safety research, such as personal characteristics (e.g. Iverson and Erwin, 1997 and Sutherland and Cooper, 1991), attitudinal variables (e.g. Barling and Hutchinson, 2000 and Parker et al., 2001), and contextual/organizational variables (e.g. Hoffmann and Stetzer, 1996 and Hoffmann and Stetzer, 1998). Griffin and Neal (2000) used structural equation modeling to establish a theoretical framework linking safety climate and safety performance, with safety knowledge and motivation as mediators. Barling et al. (2002) developed, tested, and replicated a model in which safety-specific transformational leadership predicted occupational injuries through the effects of perceived safety climate, safety consciousness, and safety-related events in two separate studies.

However, there are not many studies investigating the direct and indirect role of psychological strains in accident involvement. One of the very few was done by Janssen and Bakker (2001), who tested and refined the Demand–Control–Support Model among Dutch construction workers using a series of structural equation analyses. They concluded that burnout acts as a mediator between demanding working conditions and health complaints. Mearns et al. (2001) reported that 'unsafe' behavior is the best predictor of accident/near misses as measured by self-report data and that unsafe behavior is, in turn, driven by perceptions of pressure for production. Recently, Probst and Brubaker (2001) have found that employees who report high perceptions of job insecurity exhibit

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decreased safety motivation and compliance, which in turn are related to higher levels of workplace injuries and accidents. Probst (2002) has further demonstrated the role of job insecurity in safety by conducting a laboratory experiment, in which student participants faced with the threat of layoffs were more productive, yet violated more safety rules and produced lower quality outputs, than participants in the control condition.

1.5. The present study

In the existing literature relevant to a Chinese context, there is evidence showing that organizational climate and psychological strains are related. For instance, organizational climate and job satisfaction are found to be positively related in white collar and blue collar Chinese workers (Siu et al., 1997a and Siu et al., 1997b); and organizational climate is negatively related to psychological distress (Siu, 2001a), job satisfaction and absenteeism (Siu, 2002) among nurses. Nevertheless, there is little research on the direct effects of safety climate and psychological strains on safety performance, and studies on the mediating role of psychological strains in the relationship between safety climate and safety performance are even rarer.

One of the purposes of the current study was to replicate the work of Donald and Canter, 1993 and Donald and Canter, 1994 among samples of Chinese construction workers, using some parts of their SAQ to provide at least initial cross-cultural evidence. Another purpose of the study was to test the direct and mediating effects of psychological strains (psychological distress and job satisfaction) on the relationship between safety climate (safety attitudes and communication) and safety performance (self-reported accident involvement). As noted, there have been few if any studies relating safety climate, psychological strains, and employee safety in Chinese societies. The results of this study will particularly bridge this gap in knowledge and contribute to theories in organizational and occupational health psychology. Furthermore, a tool for management safety audit will be validated and available in workplaces in Chinese societies. Suggestions will then be given to contractors so as to implement safety measures and prevent construction injuries.

Fig. 1 depicts the hypothesized model of the study. Based on previous literature (e.g. Donald et al., 1993, 1994; Guastello, 1989, Guastello, 1991 and Zohar, 1980), it was hypothesized that construction workers' perception of a positive safety climate in their workplace (high scores on safety attitudes and communication) would report better safety performance (lower accident rates or occupational injuries). It was also hypothesized that workers who are psychologically strained (feel distressed or dissatisfied) would report worse safety performance (e.g. Murray et al., 1997).

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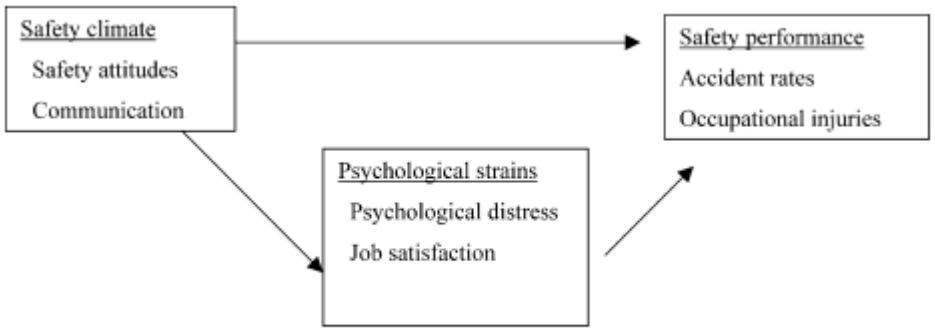

Fig. 1. A hypothesized model relating safety climate, psychological strains, and safety performance.

Based on the work of Hoffmann and Stetzer (1996), it was also hypothesized that workers' perception of safety climate would be related to their reports of psychological strains (psychological distress or job dissatisfaction) in a negative fashion, and workers under strains would be more prone to accidents or injuries (e.g. Guastello et al., 1999). In other words, workers who perceive a negative safety climate in the workplace would feel dissatisfied or distressed, which, in turn, increase their chance of involving accidents or injuries. Since the Asian financial crisis in 1997, many workers in Hong Kong perceive work stress due to job insecurity. Based on recent research findings (e.g. Mearns et al., 2001, Probst and Brubaker, 2001 and Probst, 2002), it is expected that when the construction workers in Hong Kong perceive a positive safety climate at work, because they face the threats of layoffs they then perceive pressure for good performance (quality production), they would focus their attention on completing the work and less on the safety procedures. This, in turn, may make them violate more safety rules leading to a higher accident and injury rate. As a result, it was hypothesized that psychological strains are mediators between safety climate and safety performance. In sum, the following hypotheses were tested:

H1.

Safety climate (safety attitudes and communication) predicts safety performance (accident rates and occupational injuries).

H2.

Psychological distress predicts safety performance (accident rates and occupational injuries).

H3.

Job satisfaction predicts safety performance (accident rates and occupational injuries).

H4.

Psychological distress mediates the relationship between safety climate (safety attitudes and communication) and safety performance (accident rates and occupational injuries).

H5.

Job satisfaction mediates the relationship between safety climate (safety attitudes and communication) and safety performance (accident rates and occupational injuries).

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2. Method

Both qualitative and quantitative approaches were adopted for the study. Qualitative in-depth interviews were conducted before the survey, and face-to-face questionnaire surveys were employed to collect both subjective and objective data.

2.1. Pre-survey interviews

A total of 18 qualitative in-depth interviews were conducted before the survey. Pre-survey interviews were conducted with high-ranking company officials to ensure that relevant independent and dependent variables were not overlooked in the development of the final survey instrument.

2.2. Survey

2.2.1. Sample and procedures for the survey

The data were collected from 374 workers working in 27 construction sites by purposive sampling method between February and May 2000. Face-to-face surveys with workers were conducted. All participants were paid a token sum of HK$ 50 (US$ 7) in order to compensate for the time they spent completing the questionnaires during the interviews.

Among the 374 respondents, 97.9% were males (n=366) and only 2.1% were females (n=8). The mean age of the sample was 34.7 years. The mean length of tenure for employment in the current company was 3.17 years (range 0.08 – 20 years) and for the present job was 8.13 years (range 0 – 40 years).

2.2.2. Instrument for the survey

Selected subscales of the Safety Attitudes Questionnaire by Donald et al. (1993) were used as part of the study questionnaire to measure safety climate (including safety attitudes and communication) and safety performance (accident rates and occupational injuries). These were translated into Chinese by a professional translator, used a back-translation method. Items measuring psychological strains and demographic factors were also included in the questionnaire. In detail, the different scales comprised.

2.2.2.1. Safety climate

A. Safety attitudes. Forty-five questions of the SAQ were used measuring Yourself and Safety (11 items), Your Colleagues (11 items), Management (7 items), Safety Officers (8 items), Your Supervisors (8 items). These were measured on a seven-point Likert-type scale where 1: very strongly disagree; and 7: very strongly agree.

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B. Communication. Seven items were selected from the SAQ measuring the degree of open, free-flowing exchange with management about issues within department/company. These were measured on a seven-point Likert-type scaling where 1: very strongly disagree; and 7: very strongly agree.

2.2.2.2. Psychological strains

A. *Psychological distress*. Thirteen items measuring anxiety, depression, and work retardation (Siu and Cooper, 1998) were used and they were measured at a six-point scale where 1: *never*; and 6: *always*(high score denotes higher distress).

B. Job satisfaction. Two items were used to measure the respondents' satisfaction with the companies they are working at and their present jobs. A six-point scale was used where 1: very much dissatisfaction; and 6: very much satisfaction (high score denotes high satisfaction).

2.2.2.3. Safety performance

Accident rates and occupational injuries

Even though it is likely that self-reporting of accidents may lead to under-reporting of accidents (Marottoli et al., 1997), it is also argued that the use of self-reported measures of involvement in accidents is a reliable method measuring safety outcomes (Young et al., 1997). Therefore, three questions were used to collect self-reported measures of accident involvement: "Have you ever been involved in an accident, or near miss incident, of any kind at work, but did not require absence from work in the last 6 months? Yes or no"; "If yes, how many times?" and "How many times have you suffered from the following injuries, which require absence from work for three consecutive days, in the last 6 months? Strains or sprains, cuts or lacerations, burns, bruises or contusions, fractured bone, dislocated joint, other injuries" (a six-point scale was used ranging from 1: never to 6: five times or more). The second question assesses accident rates and the third question measures occupational injuries.

2.2.2.4. Demographic factors

Items used to collect the personal information about the respondents included age, gender, absenteeism (number of days of absence due to injuries), years of training and working experience.

3. Summary of results of the pre-survey interviews

An analysis of the qualitative answers revealed that the main cause of accident or injuries among construction workers was due to the unwillingness of workers to comply with safety rules and regulations. Concerning organizational roles, most of the respondents felt that supervisors should

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take the responsibility for imparting safety knowledge and regulations. Moreover, most of the respondents recognized the important roles of safety committees and safety meetings.

4. Results of the survey

4.1. Reliabilities of scales

Modeled on the work of Donald and Canter, 1990 and Donald and Canter, 1994, the non-metric multidimensional scaling (MDS) procedure of smallest space analysis (SSA-I) was used to examine the components of the instrument by analyzing the interrelationships between items. According to Donald and Canter (1990), the SSA-I program begins by calculating the association coefficients between each pair of questionnaire items. It then represents the items as points in an n-dimensional space such that the rank of the distances between the points is the inverse of the rank of the inter-item association coefficients. The closer together two points are in the space, the higher their positive association. The coefficient of alienation is usually considered acceptable when it is 0.2 or below. Guttman's μ was used as the association coefficient in the study.

The results show that the coefficient of alienation (Guttman's μ) is 0.18, which is acceptable. The SSA plots show the different partitions of psychological distress items, safety attitudes items, communication items, and job satisfaction items. The internal consistency of each component is assessed by its coefficient α, which ranges from 0.81 to 0.93. The validity of the structure of safety attitudes (consisting of three facets: organizational roles, safety object, and behavioral modality) was demonstrated by SSA-I and reported in another paper (Siu, 2001b), as a result only 33 items instead of 45 were included for later analysis.

About 17% (n=63) of the respondents reported that they were involved in an accident, or incident of near miss, of any kind at work, but did not require absence, in the last 6 months. Among the seven kinds of occupational injuries, the most common injury suffered in the last 6 months was bruises/contusions (28.7%, n=105), followed by strains/sprains (28.5%, n=104). The mean length of absence due to injuries was 3.11 days.

Table 1 presents the means, S.D., range, coefficient α, and correlations among all the scales.

Table 1
Intercorrelations among main variables

	α	Mean	S.D.	Range	1	2	3	4	5	6
Safety attitudes (33 items)	0.93	157.34	18.26	104.00–217.00	–					
Communication (7 items)	0.84	31.85	5.58	28.63–35.28	0.66***	–				
Psychological distress (13 items)	0.93	38.35	12.08	32.89–47.97	−0.23***	−0.19***	–			
Job satisfaction (2 items)	0.81	8.28	1.77	8.14–8.42	0.43***	0.50***	−0.21***	–		
Accident rates (1 item)	n.a.	9.06	3.54	6–29	−0.10	−0.19***	0.22***	−0.11*	–	
Occupational injuries (7 items)	n.a.	6.23	3.02	14–30	−0.14*	−0.07	0.11*	−0.14*	−0.09	–

n.a.—not applicable.
* $P < 0.05$.
*** $P < 0.001$.

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4.2. Path analysis

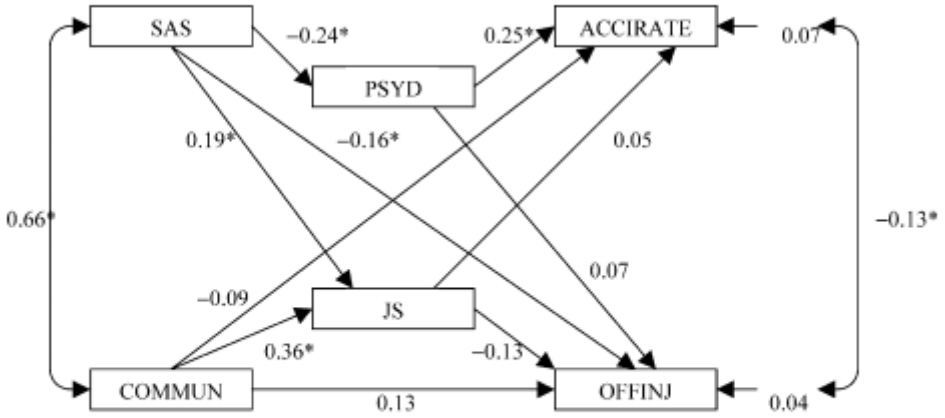
We conducted a path analysis using the EQS program to test the hypotheses and the goodness of fit of the hypothesized model relating safety climate, psychological strains, and safety performance as depicted in Fig. 1. After deleting missing data, there were 323 cases available for analysis. The EQS program provides different indices to ascertain the model fit. The present study used Chi-squared values (χ2), Comparative Fit Index (CFI), the Bentler-Bonett Normed Fit Index (NFI), and the Bentler-Bonett Non-Normed Fit Index (NNFI) to determine the goodness of fit of a model. CFI, NFI and NNFI values of 0.9 or above are taken to indicate a good model fit to the sample data.

Table 2 shows the χ2 values and fit indices for the nested model analyses of the measurement models. In Model 1, the direct and indirect relationships of safety climate and safety performance are tested. The results show that safety attitudes predict occupational injuries; and psychological distress predicts accident rates. Furthermore, safety attitudes have indirect relationship with accident rates, mediated by psychological distress. However, the path coefficients relating communication to accident rates or injuries are non-significant. Moreover, one of the three indices is below 0.9. A Wald test suggested a deletion of the paths relating safety attitudes and accident rates, and that relating communication and psychological distress. In Model 2, the χ2-value of this modified model was quite small, and the three indices are above 0.9, suggesting a substantial improvement in the goodness of fit. However, the results obtained in Model 3 are even better by adding a covariate between accident rate and occupational injuries. Therefore, we accept Model 3 as the finalized model as depicted in Fig. 2.

Table 2
Comparison of hypothesized structural model with three alternative models

	χ^2	d.f.	*P*	NFI	NNFI	CFI	RMSEA
Model 1	7.52	2	0.02	0.98	0.86	0.98	0.10
Model 2	7.73	4	0.10	0.98	0.95	0.99	0.06
Model 3	3.11	3	0.37	0.99	0.99	1.00	0.01

Note: Model 1, including all direct and indirect paths; Model 2, deleting two paths; Model 3, adding one covariate; χ^2, Chi-square; d.f., degree of freedom; *P*, probability level, NFI, Bentler-Bonett Normed Fit Index; NNFI, Bentler-Bonett Non-Normed Fit Index, CFI, Comparative Fit Index, RMSEA, root mean square error of approximation.



Note. SAS = Safety attitudes; COMMUN = Communications;
PSYD = Psychological distress; JS = Job satisfaction
ACCIRATE = Accident rates; OFFINJ = Occupational injuries
*p < .05 ** p < .01 ***p < .001

Fig. 2. The finalized model with path coefficients. Standardized structural parameters are reported.

Fig. 2 shows that safety attitudes predict occupational injuries but not accident rates, and communication does not predict safety performance (accident rates and occupational injuries). Therefore, Hypothesis 1 (H1) can only be partially supported. Fig. 2 also shows that psychological distress predicts accident rates but not occupational injuries, therefore, Hypothesis 2 (H2) can only be partially supported. Nevertheless, safety performance (accident rates and occupational injuries) is not predicted by job satisfaction. Therefore, Hypothesis 3 (H3) cannot be supported. It can also be seen from Fig. 2 that accident rates are predicted by psychological distress, and psychological distress is predicted strongly by safety attitudes. Since the direct path between safety attitudes and accident rates is not significant, we then conclude that psychological distress is a mediator between safety attitudes and accident rates. However, psychological distress is not a mediator between safety attitudes and occupational injuries. As psychological distress is not predicted by communication, psychological distress appears not to be a mediator between communication and safety performance (accident rates and occupational injuries). Therefore, Hypothesis 4 (H4) can only be partially supported. Even though job satisfaction is predicted by safety climate (safety attitudes and communication), job satisfaction does not predict safety performance (accident rates and occupational injuries), it is therefore not a mediator between safety climate (safety attitudes and communication) and safety performance (accident rates and occupational injuries). Therefore, Hypothesis 5 (H5) cannot be supported.

5. Discussion

5.1. Validity and reliability of the instrument

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The purpose of the study was to replicate the work of Donald and Canter, 1993 and Donald and Canter, 1994 in samples of Chinese construction workers, using some parts of their SAQ, in order to provide its cross-cultural evidence. In-depth interviews were conducted before the survey. The results obtained from the interviews show that the SAQ covers the important causes and responsibilities of accidents and occupational injuries as expressed by senior and middle management. Therefore, the content validity of the SAQ has been demonstrated. The acceptably high α for all scales show that the instrument used has demonstrated high reliability. The different domains in the instrument were explicated in the SSA plots. Therefore, the Chinese shortened version of the SAQ is a reliable safety audit in the present study.

5.2. Relationship between safety climate, safety performance, and psychological strains

Another purpose of the study is to test the direct and mediating role of psychological strains (psychological distress and job satisfaction) on the relationships between safety climate and safety performance. The results of the structural equation modeling provide partial support of the hypothesized model. It is evident from Fig. 2 that some of the coefficients are weak associations, however, the overall model has an acceptable fit to the data. In line with many studies conducted in Western countries (e.g. Donald and Canter, 1993 and Donald and Canter, 1994), the results of the present study show that safety attitudes predict occupational injuries. It seems that it is possible to assess construction workers' safety attitudes to predict injuries, so that proactive action can be taken. However, unlike previous studies, communication was not found to be a predictor of safety performance in the present study. This is perhaps due to the fact that communication in the present study was measured as a general organizational climate, not measured in terms of exchange of safety issues as in previous studies (e.g. Hoffmann et al., 1998). Future research may model work from Neal et al. (2000), to investigate the impact of organizational climate on safety climate, which, in turn, may affect safety performance.

The results from the present study also show that workers' levels of psychological distress predict accident rates. This research finding corroborates previous studies conducted in Western societies (e.g. Guastello et al., 1999 and Murray et al., 1997). Therefore, we should seek to understand the sources of psychological strains in future research. As noted earlier, there are very few studies relating work stress and employee safety in Chinese societies. So this study also provides novel insights into safety and psychological strains in a large Asian city. It provides a basis for further tests in similar Asian cities, where the construction industry forms a major sector of the economy and employment.

The present study is also one of the very few which has demonstrated the mediating role of psychological distress on the relationship between safety attitudes and accident rates. It appears that workers who perceived negative safety attitudes displayed by management or colleagues in

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the workplace would feel distressed, this in turn would cause them to have a higher chance of involving accident at work. In other words, psychological distress has direct and mediating effects on accident rates as we hypothesized.

As noted earlier, we took the argument by Hoffmann and Stetzer (1996), that if the respondents in this study might have perceived work pressure for quality performance, they then focused their attention on completing the work in hand and less on the safety of their working procedures. Therefore, they would have had an increased tendency to engage in unsafe acts. It is possible that when the respondents perceived a good safety climate at work, because they faced the threats of layoffs, they then perceived pressure for good performance (quality production); as a result, they focused their attention on completing the work and less on the safety procedures. This, in turn, might have made them violate more safety rules leading to a higher accident rate. We also suspect that the current adverse economic climate, which affects the construction workers in particular, can be a factor causing stress among workers, which in turn affects their safety performance at work. However, the argument relating job insecurity and safety performance put forward by Probst and co-workers (Probst and Brubaker, 2001 and Probst, 2002) needs to be examined with empirical evidence in future research in Hong Kong.

Even though the causal model derived from the present study is somewhat different from previous causation models (e.g. Guastello, 1989 and Guastello, 1991), the present study does contribute to theories in occupational health psychology. The findings of the current study are also important from a practical standpoint. An important policy and practice implication of these findings is that the management group in construction firms should take heed of the psychological well-being of workers. Workers under stress are apparently more prone to accident or occupational injuries. Therefore, a stress audit should be used in addition to a safety audit as diagnostic tests in such firms from time to time. The management group could encourage staff to attend seminars or workshops on stress management as a kind of secondary intervention. The relationship between work stress and safety is obviously another potential future research area among construction workers in Chinese societies.

5.3. Conclusions

The Chinese version of the Safety Attitude Questionnaire appears to be a valid and reliable instrument for measuring safety climate (safety attitudes and communication) among construction workers in Hong Kong. It has the potential to be used for preventive measure in the construction industry and some other industries in Hong Kong. In addition, we suggest that a stress audit should be used from time to time to assess workers' job stress and job strains levels, for preventive intervention purposes.

5.4. Limitations

Due to financial and time constraints, and practicalities in making contacts with contractors and subcontractors, the limitations of the study include the fact that only a cross-sectional survey was possible, and the sample for the survey is not randomly selected. However, the research team attempted to overcome these problems by conducting pre-survey interviews, and surveying workers from as many different sites as possible. The study is also potentially flawed in its use of self-reported measures of accidents and injuries. Objective measures should also be used in future study to supplement and cross check such sources.

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