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Safety Climate and Employee Health Among Blue Collar Workers in Hong Kong and China: Age and Gender Differences[1]

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Abstract

The present study administers a Chinese version of the Safety Attitude Questionnaire (SAQ) to blue collar Chinese workers in Hong Kong (N = 120, 44 males, 66 females) and China (N = 313, 83 males, 223 females); it examines relations among safety climate (safety attitudes and communication), work stress (job strains) and safety performance (accident rates and occupational injuries). The study also aims at comparing safety climate and safety performance between older and younger workers, and between male and female workers. The results show that the Chinese SAQ is a moderately reliable instrument; some safety attitude scales are related to accident rates for both samples. Further, job strains (perceived work stress, psychological distress and job dissatisfaction) are related to accident rates or injuries.

With respect to age and gender differences, there are age differences in some safety attitude scales for the China sample but not the Hong Kong sample, with older workers exhibit more positive attitudes towards safety. However, there is no age difference in communication, accident rates or injuries for both samples. The results also show that there are some gender differences in safety attitude scales for both samples, with females reported more positive attitudes towards safety. However, there is no gender difference in communication, accident rates, or injuries for both samples. The implications of these results are discussed in the paper.

[1] This research has been granted by the Research Committee of Lingnan University.

Introduction

Thousands of people are killed annually in industrial accidents in Hong Kong, and the number of disabling injuries is also a staggering figure. Employee safety is costly in economic terms and great sum of money is lost through losses of wages, workers' compensation and medical benefits. It is estimated that the lost working time because of injuries is about five times greater than the working time lost because of strikes.

The development of safety audit systems appears to have paralleled the stages improvements in general safety practices have moved through. Improvements in safety first began as a consequence of changes to the physical environment and working conditions of employees (Donald, 1994). These are known as 'human factors' which particular attention has been paid to the physical and cognitive characteristics and limitations of operators, this being mainly the province of ergonomics. In addition, more recently greater attention has been directed to cognitive error, particularly mental slips and lapses.

The application of ergonomic methodology and principles has led to great improvements in industrial safety. As Donald (1994) stated, many organizations are finding that their accident rates level off after periods of continuing improvement and that expending further effort in the traditional human factors area results in little further gain. This has stimulated a search for new methods and approaches, and a growing interest in social psychological factors, particularly safety attitudes and climate. Donald and Canter (1994) stated 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. A safety-climate instrument was developed by Zohar (1980) including seven dimensions (e.g. degree of management commitment to safety, effects of safe job performance on promotion, relative effectiveness of enforcement versus guidance in promoting safety). This instrument was administered in 20 factories in Israel and demonstrated that the higher the perceived safety climate of an organization, the higher it had been rated on its safety practices.

Cox and Cox (1991) argued that employee attitudes are one of 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. Donald and Canter (1993) proposed using the attitudinal approach, particularly with respect to safety attitudes and climate. This attitudinal approach starts from a basic premise: 'a large number of accidents are under the control of those involved in them. The people involved may not intend to have an accident, but the behavior that leads them to the accident is intentional, and they are aware of what they are doing. This is in contrast to the idea that an accident happens because of some momentary lapse of concentration or slip' (p.5). They then developed a Safety Attitude Questionnaire (SAQ) to measure attitude, which comprises sixteen scales (for details, see instrument section). The rationale is that surveying workers' safety attitudes, using questionnaires as measurement instruments, may appear to be similar to management safety audits.

They conducted safety research using the SAQ in more than 40 companies over six years, and concluded from their research that it is possible to measure attitudes towards safety in a valid and reliable way, and attitudes are predictive of safety performance. For instance, 14 out of the 16 safety attitude scales were found statistically significantly related to lost-time accidents (Donald, 1994). The implication of these results is, if a department's safety attitudes are surveyed, it is possible to predict the accident rates that are likely within that department and to take proactive corrective action.

Job strains are also believed to be related to employee safety (Barrar and Cooper, 1992). For instance, stress has been suspected to play a role in industrial accidents (Goldberger and Brezniz, 1982). The effects of job dissatisfaction on work injuries have also been examined. Three studies reported a positive relation between job dissatisfaction and work-related accidents and injuries (Cooper, and Sutherland, 1987; Holcom, Lehman, and Simpson, 1993; Zwerling et al, 1996).

A number of demographic factors are found to be related to accidents. It is well-documented that age and accident rate is negatively related because older workers are more experienced on the job and have greater job knowledge and job skills than younger workers (e.g. Stalnaker, 1998). However, the stage of health and some physical abilities such as vision, reaction time and hearing deteriorate with age. Besides, gender is another controversial demographic factor accounting for differences in safety behaviour. For instance, one study

showed that women have a 45 per cent greater accident rate than men, because women have to take more external responsibilities after work (DeBobes, 1986). On the other hand, some studies showed that men reported a greater chance of accident injury than women (e.g. Harrell, 1990).

The Present Study

The validity and reliability of the SAQ has been established in many Western societies. If it is also found to be a valid instrument among Chinese respondents in Hong Kong and China – the two largest societies in the world, it will contribute to the generalizability of theories in organizational psychology. The purpose of replicating the study in different sites in Hong Kong and China is to arrive at a higher convergent validity. In Hong Kong, industrial accidents reported in 1999 mainly occur in blue collar settings (Tables 2.13 & 2.14, p.28-29, Hong Kong Monthly Digest of Statistics, April 2000), and it is believed that this is also true in China. Therefore the present study will look at blue collar workers as targeted samples.

To date, there are not many studies relating work stress, climate, and employee safety in both Western and Chinese societies. In Hong Kong, Siu and Donald (1996) conducted a study investigating the impact of particular psychosocial factors on workers' health in Hong Kong. For instance, they found that a number of psychosocial factors at work were related to health complaints and job satisfaction. Some other studies in Hong Kong also revealed that organizational climate is a source of stress affecting workers' job satisfaction and well-being (Siu, Cooper, and Donald, 1997; Siu, Donald, and Cooper, 1997; Siu and Cooper, 1998; Siu, Lu, and Cooper, 1999). However, none of them relates climate, stress and safety. The results of this study will bridge the gap of this knowledge and contribute to theories in organizational psychology. Furthermore, a tool for management safety audit will be validated and available in workplaces in Chinese societies.

As reported in previous studies, communication is one of the dimensions of psychological climate (e.g. Koys & DeCotiis, 1991), and it is believed that a good flow of communication of safety knowledge and policy within an organization will enhance workers' awareness and behaviour towards safety. Cheyne and Cox (1998) used structural

equation modelling to show that differences in communication affect the level of safety activity. Therefore, besides safety attitudes, communication is also included as one dimension of safety climate in the present study. Further, due to the conflicting research evidence in relation to age and gender, the study will also examine age and gender differences in safety attitudes and safety performance.

In sum, the purpose of the present study is to develop and administer a Chinese version of a portion of the Safety Attitude Questionnaire (SAQ) to blue collar Chinese workers in Hong Kong and China, and to examine the relationship between safety attitudes, safety climate, work stress and safety performance. The second purpose of the study is to compare the safety attitudes and safety performance between older and younger workers. The third purpose is to compare safety attitudes and safety performance between male and female workers. The objectives of the study are as follows:

a) to validate the Chinese version of the SAQ in a Chinese sample;
b) to study the relationship between safety attitudes, safety climate, work stress and safety performance;
c) to compare the safety attitudes of older and younger workers;
d) to compare the safety performance of older and younger workers;
e) to compare the safety attitudes of male and female workers;
f) to compare the safety performance between male and female workers.

Theoretical Framework

The model of the study is depicted in Figure 1. In this model, the independent variables are demographic factors (in particular age and gender), safety climate including safety attitudes and communication. The dependent variables are employee health including safety performance (accident rate and occupational injuries) and job strains (perceived work pressure, psychological distress, and job dissatisfaction).

[insert Figure 1 about here]

Based on this model, a number of hypotheses are derived and they are presented as follows:

1. Positive safety attitudes are negatively related to accident rate and occupational injuries;
2. Good communication is negatively related to accident rate and occupational injuries;
3. Positive safety attitudes are negatively related to job strains (perceived work stress, psychological distress, and job dissatisfaction);
4. Good communication is negatively related to job strains (perceived work stress, psychological distress, and job dissatisfaction);
5. Job strains (perceived work stress, psychological distress, and job dissatisfaction) and safety performance (accident rate and occupational injuries) are positively related;
6. There are differences in safety attitudes between older and younger workers;
7. There are differences in communication between older and younger workers;
8. There are differences in accident rate and occupational injuries between older and younger workers;
9. There are differences in safety attitudes between male and female workers;
10. There are differences in communication between male and female workers;
11. There are differences in accident rate and occupational injuries between male and female workers.

Method

A self-administered questionnaire survey method was employed to collect both quantitative and qualitative data.

Sample and Procedures

The data is collected from 11 factories/companies, where 5 factories were located in China (1 garment factory, 2 electronic product factories, 1 shoe-making factory, and 1 textile factory) and 6 factories/companies were located in Hong Kong (4 garment factories and 2 contractor companies) between April and June 1999. Of the 549 questionnaires

distributed, 390 questionnaires were distributed to the factories in China and 159 questionnaires to the factories/companies in Hong Kong. The reason for recruiting more blue collar workers in China is due to the fact that there are more blue collar workers (particularly in manufacturing industry) in China than in Hong Kong nowadays. The questionnaires were returned between April and June 1999. All participants were paid a small sum of money in order to compensate the time they spent on completing questionnaires during the interviews. They were assured that their individual responses would remain confidential.

Instruments

The Safety Attitudes Questionnaire (SAQ) by Donald et al. (1993), and selected subscales of the SAQ were used as part of the questionnaire for the study to measure safety climate (including safety attitudes and communication) and safety performance (accident rate and occupational injuries), and they were translated into Chinese by a professional translator. Besides items measuring demographic factors and job strains were also included in the questionnaire. A detailed description of the different parts of the questionnaire is given as follows:

Safety Climate:

Safety Attitudes. 16 Safety Attitudes Scales of the SAQ are used and they are measured on a 7-point Likert-type scaling where 1 = very strongly disagree and 7 = very strongly agree. They include:

A. Shopfloor satisfaction with the safety system (3 items). The degree to which employees express themselves as satisfied with specific aspects of the safety system such as safety equipment, safety precautions, and safety procedures.

B. Housekeeping and safety equipment (4 items). Employees assess general housekeeping and the checking of safety equipment.

C. Shopfloor encouragement and support (4 items). Employees assess the degree of interpersonal support and encouragement they and their workmates afford each other.

D. Shopfloor training (3 items). Employees assess their knowledge of their training needs together with their satisfaction with the adequacy of the training they have had.

E. Level of safe working behavior (2 items). This scale relates to employees' rating of how safely they believe themselves to work in general.

F. Safety meetings (3 items). Employees rate the level of involvement they have in meetings which involve discussions about safety, satisfaction with these meetings, and their knowledge about what has been discussed in Safety Committee Meetings.

G. Safety working procedures (3 items). Employees rate their level of understanding of the safe working procedures and any changes which may be made to them.

H. Safety information (3 items). The success with which safety information in general, including aspects such as results of safety inspections, is communicated to employees.

M1. Management/Supervisor satisfaction with the safety system (4 items). Employees rate their managers' and supervisors' perceived satisfaction with aspects of the safety system. These issues include safety in general, as well as safety procedures, results of safety inspections and participants' safety training.

M2. Management/Supervisor knowledge of the safety system (3 items). Employees rate their managers' and supervisors' perceived knowledge of aspects of the safety system which relate both to safety management in general and to the day to day activities of their group/department. These issues include safe working procedures, Safety Committee Meetings, use of safety equipment, and safety training needs.

M3. Management/Supervisor encouragement and support (3 items). Employees appraise the degree of support and encouragement which they receive from management and their supervisors.

M4. Pressure from management/supervisor (4 items). Employees evaluate the pressures which operate to encourage them to infringe safety regulations, and relate these to their understanding of their job, and their actions in carrying it out.

M5. Personal contact with management/supervisor (2 items). Employees rate the degree of interpersonal contact they have with management and supervisors in safety related issues.

TL1. Team leader practice (4 items). Employees assess their team leader in terms of the interpersonal support they receive from them, as well as the degree to which they enforce the following of safe working procedures

TL2. Team leader satisfaction with the safety system (2 items). Employees rate their team leader's satisfaction with the safety system.

TL3. Team leader knowledge with the safety system (3 items). Employees rate their team leader's knowledge with the safety system.

Communication. 10 items measuring communication aspect of safety climate from the SAQ are also selected. They are measured on a 7-point Likert-type scaling where 1 = very strongly disagree and 7 = very strongly agree.

Employee Health:

Safety Performance:

Accident rate and occupational injuries. 3 questions were used to collect information about accident rate ("Have you ever been involved in an accident, or incident, of any kind at work, in the last 6 months? yes or no."; "How many times?") and occupational injuries

("How many times you have suffered from the following injuries, in the last 6 months? strains or sprains, cuts or lacerations, burns, bruises or contusions, fractured bone, dislocated joint, other injuries" – a 6-point scale was used ranging from 1 [never] to 6 [five times or more])

One question was used to assess opinion about who was mainly at fault if accident occurred (with an option of seven choices: management, workmates, line manager, yourself, team leader, contractor, other).

Job Strains:

Perceived work pressure. 2 items are constructed and they are measured on a 6-point scale where 1 = very strongly disagree and 6 = very strongly agree (high score denotes high work pressure).

Psychological Distress. Siu and Cooper (1998) 13 items measuring psychological distress are used and they are measured at a 6-point scale where 1 = never and 6 = always (high score denotes higher distress).

Job satisfaction. 2 items are used to measure the respondents' satisfactory level on the factories/companies they are working at and their present jobs. A 6-point scale is used where 1 = very much dissatisfaction and 6 = very much satisfaction (high score denotes high satisfaction).

Demographic variables.

Some items are used to collect the personal information about the respondents including age, gender, absenteeism, apprenticeship, years of training and working experience.

Results

Response Rates and Sample Distributions

The response rate of the 11 factories/companies was 91.07% (n=500) and 86.60% of them were valid cases which have been computed and analyzed (n=433). The response rates of China's sample was 92.05% (n=359) and of Hong Kong's sample was 88.68% (n=141). In the end, there are 313 valid cases in China and 120 valid cases in Hong Kong. 30.53% of them are male (n=127) and 69.47% are female (n=289) (with 17 respondents did not answer).

Table 1 depicts the sample distributions in China and Hong Kong. The distributions of gender in the two groups are very similar. However, the distributions of age are different. In the China sample, 27.12% were males (n=83) and 72.88% were females (n=223). On average, workers in China were 27.42 years old (range=16-59), had worked in the current factories/companies 2.30 years (range=0.08-15 years), and had been in the present post for 2.41 years (range=0-28 years).

On the other hand, in the Hong Kong sample, 40% were males (n=44) and 60% were females (n=66). On average, workers in Hong Kong were 38.41 years old (range=16-69 years), had worked for the current factories/companies 5.50 years (range=0.08-20 years) and had been in the present post for 7.78 years (range=0.17-30 years).

[insert Table 1 about here]

Reliabilities of Scales

Table 2 presents the means, standard deviations, and coefficient alphas for the scales in the Hong Kong and China samples. Most of the alphas are acceptable but some are rather low, in particular in the China sample. The alphas of the scales of "safety meeting". "safety working procedures". "management/supervisor satisfaction with the safety system", and "management/supervisor knowledge of the safety system" are very low and unacceptable in both samples. Furthermore, the alpha of the scale "personal contact with management/supervisor" for the China sample, and "team leader practice' for the Hong Kong sample

are also unacceptable. Interpretations of results relating to these scales must be done with caution.

[insert Table 2 about here]

Univariate Analysis

Training Record and Absenteeism

The distribution of apprenticeship and formal training in the two groups are very similar. However, the distribution of absenteeism are different. In the China sample, 51.30% of them had served apprenticeship (n=158) and 36.84% had been trained within the factories/companies they are working (n=112). In the Hong Kong sample, 47.66% of them had served apprenticeship (n=51), and 32.71% had been trained within the factories/companies they are working (n=35). Concerning the number of years of training, the range is from zero to 10. However, the mode is "none to less than a year" of training. The average number of years of training in China and Hong Kong are 0.39 and 0.74 respectively.

The average number of days of absenteeism are 2.40 and 5.41 in China and Hong Kong respectively; and the mean of absence due to accident (total number of days of absence minus number of days of absence due to illness) was 1.04 and 3.49 days in China and Hong Kong respectively. Workers in Hong Kong reported more days of absences.

Safety Performance

Only 6.7% (n=8) of the workers in Hong Kong reported that they were involved in an accident, or incident, of any kind at work, in the last 6 months, and 81.7% (n=98) said 'No' to this question (with 11.7% [n=14] missing cases). For the China group, 12.5% (n=39) of the workers said "Yes" and 85.9% (n=269) said "No" to the question. The means and percentages of accident rate and each kind of occupational injuries were also very low for both samples, even though Hong Kong workers reported higher incidents of accidents or injuries (see Table 3). Table 4 shows that most China workers would attribute 'management' as mainly at fault, whereas most Hong Kong workers would think workers themselves should take responsibilities for accidents.

[insert Table 3 & 4 about here]

Bivariate Analysis

Relationship between Safety Climate, Safety Performance, and Work Stress

Table 5 shows the intercorrelations between the main variables. Six out of 16 safety attitude scales (E, G, H, M1, M2, TL3) were statistically significantly correlated with accident rate, and 4 out of 16 scales correlated with injuries (D, E, F, TL1) for the China sample. For the Hong Kong sample, 8 out of 16 attitude scales were statistically significantly correlated with accident rate (A, B, C, D, E, F, M5, TL1), and 12 out of 16 scales correlated with injuries (A, B, D, E, F, H, M2. M3, M4, M5, TL1, TL3). Therefore hypothesis 1 can be partially supported.

[insert Table 5 about here]

In relating other dimension of safety climate with accident, there was no significant relationship between 'communication' and accident or injuries for both samples (see Table 5). Therefore hypothesis 2 cannot be supported.

Table 5 also shows that, for the China sample, most safety attitude scales correlated statistically significantly with perceived work pressure (13 out of 16, in negative direction), psychological distress (6 out of 16, in negative direction), and job satisfaction (14 out of 16, in positive direction). For the Hong Kong sample, none of the safety attitude scales was related to perceived work pressure, but all safety attitude scales were related statistically significantly to psychological distress (in negative direction). Further, 14 out of 16 attitude scales were statistically significantly related to job satisfaction (in positive direction). Therefore hypothesis 3 can be partially supported.

Furthermore, 'communication' was negatively and statistically significantly related to perceived work stress, and positively and statistically significantly related to job satisfaction, but had no relationship with psychological distress for the China sample. A slightly different results were obtained in the Hong Kong sample, in

which 'communication' was not related to perceived work pressure, but was negatively related to psychological distress and positively related to job satisfaction, both are statistically significant. Therefore, hypothesis 4 can only be partially supported.

In relating job strains and safety performance for the China group, job satisfaction was negatively and statistically significantly correlated with accident rate, and perceived work pressure and psychological distress were positively and statistically significantly related to injuries. For the Hong Kong group, psychological distress was positively and statistically significantly related to injuries, and job satisfaction was negatively and statistically significantly related to injuries. Therefore hypothesis 5 can be partially supported.

Age and Gender Differences in Safety Climate and Safety Performance

There were age differences in 6 safety attitude scales for the China sample, with older workers exhibited more positive attitudes towards safety (see Table 6). However, there was no age difference in safety attitude for the Hong Kong sample, therefore hypothesis 6 can only be partially supported.

[insert Table 6 about here]

There was no age difference in 'communication' for both samples, therefore hypothesis 7 cannot be supported. Table 6 shows that there was no age difference in accident rate or injuries for both samples, therefore hypothesis 8 cannot be supported.

Concerning gender, Table 7 shows that there were some gender differences in safety attitude scales for the China sample (3 out of 16) and the Hong Kong sample (3 out of 16), with females reported more positive attitudes towards safety. Therefore hypothesis 9 can be partially supported. However, there was no gender difference in 'communication', accident rate, or injuries for both samples, therefore hypotheses 10 and 11 cannot be supported.

[insert Table 7 about here]

Discussion

Reliability of Safety Attitude Questionnaire (SAQ)

The purpose of the study was to replicate the work of Donald and his collaborators (1993, 1994) work in samples of Chinese blue collar workers, using some parts of their SAQ. The results show that the Chinese version of the SAQ was a moderately reliable instrument. It is the first time that the SAQ was administered to samples of workers in China and Hong Kong. Perhaps as suggested by some researchers who conducted studies using Western standardized instruments among Chinese employees (e.g. Xie and Jamal, 1993; Chiu & Kosinski, 1995), safety climate may be a new construct to blue collar Chinese workers (particularly true for workers in China), this then leads to lower reliability of the measures.

Relationship between Safety Climate, Safety Performance and Work Stress

Like previous studies using the SAQ in European countries, some safety scales were found to be related to accident rate and injuries and therefore safety attitudes were predictors of safety performance. These results corroborate studies in Western societies (e.g. Donald, 1994), and therefore contribute to generalizability of findings that employee attitudes are one of the most important indices of safety climate (Cox & Cox, 1991; Donald et al., 1993, 1994). Further, the present study demonstrates that the Safety Attitude Questionnaire (SAQ) (Donald & Canter, 1993) can be used across culture.

The implications of these results are that some safety attitude scales are most predictive of safety performance, and some do not seem to predict at all. To illustrate, for workers in China, 'safety information' is most predictive of accident rate, and 'shopfloor training' and 'level of safe working behaviour' are most predictive of injuries. These should therefore be paid particular attention in recruiting new staff or retraining existing staff. For the workers in Hong Kong, 'shopfloor satisfaction with safety system', 'level of safe working behaviour' and 'team leader practice' are most predictive of accident rate; whereas 'housekeeping and safe equipment', 'shopfloor training', 'level of safe working behaviour', 'safety meeting', 'management/supervisor knowledge of the safety system',

'management/supervisor encouragement and support', and 'personal contact with management/supervisor' are most predictive of injuries. Therefore, besides safety training, perceived support given to the workforce by management is also highly predictive of their propensity to have accidents or injuries.

Furthermore, the items forming the scales that are not correlated with safety indicators may be omitted from the questionnaire, reducing the size further. The resulted attitude scales may be used as a diagnostic tool which can aid management decision-making and be used for proposing safety initiatives.

However, the results show that 'communication' was not related to accident at all for both samples, therefore communication was not so predictive of accident rate or occupational injuries as found in Western literature. One of the possible reasons may be that the samples were not chosen from high risk group, such as construction industry or catering industry. Future research using this Chinese version of the SAQ as safety audit should be encouraged in these high risk groups in Hong Kong and China.

As mentioned earlier, there have not many studies relating work stress and employee safety in both Western and Chinese societies. The results of the present study demonstrate that work stress, psychological distress and job dissatisfaction are related to accident rate/injuries. These findings corroborate previous studies conducted in Western societies (e.g. Barrar & Cooper, 1992; Cooper & Sutherland, 1987). An implication of these findings is that the management group should take note of the psychological well-being of workers. Workers under stress are more prone to accident or occupational injuries. Therefore stress audit in addition to safety audit should be used as diagnostic tests from time to time. Relationship between work stress and safety is obviously another potential research area in organizational psychology.

Age and Gender Differences in Safety Climate and Safety Performance

The present study revealed that older workers in China had more positive attitudes towards safety than their younger counterparts. These results corroborate previous findings that older workers are more experienced on the job and have greater job knowledge and job skills

(e.g. Stalnaker, 1998). Even though the present study did not find age difference in accident rate or injuries, since older workers had higher job satisfaction (see Table 6), and job satisfaction was negatively related to accident rate (see Table 5), similar research should be replicated to test if there is any age difference in safety performance.

However, there is no age difference found in safety attitudes or safety performance. Future research should be conducted among Hong Kong workers using a larger sample size.

With respect to gender difference, the present study consistently found from workers in Hong Kong and China that men scored lower in some safety attitude scales (see Table 7). Even though there is no gender difference in safety performance, since men perceived greater work pressure and had lower job satisfaction (see Table 7), and job satisfaction was related to accident rate/injuries (see Table 5), similar research should be replicated to test if there is any gender difference in safety performance.

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Figure 1. Model of the Study

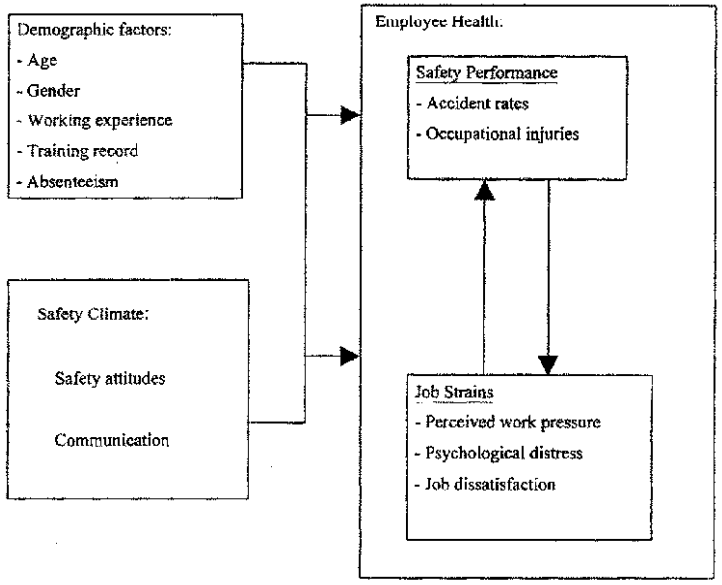

Table 1. Sample distributions in China and Hong Kong

	China (N=313)			Hong Kong (N=120)		
	n	%	*Mean (Range)*	*n*	%	*Mean (Range)*
Age (in year)						
Below 20	83	32.3		2	1.8	
20-29	126	47.9		15	13.6	
30-39	33	12.8		38	34.5	
40-49	14	5.4		43	39.1	
50-59	1	0.4		11	10.0	
60-69	-----	-----		1	0.9	
Did not answer	56	17.9		10	8.3	
			27.42 (16-59)			38.41 (16-69)
Sex						
Male	83	28.8		44	40.0	
Female	223	71.2		66	60.0	
Did not answer	7	2.2		10	8.3	
Working experience (in years)						
Worked for this Company						
Less than 5.99	272	86.9		50	41.7	
6 – 10.99	20	6.4		30	25.0	
11 – 15.99	1	0.3		16	13.3	
16 – 20.99	1	0.3		5	4.2	
21 – 25.99	1	0.3		2	1.7	
26 and above	1	0.3		3	2.5	
Did not answer	17	5.5		14	11.6	
			2.41 (0-28)			7.78 (0.17-30)
Present post with this company						
Less than 5.99	277	88.5		62	51.7	
6 – 10.99	19	6.1		30	25.0	
11 – 15.99	3	1.0		12	10.0	
16 – 20.99	-----	-----		2	1.7	
Did not answer	14	4.4		14	11.6	
			2.30 (0.08-15)			5.50 (0.08-20)

Table 2. Means, standard deviations, and coefficient alphas for the scales used in the study

Variable	China (N=313)				Hong Kong (N=120)			
	Alpha	*Mean*	*S.D.*	*Range*	*Alpha*	*Mean*	*S.D.*	*Range*
A. Shopfloor satisfaction with safety system (3)	0.68	14.08	2.83	5-21	0.70	14.79	2.52	3-20
B. Housekeeping and safety equipment (4)	0.58	20.90	2.95	9-28	0.67	20.73	3.05	13-28
C. Shopfloor encouragement and support (4)	0.71	21.17	3.37	12-28	0.75	20.19	2.82	12-26
D. Shopfloor training (3)	0.58	14.62	2.54	4-21	0.58	14.61	2.16	8-20
E. Level of safe working behavior (2)	0.72	9.60	2.11	2-14	0.69	10.47	1.71	3-14
F. Safety meetings (3)	0.34	15.00	2.20	7-21	0.50	14.37	1.99	5-18
G. Safety working procedures (3)	0.37	14.15	2.61	7-21	0.32	14.89	2.11	7-20
H. Safety information (3)	0.59	14.04	2.82	3-21	0.66	14.64	2.51	4-21
M1. Management/Supervisor satisfaction with the safety system (4)	0.39	18.37	3.34	7-43	0.22	20.34	5.63	12-72
M2. Management/Supervisor knowledge of the safety system (3)	0.49	14.10	2.62	5-21	0.33	14.94	1.95	11-20
M3. Management/Supervisor encouragement and support (3)	0.71	14.56	2.85	3-21	0.66	14.32	2.56	5-19
M4. Pressure from management/supervisor (4)	0.71	20.08	4.27	6-28	0.84	16.67	4.66	8-28
M5. Personal contact with management/supervisor (2)	0.41	8.62	2.08	2-14	0.64	9.10	1.84	4-14
TL1. Team leader practice (4)	0.71	20.60	3.29	4-28	0.45	19.04	2.65	10-25
TL2. Team leader satisfaction with the safety system (2)	0.54	9.51	1.65	2-14	0.81	10.17	1.63	6-14
TL3. Team leader knowledge with the safety system (3)	0.63	14.22	2.41	5-21	0.83	14.90	2.44	7-21
Communication (10)	0.64	45.57	5.92	16-62	0.51	47.20	7.79	31-106
Perceived work pressure (2)	0.57	7.34	1.86	2-12	0.81	7.35	1.77	2-12
Psychological distress (13)	0.83	38.58	10.08	13-78	0.90	37.33	11.19	16-63
Job satisfaction (2)	0.75	7.85	1.94	2-12	0.85	8.61	1.94	2-12

Table 3. The means and percentages of accident rates and occupational injuries

	China (N=313)				Hong Kong (N=120)			
	Mean	*S.D.*	*Range*	*Missing*	*Mean*	*S.D.*	*Range*	*Missing*
Accident rate (how many times?)	0.22	0.75	0-6	7	0.17	0.83	0-6	15
Injuries:								
Strains/Sprains	1.12	0.54	1-6	7	1.25	0.75	1-6	13
Cuts/Lacerations	1.30	0.87	1-6	8	1.28	0.99	1-6	15
Burns	1.12	0.57	1-6	7	1.12	0.71	1-6	13
Bruises/Contusions	1.17	0.55	1-5	7	1.34	0.98	1-6	13
Fractured bone	1.01	0.08	1-2	7	1.02	0.14	1-2	15
Dislocated joint	1.01	0.08	1-2	9	1.03	0.22	1-3	15
Other injuries	1.09	0.49	1-6	7	1.04	0.39	1-5	15

Table 4. Respondents' opinion on who was mainly at fault if accidents occurred

	China (N=313)				Hong Kong (N=120)	
	n	%		*n*	%	
Management	71	22.7		17	14.2	
Workmates	14	4.5		16	13.3	
Line manager	32	10.2		1	0.8	
Team leader	15	4.8		4	3.3	
Contractor	67	21.4		----	----	
Yourself	43	13.7		36	30.0	
Others	24	7.7		8	6.7	
Did not answer	47	15.0		38	31.7	

Table 5. Intercorrelation between variables (China)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1. A	-----																					
2. B	.175**	-----																				
3. C	.153*	.380***	-----																			
4. D	.448***	.152*	.367***	-----																		
5. E	.437***	.243***	.199**	.268***	-----																	
6. F	.350***	.257***	.318***	.571***	.302***	-----																
7. G	.193**	.438***	.223***	.181**	.358***	.182**	-----															
8. H	.525***	.188**	.282***	.559***	.333***	.459***	.157*	-----														
9. M1	.379***	.215***	.295***	.312***	.291***	.264***	.264***	.311***	-----													
10. M2	.363***	.228***	.156*	.340***	.433***	.323***	.280***	.287***	.665***	-----												
11. M3	.281***	.305***	.307***	.333***	.308***	.373***	.341***	.268***	.311***	.363***	-----											
12. M4	.082	.126*	.227***	.115	.166*	.072	.092	.010	.130	.138*	.254***	-----										
13. M5	.166*	.198**	.158*	.141*	.134*	.210***	.189**	.176**	.145*	.242***	.540***	.044	-----									
14. TL3	.326***	.306***	.177**	.265***	.334***	.296***	.315***	.258***	.322***	.349***	.289***	.244***	.160*	-----								
15. TL2	.322***	.215***	.252***	.246***	.273***	.041	.238***	.151*	.436***	.388***	.231***	.225***	.124	.466***	-----							
16. TLI	.156*	.273***	.431***	.349***	.194**	.324***	.264***	.334***	.308***	.193**	.515***	.464***	.417***	.246***	.248***	-----						
17. TCOMMUN	.178**	.342***	.370***	.344***	.330***	.336***	.311***	.284***	.334***	.359***	.520***	.092	.346***	.236***	.090	.418***	-----					
18. TDEGREE	-.275***	-.047	-.077	-.203**	-.205***	-.156*	-.151*	-.160*	-.063	-.219***	-.132*	-.217***	-.182**	-.190**	-.130*	-.216***	-.149*	-----				
19. TPSYD	-.169*	.025	-.104	-.159*	-.203**	-.118	-.117	-.106	-.077	-.126	-.114	-.181**	-.077	-.150*	-.246***	-.204**	-.095	.379***	-----			
20. TJS	.211***	.188**	.075	.233***	.326***	.231***	.287***	.157*	.203**	.269***	.278***	.210***	.108	.302***	.245***	.258***	.190**	-.238***	-.453***	-----		
21. ACCIDENT RATE	-.013	-.075	-.013	.003	-.115*	-.060	-.132*	-.269***	.121*	-.117*	-.107	.057	-.026	-.136*	-.035	-.051	-.102	.042	.091	-.126*	-----	
22. INJURIES	-.101	.011	.043	-.175**	-.208***	-.137*	-.056	-.063	.023	-.115	-.005	-.025	-.026	.005	-.075	-.128*	-.020	.123*	.184**	-.103	.243***	-----

(Hong Kong)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1. A	-----																					
2. B	.582***	-----																				
3. C	.629***	.638***	-----																			
4. D	.784***	.517***	.531***	-----																		
5. E	.647***	.558***	.576***	.607***	-----																	
6. F	.502***	.521***	.407***	.628***	.372***	-----																
7. G	.446***	.565***	.448***	.439***	.390***	.266**	-----															
8. H	.659***	.431***	.566***	.601***	.378***	.610***	.319***	-----														
9. M1	.315***	.270**	.252*	.232*	.196*	.272**	.213*	.321***	-----													
10. M2	.328***	.455***	.361***	.286**	.192*	.329***	.419***	.291**	.281**	-----												
11. M3	.482***	.552***	.460***	.569***	.462***	.534***	.157	.346***	.270**	.326***	-----											
12. M4	-.098	.209*	.070	-.086	.019	-.009	.100	-.064	-.175	-.032	-.070	-----										
13. M5	.542***	.535***	.349***	.544***	.420***	.513***	.221*	.346***	.249**	.365***	.768***	-.258**	-----									
14. TL3	.680***	.502***	.537***	.651***	.585***	.529***	.309***	.291**	.191*	.339***	.642***	-.135	.713***	-----								
15. TL2	.665***	.573***	.578***	.599***	.448***	.476**	.322***	.250**	.405***	.507***	.527***	-.079	.547***	.618***	-----							
16. TLI	.601***	.552***	.425***	.574***	.445***	.452***	.356***	.272**	.261**	.450***	.550***	.078	.648***	.633***	.694***	-----						
17. TCOMMUN	.594***	.615***	.439***	.453***	.373***	.476***	.237*	.324***	.204*	.289**	.431***	-.012	.528***	.621***	.456***	.457***	-----					
18. TDEGREE	-.095	-.091	.128	-.114	-.126	-.032	-.017	-.148	-.009	.034	.126	-.018	.050	.112	.151	-.021	.017	-----				
19. TPSYD	-.310**	-.521***	-.318**	-.356***	-.434***	-.371***	-.268**	-.282**	-.216*	-.370***	-.330***	-.281*	-.249*	-.322***	-.306**	-.373***	-.242*	.275**	-----			
20. TJS	.388**	.490***	.207*	.359***	.203*	.448***	.138	.287**	.205*	.335***	.373***	.144	.336***	.404***	.309***	.389***	.396***	-.143	-.474***	-----		
21. ACCIDENT RATE	-.323***	-.220*	-.214*	-.258*	-.283**	-.196*	-.093	-.119	-.058	-.104	-.170	.060	-.218*	-.165	-.127	-.259**	-.161	.061	.192	-.154	-----	
22. INJURIES	-.245*	-.339***	-.050	-.332***	-.260**	-.487***	-.378	-.247*	-.032	-.309**	-.363***	-.237*	-.271**	-.212*	-.116	-.250*	-.070	.016	.409***	-.276**	.447***	-----

* p < 0.05 ** p < 0.01 *** p < 0.001

A = Shopfloor satisfaction with safety system, B = Housekeeping and safety equipment, C = Shopfloor encouragement and support, D = Shopfloor training
E = Level of safe working behavior, F = Safety meeting, G = Safety working procedures, H = Safety information,
M1 = Management/supervisor satisfaction with the safety system, M2 = Management/supervisor knowledge of the safety system,
M3 = Management/supervisor encouragement and support, M4 = Pressure from management/supervisor, M5 = Personal contact with management/supervisor
TL1 = Team leader practice, TL2 = Team leader satisfaction with the safety system, TL3 = Team leader knowledge with the safety system,
TCOMMUN = Communication, TDEGREE = Perceived work pressure, TPSYD = Psychological distress, TJS = Job satisfaction,
ACCIDENT RATE = Times of accident involved, INJURIES = Total times of injuries involved.

Table 6. t-tests: Age differences # in safety attitudes, communication and job strains

	Aged 16 - 39		Aged 40 or above		
	Mean	*SD*	*Mean*	*SD*	*t-value*
China					
Safety Attitudes Scales					
Shopfloor satisfaction with safety system	14.03	2.80	16.15	3.02	-2.67 **
Housekeeping and safety equipment	20.89	2.94	21.36	3.43	-0.58
Shopfloor encouragement and support	21.15	3.38	21.85	3.13	-0.73
Shopfloor training	14.59	2.53	15.54	2.90	-1.32
Level of safe working behavior	9.54	2.11	11.00	1.77	-2.64 **
Safety meetings	14.98	2.18	15.93	2.20	-1.59
Safety working procedures	14.08	2.60	15.87	2.45	-2.60 **
Safety information	14.03	2.84	14.58	2.84	-0.66
Management/supervisor satisfaction with the safety system	18.36	3.18	19.07	5.50	-0.78
Management/supervisor knowledge of the safety system	14.03	2.60	16.00	2.52	-2.67 **
Management/supervisor encouragement and support	14.51	2.84	16.31	2.21	-2.24 *
Pressure from management/supervisor	20.07	4.16	21.23	5.96	-0.96
Personal contact with management/supervisor	8.59	2.11	9.00	1.30	-0.72
Team leader practice	20.56	3.30	22.00	3.52	-1.42
Team leader satisfaction with the safety system	9.47	1.62	10.82	2.09	-2.67 **
Team leader knowledge with the safety system	14.17	2.37	16.09	2.55	-2.63 **
Communication	44.55	5.63	47.00	6.79	-1.56
Accident rate	0.22	0.76	0.27	0.70	-0.26
Occupational injuries	7.85	1.86	7.20	0.77	1.34
Job strains					
Perceived work pressure	7.40	1.83	6.14	2.11	2.48 *
Psychological distress	38.81	9.91	33.93	12.23	1.77
Job satisfaction	7.56	1.91	10.20	0.94	-5.31 ***
Hong Kong					
Safety Attitudes Scales					
Shopfloor satisfaction with safety system	14.48	2.82	15.02	2.18	-1.07
Housekeeping and safety equipment	20.42	3.17	21.04	3.16	-0.99
Shopfloor encouragement and support	20.10	2.78	20.42	2.89	-0.55
Shopfloor training	14.41	2.48	14.72	1.90	-0.72
Level of safe working behavior	10.40	1.77	10.66	1.43	-0.84
Safety meetings	14.21	1.95	14.44	2.13	-0.58
Safety working procedures	14.83	2.44	14.98	1.85	-0.35
Safety information	14.09	2.70	14.93	2.24	-1.67
Management/supervisor satisfaction with the safety system	19.93	2.57	20.67	7.86	-0.67
Management/supervisor knowledge of the safety system	14.96	1.87	14.76	1.93	0.54
Management/supervisor encouragement and support	14.34	2.47	14.21	2.38	0.27
Pressure from management/supervisor	17.45	4.76	16.34	4.42	1.22
Personal contact with management/supervisor	9.04	1.78	9.11	1.86	-0.21
Team leader practice	18.87	2.97	19.04	2.39	-0.33
Team leader satisfaction with the safety system	9.95	1.61	10.25	1.48	-0.99
Team leader knowledge with the safety system	15.06	2.62	14.77	2.09	0.60
Communication	47.92	9.80	46.42	5.85	0.94
Accident rate	0.18	0.87	0.18	0.83	-0.02
Occupational injuries	8.21	3.49	8.02	2.49	0.32
Job strains					
Perceived work pressure	7.50	1.73	7.23	1.75	0.80
Psychological distress	38.27	10.62	37.24	11.48	0.46
Job satisfaction	8.48	1.96	8.60	2.03	-0.30

* $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$

The age groups are divided into two groups where one is aged between 16 - 39 and the other one is aged 40 or above

Table 7. t-tests:Gender differences in safety attitudes, communication and job strains

	Male		Female		
	Mean	*SD*	*Mean*	*SD*	*t-value*
China					
Safety Attitudes Scales					
Shopfloor satisfaction with safety system	13.64	3.20	14.25	2.67	-1.65
Housekeeping and safety equipment	20.30	3.27	21.13	2.82	-2.16 *
Shopfloor encouragement and support	20.89	3.54	21.28	3.32	-0.85
Shopfloor training	13.85	2.76	14.91	2.40	-3.20 **
Level of safe working behavior	9.59	2.15	9.61	2.09	-0.11
Safety meetings	14.82	2.46	15.09	2.09	-0.94
Safety working procedures	14.15	2.77	14.13	2.54	0.06
Safety information	13.24	3.51	14.35	2.46	-3.01 **
Management/supervisor satisfaction with the safety system	20.25	4.53	20.75	2.76	-0.15
Management/supervisor knowledge of the safety system	9.64	1.76	9.48	1.63	1.14
Management/supervisor encouragement and support	14.60	2.44	14.09	2.39	-0.59
Pressure from management/supervisor	18.31	4.45	18.38	2.78	0.04
Personal contact with management/supervisor	14.38	2.85	13.99	2.55	0.03
Team leader practice	14.41	3.19	14.63	2.70	-1.12
Team leader satisfaction with the safety system	20.18	4.74	20.16	4.01	0.71
Team leader knowledge with the safety system	8.61	2.16	8.61	2.03	1.57
Communication	44.26	6.23	44.77	5.46	-0.63
Accident rate	0.31	1.00	0.19	0.64	1.29
Occupational injuries	7.83	1.68	7.81	1.88	0.08
Job strains					
Perceived work pressure	7.59	1.83	7.25	1.86	1.41
Psychological distress	37.40	9.80	38.93	10.06	-1.15
Job satisfaction	7.66	1.86	7.74	2.03	-0.31
Hong Kong					
Safety Attitudes Scales					
Shopfloor satisfaction with safety system	14.30	2.92	15.05	2.16	-1.48
Housekeeping and safety equipment	20.10	3.58	21.13	2.80	-1.64
Shopfloor encouragement and support	19.92	2.97	20.42	2.79	-0.82
Shopfloor training	13.89	2.35	15.08	1.97	-2.82 **
Level of safe working behavior	10.18	1.74	10.80	1.44	-2.00 *
Safety meetings	13.67	2.22	14.77	1.80	-2.78 **
Safety working procedures	14.79	2.57	15.03	1.82	-0.56
Safety information	14.42	2.67	14.54	2.40	-0.23
Management/supervisor satisfaction with the safety system	20.98	8.41	19.78	2.65	1.03
Management/supervisor knowledge of the safety system	14.67	1.77	14.97	2.00	-0.77
Management/supervisor encouragement and support	14.07	2.90	14.48	1.90	-0.88
Pressure from management/supervisor	17.79	3.75	16.71	5.02	1.18
Personal contact with management/supervisor	8.77	2.03	9.28	1.61	-1.42
Team leader practice	19.05	3.02	19.05	2.44	-0.01
Team leader satisfaction with the safety system	9.91	1.54	10.23	1.56	-1.05
Team leader knowledge with the safety system	14.59	2.86	15.15	1.95	-1.18
Communication	44.80	5.71	48.54	9.08	-2.33 *
Accident rate	0.32	1.21	0.08	0.42	1.40
Occupational injuries	8.48	3.96	7.75	1.97	1.20
Job strains					
Perceived work pressure	7.56	1.65	7.16	1.73	1.18
Psychological distress	39.36	11.75	34.80	10.10	2.06 *
Job satisfaction	7.74	2.37	9.15	1.44	-3.75 ***

* $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$

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