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The mediation role of safety training between risk perception and safety behaviors among non-medical hospital staff

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Abstract

The relationship between risk perception and safety outcomes has been extensively studied in the past, but there is scarce research on the mediating effect of safety training on risk perception and both safety dimensions of safety behaviors in hospital settings. This study investigates the role of safety training as a mediator in the relationship between risk perception and safety behavior, as measured by compliance and participation in safety measures. The cross-sectional data from one big private hospital in Saudi Arabia was examined using the most recent iteration of Smart Partial Least Squares (PLS4). A 71% response rate was achieved on surveys that were personally handed out to 155 non-medical staff in hospitals. In this study, the significance level for Percentile Bootstrapping with a 95% confidence interval and $p \leq 0.05$ was utilized to analyze mediation. Safety training served as a full mediating variable in the link between risk perception and safety compliance. Surprisingly, safety training did not act as a mediator in the relationship between risk perception and safety participation. This study fills a gap in the body of knowledge about non-medical staff's attitudes toward risk, safety training, and safety behaviors. Additionally, it helps us comprehend how safety training can help people perceive risks and behave safely. Considering that hospital management and safety officials receive high-quality training on safety concerns, more workers follow safety precautions, and the number of workplace accidents is reduced. The results of this study can be used as a foundation for future studies to enhance occupational safety practices.

Keywords: Non-medical staff, Risk perception, Safety behaviors, Safety compliance, Safety participation, Safety training, Saudi Arabia, Smart partial least squares.

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1. Introduction

Getting free of accidents, injuries, and losses is a real dream for individuals and organizations. Given that injuries and accidents in hospital units are still important safety concerns, hospital settings as workplaces for many occupations are still in the early stages of occupational safety improvement [1, 2]. Surprisingly, these injuries and accidents are preventable, as human factors are the main cause of safe and unsafe behaviors [3]. The direct and indirect cost of these accidents is disconcerting. Despite these facts, there is agreement that safety behaviors are a key approach to improving safety outcomes [1].

Frontline employees who are not medical professionals are an essential part of hospital settings and share administrative duties with medical professionals (such as doctors and nurses), making them vulnerable to the hazardous hospital environment [4]. The non-medical workforce is sourced from the general public, and typically they lack technical safety training in infectious illness and other frequent hospital hazards, especially if we take the COVID-19 pandemic period into consideration [5, 6]. Non-medical staff means all personnel not directly involved in medical care, including laundry workers, chefs, housekeepers, security, administrators, etc., Most non-medical staff do not receive superior education and technical training regarding safety contexts.

The field of literature has explored the category of hospital personnel that is both seldom and overlooked. Thus, this study comes to support the literature among those individuals and highlights the mediation role of safety training between risk perception and both common safety behaviors dimensions. The following literature is mentioned to emphasize study hypotheses.

2. Literature Review

2.1. Safety Behaviors

A safe workplace is supposed to achieve safe behaviors and control risky behaviors. Safety participation and compliance are two aspects of safety behaviors that are seen as aspects of individual safety performance [1]. According to Beus, et al. [7], safety behaviors are defined as "any workplace behaviors that affect the likelihood of physical harm to persons". These actions are crucial for enhancing safety results and reducing the risk of workplace accidents and injuries [8]. Safety participation and compliance are two dimensions of safety behaviors [1, 9, 10]. Safety participation refers to actions that promote workplace safety, such as helping coworkers with safety-related issues or voluntarily attending safety meetings. Safety compliance refers to actions focused on meeting minimum safety standards at work, such as adhering to safety procedures and donning required protective equipment [11].

2.2. Risk Perception

Risk perception is important for people's behavior [12]. The concept "risk" is recognized as "an uncertain consequence of an event or an activity concerning something that humans value" [13]. Risk perception, on the other hand, is a subjective assessment that people form regarding the features and severity of a risk [13]. Risk perception relates to beliefs about potential harm or the likelihood of a loss. Due to the nature of their work and educational background, non-medical staff members' perceptions of risk may differ from those of the medical staff. In terms of context for safety, the majority of non-medical workers are not adequately educated. Despite evidence acknowledging the link between risk perception and safety behaviors, it is still controversial and largely contradictory [14]. For instance, some studies supported the positive link between risk perception and safety and risky behaviors [4, 15]. In contrast, other studies found negative impacts [14, 16]. The existing literature has conflicting conclusions as a result of the dual nature of hindrance and challenge in relation to employment demands. Employee risk is perceived differently depending on the circumstances as a challenge or hindrance to work [17, 18]. The mechanisms by which risk perceptions affect behavior related to safety are, however, poorly understood [4].

2.3. Safety Training

Safety training among hospital staff is one important dimension in configuring the safety climate in healthcare organizations. Previous literature confirm the role of safety climate as one necessary intervening variable to strengthen the link between risk perceptions and safety behavior [14]. However, the issue here is that safety climate is a baggy concept and defined as a multidimensional factor; thus, it's debatable in terms of conceptualization and measurement [19, 20]. In more detail, safety training is "the first of the seven factors and explains the largest variance in the perception of safety climate" [21] and is one of the agreed-upon necessary practices of safety management [22, 23]. Safety training is described as activities that improve safety, attitudes, knowledge, and skills through safety-related training programs [22]. Accordingly, safety training in hospitals contributes to successfully adhering to safety regulations among hospital workers [24].

Job Demands-Resources Theory (JD-R theory) proposes that job resources can mitigate the negative effects of job burden demands on performance, according to Bakker and Demerouti [18]. Safety training is an effective resource for enhancing healthcare workers' safety [1]. Effective safety training for workers is important to enhance their safety skills and knowledge, change their attitudes toward safety [23, 25], and improve their safety behaviors [22, 26]. According to Zohar [20], firms with low accident rates had good safety training programs.

The importance of risk perception lies in its significance in the design and development of safety training programs. Additionally, the known impact of safety training on employees' safety behaviors is also crucial. Thus, this study investigated safety training as a mediator to explain the relationship between non-medical staff's risk perceptions and their safety behaviors. In this context, the following hypotheses are posited:

H₁: Safety training mediates the positive relationship between risk perception and safety compliance.

H₂: Safety training mediates the positive relationship between risk perception and safety participation.

3. Methods

3.1. Research Design, Settings, and Data Collection Procedure

This study highlighted the hospital setting as a place of work for non-medical staff that is vulnerable to hazardous hospital environments. By incorporating the intervening variable (i.e., safety training) and applying structural equation modeling (i.e., SmartPLS4), which provides a powerful statistical technique in the Saudi context that has not been studied before, the study model extends the earlier inconsistent literature regarding the relationship between risk perception and safety behaviors.

Thus, quantitative cross-sectional data were collected using self-administered questionnaires to test the study hypotheses. The population was all non-medical staff ($n = 148$) in one private hospital in the Jeddah province of the Kingdom of Saudi Arabia.

Considering the small population, the survey was distributed to all non-medical staff working there. Before distribution, ethical approval number RES-2021-0035 was received from *Batterjee Medical College*, and the targeted hospital granted approval. The study's objectives and questionnaire components were explained to respondents, who signed informed consent forms. Participation was voluntary; no compensation was received, and participants were guaranteed autonomy.

Study questionnaires were distributed in two versions (Arabic and English) to allow a better response rate. 105 of the 148 respondents that were surveyed and received a response rate of 71% completed the study questionnaires. The data was gathered between April and May 15, 2022.

3.2. Study Measure

Two segments made up the survey. In the first section, demographic data such as gender, age, marital status, education, and experience were gathered. The second section investigated the four factors of risk perception, safety training, compliance, and participation in safety activities. The study measures risk perception by adapting three items from [Gyekye and Salminen \[27\]](#); Cronbach's alpha was 0.91. Safety training was defined as activities that improve safety and attitudes, knowledge, and skills via safety-related training programs [\[22\]](#); Cronbach's alpha was 0.82 for the six items that were adapted from [Vinodkumar and Bhasi \[23\]](#).

Safety compliance was defined as the main safety tasks and activities that individuals need to carry out to maintain workplace safety [\[10\]](#); eleven items were adopted from [Hayes's et al. \[28\]](#) to measure safety compliance, and Cronbach's alpha was 0.67.

A behavior that indirectly takes part in an individual's personal safety but that helps to develop an environment that supports safety is the definition of safety participation [\[10\]](#). To measure safety participation, five questions were modified from [Vinodkumar and Bhasi \[23\]](#).

Cronbach's alpha was 0.66. Safety compliance and safety involvement were previously studied in the Arab environment and were shown to be reliable [\[1, 29\]](#). Each item used a 5-point Likert scale, from 1 = strongly disagree to 5 = strongly agree. [Appendix 1](#) presents the study scale.

3.3. Data Analysis Procedure

The Statistical Package for the Social Sciences (SPSS) version 23 was applied to treat the missing values and perform a preliminary analysis, including normality, common method variance, and descriptive data. Thereafter, SmartPLS4 measurement and structural model were chosen to test both validity and reliability of the study sample and, consequently, analyze to test mediation analyses as it is powerful statistical and can deal with a small sample size [\[30\]](#).

4. Results

4.1. Demographic Characteristics

As [Table 1](#) shows the non-medical staff demographic characteristics, most respondents are young and were aged between 25 and 34 and married; moreover, most had low education levels. Most of the respondents—about half—had 5 to 15 years of job experience.

4.2. Validity and Reliability of the Study

The smartPLS4 measurement model offers a number of tests that confirm the validity and reliability of the study's variables. [Table 2](#) shows the study variables' Cronbach's alpha, and Composite Reliability (CR) as reliability indicators, and the Average Variance Extracted (AVE), Fornell-Larcker Criterion, and Heterotrait-Monotrait Ratio (HTMT) as validity indicators.

While [Table 3](#) presents the cross-loading of the study items. Accordingly, all of the presented metrics had satisfactory results and were reliable and valid for testing the structural model [\[31\]](#).

Table 1.
Demographic characteristics.

Characteristic	Profile	N	%
Gender	Male	66	62.9
	Female	39	37.1
Age	Less 24 y	15	14.3
	25-34 y	46	43.8
	35-44 y	28	26.7
	Above 45 y	16	15.2
Marital status	Married	46	43.8
	Single	51	48.6
	Divorced	8	7.6
Level of education	Illiterate	19	18.1
	Primary school	71	67.6
	High school	13	12.4
	College	2	1.9
Experience	Less than 5 y	32	30.5
	5-15 y	51	48.6
	15-25 y	22	21.0
Total		105	

Table 2.
Validity and reliability.

	Cronbach's alpha [≥0.70]	CR [≥0.70]	AVE [≥0.50]	
RP	0.732	0.760	0.641	
SC	0.944	0.952	0.692	
SP	0.805	0.825	0.630	
ST	0.955	0.960	0.849	
Discriminant validity				
Fornell-Larcker criterion	RP	SC	SP	ST
RP	0.801			
SC	0.262	0.832		
SP	0.266	0.199	0.794	
ST	0.355	0.549	0.132	0.921
HTMT	RP	SC	SP	ST
RP				
SC	0.281			
SP	0.313	0.208		
ST	0.411	0.567	0.149	

Note: RP: Risk perception, SC: Safety compliance, SP: Safety participation, ST: Safety training.

Table 3.
Items cross-loadings.

Item	RP	SC	SP	ST
RP1	0.813	0.275	0.283	0.325
RP2	0.777	0.132	0.115	0.255
RP3	0.811	0.185	0.200	0.256
SC2	0.047	0.657	0.076	0.267
SC3	0.122	0.791	0.139	0.455
SC4	0.140	0.842	0.116	0.425
SC5	0.223	0.895	0.160	0.471
SC6	0.303	0.898	0.263	0.529
SC7	0.242	0.805	0.211	0.440
SC8	0.215	0.855	0.178	0.471
SC9	0.285	0.819	0.136	0.496
SC10	0.287	0.899	0.167	0.489
SP2	0.167	0.059	0.722	0.100
SP3	0.179	0.065	0.795	0.058
SP4	0.233	0.206	0.805	0.143
SP5	0.248	0.249	0.847	0.106
ST2	0.369	0.577	0.113	0.929
ST3	0.323	0.494	0.208	0.927
ST4	0.343	0.481	0.059	0.922
ST5	0.324	0.484	0.109	0.946
ST6	0.271	0.481	0.117	0.881

4.3. Mediation Analysis

As this study proposed two mediation hypotheses of safety training in its model, SmartPLS4 was suitable because bootstrapping gives more accurate calculation measures [32]. Calculating the direct and indirect effects (Path A and Path B) is necessary to deduce the mediation effect. The percentile bootstrap Confidence Interval (CI) should not straddle the zero in between [33].

H₁ focused on the relationship between non-medical staff's risk perception and their safety compliance and their part of safety training as a mediator. The relationship between risk perception and safety training along Path A was significant (B = 0.355, T = 3.865, P = 0.000), while the Path B between safety training and safety compliance was significant (B = 0.522, T = 6.742, P = 0.000). Significant results for the indirect effect (RP -> ST -> SC) are obtained (B = 0.186, T = 3.040, P = 0.002). As a result, between [LL = 0.150, UL = 0.220], the Percentile Bootstrap 95% Confidence Interval did not cross Zero. Path C had no bearing on the situation (B = 0.076, T = 0.810, P = 0.418). The outcome from negligible to substantial showed full mediation of safety training between risk perception and safety compliance, given that safety training in this relationship (Indirect Effect) was completely changed [32]. H₁ was therefore supported.

H₂ details the relationship between non-medical staff's risk perception and safety participation and the mediation impact of safety training as a mediator. The relationship between risk perception and safety training along Path A was significant (B = 0.355, T = 3.865, P = 0.000). Path B between safety training and safety participation was not significant (B = 0.043, T = 0.375, P = 0.708). Additionally, the indirect effect (RP -> ST -> SP) result was not statistically significant (B = 0.015, T = 0.347, P = 0.729). The Percentile Bootstrap 95% Confidence Interval lies between [LL = -0.359, UL = 0.390] and crosses Zero. As a result, H₂ was not supported and safety training did not mediate between risk perception and safety participation. See Table 4 and Figure 1.

The study, looking for R² as well, has discovered that risk perception and safety training account for 31% and 7% of the variances in safety compliance and participation, respectively, among non-medical workers in the Saudi setting.

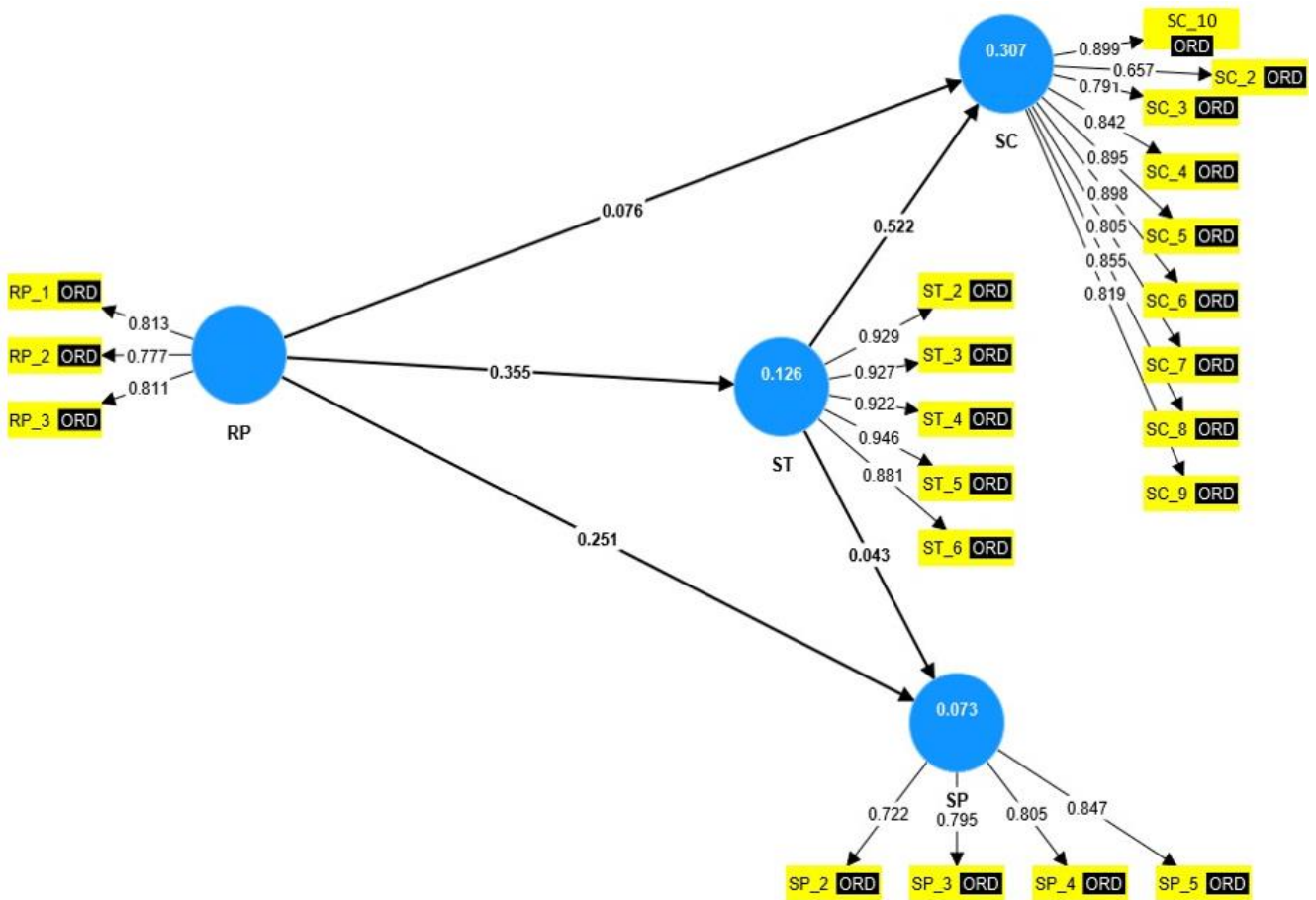


Figure 1. SmartPLS4 output.

Table 4.

The mediation analysis of safety training between the effect of risk perception and both safety behaviors dimension.

Direct link			Path coefficients (β)		Standard error (SE)	Standard deviation (STDEV)		Effect size (F^2)		T - values		P- value
Path A	RP -> ST		0.355		0.364	0.092		0.145		3.865		0.000**
Path B	ST -> SC		0.522		0.521	0.077		0.343		6.742		0.000**
Path C	RP -> SC		0.076		0.078	0.094		0.007		0.810		0.418 ^{n.s}
Total effect RP -> SC			Direct effect RP -> SC			Indirect effect of RP on SC					Percentile bootstrap 95% confidence interval	
β	T-value	P- value	β	T-value	P- value	Hypothesis # 1	β	SE	T-value	P- value	Lower	Upper
0.262	2.377	0.017**	0.076	0.810	0.418 ^{n.s}	RP -> ST -> SC	0.186	0.191	3.040	0.002**	0.150	0.220
Direct link			Path coefficients (B)		Standard error (SE)	Standard deviation (STDEV)		Effect size (F^2)		T - values		P- value
Path A	RP -> ST		0.355		0.364	0.092		0.145		3.865		0.000**
Path B	ST -> SP		0.043		0.046	0.114		0.002		0.375		0.708 ^{n.s}
Path C	RP -> SP		0.251		0.273	0.105		0.059		2.397		0.017*
Total effect RP -> SP			Direct effect RP -> SP			Indirect effect of RP on SP					Percentile bootstrap 95% confidence interval	
β	T-value	P- value	β	T-value	P- value	Hypothesis # 2	β	SE	T-value	P- value	Lower	Upper
0.266	3.121	0.002**	0.251	2.397	0.017*	RP -> ST -> SP	0.015	0.018	0.347	0.729 ^{n.s}	-0.359	0.390

Note: Significance: *: $p < 0.01$, **: $p < 0.001$, n.s: not significant. Small F^2 (0.02–0.15), medium F^2 (0.15–0.35), large $F^2 > 0.35$.

Source: Primary data.

5. Discussion

The non-medical employees of the hospital were the subjects of this study, which looked at the role of their safety training in mediating the relationship between risk perception and both compliance with and safety participation. The perception of risk between healthcare workers and the general population has been distinguished according to a recent study by [Simione and Gnagnarella \[34\]](#). However, looking at risk perception among non-medical staff is limited. Accordingly, this study will focus on non-medical staff's risk perceptions in their professions.

Considering the contextual position of risk perception, a positive or negative impact could be posited [\[14\]](#). For instance, receiving high risk could elevate the protective measures and alarming system against possible hazards to avoid accidents and fatal injuries. On the other side, [Xia, et al. \[14\]](#) argued that perceived high risky job tasks as a stressors and job hindrance demands; hence, consuming mental and physical effort increases stress levels and may negatively impact the safety behaviors [\[17\]](#). The dual effect of job demands and resources theory, which has been supported by other studies, is responsible for the conflicting results between perceived risk and safety behaviors [\[17, 18\]](#).

The current study's findings are consistent with the first proposition of the job demands-resources (JD-R) theory in that they show a positive association between risk perception and safety compliance as well as participation behaviors. As the first study in this field, this one aimed to fill a gap in the literature.

The current study first determines whether safety training has a mediating influence between risk perception and safety behaviors. As a result, the association between risk perception and safety compliance changed from being insignificant to being significant because of the full mediation effect of safety training that was discovered between the positive relationship between risk perception and safety compliance. In more detail, the risk perception of the non-medical staff is not related to their compliance with safety procedures. However, when they receive training and acquire the needed safety knowledge and skills, their risk perception will affect their safety compliance. This finding reflects the importance of safety training in shaping the safety climate in hospitals [\[21\]](#), enhancing safety skills, knowledge, and attitudes toward safety [\[23, 25\]](#), and therefore improving safety behaviors [\[22, 26\]](#).

Surprisingly, even if the existence of the positive link between risk perception and safety participation was validated, the finding of the second hypothesis was not. Unexpectedly, safety training failed to mediate the association between risk perception (RP) and safety participation, which is favorable. This may be influenced by characteristics like education level and training quality, and other variables like management commitment may also have an impact on safety participation [\[1, 29\]](#). This finding confirms and agrees with the literature that the association between risk perception and safety behaviors is still controversial and largely contradictory [\[14\]](#). Thus, more literature is needed in this regard.

5.1. Implications for Health Policy

The importance of safety training is extensively established in previous literature [\[20, 23, 25\]](#). However, practically, healthcare organizations specifically in the hospital setting are aware of the undesirable consequences of occupational accidents. This issue remains a serious safety concern and must be considered by health policymakers, hospital managers, and safety officers. Safety programs could be at the national or hospital levels. Regardless of these levels, safety training should not be limited to core safety activities such as wearing personal protective equipment. Effective safety training programs that cover knowledge, abilities, and attitudes are advised to increase worker adherence to safety policies and participation in safety-related activities in healthcare companies. Furthermore, risk perception is important for people's behavior; thus, hospital managers should consider their employees' risk perception; this will not be achieved without establishing a safe and healthy work environment.

5.2. Limitations and Suggested Future Research

It is important to take potential constraints into account when interpreting study results. The findings are limited to including respondents from different kinds of hospitals, such as public hospitals. Moreover, the nature of the study is cross-sectional using a self-reported questionnaire; accordingly, the findings may not be generalizable. Future studies of the longitudinal approach could focus on other variables affecting safety behaviors.

6. Conclusion

Hospital injuries and accidents are a severe safety concern. The non-medical staff, as frontline workers, is an integral component of hospital settings. Safe work places supposed to achieve safe behaviors and control risky behaviors. Risk perception is critically essential in configuring non-medical staff safety behavior. This study shows that risk perception is directly related to safety participation and indirectly to safety compliance through safety training among non-medical staff in Saudi Arabia. Safety training is essential to improving the workplace's safety climate and employees' safety behaviors. To some extent, creating effective and comprehensive safety training for all hospital employees, either medical or non-medical staff, is a key to safety performance and improving occupational safety in healthcare organizations.

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Appendix

Appendix 1. Study scale.

#	Risk perception	
1.	I feel that my work is risky	Returned
2.	I feel that my work is very dangerous	Returned
3.	I think I might get hurt in my work	Returned
#	Safety training	
1.	My company gives comprehensive training to the employees in workplace health and safety issues	Omitted
2.	Newly recruits are trained adequately to learn safety rules and procedures	Returned
3.	Safety issues are given high priority in training programs	Returned
4.	I am not adequately trained to respond to emergency situations in my workplace	Returned
5.	Management encourages the workers to attend safety-training programs	Returned
6.	Safety training given to me is adequate to enable to me to assess hazards in workplace	Returned
#	Safety compliance	
1.	I do not follow safety rules that I think are unnecessary	Omitted
2.	I handle all situations as if there is a possibility of having an accident	Returned
3.	I wear safety equipment required by practice	Returned
4.	I keep my work area clean	Returned
5.	I encourage co-workers to be safe	Returned
6.	I keep my work equipment in safe working condition.	Returned
7.	I report safety problems to my supervisor when I see safety problems.	Returned
8.	I correct safety problems to ensure accidents will not occur.	Returned
9.	I take shortcuts to safe working behaviors in order to get the job done faster.	Returned
10.	I overlook safety procedures in order to get my task done more quickly.	Returned
11.	I follow all safety procedures regardless of the situation I am in.	Returned
#	Safety participation	
1.	I encourage my co-worker to work safely	Omitted
2.	I voluntarily carry out tasks or activities that help to improve my unit safety	Returned
3.	I put extra effort to improve the safety in my unit	Returned
4.	I always point out to the management if any safety related matters are noticed in my unit	Returned
5.	I help my co-workers when they are working under risky or hazardous conditions.	Returned