



The Development and Validation of a General Occupational Safety Scale for Employees Across Sectors

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Abstract

Objectives: Identifying the needs and areas for improvement in occupational safety for emergency and disaster management workers will facilitate easier management of occupational safety during emergencies. The aim of this thesis is to establish the structure of occupational safety among emergency and disaster management workers and to measure their perception of the safety climate.

Materials and Methods: The study involved 250 emergency and disaster management workers in Istanbul. A pool of 100 questions was created by reviewing the literature on occupational health and safety performance. Following in-depth discussions with a team of experts and adhering to the stages of survey and scale development literature, the Occupational Safety Scale (OSS) was developed. Participants were asked to fill out a personal information form, the OSS survey, the Safety Climate Scale (SCS) survey, and the Job Satisfaction Survey. Comparative results were evaluated by examining these relationships.

Results: According to the factor analysis results, the six-factor structure of the OSS is reliable at the 0.91 omega level. The alpha coefficient of the sub-factors of the scale varies between 0.76-0.89. As a result of the analysis, it was determined that the OSS is valid and reliable. Factors associated with the OSS were age, job experience, education level, and profession. Factors associated with the Job Satisfaction Scale were age, job experience, profession, and gender. Factors influencing the SCS were education, age, profession, and gender. Other relationships and influencing factors were also examined.

Conclusions: In conclusion, this study aimed to reveal the structure of occupational safety among emergency and disaster management workers. During this process, a valid and reliable OSS, which can be used for both emergency disaster management and other sectors, was developed.

Keywords: Occupational Safety Scale, Validity, Reliability, Scale development

Introduction

Globalization movements, which are the source of technological acceleration, are drawing national economies into a fierce struggle. This development in the economic field has caused the understanding of business life to change to a great extent. The surprising growth rate in the scientific and technological fields and the possible psycho-physical effects of various products (machinery, tools, equipment and chemical substances, etc.) that they have included in human life have not yet been clarified. Rapid technological developments in the industrial sense have brought with them new occupational diseases and work accidents. When we look at the research on the causes of work accidents; it is seen that 81% of the fault rate belongs to humans, 17% to the working environment conditions and 2% to uncontrollable reasons. The fact that the research results show that 98% of work accidents are preventable reveals the vital importance of the function of occupational health and safety (OHS) to prevent and predict work accidents (1). In Maslow's "Hierarchy of Needs", where he defines the needs of people in stages, he

emphasizes that moving to the next stage is only possible if the need related to the previous stage is met. If a person who manages to pass the first stage, which includes physiological needs, cannot meet the need for safety in the second stage, these stages, the subject of which is human, will undoubtedly have no meaning. However, a person whose need for safety is met can fight for his own rights and put them into practice. The increasing frequency of work accidents in business life or injuries, disabilities, occupational diseases or deaths resulting from exposure to harmful chemicals in the work field have led to the emergence and development of the concept of OHS (2).

OHS is also one of the main supporting parts of emergency disaster management. The concept of OHS has been considered quite important in recent years. OHS includes two important concepts in its content: occupational health and occupational safety. According to the joint commission of the World Health Organization (WHO) and the International Labor Organization (ILO); "Occupational health aims to protect and develop the physical, mental and social well-being of workers in every

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Key Messages

- ▶ The OSS is designed to be used as a performance scale regarding occupational safety for all sectors. This study presents the OSS which was created to ensure improvements in occupational safety in all sectors.

profession at the highest level; to prevent workers from losing their health due to working conditions; to protect workers from risks arising from factors harmful to health in the workplace; to ensure that workers work in a job suitable for their physical and psychological equipment, and in short, to adapt the job to the person and to adapt each person to their job.” Occupational safety, on the other hand, is a concept that includes technical interventions to foresee the dangers that workers may encounter at work and to eliminate them or to minimize the level of danger (3).

The aim of OHS studies is to reduce the harmful effects of the dangers that endanger the lives of individuals, which mostly manifest themselves in the form of accidents or diseases, to the extent possible, to transform individuals’ work areas into safe and healthy places, and to cover all parameters of measures related to protecting people and increasing labor productivity. Failure to show the necessary attention to the field of OHS can lead to serious financial losses. The absence of OHS in the work environment can cause accidents, occupational diseases and even deaths for workers. Therefore, these situations cause workers to lose their working power partially or permanently. If the employee is exposed to a danger that may cause disability, even if it provides disability income, a decrease in the economic level will be inevitable. On the other hand, the end of an individual’s working life due to disability or illness may reveal psychological and physical problems. Work accidents are problematic not only for employees but also for employers. Because work accidents disrupt production and efficiency along with health expenses, compensations, court expenses and penal payments, and therefore have the effect of causing the company to fail to fulfill its market commitments and thus causing market loss. Another area of impact of work accidents is the country’s economy.

When the needs and areas open to improvement of emergency disaster management employees regarding work safety are determined; when their perceptions and attitudes are known, it will be much easier to manage work safety in emergencies. There is no work safety scale for emergency and disaster management employees in the literature. The work safety scale for all areas has been used limitedly. Therefore, this study aims to develop a work safety scale to determine the work safety structure of emergency and disaster management employees, measure the perception of the safety climate and reveal areas open to improvement. In addition, it was aimed to determine

the job safety scale, safety climate perception and job satisfaction scores of emergency disaster management employees and to reveal the relationship between them.

Materials and Methods

Questionnaire Development

Before discussing the scale development process, it is useful to mention some applications carried out during our study. First of all, a literature review was conducted on some concepts within the scope of our study. Here, scans were conducted on emergency, disaster, disaster management, risk, risk analysis, near-miss incident, work accident, occupational diseases, OHS, security, safety climate, job satisfaction and many other concepts. It was checked whether there was a similar scale related to the subject. As a result of the research, the need for an “Occupational Safety Scale” (OSS) applicable in Turkish and for all sectors was determined. Work has been initiated in this direction. In order to create a new “Occupational Safety Scale”, a pool of 100 questions was first created by using the literature. The question pool in question is in the first stage form. In addition, semi-structured in-depth face-to-face interviews were conducted with equal numbers of participants of different ages and genders with at least 2 years of experience from 4 different groups working in the field of emergency and disaster. A voice recording of one and a half hours was taken for each interview and then the transcription process was carried out.

A preliminary study was conducted. After the results of this preliminary study, the main study was started. After receiving opinions from experts in four different fields, the question pool, which was reduced to 40 questions, was reduced to 25 questions with the qualitative analysis of the interview transcriptions. Then, the created survey was applied to a group of 100 people with a random sample from the universe of paramedic employees in Istanbul. As a result of this study, we understood that this scale study needed to be transformed into common items for all fields, not specific to the field. We updated the questions of a job safety scale pool specific to all fields and then consulted the expert opinions again. The preliminary study revealed the necessity of a general occupational safety scale with well-established sub-dimensions not only in the health or emergency disaster areas but also in all sectoral areas. The name and form of our study have changed from the initial idea. In order to create a scale applicable to all businesses and processes from office personnel to field and factory personnel, a pool of 43 items was created by following the scale creation stages and criteria. The questions in the created pool of items were revised by receiving expert opinions. Afterwards, the final structure of the scale was created by collecting data and performing statistical analyses. The created factor structure was determined with Exploratory Factor Analysis and confirmed with Confirmatory Factor Analysis.

Study Design and Participants

Ethical approval for this survey study was received from Istanbul Bilgi University Scientific Research Ethics Committee on January 20, 2020 with project number 2020-30003-04. Written informed consent was obtained from all participants in accordance with the Declaration of Helsinki. G*Power 3.1 program was used to determine the sample size. Type I error was $\alpha=0.05$, acceptable sampling error was 5%, and the standard deviation determined in the calculation made on the preliminary group of 200 people was calculated as 20.22 in the power analysis, and the sample size to be reached was calculated as 250 people. Employees with at least one year of experience in emergency and disaster management in Istanbul were included in the study. All participants were also asked to fill out the personal information data form, but their names were kept confidential. The personal information data form also includes information on the gender, age, education level, sectoral experience and profession of healthcare professionals in the field of search and rescue. There were 118 (48.8%) men and 124 (51.2%) women participants. Thirty-five (14.5%) of the subjects were younger than 25 years, 102 (42.1%) were between 25 and 34 years old, 57 (23.6%) were between 35 and 44 years old, and 48 (19.8%) were older than 45 years. Of the participants, 145 (59.9%) were health care professionals and 97 (40.1%) were technical or support staff. 55 had a high school degree (22.7%), 115 had an associate degree (47.5%), 72 (29.8%) had higher education graduates.

Tests

Minnesota Satisfaction Questionnaire

The Minnesota Satisfaction Questionnaire (MSQ) is a 5-point Likert-type scale consisting of 20 items developed by Weiss et al (4) in 1967. MSQ assesses job satisfaction. MSQ consists internal satisfaction and external satisfaction sub-dimensions. MSQ has been a well-known tool that has been used consistently over time.

Safety Climate Scale

The Safety Climate Scale (SCS), prepared by Zohar and Luria (5), consists of 49 questions belonging to seven subsections: communication, security management, individual responsibility, security standards, personal participation, management commitment, and fatalism.

Occupational Safety Scale

The Work Safety scale is the original part of our study. The Work Safety Scale consists of 43 questions. There are 6 sub-dimensions here. These are Preventive Activities, Safety Management Training, Work Environment Safety, Safety Internal Audit, Emergencies and Safety Standard sub-factors.

Statistical Analysis

During the research process, SPSS 21 and Jasp 18 package

programs were used for statistical analysis. For this purpose, firstly, the status of the data providing the normal distribution assumption was examined by examining the descriptive statistics and distributions. Exploratory factor analysis and confirmatory factor analysis were used for the validity findings of the developed scale. Cronbach alpha and McDonald Omega coefficients of the reliability findings of the scales were examined. After the validity and reliability analyses, the research variables were created. The differentiation status of the created variables according to demographic variables was examined using independent samples t test (paired groups) and one-way analysis of variance (three and above groups). The interactions between the variables were examined using Pearson product moment correlation analysis. In all analyses, the statistical significance level was accepted as $P < 0.05$.

Results

At this stage of the research, exploratory factor analysis was used to provide evidence of the validity of the scale and to determine the factor structures. As a result of the analysis used, a 6-factor structure was created. The results of the exploratory factor analysis are shown in Table 1.

The findings obtained in Table 1 indicate that the OSS can validly measure the perception of the specified behavioral tendency in a six-factor structure. The 6-factor structure of the scale can explain 47.31% of the variance of the specified behavior. This result is higher than the opinions stated in the literature that the minimum variance that needs to be explained for scales is 44%. Although these results indicate that the measurement tool makes valid measurements, the confirmatory factor analysis results of the scale are shown in Figure 1 in order to provide more evidence of validity.

The reliability results of the scale were examined with McDonald's Omega coefficient, which is recommended to be used in the literature in the process of examining the reliability results of multi-factor structures. With these results, the six-factor structure of the scale is reliable at the 0.91 omega level. The alpha coefficient of the sub-factors of the scale varies between 0.76-0.89.

Descriptive statistics of the data set are shown in Table 2. In the first stage of the research, the data set was examined and missing data and extreme value control was performed. By examining the z scores of the variables in the data set, 8 participants who showed extreme and outlier values outside of ± 3 standard deviations were removed from the data set. With these results, it can be said that the data set consists of 242 people. When the findings in Table 2 are examined, it is determined that the skewness and kurtosis coefficients of the variables for the sub-factors and total scores of the SCS, Job Satisfaction Scale and Job Safety Scale are between -3 and +3.

As a result of the correlation analysis performed to determine the direction and degree of relationship

Table 1. Exploratory Factor Analysis Results for the Occupational Safety Scale

	Factor					
	Preventive Actions	Safety Management Education	Working Environment Safety	Internal Security Audit	Emergencies	Safety Standard
OS-Q20	0.827					
OS-Q42	0.718					
OS-Q39	0.657					
OS-Q18	0.610					
OS-Q41	0.595					
OS-Q19	0.578					
OS-Q17	0.341					
OS-Q8		0.902				
OS-Q9		0.802				
OS-Q11		0.566				
OS-Q10		0.529				
OS-Q2		0.414				
OS-Q1			0.940			
OS-Q24			0.543			
OS-Q25			0.472			
OS-Q16			0.443			
OS-Q30				0.622		
OS-Q43				0.517		
OS-Q38				0.488		
OS-Q14				0.346		
OS-Q32					0.722	
OS-Q33					0.652	
OS-Q31					0.489	
OS-Q5						0.571
OS-Q29						0.436
OS-Q6						0.333
Rotation sums of squared loadings	4.905	5.253	4.755	3.894	1.336	2.091
Eigenvalue	7.291	2.387	1.832	1.512	1.263	1.212
Explained variance	26.218	7.196	4.950	6.620	2.940	2.393

between the three scales used in the study, a positive but minor relationship was found between all scales (Table 3).

Discussion

A safe work environment can help companies increase employee productivity and morale. Therefore, studies of safety climate by researchers can help identify factors and related variables that may influence safety climate. To our knowledge, there is no known scale to measure safety climate for emergency and disaster management personnel. Since there is a need for an OSS to assess emergency and disaster management employees, this study developed a workplace safety scale that can reveal the attitudes of emergency and disaster management employees. The results showed that the OSS has acceptable validity and reliability and can be used with emergency and disaster workers.

A safety climate is when employees develop and act upon patterns of perception about their business environment, management safety perceptions and activities, and business risk control. Important components of safety climate include management values, management and organizational practices, communication, and worker participation in workplace health and safety. Safety

performance is the good, service, or idea that helps organizations achieve their OHS goals and moves in that direction. In this regard, safety performance measurement allows to identify the areas of organizations that are not in line with occupational safety and health objectives. Moreover, it helps to reorganize these areas according to the objectives (6). Low organizational commitment leads to negative consequences for the individual and the organization, such as absenteeism, low performance, tardiness, and termination. However, it is very important that a high-performing and skilled employee remains in the organization and contributes to increased productivity. In addition, research has shown that retaining employees with high commitment to the organization reduces the costs incurred by turnover rates (7). Many studies have shown that safety climate components reduce accidents and incidents (8-10). This OSS, which we developed in our study, assesses many areas such as communication, safety management, safety standards, personal involvement, and employee management commitment. This OSS, which assesses many components of the safety climate, will be very useful in determining the perception of the safety climate by the emergency response workforce.

The developed OSS attracts attention with its 6-factor

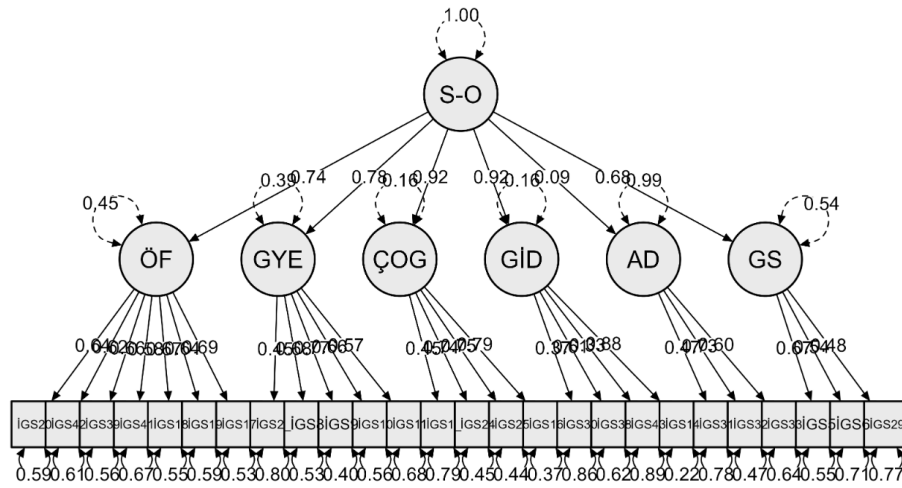


Figure 1. Results of Confirmatory Factor Analysis of the Occupational Safety Scale.

structure and high reliability values (omega coefficient 0.91, alpha coefficients 0.76-0.89). It has been confirmed that the scale is an effective tool in measuring occupational safety perception. This scale not only meets the needs of emergency and disaster management workers, but also provides a structure that will allow the evaluation of occupational safety culture in different sectors.

A second way to measure the validity of the scale

is to analyze it according to external criteria such as discriminant validity, convergent validity, and group differences (11,12). In our study, correlational analyzes were performed to show whether the battery was correlated with measures of a similar or different nature during the validation process. In the correlation analysis performed to determine the direction and strength of the relationship between the SCS, OSS, and MSQ scales used

Table 2. Descriptive Statistics for the Dataset

	Mean	Standard Deviation	Skewness Coefficient	Kurtosis Coefficient	Min.	Max.
Communication	32.521	4.563	-0.890	-0.081	19.00	39.00
Security Management	37.037	5.893	-0.741	-0.016	21.00	48.00
Individual Responsibility	16.512	1.931	-0.952	0.608	11.00	20.00
Security Standards	17.190	2.087	-0.018	-0.216	12.00	22.00
Personal Participation	18.533	2.307	-0.375	-0.009	13.00	24.00
Management Commitment	36.244	6.504	-0.832	-0.202	18.00	48.00
Fatalism	12.781	2.503	0.230	-0.039	7.00	21.00
Total (SCS)	170.818	18.624	-0.961	0.228	112.00	199.00
Internal Satisfaction	4.284	0.245	-0.327	0.197	3.42	4.83
External Satisfaction	4.435	0.416	-0.709	-0.015	3.00	5.00
Total (MSQ)	4.360	0.279	-0.854	0.935	3.21	4.92
Preventive Activities	30.554	3.694	-0.1309	2.060	15.00	35.00
Safety Management Training	21.380	3.390	-0.1512	2.183	9.00	25.00
Work Environment Safety	15.806	3.758	-0.774	-0.651	7.00	20.00
Safety Internal Audit	16.860	2.464	-0.545	-0.638	11.00	20.00
Emergencies	14.277	1.071	-0.1409	0.960	11.00	15.00
Safety Standard	13.021	1.633	-0.471	-0.478	8.00	15.00
Total (OSS)	111.897	12.088	-0.667	-0.777	80.00	128.00

Table 3. Correlation Results Between Safety Climate Scale (SCS), Occupational Safety Scale (OSS) and Minnesota Satisfaction Questionnaire (MSQ)

	SCS		MSQ	
	r (Spearman Coefficient)	P	r (Spearman Coefficient)	P
OSS	0.276**	0.000	0.365**	0.000
MSQ	0.226**	0.000		

**P < 0.01.

in the study, there was a weak positive correlation between all scales. The correlation results indicate that the OSS has validity.

In summary, this study shows that the developed OSS is a new and promising battery with acceptable validity and reliability in assessing the safety perception of emergency and disaster management employees. This scale was developed in accordance with the safety environment scale required for disaster management workers in Turkey. This scale can be used to study the perception of safety climate by emergency and disaster management personnel. It is recommended that the validity and reliability of the scale be re-examined in multicenter studies with larger participation.

Limitations of the Study

The study was limited to emergency and disaster management workers in Istanbul. Studies conducted in different regions and sectors may increase the generalizability of the findings. The study is limited to measuring the current perceptions of the participants. Long-term longitudinal studies may allow us to better understand the changes that occur over time. Testing the developed scale in different sectors such as construction, mining, and healthcare may contribute to the understanding of sectoral differences.

Directions for Future Research

The development and validation of the OSS for emergency and disaster management employees provide a robust tool to assess and improve safety perceptions within this critical sector. Future research should focus on practical applications of the OSS, such as integrating it into regular safety audits and training programs. By doing so, organizations can proactively address safety issues and enhance the overall safety climate. Additionally, the scale can be used to evaluate the effectiveness of safety interventions over time, thereby ensuring continuous improvement in occupational safety practices.

To increase the generalizability of the OSS, future studies should expand the scope beyond Istanbul and include a diverse range of geographical locations and emergency management contexts. This will help to determine if the scale is universally applicable or if it needs adjustments to account for regional and contextual differences. Furthermore, incorporating a wider demographic, including different cultural backgrounds and varying levels of disaster severity, will enhance the robustness and applicability of the OSS.

While the current study offers valuable insights, there are opportunities to refine the research design. Future research should consider employing longitudinal designs to track changes in safety climate perceptions over time and identify causal relationships. Additionally, increasing the sample size and diversity will improve the statistical power and generalizability of the findings. Utilizing

advanced statistical methods, such as structural equation modeling (SEM), could also provide deeper insights into the underlying factors that influence safety climate perceptions.

Several new research questions emerged from the limitations and results of this study. These include: How do specific safety interventions impact the safety climate as measured by the OSS over extended periods? What are the differences in safety climate perceptions between various types of emergency management employees (e.g., paramedics, firefighters, and administrative staff)? How do external factors, such as organizational culture and leadership styles, influence the safety climate in emergency management settings? What role do individual differences (e.g., resilience, stress levels) play in shaping safety climate perceptions?

Conducting longitudinal studies to assess the OSS's predictive validity will provide insights into the scale's long-term usability and relevance. These studies can track changes in safety climate perceptions and their impact on actual safety outcomes over time. Comparing the OSS with existing safety climate tools in similar contexts can help determine its relative effectiveness and identify areas for improvement. Such comparative studies can highlight the unique strengths of the OSS and suggest potential enhancements based on best practices from other validated tools. Also, exploring the integration of the OSS with digital platforms and mobile applications can facilitate real-time data collection and analysis. This approach can provide immediate feedback to organizations, enabling them to address safety concerns promptly. Conducting cross-cultural validation studies to ensure the OSS's applicability in different cultural settings will enhance its global relevance. This will involve translating the scale and testing its validity and reliability across various languages and cultural contexts.

In summary, the OSS presents a promising tool for improving occupational safety in emergency and disaster management. By addressing the outlined future research directions, scholars can further refine the scale, enhance its applicability, and contribute to a safer working environment for emergency management professionals globally.

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Conflict of Interests

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