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Development of a Turkish Occupational Health and Safety Perceived Competency Scale

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Abstract

This study aimed to develop a Turkish Occupational Health and Safety Perceived Competency Scale (OHSPCS) about the perceived competency in Occupational Health and Safety (OHS) on employees of a faculty of a public university. Identifying OHS-related problems at workplaces and taking necessary precautions are essential. No studies from Turkey are available about assessing perceived competency in OHS and the respective scales. OHS has recently been included in the public sector agenda but the implementation of OHS has not been completed and related studies have not been conducted yet. This is a methodological study with a cross-sectional design. The first version of the scale comprised 55 items scored on a five-point Likert scale. The "alpha internal consistency coefficient" test was used to study the reliability of Turkish OHSPCS. Due to the results of preliminary analysis it was decided that to compose Turkish OHSPCS as 29 items. Then it as applied to the main study group. By this study, a valid and reliable scale aiming to measure perceived OHS competence on employees of a chosen public university faculty was developed. This new scale will help activate strategies and policies about OHS and determine the current situation and perceptions about OHS in organizational structuring, human resources, and current legislation.

Keywords: Public employees, occupational health and safety, competence perception, perceived competence scale

1. Introduction

Occupational Health and Safety (OHS) concerns both the health and well-being of the vast majority of the active adult population and it is of great importance as a human rights issue. This field comprises many different disciplines which includes medicine, economics and sociology standing closely related on the other (Abrahms 2001). OHS is a dynamic field because of the following reasons including the capital-labour relationship aspect of the subject matter, the essential of the protection of the rights of the individual by the state as an important element of the social state principle, and the need to change and reorganize working conditions in favour of the worker (Rosenau 1935).

Occupational health comprises a set of activities aimed to achieve, maintain, and improve the physical, mental, and social well-being of employees from all professions (Bilir 2016, ILO 2019). The number of occupational accidents and diseases has increased along with industrialization resulting in societal responses in Turkey parallel to those in the World bringing the need for studies about OHS into the agenda (Bilir ve Yildiz 2014, Akbulut 2001).

Studies about determining employee awareness, knowledge, and perceptions of OHS and finding out characteristics of a safety culture in Turkey are markedly limited. There are quite a few studies about OHS, especially in the public sector. Because of confusion resulting from variable interpretations of the legislation and because of postponements, scientific studies and detailed examinations have become necessary on such groups of individuals suspected of whether they have received adequate OHS services or not (Casgem 2017). For all these reasons, this study was planned to be conducted on a chosen group of public employees. In this study, it was aimed to develop a Turkish Occupational Health and Safety Perceived Competency Scale (OHSPCS) to measure employee perception about OHS in a selected faculty of a public university.

2. Materials and Methods

This is a methodological study that aimed to develop a scale and was conducted through a cross-sectional design. The Turkish OHSPCS was used as a data source in this study. The study was conducted in the Faculty of Agriculture of Ankara University in the period between October 2017 and June 2020. The study was performed in two stages as the preliminary application of the drafted scale and the application of the finalized scale. It was aimed to apply the final version of the scale to 307 eligible individuals, who did not participate in the preliminary application. Of the eligible 307 participants, 194 participated in the main participant group for the application of the final version of the scale.

The Turkish OHSPCS was developed through the following stages including literature reviews, creation of an item pool, selecting the form of the scale, obtaining expert opinions, the preliminary application of the drafted version, analyses of reliability and validity calculations, and developing the final version of the scale (Devellis 2012). The first draft scale that was preliminarily applied consisted of 55 items to be scored on a five-point Likert scale for participants to state how much they would consider themselves competent by using one of the "not at all", "little", "partly", "quiet", and very much" expressions concerning each statement

(Ozturk ve Babacan 2012). During the preliminary application phase, the researcher delivered the hard copies of the draft 55-item Turkish OHSPCS to 200 employees, who filled out the scale under observation. After assessing the suitability of the dataset, forms from 194 participants were included in the analysis. The compliance of the items for factor analysis was examined. It was decided that factor analysis could be performed based on Keiser-Meier-Olkin (KMO = 0.922) and Bartlett Sphericity tests ($\chi^2 1485 = 7155.62$; $p < 0.05$).

The "alpha internal consistency coefficient" test was used to test the reliability of Turkish OHSPCS. Principal Component Analysis (PCA), Exploratory Factor Analysis (EFA), and Confirmatory Factor Analysis (CFA) were performed to test the validity (Comrey and Lee 1992, Devellis 2012). Based on the results of analyses of data obtained from the preliminary application of the draft scale, Turkish OHSPCS was consist of 22 items. In addition to these 22 items, it was decided to keep seven items (item numbers 2,9,10,19,22,28 and 29) in the scale in terms of content validity (Tabachnick and Fidell 2012). Thus, the final Turkish OHSPCS was consist of 29 items. The 29-item Turkish OHSPCS was applied to the main group of study participants. Results of analyses revealed that the validity and reliability levels of the scores obtained by the application of the final version of the scale to the participants were high. For the aim of the study, a single-factor 29-item Turkish OHSPCS has been developed. The scale items are scored on a five-point Likert scale. None of the scale items are reverse scored. The lowest and highest scores that can be obtained from the scale are 29 and 145, respectively. Increasing scores indicate that the perceived competence in OHS is high.

3. Results

Based on the results of PCA and EFA conducted on the data obtained by the preliminary application of the 55-item draft Turkish OHSPCS; a three-factor and 29-item structure was obtained. The validity and reliability of the three-factor and 29-item scale were analysed.

Table 1 shows the factor loadings of the items. Factor loadings were between 0.598 and 0.806 for the first factor, between 0.423 and 0.914 for the second factor, and between 0.361 and 0.834 for the third factor. The Cronbach α-values were examined to find out the internal consistency reliability of the factors. These Cronbach α-values of the factors from one to three were 0.914, 0.911, and 0.872, respectively. These values showed that the internal consistency reliability of the factors was high. The examination of the factor

loadings of item number 51; "I can tell who will pay for the cost of OHS activities", revealed a difference of less than 0.10 indicating that the item measured an overlapping structure in two factors. However, item number 51 was decided to be kept in the scale within the context of content validity (Cokluk, Sekercioglu ve Buyukozturk 2014). Thus, the construct of the scale transformed into a form that would be suitable to investigate the problems in the study. According to the findings obtained at this stage, it was considered correct to use scale scores separately.

The validity and reliability of the scores obtained after the application of the final version of the scale were examined. The IBM SPSS 21.0 [IBM Corporation (2012). IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp.] package software was used for reliability and the MPlus 7.0 [Muthén & Muthén. (1998-2012). Mplus User's Guide. 7th Edition. Los Angeles, CA.] package software was used for validity. Firstly, the internal consistency of the scores was determined. The Cronbach α-coefficients for the obtained scores were found as 0.889, 0.924, and 0.893, respectively. According to Robinson et al. (Robinson, Shaver and Wrightsman 1991), the lower acceptable level for α is 0.70. Thus, it was determined that the internal consistencies of the factors and the scale scores were at acceptable levels.

A CFA was performed to determine the construct validity; that is, the three-factor structure was tested to find out to what extent the data would represent the three-factor structure with 29 items. For the model-data fit, the following results were obtained: $X^2 = 799, 15$; <0.05; Comparative Fit Index (CFI) = 0.874; Root Mean Square Error of Approximation (RMSEA) = 0.077, and Standardized Root Mean Square Residual (SRMR) = 0.062. Values of 0.95 and higher for CFI, 0.06 and lower for RMSEA, and 0.08 and lower for SRMR were the acceptable values. When these coefficients were compared to acceptable values, it was decided that the model was not acceptable (Reise, Scheines, Widaman and Haviland 2013).

Table 1. Distribution of Item Factor Loads and Cronbach α Values Regarding the Three-factor 29-item Scale Structure

Item	Factor		
	1	2	3
Factor1. Occupational Health and Safety Basic Approaches and Applications (α = 0,914)			
13. I can say the purposes of occupational health and safety.	**0,806**	-0,091	0,078
8. I can list the risk groups in working life.	**0,738**	-0,101	0,070
16. I can explain in which situations risk assessments should be made.	**0,721**	0,154	-0,062
10. I can explain the benefits of occupational health and safety studies.	**0,706**	0,089	-0,056
20. I can explain the occupational health and safety culture.	**0,674**	0,116	0,059
12. I can list the duties of the occupational health physicians.	**0,670**	0,131	-0,174
9. I can notice hazardous situations in the workplace.	**0,668**	-0,232	0,162
22. I can suggest solutions during risk assessment studies.	**0,667**	-0,019	0,174
18. I can detect ergonomic problems in my work environment.	**0,645**	0,027	-0,023
17. I can tell the way I should follow when I suspect an occupational disease.	**0,635**	-0,002	0,023
7. In case of a workplace accident, I can say what sould be done in order.	**0,598**	-0,037	0,035
Factor 2. Occupational Health and Safety Basic Information and Concepts (α = 0,911)			
34. I can list the duties of occupational health and safety committee.	-0,080	**0,914**	-0,115
37. I can explain the legal basis of occupational health and safety training.	-0,006	**0,807**	-0,104
32. I can explain how often the emergency drills should be done.	-0,110	**0,720**	0,074
36. I can explain who is responsible for occupational health and safety.	-0,053	**0,716**	0,108
38. As an employee, I can list my obligations regarding occupational health and safety.	-0,149	**0,702**	0,232
31. I can explain in which situations occupational health and safety training should be given.	0,085	**0,659**	0,059
33. I can explain the importance of participating in the work of the occupational health physicians for my health.	-0,115	**0,653**	0,184
24. I can explain the difference in the work to be done according to the hazard classes in workplaces.	0,323	**0,566**	-0,149
26. As an employee, I can explain my legal rights on occupational health and safety.	0,228	**0,548**	-0,093
29. I know which problems to consult my occupational safety specialist.	0,270	**0,525**	-0,067
49. I can list which records on occupational health and safety are kept in the workplace.	0,114	**0,423**	0,166
Factor 3. Protective Measures and Rules (α = 0,872)			
48. I can make suggestions while preparing the emergency plan.	-0,047	0,022	**0,834**
54. I can explain the near-miss incident.	0,100	-0,071	**0,721**
55. I can list the personal protective equipment used in my workplace.	0,138	-0,082	**0,711**
46. I can say the meaning of the warning signs in my workplace.	0,056	-0,041	**0,673**

47. I can say what to do in a near miss.	-0,065	0,234	**0,650**
44. I can tell how to maintain order in my work environment.	-0,019	0,252	**0,537**
51. I can say who will pay the cost of occupational health and safety practices.	0,035	0,264	**0,361**

The positive and high-level correlations across the factors obtained by CFA raised the need to question whether the factors were structurally different from each other. For this purpose, four models were tested. These models were the single-factor model (SFM), CFA, second-level confirmatory factor analysis (SL-CFA), and bifactor confirmatory factor analysis (BFCDA) (Rodriguez, Reise and Haviland 2016). Model-data fit statistics obtained by these models are presented in Table 2.

Table 2 shows that the fit indices of SFM are not at acceptable levels (RMSEA >0.06; CFI < 0.95; WRMR> 1). It is observed that model-data fit for CFA, SL-CFA, and bifactor confirmatory model (BCM) are at acceptable levels. However, RMSEA values are more than 0.06 for both CFA and SL-CFA. Of the examined models, BCM is determined as the model with the highest level of model-data fit. It is observed that CFI has the highest levels but RMSEA and WRMR have the lowest levels. X^2/sd used in the model comparison is observed to show the lowest levels for BCM, too.

Table 2. Model-Data Fit Index of Estimated Models

	sd	χ^2	χ^2/sd	RMSEA	CFI	WRMR
Single-Factor Model	377	1086,018	2,881	0,098	0,910	1,456
Confirmatory Factor Analysis	374	749,270	2,003	0,072	0,953	1,111
Second-level CFA	374	749,270	2,003	0,072	0,953	1,111
Bifactor Confirmatory Factor Analysis	348	605,559	**1,739**	**0,062**	**0,967**	**0,921**

The coefficients obtained after the selection of BCM are presented in Table 3. When these values are examined, it is seen that the explained common variance (ECV) by the general factor is 0.78 with sub-factors ranging from 0.04 to 0.11. It is determined that ECV by the sub-factors is low. When the hierarchical omega-values (ωH) are examined, it is observed that ωH for the general factor is 0.91 and the ωH values for the specific factors range from 0.00 to 0.28. The H-coefficients for the repeatability of the structure

through similar data sets and the confirmatory factor coefficients for factor specificity meet the desired values only for the general factor (Yu CY (2002).

Table 3. Additional Coefficients Obtained Regarding the Bifactor Model

	ECV	ω	ωS	ωH	ωHS	H	FD	PUC
General Factor	0,780	0,972		0,911		0,968	0,981	0,677
Factor **1**	0,114		0,917		0,283	0,733	0,893	
Factor **2**	0,039		0,949		0,002	0,444	0,809	
Factor **3**	0,067		0,919		0,231	0,595	0,852	

Note: ECV= Explained Common Variance, ω= Omega, ωS= Specific Omega, ωH= Hierarchical Omega, ωHS= Specific Hierarchical Omega, H= Construct Replicability, H, FD=Factor Determinancy PUC= Percent of Uncontaminated Correlations

The factor loadings obtained by BCM estimation and the factor loadings obtained by SFM are presented in Table 4. When these values are examined, the estimated factor loadings of SFM and BCM are observed to be close to each other. However, it has been determined that factor loadings of most items associated with the general factor were lower in BCM compared to SFM. It has been found out that particularly the loadings of the sub-factors of items 1, 2, 3, 4, 5, 8, 22, 24, 25, 26, 27, 28, and 29 are at acceptable levels. However, sub-factor loadings of other items are quite low and even negative for some items. Notably, the factor loadings of such items for the general factor are very close to the factor loadings estimated in the Single Factor Model. Another point that draws attention here is that; in BCM, the specific factor loading is higher than general factor loading only in item 4. This means that item number 4 distinguishes the sub-factor feature better compared to the general factor feature.

The individual-item explained common variance (IECV) values were calculated over the factor loadings of the general factor and sub-factors estimated through the BCM. It is seen that the IECV values are higher than 0.50 for all items but item number 4 indicating that the explained variance by the general factor is higher than the one calculated for specific factors for the scale items. So, the items are more explanatory by the general factor. The average relative parameter bias (ARPB) value for these values is 0.071, which is low.

Table 4. Distribution of Factor Loads Obtained by Single Factor Model and Bifactor Model

Item		Bifactor Model			
	Single Factor Model	General Factor	Sub-Factor 1	Sub-Factor 2	Sub-Factor 3
1	0,678	0,569	0,565		
2	0,610	0,507	0,486		
3	0,713	0,633	0,485		
4	0,647	0,520	**0,630**		
5	0,690	0,586	0,559		
6	0,562	0,559	0,133		
7	0,597	0,560	0,307		
8	0.633	0,553	0,470		
9	0,643	0,612	0,271		
10	0,558	0,536	0,177		
11	0,738	0,736	0,168		
12	0,708	0,725		0,220	
13	0,770	0,790		0,206	
14	0,802	0,822		0,067	
15	0,807	0,824		-0,120	
16	0,830	0,849		-0,208	
17	0,830	0,850		-0,139	
18	0,571	0,590		-0,371	
19	0,771	0,792		-0,167	
20	0,749	0,770		0,216	
21	0,753	0,773		0,119	
22	0,616	0,636		0,518	
23	0,679	0,676			0,167
24	0,735	0,661			0,523
25	0,717	0,645			0,501
26	0,720	0,674			0,365
27	0,790	0,712			0,474
28	0,785	0,749			0,365
29	0,651	0,615			0,343

The Turkish OHSPCS is a 29-item scale. The scale had a preliminarily estimated three-factor construct. However, the scale was tested through BCM because the respective factors exhibited a high level of association. Based on the coefficients calculated in this modelling approach; a dominant single factorial inference was concluded in the presence of high ECV for the general factor and low ECV for the sub-factors, that is an ECV value of more than 0.60 for the general factor; with the percent of uncontaminated correlations (PUC) less than 0.80, and a ωH value of more than 0.70. Therefore, it was decided that it would

be more accurate to interpret the total scores obtained from a single factor while evaluating the scale scores (Bonifay, Reise, Scheines and Meijer 2015).

Results of analyses revealed that the validity and reliability levels of the scores obtained by the application of the final version of the scale to the participants were high. For the aim of the study, a single-factor 29-item Turkish OHSPCS has been developed. The scale items are scored on a five-point Likert scale. None of the scale items are reverse scored. The lowest and highest scores that could be obtained from the scale are 29 and 145, respectively. Increasing scores indicate that the perceived competence in OHS is high.

4. Discussion

No studies about perceived OHS competence in Turkey have been found in the literature. As far as we know, this is the first study, where a scale aiming to measure perceived OHS competence on employees of a chosen public university faculty was developed as a valid and reliable assessment tool.

The primary aim of the study is to develop a valid and reliable scale aiming to measure employees' perceived competence about OHS. The primary aim described above was achieved in the study. The Turkish OHSPCS was developed through the following stages including literature reviews, creation of an item pool, selecting the form of the scale, obtaining expert opinions, the preliminary application of the drafted version, analyses of reliability and validity calculations, and developing the final version of the scale.

The Turkish OHSPCS is considered a practical measurement tool that can be used to determine the level of OHS competence in workplaces and to develop workplace-specific strategies. It is thought that the data obtained by this newly developed scale will contribute to the development of sectoral and national policies. However, since each business has a unique structure, it should be kept in mind that it will not be very functional to compare or rank the workplaces using the data obtained by the scale. In this context, it is thought that data obtained by the scale can be evaluated as an opportunity to identify aspects that need to be improved in the workplace.

The item pool prepared for the draft scale was prepared with the opinions of field experts for the item number and content validity, considering the conditions of the selected university faculty; where the researcher worked as an occupational physician. The high common variance values of the items were more

than 0.50 showing that the generalizability was high. By reaching the original Turkish OHSPCS, it is thought that it will provide valid and reliable results when applied in different business lines and different institutions (private sector, public), thus becoming a widely used scale.

The final Turkish OHSPCS (29-item) applied in the main phase of the study is suitable regarding the time needed for participants to fill out the scale. Concerning content validity, 7 more items were added to the 22 items. The 22-item form is suitable for use, too. As the number of items increases, the participants' unwillingness may increase, and participants may tend to become distracted while reading the items.

Keeping the participant identity private is another practicality in the application of Turkish OHSPCS. The scale can become a tool allowing employees to convey messages to the employer anonymously. This can be another benefit that would be obtained by the application of OHSPCS because employee responses about OHS competence will be used for obtaining OHS-associated improvements in the workplace providing benefits to employees. OHS services concern both the employee and the employer.

In general, only one method is used in scale development studies. In this study, the most accurate result to find out the validity of Turkish OHSPCS was obtained by comparing different methods through the conduct of PCA, CFA, and EFA.

There is a direct relationship between public health and OHS. Because the share of the working population in the community is high, it is not possible to talk about a healthy community without OHS (WHO 2006). Studies have found a direct relationship between the corporate safety culture and the individual safety culture. In workplaces with well-developed corporate safety culture, the individual safety culture is favourably affected, too. Therefore, it is a well-known fact that any regulations about OHS will yield favourable results for employees after the application of a scale both in the public and private sectors (Tektas N, Ceviz ve Tektas M 2018).

There is a need to develop necessary regulations to ensure the establishment of a safety culture, health literacy, basic health acculturation, and a supportive environment; to achieve targeted levels in national welfare, industrialization, and the implementation of the law, and to mitigate inequalities in income distribution and educational opportunity levels (Saygun 2019, Casgem 2018).

Because OHS ensures the contribution of healthy employees to production; studies about OHS become extremely important in protecting the prospect of employees besides increasing the welfare of enterprises and consequently the community. Besides despondency resulting from occupational accidents and occupational diseases, material losses may occur due to failures in OHS affecting the national economy unfavourably. Therefore, identifying OHS-related problems at workplaces and taking necessary precautions are essential. The most important point in OHS studies is to adopt a proactive approach. Even if the working conditions are safe enough, occupational accidents and occupational diseases occur due to the unsafe behaviour of employees. Therefore, it is extremely important to provide the necessary training for employees so that they can adopt safe behaviour patterns. It is not enough to improve the health and safety culture only in workplaces. This understanding should be aimed to be adopted by community entirely (Ahmad, Sattar and Nawaz 2016).

5. Conclusions

Permanent measures to ensure OHS can only be implemented through the active participation of the state as the body responsible for developing and enforcing regulations, employers as providers of jobs, and the involvement of employees, unions, and community. Primarily, problems should be determined to carry out further effective studies. Although various studies have tried to clarify this subject matter, there is not enough body of research available yet. It should be aimed to increase the number of future studies about OHS. This is the first study developing a scale to measure perceived competence in OHS and it is thought that the study will be an important guide for future studies.

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Research and Publication Ethics:

In this study, the rules of research and publication ethics were fully followed by authors.