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RESEARCH ARTICLE

PHYSICIANS OCCUPATIONAL HEALTH AND OCCUPATIONAL DISEASES ATTITUDE SCALE DEVELOPMENT

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ABSTRACT

Background and Purpose: Occupational diseases (ODs) and work-related diseases are important issues that affect work life and involve economic, medical, social, and ethical dimensions. The aim of this study was to develop a scale to measure the attitudes of physicians working or likely to work on the diagnosis and notification of ODs toward occupational health and OD.

Methods: This study was planned as a scale development study. During the scale development process, the item pool was determined using the three-round Delphi method, and explanatory and confirmatory factor analyses were performed using the pilot study data. A pilot study was conducted for the validity of the scale (n = 142). Data were collected again for confirmatory factor analysis of the scale (n = 216)

Results: The total explained variance of the scale was calculated as 67.80%. The KMO value of the scale was calculated as 0.87, In the exploratory factor analysis, the scale was divided into four dimensions. The scale was transformed into a 19-item scale comprising four subdimensions: “self-efficacy”, “readiness”, “awareness” and “contribution”. While evaluating the scale items, the VIF value of all items was below 5 and the correlation between the items was min:0,299, max: 0,803. All the scale items had a t-value of >1.96. The reliability coefficient of the scale was calculated as 0.943 according to the classical test theory and generalizability theory.

Conclusion: The “Attitude Scale toward Occupational Health and Occupational Diseases for Physicians,” developed in this study, is a valid and reliable tool to determine the attitude of physicians toward occupational health and ODs.

Keywords: occupational health, occupational disease, scale development, validity, reliability

INTRODUCTION

The incidence of occupational diseases (ODs) is estimated to be 4–12 per 10,000 among all diseases worldwide (1). The International Labor Organization (ILO) used the definition of “hidden epidemic” in 2013 to draw attention to the burden of ODs. In the same

report, ILO stated that the word hidden was used to highlight the inability to adequately diagnose ODs (2). Even in developed countries, OD notifications remain below the estimated numbers and the situation in developing countries is much poorer (3). For example, in Turkey, the subject of "work accidents and work-related health problems" was added for the first time in 2007 in the household labor force survey of the Turkish Statistical Institute. In the survey, which was revised in 2013, the prevalence of individuals with work-related health problems in the past 12 months was determined as 2.1%. Accordingly, the expected number of ODs in the population of approximately 30 million registered employees for 2019 should be >100,000 according to the Harrington theory. However, in the same period, the diagnosis of ODs was reported as 1091 according to the 2019 data announced in the SSI Statistical Yearbooks in Turkey (4,5). The announced data do not reflect the big picture as OD notifications are made only for insurance-related purposes in Turkey. Those reported by SSI Statistical Yearbooks are only cases with a loss of working power and occupational earning power of >10% (6). Efforts have been made to collect OD data for surveillance purposes in pilot studies initiated by the Public Health Institution in 2017 by the Ministry of Health. However, official statistics have not yet been published (7).

Comprehensive information in terms of causality has been provided in the ILO and World Health Organization OD diagnosis notification guidelines and OD lists as well as the Diagnosis and Notification Guidelines for Occupational Diseases and Work-Related Diseases and the List of Occupational Diseases at the national level (8,9). ILO recommends that countries establish a registration and notification system for surveillance by taking into account the sociocultural and ecopolitical structure of each country (9–11). For this reason, ILO states that preliminary studies such as needs analysis, barrier analysis, strength and weakness analysis, and the establishment of systems to take necessary precautions are very important.

There are barriers in different areas that prevent the diagnosis and notification of work-related diseases (work-aggravated illnesses and ODs). One of the most important obstacles is the level of knowledge and awareness and the willingness to report. In this regard, studies have been conducted in many countries to increase the motivation of physicians (12).

The results of Ramazzini's advice in the 1800s, "Ask your patients about their profession, and you will understand the true cause of their illness," are not satisfactory. In a previous study, Alagüney et al. evaluated the attitudes and behaviors of physicians regarding taking occupational anamnesis and reported that only 44.1% of family physicians took occupational anamnesis and referred 93.4% of suspicious cases to the OD hospital for further examination. Only 29% of the physicians reported that they had received training on OD during their education, and the remaining physicians stated that they wanted to receive training on this subject. The authors emphasized that correctly identifying the barriers obstructing reporting is the most important step in achieving an effective reporting system (13).

There is a need to establish a measurement tool for the evaluation of the current situation of physicians related to ODs or the effectiveness of training programs. Many models have been suggested, especially in the planning of educational programs (14,15). In most of these models, a valid and reliable measurement tool should be developed in the first step to evaluate the current status and/or needs so as to perform objective evaluation and evaluate the development of individuals. The measurement tool to be developed for this purpose should be able to evaluate the participants from different aspects within the context of a model. Among these aspects, self-efficacy for assessing how well physicians have achieved their own behavioral standards and goals, readiness for assessing whether they have the necessary capabilities to exhibit a behavior, and awareness for assessing their awareness of the situation related to employee health and ODs are very important.

In Turkey, there is no measurement tool to analyze the current situation of physicians regarding employee health and ODs and enable the evaluation of individual development in training programs. Therefore, the aim of this study was to develop an "attitude scale for physicians toward occupational health and occupational diseases."

METHOD

Scale development process:

The study was planned as methodological research (scale development study) using a quantitative research design. The target group was determined as physicians who have worked or may have the

Table 1. Descriptive analysis of the scale, exploratory factor analysis

No	Item	Mean	±	SD	F1	F2	F3	F4
	Self-efficacy							
1	As a health worker, I have sufficient knowledge in the field of occupational health and occupational diseases.	3.44	±	1.00	0.77			
2	As a health worker, I am competent at the application level in the field of employee health and occupational diseases.	3.24	±	1.08	0.78			
10	As a healthcare worker, I have a good command of the legislation on employee health and occupational diseases.	2.80	±	1.20	0.95			
11	As a healthcare worker, I think that I have a good command of business/factory/in-house special practices related to employee health and occupational diseases.	2.75	±	1.27	0,73			
13	When I suspect an occupational disease in my patient, I have no difficulty in applying the necessary procedures.	3.03	±	1.19	0.78			
12	As a healthcare worker, I can refer my patients to the upper center when I encounter a health problem related to employee health or occupational diseases.	3.65	±	1.08	0.70			
23	When I suspect an occupational disease in my patients, I reach out to my patient's workplace physician or occupational safety specialist and inform them.	3.15	±	1.30	0.50			
	Readiness							
3	When my patients apply to me with any complaints, I ask about their jobs/professions/working conditions.	3.76	±	1.18		0.81		
4	When my patients apply to me with any complaints, I associate their disease history with the working conditions during the examination.	3.75	±	1.09		0.93		
5	When my patients apply with any complaints, I associate their symptoms with working conditions.	3.77	±	1.14		0.98		
6	When I suspect a health problem related to occupational health or occupational diseases in my patients, I can manage the relevant processes.	3.33	±	1.08		0.57		
	Awareness							
17	I am interested in managing processes related to employee health and occupational diseases.	3.15	±	1.20			0,58	
18	If I come across news, articles or advertisements about occupational health and disease in the news or information sources I follow, I am interested.	3.50	±	1.24			0.40	
19	I am curious about the occupational health and safety measures taken for the employees at the place where I started work.	3.71	±	1.11			0.75	
20	I check the occupational health and safety measures for myself at the place where I started working.	3.40	±	1.13			0.79	
	Contribution							
24	Employee health and occupational diseases studies provide economic contribution to workplaces/factories/institutions in terms of preventive health services.	3.97	±	1.06				0.60
25	Employee health and occupational diseases studies provide scientific contribution to the field of employee health.	4.09	±	0.88				0.75
26	Employee health and occupational diseases studies increase the quality of production.	4.27	±	0.85				0.87
27	Employee health and occupational diseases studies contribute to the country's economy.	4.41	±	0.78				0.77

potential to work on the diagnosis and notification of ODs. During the scale development process, the item pool was determined using the three-round Delphi method, and the prepared item pool was converted into a measurement tool and tested for the pilot study. Exploratory and confirmatory factor analyses were performed using the data of the pilot study. Based on these analyses, the final version of the scale was

Table 2. VIF, Item t-values (C.R.), AVE (Average Variance Extracted) subdimension averages, discrimination validation, and correlation analyses between the subdimensions (Pearson's r)

		VIF*	t-values of items/ C.R.	Mean ± SD	AVE	Self-efficacy	Readiness	Awareness	Contribution
Self-efficacy	**Item 1**	3.78	7.60	3.24±0.32	0.671	0.82 (1)	0.435		
	Item 2	4.31	7.79						
	Item 3	4.97	8.25						
	Item 4	4.55	8.04						
	Item 5	2.09	7.00						
	Item 6	1.74	6.53						
	Item 7	1.62	7.53						
Readiness	**Item 8**	3.43	10.68	3.74±0.20	0.807	0.74 (0.733)**	0.90 (1)		
	Item 9	4.05	11.27						
	Item 10	3.94	11.34						
	Item 11	2.20	10.75						
Awareness	**Item 12**	2.53	10.01	3.47±0.24	0.738	0.76 (0.803)**	0.68 (0.672)**	0.86 (1)	
	Item 13	2.51	9.42						
	Item 14	2.42	8.53						
	Item 15	2.56	9.15						
Contribution	**Item 16**	1.45	6.48	4.18±0.18	0.679	0.32 (0.299)**	0.38 (0.328)**	0.41 (0.428)**	0.82 (1)
	Item 17	1.99	7.67						
	Item 18	2.52	8.92						
	Item 19	2.14	7.62						
Total				3.59±0.44					

*VIF (variance inflation factor)

** Correlation is significant at the 0.01 level (2-tailed).

prepared. Each step of the Delphi method was shared by the researchers on the online platform after an informative message. Collecting data online from volunteers for the pilot study was accepted as an optional bias; however, efforts were made to increase the representation by collecting data from different physician groups.

In the first round of Delphi, a group of subject matter experts were asked to express their views anonymously on "the positive and need-to-develop attitudes of health professionals toward occupational health and occupational diseases" (n = 12). In line with these views, an item pool comprising 27 items was created by the researchers.

In the second round of Delphi, 17 subject area experts different from those in the first round were asked to evaluate the item pool anonymously. In line with their feedback, a 27-item item list was created.

In the third round of Delphi, a group of five experts with doctoral-level experience in the fields of employee health/ODs and scale development/adaptation were asked to evaluate the scale. The feedback and data obtained after each step of the Delphi method were analyzed by the research group through online meetings. In line with the obtained feedback, 27 scale items were arranged, and it was decided to use a 5-point Likert scale for the responses.

In terms of the sample size, the number of participants was considered to be at least five times the number of items, >100 for the stability of the exploratory factor analysis, and >200 for the confirmatory factor analysis. As a result, data was obtained from 142 volunteers for exploratory factor analysis and 216 volunteers for confirmatory factor analysis, one week apart.

Analyzes

MS Excel, SPSS, JASP, AMOS, SmartPLS, and EduG software were used to analyze the pilot data. Missing data were approximated by linear interpolation. Content validity indexes (I-CVI and S-CVIave) were calculated for content validity analysis. Variance inflation factor (VIF), t-value (C.R.) and AVE (Average Variance Extracted) were calculated for the evaluation of the scale items. Exploratory and confirmatory factor analyses were performed. The KMO test was performed to evaluate the factorability of the scale. The KMO value, total explained variance, and correlation coefficients between the

Table 3. Confirmatory factor analysis*

Fit Indexes	Criteria for a perfect fit	Criteria for acceptable fit	Calculated fit indices	Result
x^2sd	0 ≤ χ2/sd ≤ 2	2≤ χ2/sd ≤ 3	2.13	acceptable fit
RMSR	0.00 ≤ RMSR ≤0.05	0.05 ≤ RMSR ≤0.10	0.07	acceptable fit
AGFI	0.90≤AGFI≤1.00	0.85 ≤ AGFI ≤0.90	0.89	acceptable fit
CFI	0.95 ≤ CFI ≤1.00	0.90 ≤ CFI ≤ 0.95	0.92	acceptable fit
NNFI	0.95 ≤ NNFI ≤1.00	0.90 ≤ NNFI≤0.95	0.93	acceptable fit
RMSEA	0.00≤ RMSEA ≤0.05	0.05≤ RMSEA ≤0.08	0.07	acceptable fit
GFI	0.95 ≤ GFI ≤ 1.00	0.90 ≤ GFI ≤ 0.95	0.91	acceptable fit

***** Analysis of fit indices in structural equation modeling

SRMR: Standardized Root Mean Square Residual; AGFI: Adjusted Goodness-of-Fit; CFI: Comparative Fit Index; NNFI: Non-Normed Fit Index; RMSEA: Root Mean Square Error of Approximation

subdimensions were calculated, minimum goodness-of-fit indices were calculated, and reliability analyses were performed. The classical test theory and generalizability theory were used in the reliability analysis of the scale. Finally, scale total scores and subdimension scores were calculated.

Ethical approval

The Süleyman Demirel University Non-Interventional Ethics Committee accepted this study (Date: 01.06.2021, No: 51/8).

RESULTS

In the first Delphi round of the scale development study, an item pool was created. The lowest I-CVI value of the items was calculated as 0.91 and the highest as 1.00. The mean scale content validity index (SCVIave) value of the scale was calculated as 0.97. At the end of the second round, a list of 27 items was created in line with feedback from the experts (Scale V1).

The total explained variance of the scale was calculated as 67.80%. The KMO value of the scale was calculated as 0.87, and the scale was considered factorable. In the exploratory factor analysis, the scale was divided into four dimensions. Item 21, with a factor load of <0.40; items 7 and 8, with inappropriate factor distribution; and items 9, 14, 15, 16, and 22, which did not support the model and contribute to the scale, were excluded from the scale. The scale was transformed into a 19-item scale comprising four subdimensions: “self-efficacy” comprising seven items, “readiness” comprising four items, “awareness” comprising four items, and “contribution” comprising four items (Scale V2) (Table 1).

While evaluating the scale items, the VIF value of all items was below 5 (Min:1.74, Max:4.97) and the correlation between the items was min:0,299, max: 0,803 (Table 2). As a rule of thumb and for adequate convergent, an AVE (Average Variance Extracted) of at least 0.50 is highly recommended. In our study, all AVE values were calculated above 0.50 (min: 0.671; max: 0.807) (Table 4). All the scale items had a t-value of >1.96 (Table 2).

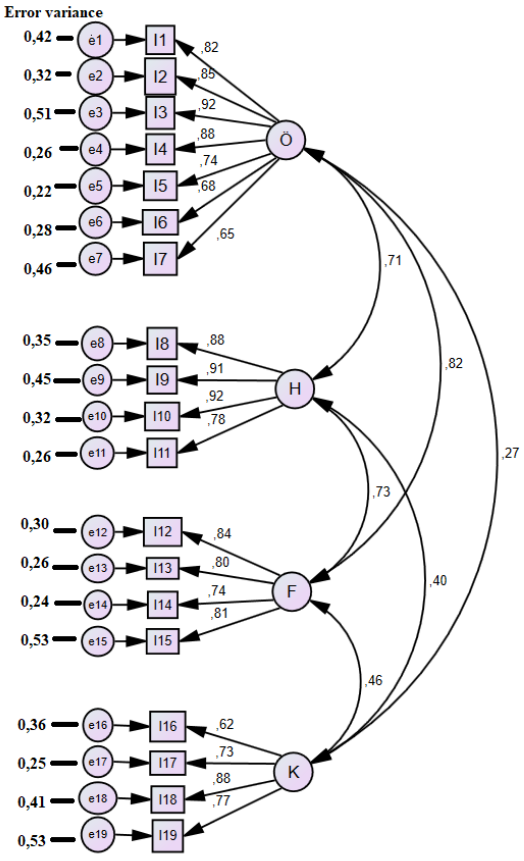

Figure 1. Four-factor scale diagram with CFA applied

Table 4. Score analysis of the scale, AVE and Reliability analysis

	n	Mean	Median	AVE	Cronbach's α	95% Confidence Interval lower bound	95% Confidence Interval upper bound
Self-efficacy	7	22.06±6.61	22	0.671	0.92	0.89	0.94
Readiness	4	14.61±3.99	15	0.807	0.92	0.90	0.94
Awareness	4	13.74±3.93	14	0.738	0.87	0.83	0.91
Contribution	4	16.73±2.92	17	0.679	0.83	0.77	0.87
Total	19	67.16±14.27	66		0.94	0.93	0.96

Table 5. Variance analysis

Source	Sum of Squares	Degrees of Freedom	Mean squares	Factor				
				Random	Mixed	Adjusted	%	Standard Error
Participant	1510.46	141	10.71	0.52	0.52	0.52	36.8	0.06
Item	548.18	18	30.45	0.20	0.20	0.20	14.6	0.06
Participant-Item	1770.37	2538	0.69	0.69	0.69	0.69	48.6	0.01
Total	3829.00	2697					100%	

The correlation coefficients between the subdimensions and discrimination indices were calculated to evaluate the relationship between the subdimensions of the scale. The correlation coefficients between all subdimensions were calculated as <0.85 (Table 2). The correlation coefficients of the contribution factor with other factors were calculated as 0.299, 0.328, and 0.428). Although these coefficients were <0.50, this subdimension was included in the confirmatory factor analysis because it had a high average and was evaluated by subject experts to be compliant with the model.

When the discrimination indexes between the subdimensions were evaluated, the subdimensions were associated with each other and were considered suitable for the model to be tested in confirmatory factor analysis (Table 2).

Confirmatory factor and reliability analyses were performed with all subdimensions of the scale. The results and the scale diagram are presented in Table 3 and Figure 1.

The reliability coefficient of the scale was calculated as 0.943 according to the classical test theory and generalizability theory (Table 4).

Analysis of variance performed according to the generalizability theory of the scale showed that the percentage of the variance component estimated for the participants was 36.8%, the percentage of the variance component estimated for the items was 14.6%, and the percentage of the variance component estimated for the participants–items was 48.6% (Table 5).

The scale scores were analyzed, and the mean scores of the self-efficacy, readiness, awareness, contribution subdimensions and the mean total scale score were calculated (Table 4).

DISCUSSION

The relationship between work life and health is a topic that continues to gain importance worldwide. It is estimated that there is a 10%–25% burden attributed to the profession of disease diagnoses, which increases with prolonged life expectancy. With the COVID-19 pandemic, the importance of preventive medicine practices has been recognized, and accordingly, the importance of obtaining data for ODs, which we accept as preventable diseases, has emerged. The Attitudes Scale toward Occupational Health and Diseases for Physicians, which we developed to evaluate attitudes such as self-efficacy, readiness, awareness, contribution of physicians to make OD notifications, will make significant contributions to this field. The reliability of the scale, sub dimensions, correlation between sub dimensions, distinctiveness, and strength of the sub dimensions were determined.

It is recommended to use scale development guides in scale development studies (16). In the Delphi method, it is recommended to obtain the opinions of 2–20 experts in the first round, obtain the opinions of 2–20 experts for content validity in the second round, and evaluate the scale with at least five doctoral-level experts in the third round (17,18). In the present study, scale development guides were used by complying with all scientific rules in accordance with the literature. An item list was created by taking the opinions of a sufficient number of specialist physicians and doctoral-level experts. By meeting all the conditions in all scale development steps, efforts were made to ensure that the developed scale included the most important components for the experts in the field of ODs and employee health. However, this is a very complex field and involves many variables and different disciplines. It was predicted that attempting to represent all these variables and keeping the examples much wider rather than the minimum would increase the number of items in the scale and result in additional sub dimensions. This would in turn reduce the applicability of the developed scale in the field with a much larger number of items. Therefore, the scale was developed while meeting the minimum requirements of a scientific scale. For this reason, we think that the prepared scale is highly applicable to physicians in the field in terms of the number of items and subdimensions.

The variables of work life and the socioeconomic, cultural, and ethical dimensions of the subject necessitate the evaluation of the subject from different perspectives. Although various barriers obstruct the diagnosis and notification of ODs in Turkey, the role of primary healthcare physicians in the diagnosis and notification system is particularly insufficient. Alagüney et al. found that the OD notifications made by family physicians who are involved in primary health care service and their training on the subject were very insufficient. It is important that these variables, which are related to a healthy work life, are included as subdimensions of the scale. In the present study, items were prepared for the dimensions of self-efficacy, to assess how far the physicians reach their behavioral standards and goals; readiness, to evaluate the necessary capabilities to exhibit a behavior; awareness, to evaluate the awareness levels of physicians related to employee health and OD; and additional items to evaluate the scientific and economic contributions of employee health and OD protective measures.

In scale development, it is suggested that the construct validity of the subdimensions should be sufficient and the discriminant validity should be strong (19,20). In our study, the correlations between these subfactors (self-efficacy, readiness, and awareness) were found to be sufficient for construct validity and discriminant validity was strong, in accordance with the literature. Therefore, the scale revealed the highly variable subdimension causes of behavioral deficiencies of the physicians. Thus, we think that the scale can be used in educational planning to overcome these deficiencies.

It is recommended to analyze the scale in terms of validity during the scale development process (21,22). In this step, content validity indices (I-CVI and S-CVIave) are calculated by taking the opinion of 2–20 experts for content validation, and a mean value of >0.9 for I-CVI and SCVI is accepted as excellent content validity (18,23–25). The discriminant validation, on the other hand, provides evidence for the interrelatedness of measures of constructs that should theoretically be highly correlated (26). When the discrimination indexes between the subdimensions were evaluated in our study, the subdimensions were found to be correlated with each other and were evaluated as suitable for the model to be tested in confirmatory factor analysis.

Evaluation of the scale items by calculating variance inflation factors determines the strength of the correlation between the items. In general, VIF values of ≥10 are considered problematic, and values of <5 are considered appropriate (27,28). The t-value is calculated to evaluate whether the latent variables explain the observed variables, and for $p < 0.05$, a t-value of >1.96 is acceptable. In the present study, consistent with the findings of the literature, the correlation coefficient between the subdimensions showed a statistically significant difference. In addition to this information, when the variance was evaluated according to the inflation factor, no problem was found in the relationship between the items. The t-value, which reflects how much the latent variables explain the observed variables for each item, was also evaluated as appropriate. In line with these findings, it was found that the scale items would contribute adequately to the scale formation.

In the reliability analyses performed to evaluate the internal consistency of a scale, a coefficient of >0.70

is accepted as reliable according to the classical test theory and generalizability theory (29,30). The findings of the scale developed in the present study were evaluated as reliable in accordance with the literature.

Exploratory and confirmatory factor analyses is performed for the holistic evaluation of the scale and for the subdimension analysis, in other words, for construct validity. In factor analysis, a KMO value of >0.50 is required for the scale to be factorable (31). In the present study, the KMO value was >0.50, indicating that the scale was factorable. In addition, in exploratory factor analysis, the total explained variance represents how much the factors and items explain the variable to be measured by the scale. The fact that the explained variance exceeds 50% of the total variance is an important criterion of factor analysis (32). In the present study, in accordance with the literature, the total explained variance in the exploratory factor analysis was >50% and largely explained the variable to be measured. In the exploratory factor analysis performed to determine the subdimensions of the scale, the factor loads of the items should be >0.40 (33). In the present study, the factor loads of all items were calculated as >0.40, consistent with the literature. The scale was divided into four subdimensions: self-efficacy, readiness, awareness, and contribution. For the significance of the discriminant validity of the subdimensions, the correlation coefficients between the subdimensions should be <0.85 (20). A p-value of <0.05 is considered statistically significant. In the present study, there was a statistically significant difference between the subdimensions, which is in line with the literature.

In scale development studies, confirmatory factor analysis is performed to evaluate whether the subdimensions form a coherent model. In this analysis, various goodness-of-fit indices are calculated, and cutoff values are determined. Model chi-square, root mean square error of approximation (RMSEA), comparative fit index (CFI), and standardized root mean square residual (SRMR) are recommended as minimum goodness-of-fit indices (34,35). In the present study, SRMR <0.08, AGFI (adjusted goodness-of-fit) ≥0.90, CFI ≥.90, non-normed fit index (NNFI) ≥ 0.95, and RMSEA < 0.08 cutoff values were determined (36,37). In accordance with the literature, we concluded that this model has the capacity to measure the attitude level of physicians regarding occupational health and ODs from different aspects and enable the evaluation of their development.

In reliability analyses performed to evaluate the internal consistency of the scale, a coefficient of >0.70 is accepted as reliable according to the classical test theory and generalizability theory (29,30). The scale developed in our study was found to be reliable, in accordance with the literature.

In analyses performed according to the generalizability theory, the high relative value of the percentage of variance component estimated for individuals in a one-faced crossed design indicates that the discrimination is sufficient, and the balanced distribution in the difficulty levels of the percentage of variance component estimated for the items indicates that the generalizability is strong. The fact that the variance component estimated for the individual–item is partially low indicates that systematic or unsystematic error sources can be partially controlled (38,39).

In the present study, although the total score of the scale was above the median value, the mean scores of self-efficacy, readiness, awareness, and contribution were calculated below the median value. Self-efficacy refers to the competence that a person feels about his/her ability to successfully perform job-related tasks (40). Readiness and awareness are among the minimum conditions for change management and are areas that can be improved with training programs (41).

The results of our study indicate that physicians do not consider themselves sufficient in the field of occupational health and ODs, their readiness level is insufficient, their level of awareness can be improved, and the opinions about the level of contribution are unsatisfactory and these areas need improvement.

The Attitude Scale toward Occupational Health and Occupational Diseases for Physicians, developed in this study, is a valid and reliable tool that can be used to determine the attitude levels of physicians toward occupational health and diseases and evaluate the development of participants in training programs.

CONCLUSION

In the present study, the collection of data on a voluntary basis in the online environment and the minimum standards for data count recommended for each item are among the limitations of the study. However, we believe that the study is very valuable in terms of being a pioneering study in the field of

employee health and ODs. To further develop the scale and make meaningful contributions to the field, the scale should be adapted to different languages/cultures and tested at the international level and in wider and different populations. In addition, we believe that a measurement tool developed for this attitude will make very important contributions to the collection of big data and follow-up process within a short timeframe.

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Peer-review: Externally peer-reviewed.

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