

Evaluation of the psychometric properties of the Persian version of the occupational health and safety literacy questionnaire among process industry workers

ABSTRACT

Background and Objectives: Health and safety literacy is an essential aspect of the employees' awareness level. Since an estimate of the literacy level can be effective in increasing the level of personnel awareness of safe and health behavior, the purpose of this study is to provide a tool in the form of a valid and reliable questionnaire in the field of occupational health and safety literacy.

Materials and Methods: The current research was conducted to examine feasibility of the Persian version of the occupational health and safety literacy assessment questionnaire in employees in 2023. After translating the tool using the translation-retranslation, quantitative and qualitative validity of the questionnaire were assessed by 10 experts. Repeatability and internal consistency were examined by 30 employees, and item analysis as well as construct validity by 410 employees.

Results: The impact score, CVR and CVI of the questionnaire were 3.51, 0.96 and 0.91, respectively. The construct validity confirmed the final version of the questionnaire contains 34 questions in 4 dimensions including access, review, evaluation, and use of health and job information. The ratio of the chi-square test to the degree of freedom (χ^2/df) was equal to 3.71. The RMSEA index was 0.08. The internal consistency of the questionnaire was ($\alpha=0.923$), and repeatability (ICC= 0.98) which were within the acceptable range.

Conclusion: The Persian version of occupational safety and health literacy questionnaire with 34 items and 4 dimensions was confirmed by the concept of Iranian occupational safety and health literacy. Iranian occupational health and safety specialists can use this valid and reliable tool to assess the occupational health and safety literacy and the findings can be applied for occupational health and safety interventions.

Paper Type: Research Article

Keywords: Occupational health and safety, Literacy, Gas refinery, Reliability, Questionnaire.

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Introduction

Because of the significant role of health literacy in decision-making of health-related fields, it has been the focus of policy makers for enhancement of the health literacy in both individuals and societies (1). In daily life, knowledge, motivation, assessment, and application of health information are essential for diseases prevention, health promotion, and quality of life improvement (2). Health literate people are people who are not only able to read health information, but also are able to understand and use information to take care of their health. Health literacy includes the skills of reading, listening, analysis, decision-making, and the ability to apply these skills in health situations and does not necessarily depend on education or general reading ability (3).

In the fifth world conference held by the World Health Organization on the topic of health promotion, health literacy was defined as cognitive and social skills that determines the abilities and motivations of people to access, understand, evaluate and apply information in a useful way for maintaining and promoting of health. In this definition, health literacy is defined as an individual factor and becomes a key factor in public health (4-6), consequently, health literacy is beyond the ability to read, write and understand the meanings of words and numbers in health care and can be distinct in different areas (5).

Therefore, several measurement tools have been developed in a health literacy and expanded rapidly in various fields. However, they vary in their design, approach, and purpose (7). For example, a questionnaire was designed for measuring the health

literacy of diabetic patients (LAD) by Nath and his colleagues in 2001, which its feasibility was tested in Iran (8, 9). Each health literacy measurement tool has different useful features and capabilities based on the context, but all should be able to measure health literacy in complex health care delivery (10) with more interdisciplinary audience and multifaceted nature (3).

So far, many studies have been conducted in relation to health literacy in terms of medical, oral and dental health, nutrition literacy, mental health literacy, etc., but there are few studies in the occupational health and safety literacy in workplaces. Occupational health and safety are one of the most substantial dimensions of health, which neglecting them can lead to work-related accidents and diseases or affect some behavioral aspects of employees (11). One effective factor in health promotion and accidents prevention is occupational health and safety literacy.

Therefore, increasing the level of awareness and regular training in the field of occupational health and safety literacy can reduce occupational accidents (12). Besides, improvement of the occupational health literacy can promote the access and perception of employees to various types of occupational diseases, their prevention methods as well as risks prediction. In line with the International Labor Organization (ILO) that adapted a safe and healthy work environment as one of the five fundamental rights at work in June 2022 (13), enhancing the health and safety literacy level can help to achieve this principle right. Besides, one issue that have gotten more attention in the field

of Health, Safety and Environment (HSE) literacy.

Evaluating and promoting occupational health and safety literacy is one of the basic steps in protecting against potential occupational health risks that can lead to escalating the level of organizational culture in industries and medical centers (14). Since low occupational health and safety literacy is one of the contributing factors to occupational diseases and injuries among personnel, addressing this issue can decrease work-related illnesses and injuries (15). Researches showed that occupational health literacy is related to the safety behavior of employees, the level of health and safety literacy of employees affects the experiences of occupational accidents of workers (16, 17), A worker with a higher level of health literacy prioritizes safety behaviors, policies, and procedures when making safety decisions. Therefore, it is better for organizations to employ people in high-risk jobs such as working in a refinery that have a higher level of health literacy (this does not necessarily depend on the skill of the employee or worker in that field of work. Several researches have shown that people who have poor occupational health literacy are more prone to injuries, illnesses, and accidents (15, 17).

Therefore, it can be said that the higher the level of health and safety literacy of the personnel, it leading to a reduction in occupational accidents and they understand more about the safety of their workplace (18). On the other hand, having a tool that can measure people's occupational health and safety literacy level can be very helpful. The purpose of this study is the validity, reliability

and cultural adaptation of the aforementioned questionnaire in the field of occupational health and safety literacy in Iran. For this purpose, the present study was conducted with the aim of achieving the validity, reliability and cultural adaptation of the Persian Health and Safety Literacy Questionnaire among Shahid Hashminejad Gas Refinery employees.

Materials and Methods

The current cross-sectional study was conducted to verify the suitability of Persian version of occupational health and safety literacy assessment questionnaire in a group of 410 employees within a Gas Refinery. Inclusion criteria was at least one year of work experience in the refinery, while exclusion criteria were the unwillingness of the personnel to continue the research. To provide the construct validity, sampling was carried out at the refinery. The data collection for this study utilized cluster sampling, wherein occupational groups were considered as clusters. In order to ensure representation, a greater number of samples were obtained from occupational groups with larger populations. Refinery occupational groups were including: Operator, Guards, Driver, Administrative staffs, Firefighters, Electrical and mechanical engineers, HSE personnel, Repairs, Structural personnel, Services, Technical worker, Rigger and Laboratory personnel. We applied the occupational health literacy questionnaire developed by Weeraporn Suthakorn and his colleagues in 2020 (19). The questionnaire contains 38 items in 4 dimensions including access to information with 7 items (1 to 7), comprehension of information including 14 items (8 to 22), evaluation of information 4

items (23 to 27), and application of occupational health and safety information including 10 items (28 to 38). Cronbach's alpha value of the questionnaire was reported as 0.98. The response scale for each item was from 1 to 3 (confirms, partially confirms and does not confirm). The measurement of each dimension was based on the average scores of the items of each dimension in three levels of) poor: 1-1.67, moderate: 1.68 – 2.35 and good > 2.36((19). The only change that was made in the Persian questionnaire was the change of the response scale for each item. Since the most optimal Likert scale method in Iran is 5 options (20), a 5-point Likert scale from 1 to 5 (never, rarely, sometimes, often, and always) was used in current research, and the range of scores for each dimension was between 1 to 100. The obtained score for each dimension was interpreted into three levels of (poor: 1-33.34, moderate: 33.35-66.67, and good > 66.68).

Demographic information including age, job title, marital status, level of education, work experience, working hours, and previous experience of occupational accidents. Following steps were performed in this study.

Translation tool

The backward-forward method was done in translating the questionnaires. After obtaining a permission from the main designer of the questionnaire, first, the original version of the questionnaire was translated from English to Farsi by two independent translators at the same time. The translated questionnaires were merged by a competent expert and the first Persian version was prepared. This version was again

translated into English by two other independent translators, and finally, one person as a coordinator and expert matched the English translations with the original version and fixed the possible incompatibles (21).

Face validity

Quantitative and qualitative methods were used to examine the interpretability of the items. In a qualitative method, 10 participants were discussed about the difficulty of understanding, simplicity and clarity of the items, the possibility of misunderstandings of phrases or inadequacy in the meanings of words. Then the necessary corrections were made based on feedbacks.

For the quantitative investigation of face validity, the effect of the item was used. Thus, for each of the items in the questionnaire, there are five Likert parts including, completely important (score 5), somewhat important (score 4), moderately important (score 3), slightly important (score 2) and not important at all (score 1) were considered. From 10 qualified individuals, request to determine what is important based on their experiences to measure case-specific constructs. Then the impact score was calculated on each species; larger items equal to 1.5 were considered as suitable items. The data of this section was analyzed using Excel software.

Content validity

The content validity was done step by step (22). To perform it, which reflects the adequacy of an instrument for measurement, the questionnaire examined by 10 experts including university professors, senior experts of gas refineries, senior experts form mining as well as other industries. They were

asked on the necessity and relevance of the items. Content validity ratio index (CVR-Relax) and content validity index (CVI) were used to quantitatively evaluate the content validity. A value of CVR greater than 0.62 and CVI greater than 0.79 was considered as an acceptable level (23, 24). The data of this section was analyzed using Excel software.

Repeatability and Internal consistency

After checking the face validity and content validity, the reproducibility of the tool was evaluated on 30 employees from the target community in a two-week interval.

Cronbach's alpha coefficient was used to check the internal consistency of the instrument. For this purpose, 30 employees completed the questionnaire. The data of this section was analyzed using SPSS software (version 25).

Construct validity

Confirmatory factor analysis was used to evaluate construct validity. A factor loading greater than 0.4 and the placement of goodness of fit indices in the acceptable range indicated the validity of the construct. The minimum sample size of the confirmatory factor analysis was determined based on the study of Kass RA et al. (25, 26); therefore, 380 employees (10 employees in each item) was chosen. Since 410 people answered all the questions in the questionnaire, confirmatory factor analysis was performed based on the data of 410 participants. In this study the acceptable value for Root Means Square Error of Approximation (RMSEA) was less than 0.10, the standard rate for Chi-square ratio to degree of freedom χ^2/df was between 1 and 5, and Comparative Fit Index (CFI) and Tucker-Lewis Fit Index (TLI) were greater than 0.9 (27, 28). The data of this section was analyzed

using AMOS (version 24). Software and a significance level of 5% was considered.

Results

Demographic characteristics of the participants was show in table 1. The average age and work experience of that workers were 39.92 ± 7.62 and 13.29 ± 8.16 years, respectively. Most of the participants were married (92.1%) and had a bachelor degree (37.4%). Also, there are two types of working hours: 8 and 12 hours, 20.7% of the employees are operators and 2.4% of them include the laboratories personnel or riggers, and 86.4% of them have no Experience of work accident.

Finally, items No. 3, 4, and 6 were removed due to cultural incompatibility in the area of access to occupational health and safety information. There is not a health-care volunteer in Iran's industry (item 3, 4) and it is not routine that employees of an organization participate in the training courses of another organization (item 6). Consequently, the content validity of the questionnaire was confirmed with 35 items. The average score of impact, CVR and CVI in the confirmation items was 3.51, 0.96 and 0.91 respectively. More detailed information is given in table 2. After completing the questionnaire by 30 employees, the value of Cronbach's alpha coefficient and the intraclass correlation coefficient (ICC) were calculated to check the reliability of the instrument. The overall Cronbach's alpha coefficient and ICC of the questionnaire were equal to 0.92 and 0.98 respectively that indicated the internal consistency and repeatability within the acceptable range. Table 3 shows more results of the internal consistency of the questionnaire.

Table 1: Frequency distribution of participants' demographic variables.

Parameter	Demographic characteristics	Number	Percent
Marital status	Married	387	92.1
	Single	33	7.9
Education	Below diploma	20	4.8
	Diploma	90	21.4
	College Degree	81	19.3
	Bachelor	157	37.4
	Master	67	16
	Ph.Ds.	5	1.2
Job title	Operator	87	20.7
	Guards	48	11.4
	Driver	27	6.4
	Administrative staffs	49	11.7
	Firefighters	31	7.4
	Electrical and mechanical engineers	14	3.3
	HSE personnel	18	4.3
	Repairs	32	7.6
	Structural personnel	37	8.8
	Services	35	8.3
	Technical worker	22	5.2
	Rigger	10	2.4
	Laboratory personnel	10	2.4
	Working hours	8 hours	222
12 hours		198	47.1
Experience of accident	Yes	57	13.6
	No	363	86.4

Table 2: The results of the face and content validity of the questionnaire.

No.	Parameter	CVR-Relax	CVR	CVI	Impact score	Factor loading	Verdict
Access to occupational health and safety information							
1	I can search for OHS (occupational health and safety) information by my own	1.0	0.6	0.8	3.54	0.73	Confirmed
2	I can access to OHS information from many sources such as experts, online sources, and other medias	1.0	0.8	1.0	3.47	0.72	Confirmed
3	I can access to OHS information from health center personnel.	0.6	1.0-	0.7	2.04		Rejected*
4	I can obtain occupational health and safety information from health liaisons.	0.6	1.0-	0.4	1.08		Rejected*
5	I can access HSE services whenever I have a work-related health problem.	1.0	0.4	0.8	3.97	0.69	Confirmed
6	I participate in occupational health and safety training courses organized by other organizations.	0.6	0.4	0.4	2.14		Rejected*
7	I can quickly find information about the right health care insurance when I have an accident.	0.8	0.2	0.8	2.24	0.69	Confirmed
Understanding occupational health and safety information							
8	I understand that my work involves risks and may lead to illness and injury.	1.0	1.0	0.9	4.28	0.41	Confirmed

No.	Parameter	CVR-Relax	CVR	CVI	Impact score	Factor loading	Verdict
9	think I know how to protect myself in my work.	1.0	0.8	1.0	4.58	0.58	Confirmed
10	I know how to take care of myself and stay healthy.	1.0	0.8	1.0	4.13	0.55	Confirmed
11	I know that using cotton balls in the ears cannot reduce noise level from work	1.0	0.6-	0.9	2.67	0.38	Rejected*
12	In my opinion, lifting or carrying heavy objects should be done with proper posture.	1.0	0.6	0.9	3.82	0.44	Confirmed
13	In my opinion, working postures affect musculoskeletal problems.	1.0	0.6	0.9	4.20	0.49	Confirmed
14	In my opinion, working with chemical agents should be done with safety measures.	1.0	0.4	0.9	4.75	0.66	Confirmed
15	In my opinion, opened area may cause heat or cold related illness.	1.0	0.2	0.9	3.06	0.41	Confirmed
16	In my opinion, the proper management of the workplace (that is, the arrangement of tools or appliances or electrical wires) can help reduce the risks of work.	1.0	0.0	0.9	3.97	0.63	Confirmed
17	In my opinion, working in a dusty environment should be done with proper wearing of a face mask.	1.0	0.2	0.9	4.13	0.61	Confirmed
18	I understand the methods and tips related to reducing job stress.	1.0	0.8	1.0	3.54	0.41	Confirmed
19	In my opinion, working in an environment that has less or over luminance puts pressure on eyes and can cause vision problemsless.	1.0	0.6	0.9	4.42	0.67	Confirmed
20	In my opinion, Accidents from work are preventable.	1.0	1.0	1.0	4.13	0.58	Confirmed
21	In my opinion, everyone needs to exercise regularly, even if their work involves heavy physical activity.	0.8	0.4	0.9	3.13	0.45	Confirmed
22	When I use the health services of a center, I understand the recommendations of the health center personnel.	0.8	0.4-	0.8	1.69	0.58	Confirmed
Evaluation of occupational health and safety information							
23	When I receive OHS information from social media I always check that the information is correct before I act on it or share it with others.	0.8	0.4	0.8	2.56	0.59	Confirmed
24	When I receive OHS information from brochures or printed materials, I check whether the source is reliable.	0.8	0.8	0.9	2.61	0.85	Confirmed
25	When I receive new OHS information I check it is up to date.	1.0	0.6	0.9	2.94	0.78	Confirmed
26	If I have any doubts about the received OHS information, I consult with the experts and personnel of the health center before using it.	0.8	0.6	0.9	3.47	0.70	Confirmed

No.	Parameter	CVR-Relax	CVR	CVI	Impact score	Factor loading	Verdict
	Use of occupational health and safety information						
27	If I get sick from work, I am able to do basic self-care	1.0	0.0	0.9	2.94	0.59	Confirmed
28	I check the tool before use.	1.0	0.6	0.9	3.61	0.67	Confirmed
29	I always arrange working area to allow safety (i.e. reduce dust, increase luminance, proper store electrical devices)	1.0	0.2-	1.0	3.54	0.70	Confirmed
30	When buying appliances for work, I often check the label and instructions and try to understand them.	1.0	0.6	1.0	2.67	0.66	Confirmed
31	I participate in at least one occupational health promotion activity in the organization	1.0	0.4	0.9	2.94	0.58	Confirmed
32	I take regular exercise.	1.0	0.8	1.0	2.78	0.44	Confirmed
33	I do stretching to release muscle tension from work	1.0	0.2-	0.9	2.61	0.49	Confirmed
34	I follow working procedures to prevent work injuries.	1.0	0.8	0.9	4.42	0.65	Confirmed
35	I create a happy work environment	0.8	0.2-	0.6	2.28	0.57	Confirmed
36	I can advise my coworkers about work safety.	1.0	1.0	1.0	3.06	0.66	Confirmed
37	I follow the instructions I receive from the HSE unit.	1.0	0.8	0.9	4.67	0.66	Confirmed
38	I attain yearly health check up	1.0	1.0	1.0	4.75	0.46	Confirmed

Items No. 3, 4 and 6 were removed in the content validity stage due to cultural incompatibility and item No. 11 (or number 8 after doing content validity) in the confirmatory factor analysis stage due to its factor loading being less than 0.4

Table 3: The results of the internal consistency of the questionnaire

Parameter	Number of items	Cronbach's alpha	Verdict
Access to occupational health and safety information	4	0.79	Confirmation
Understanding occupational health and safety information	14	0.84	Confirmation
Evaluation of occupational health and safety information	4	0.82	Confirmation
Application of occupational health and safety information	12	0.86	Confirmation
Total	34	0.92	Confirmation

Figure 1 and Table 2 illustrate the standard factor loading values of the items. Confirmatory factor analysis showed that the standard factor loading of all items was greater than 0.4 except for item number 11 of the original questioner (or number 8 after doing content validity). Therefore, this item was removed and the questionnaire was finalized with 34 items. After that, the value for root means square error of approximation

(RMSEA) of the final model was 0.08, The standard rate for Chi-square ratio to degree of freedom χ^2/df was 3.71, and Comparative Fit Index (CFI)¹ and Tucker-Lewis Fit Index (TLI)² were 0.97, 0.95 respectively. Table 4 demonstrate that the final model has a good fitness. Moreover, figure 1 shows the errors caused by loading each item (Inside the oval)

Table 4: Goodness indices of model fit based on the confirmatory factor analysis

Index name	Amount	Acceptable value	Result
χ^2/df	3.71	Between 1 and 5	acceptable
CFI	0.97	Greater than 0.9	acceptable
TLI	0.95	Greater than 0.9	acceptable
RMSEA	0.08	Smaller than 0.10	acceptable

TLI = Tucker-Lewis Index, CFI= Comparative Fit Index and RMSEA = Root Means Square Error of Approximation

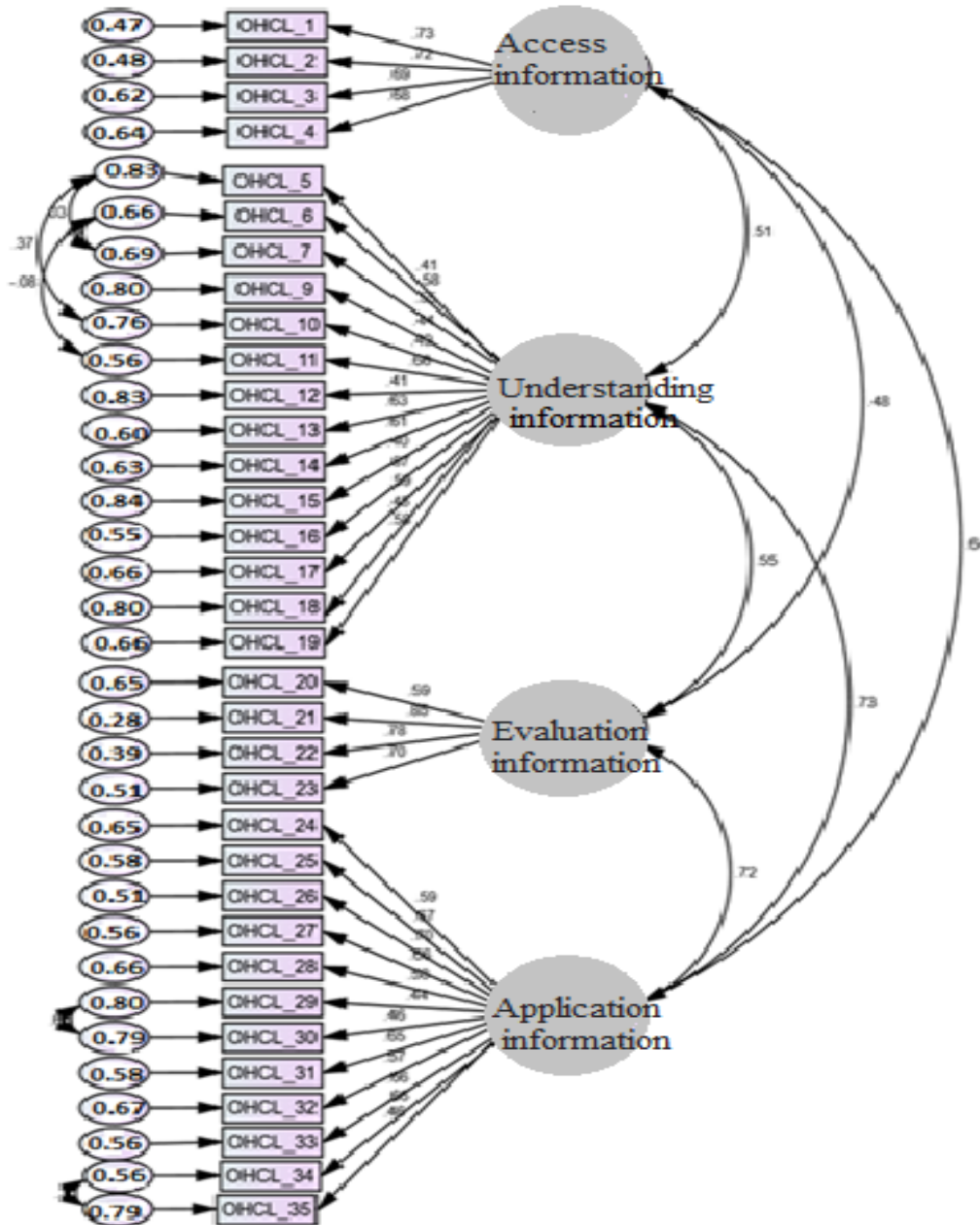


Figure 1. The confirmatory factor analysis model of the occupational health and safety literacy questionnaire.

Discussion

The present study was conducted to investigate the psychometric characteristics of occupational health and safety literacy questionnaire, including four dimensions of access, understanding, evaluation and application of occupational health and safety literacy. In 2014, a study was conducted to develop and validate the occupational health literacy for workers in Saveh Industrial Town. The content and structural validity as well as the reliability of the questionnaire were confirmed in six dimensions consist of (access, reading, understanding, evaluation, decision-making and self-efficacy). However, it was not included any questions regarding to safety and mental health (29). In current study, the psychometrics of the mentioned instrument was examined. According to the World Health Organization, health is not only related to the physical status but also related to the mental, and social conditions; therefore, in this research, questions about creating a happy work environment and exercise were also proposed to consider mental and social conditions in addition, questions were included about the harmful factors of the working environment such as chemical, physical, ergonomic and psychological factors.

Health literacy is essential in promotion of health care and can act as a vital factor of health in a society. In the previous health literacy studies, primarily approaches were descriptive or exploratory approaches, while perception skills, evaluating skills, practical application of information, and health literacy as well as organizational occupational safety literacy were less concerned (30, 31). Variety of researches have been made to

understand and measure the health literacy among different group of people. Besides scholars have developed and used different instruments to measure the health literacy. Since one significant features of an instrument is its validity and reliability, the current research was conducted to examine the validity and reliability of the occupational safety and health literacy questionnaire among employees of a Gas Refinery. The results indicated that several items required to change after performing the content analysis and based on the experts' opinion. However, in the process of construct validity, the structure of the questionnaire did not change and the original four dimensions remained the same. In total, the results of the study showed that the version of the psychometric test has a proper construct validity, reliability, and feasibility; so, like the original version can be used for workers.

Cronbach's alpha obtained between 0.79 and 0.86 indicating the internal consistency of the subscales and the reliability of a questionnaire. In the study of Nemat Azizi et al. (2019), Cronbach's alpha was estimated between 0.72 to 0.84, which means that the internal consistency of the items is high. The results of Suthakorn et al.'s research (2020) with 38 items showed high internal consistency and acceptable reliability (Cronbach's alpha 0.98), which is consistent with the present study (Cronbach's alpha between 0.79 to 0.86). Also, in a similar study in the field of health literacy conducted by McCormack et al. (Cronbach's alpha 0.86) was obtained (32).

The results of confirmatory factor analysis confirmed the structure of the questionnaire. The values of the standardized parameters

indicate the power of each question's factor loading on the factor under different scales; and confirm the fitness of the model.

In the process of promoting occupational health literacy, the importance of access and availability of health information has been emphasized (33, 34). Occupational health and safety management should also stress more on strengthening of health literacy, at the same time have principles for prevention. For instance, for improving the safety culture, especially considering the lack of skilled workers, demographic changes and new working conditions, health literacy is of increasing importance (35, 36).

Study Limitations and Strengths: The current research has also been accompanied by limitations, one of the limitations of this research was utilizing a self-report questionnaire, and consequently, it is possible that responders are influenced by motivation, level of education, colleagues, and the spirit of participation. Another limitation is application of the structural equation model, which may not able to prove causality, therefore we should consider more caution. Finally, all personnel of the refinery were male; so, we could not control the influence of gender variable. It is suggested to consider controlling demographic variables and the necessary interventions in future researches.

Conclusion

In general, the Persian version of an occupational health and safety literacy questionnaire is valid and reliable for application in refineries and oil and gas operation companies which have similar process and management system. This instrument enables safety officials in

identifying valuable information for promotion of occupational health and safety literacy of workers. This questionnaire by passing the psychometric test and providing the acceptable validity and reliability can, provide the conditions for the wide use by researchers because of short-form, ease of implementation, and coverage of various dimensions of occupational health and safety literacy.

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Availability of data and materials: The nameless datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Conflicts of interests: The authors declare that there is no conflict of interest regarding the publication of this research.

Consent for publication: Not applicable

Ethical approval and consent to participate: The study adhered to the principles of the Helsinki Declaration. All participants completed the informed consent form. In this form were emphasized on the willingness to participate in this study, the absence of costs, and the confidentiality of personal information. Also, the protocol of this study was approved by the ethics committee of Mashhad University of Medical

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