Original Article

Assessing reliability and validity of the Work Design Questionnaire as a tool for macro ergonomics surveys: A case study in an Iranian worker population in 2016

Mohammad Khandan[1], Somayeh Momenyan[2], Faezeh Javadi[3], Zahra Allahdadi[3], Alireza Koohpaei[4*], Hossein Hosseini Tabar[5]

1- MSc in Ergonomics, Department of Occupational Health and Safety, Health Faculty, Qom University of Medical Sciences, Qom, Iran.
2- MSc in Biostatistics, Paramedical Sciences Faculty, Shahid Beheshti University of Medical Sciences, Tehran, Iran.
3- BSc in Occupational Health, Department of Occupational Health and Safety, Qom University of Medical Sciences, Qom, Iran.
4- Associate prof., Department of Occupational Health and Safety, Qom University of Medical Sciences, Qom, Iran
5 MSc in Occupational Health, Department of Technology Systems, East Carolina University, Greenville, United States of America.

Article Info

Abstract

Background: The imbalance between job demand and controls is associated with physical and mental disorders. The Work Design Questionnaire (WDQ) is one of the newest tools for macro-ergonomics evaluation of organizations and workplaces. In this research, the reliability and validity of the Persian WDQ (PWDQ) in the evaluation of occupational accident management and safety promotion in Persian-language organizations were studied.

Materials and Methods: This descriptive study was performed among 397 randomly selected workers in a glass manufacturing company in Saveh, Iran, in 2016. The questionnaire had 77 questions with four main factors. A demographic questionnaire was also employed. Confirmatory factor analysis was used to confirm the structure of factors in PWDQ. Data analyses were performed in SPSS software (independent t-test and Pearson's correlation test) and LISREL.

Results: The mean total score of the questionnaire was equals to 253.44 ± 45.05. Reliability for all questions, based on Cronbach's alpha value, was calculated at 0.94. The result of the validity tests also indicated suitable generalization of the PWDQ. Furthermore, fitness parameters were in acceptable ranges. Pearson's correlation test showed that all factors of social characteristics are significantly associated with occupational accident ($P<0.05$). Moreover, feedback from job factor was negatively correlated with accident.

Conclusions: The PWDQ would be applicable as a valid and reliable tool for evaluating the work characteristics of Persian-language organizations and industries. In addition, it was found that using this tool based on the macro ergonomics principles is suitable for accidents control, safety promotion, cost management, and improvement of organizational efficiency/productivity.

Keywords: Ergonomics, Occupational Accidents, Reliability, Validity, Work.

Introduction

Job demands and resources are the most important features in work design (1). Based on the available literature, high level job demand and low level job control led to diseases and poor well-being (2, 3). The imbalance between job demand and job control are related to physical and mental disorders (4). In addition, this incongruity is associated with violation and bullying in workplaces (5).

Work design focuses on subjects such as organizational structure, function and job modification, and roles and tasks (6). Work design in ergonomics is known as human-job interface technology or work design ergonomics (7). From the perspective of macroergonomics, safety and quality can be enhanced through the appropriate designing of work systems (8).

The Macroergonomic Organizational Questionnaire Survey (MOQS) is one of the most commonly used methods in ergonomics. It can be a useful tool in different steps of the industrial/organizational (I/O) evaluation process (9). The implementation of a macroergonomic survey using a questionnaire is applicable for data gathering regarding various aspects of work systems (10). Tools like the Job Diagnostic Survey (JDS) and Multimethod Job Design Questionnaire (MJDQ) have been developed in the past and have been used frequently (11, 12). The JDS focuses on limited motivational factors (13) but lacks attention to other job characteristics (14). Moreover, the MJDQ (15, 16) showed weaknesses in construct validity (12). Therefore, useful past tools do not have desirable efficiency in the present day. For example, the JDS does not include new organizational issues and challenges (17). In order to overcome these issues, we must use a more useful method. Morgeson and Humphrey presented a comprehensive questionnaire evaluating 21 work characteristics (18). This is known as the Work Design Questionnaire (WDQ). The WDQ has been translated into different languages such as German (19), Italian (20), and Spanish (17).

There are 16 million workers working in 2 million job units in Iran. Improvement of occupational health and safety requires an effective collaboration among all departments of any organization and industry as well as governmental agencies (21). According to information obtained, in Iran, no documents about assessment of work design effects in the field of occupational health, safety, and ergonomics (OHSE) have been published as yet. Thus, the present study was designed with the aim of investigating the validity and reliability of the WDQ as well as the relationship between work characteristics and work-related accidents. It is expected that the validated Persian Work Design Questionnaire (PWDQ) be used for comprehensive macroergonomic assessment of the input/output (I/O) in Persian-speaking countries in the future.

Materials and Methods

This descriptive research was carried out among 397 employees [5 times the number of the studied questionnaire questions (22)] working in a glass manufacturing company in Saveh, Iran, in 2016. Employees were selected randomly as well as for data gathering, self-report method was selected. It should be noted that the participation of individuals in the study was completely voluntary. The consent of subjects was obtained, the purpose of the study was described to all the participants, and they were assured that their personal information would remain confidential. Furthermore, 1-year job experience was considered as the inclusion criterion in this study.

The WDQ had 77 questions with the maximum and minimum total scores of 385 and 77 points, respectively, in terms of the four main factors of task characteristics (24 items; maximum score: 120 points and minimum score: 24 points), knowledge characteristics (20 items; maximum score: 100 points and minimum score: 20 points), social characteristics (19 items; maximum score: 95 points and minimum score: 19 points), and work context characteristics (14 items; maximum score: 70 points and minimum score: 14 points). These factors were divided into 21 sub-factors. The WDQ was scored based on a 5-point Likert scale [strongly agree (5), agree (4), neither agree/disagree (3), disagree (2), and strongly disagree (1)]. Out of these 77 questions, 5 questions were reverse scored (18). High scores (total and subgroups) based on workers' opinion indicated that we had good work design in our industry. However, low scores indicated that we need to redesign our organization in terms of the studied main factors.

As a forward translation, the original WDQ was translated into Persian by a qualified bilingual translator, who was a native speaker of Persian and fluent in English. After obtaining a confirmed version of the translated questionnaire, the questionnaire was translated back into English by a native translator. It should be noted that the English translator was blind to the original version of the questionnaire. Then, the original, translated, and translated-back versions of the WDQ were given to 5 Iranian health, safety, and environmental (HSE) specialists to evaluate face validity through comparison with the original version. For the primary measurement of the tool's reliability, and in order to check the fluency of the Persian questions and prevent misunderstanding of the questions, a pilot study was performed on 30 individuals. Based on the pilot study results, the final version of the PWDQ was prepared. In addition, a demographic questionnaire with items such as age, sex, job type, education, and work tenure was used.

The reliability of the PWDQ was assessed through internal consistency reliability using Cronbach's alpha test as well as construct/composite reliability (CR). Internal consistency (IC) reliability assesses the consistency of the results of a test, ensuring that the various items measuring the different constructs deliver consistent scores (23).

CR is a measure used to determine internal compliance of the observed variables. It means that the failure of the system depends on multiple reasons and the reliability calculated based on the consideration of those multiple failures is called

composite reliability. The calculation of this measure is very similar to Cronbach's alpha test. CR value should be larger than 0.7 to be able to express good IC (24).

For a test to be reliable, it also needs to be valid. Validity can be defined as the degree to which a test measures what it is supposed to measure (25). Convergent validity (CV) refers to the degree to which two measures of constructs that theoretically should be related are in fact related. CV, alongside discriminant validity (DV), is a subtype of construct validity (26). Two criteria were considered for CV evaluation. First, indicators loading for each of the latent variables must be greater than 0.5. Second, the average variance extracted (AVE) must be greater than 0.5. AVE is a statistic that determines how much variance is captured by the latent variable in a structural equation model which is shared among other variables. AVE for a latent variable is the sum of squares for the indicators loading on the latent variable divided by the number of the questions of the hidden variable (27).

A successful evaluation of DV shows that a test of a concept is not highly correlated with other tests designed to measure theoretically different concepts (27). Poor DV means that a question belongs to two structures. In other words, in this situation, the question is ambiguous. Although there is no standard value for DV, a result of less than 0.85 tells us that DV likely exists between the two scales. As an alternative, the comparison between AVE and maximum shared squared variance (MSV) of any latent variable is recommended. The MSV results need to be less than the AVE for the DV (28). Confirmatory factor analysis (CFA) was used to test whether measures of a construct were consistent with a researcher's understanding of the nature of that construct (or factor) (29).

Similar to Morgeson and Humphrey's study (18), the present study also offered various fitness parameters: χ^2/df ratio, comparative fit index (CFI), standardized root-mean-square residual (SRMR), root mean square error of approximation (RMSEA), goodness of fit index (GFI), and normed fit index (NFI). To review and approve the test structures like the original version and its Spanish version, CFA was performed in 5 models with 4, 18, 19, 20, and 21 factors.

Assessment of the PWDQ validity and reliability as well as the relationship between characteristics of works and occupational accidents was done as follows: data analysis was performed using independent t-test and Pearson's correlation test in SPSS software (version 20, IBM Corporation, Armonk, NY, USA), and LISREL (version 8.5). It should be noted that reliability is the degree to which an assessment tool produces stable and consistent results (30).

The independent t-test was applied to compare the situation of two categories, professional jobs with specialized education and high skills requirement (such as planning, quality control circle, project management, and non-professional jobs), and those jobs without specialized education and skill requirement (such as warehouse keeper, security guard officer, and packaging unit staff). In addition, Pearson's correlation test was conducted to examine the relationship between work design and its various factors and work-related accidents.

Results

A total of 397 valid questionnaires were used during the analysis. Among the subjects, 370 workers (93.2%) were men and the others (6.8%) were women. Moreover, 80.4% of respondents (319 responders) were married and the rest were single. In terms of education, the lowest percentage of workers had an associate's degree (7.8%) and the highest percentage had diploma (34.6%) or lower (45%). The mean age of the participants was 32.47 ± 6.62 years (ranging from 18 to 53 years). Furthermore, their mean work experience was 8.89 ± 6.52 years. Detailed descriptive information is provided in table 1. Based on the procedures and job classification in the studied company, job titles of the participants were divided into the occupational groups provided in table 2.

Table 1: Socio-demographic data related to workers in a glass manufacturing company in Saveh, Iran, in 2016 (n = 397)

Variable		Frequency (%)	
Education level (n = 387)	Up to diploma	134	34.6
	Diploma	174	45.0
	Associate's degree	30	7.8
	Bachelor's degree and higher	49	12.7
Shift work (n = 377)	Yes	283	74.9
	No	94	24.9
Accident (n = 357)	Yes	81	22.7
	No	276	77.3

Table 2: Job title of the workers in a glass manufacturing company in Saveh, Iran, in 2016 (n = 397)

Occupation category	n	Age (year)		Job tenure (year)		Sex [men (%)]
		mean	SD **	mean	SD	
Machine tools operator	45	31.4	6.6	9.4	6.4	100
Production technician	41	32.6	6.7	9.2	6.8	100
Polisher	7	32.1	4.6	7.1	4.5	71.4
Electronics workers	16	31	5.3	8.4	5.1	100
Supervisor	15	35.3	6.9	12.5	8.4	93.3
Designer	3	27	5.2	5	4.5	66.7
Compressor operator	2	35.5	6.3	7	2.8	100
Packaging operator	92	32.2	6.7	8.8	7.1	96.7
Quality control team	10	30.4	5.6	6.7	4.5	70
Warehouse keeper	3	30	6.08	6.3	7.5	100
Financial officer	2	31.5	6.3	7	7.07	50
Planning and project control circle	3	25	3	2.6	2.08	33.3
Protective service person	7	31	4.5	6.8	5.7	100
Welder	10	35.9	6.8	11.8	5.9	100
Furnace operator	12	39.2	7.5	12.1	6.6	100
Driver	2	27	4.2	5.5	3.5	100
Maintenance group	21	33.9	7.05	10.5	7.3	100
Batch plant operator	2	40	0	18.5	0.7	100
Central unit operator	2	35	9.8	4	1.4	50
Milling operator	7	33	5	10.1	4	100
Technical manger	2	33.5	6.3	8	4.2	100
HSE * specialist	3	31.6	7.2	5.1	5.9	66.7
No information	87	31.9	6.3	7.7	5.6	91.6

* HSE: Health, Safety and Environmental

** SD: Standard Deviation

Table 3: Means, standard deviations, and reliability and validity indices for the Persian Work Design Questionnaire related to the workers in a glass manufacturing company in Saveh, Iran, in 2016 (n = 397)

	Construct	Mean	SD *	IC **	CR ***	ICC#	AVE##	MSV###
	Task characteristics							
1	**Works scheduling autonomy**	3.39	0.49	0.78	0.79	0.37	0.56	0.61
2	**Decision-making autonomy**	3.23	1.18	0.52	0.65	0.52	0.42	0.68
3	**Work methods autonomy**	3.29	0.89	0.78	0.79	0.33	0.56	0.68
4	**Task variety**	3.87	0.81	0.84	0.86	0.58	0.60	0.37
5	**Task significance**	3.54	0.90	0.79	0.82	0.38	0.52	0.32
6	**Task identity**	3.47	0.89	0.83	0.84	0.59	0.57	0.4
7	**Feedback from job**	3.61	0.68	0.63	0.67	0.56	0.42	0.41
	Knowledge characteristics							
8	**Job complexity**	3.29	0.88	0.77	0.79	0.54	0.52	0.29
9	**Information processing**	3.80	0.76	0.75	0.57	0.55	0.51	0.64
10	**Problem solving**	3.70	0.76	0.73	0.74	0.67	0.48	0.78
11	**Skill variety**	3.82	0.87	0.87	0.88	0.72	0.68	0.72
12	**Specialization**	3.65	1.12	0.54	0.73	0.6	0.51	0.72
	Social characteristics							
13	**Social support**	3.35	0.73	0.75	0.76	0.2	0.40	0.38
14	**Initiated interdependence**	3.53	0.84	0.70	0.72	0.47	0.50	0.58
15	**Received interdependence**	3.50	0.83	0.73	0.75	0.3	0.5	0.25
16	**Interaction outside the organization**	2.86	0.93	0.84	0.85	0.43	0.6	0.47
17	**Feedback from others**	3.37	0.93	0.79	0.8	0.5	0.63	0.39
	Work context characteristics							
18	**Ergonomics**	2.74	0.79	0.45	0.48	0.67	0.30	0.49
19	**Physical demands**	3.84	0.89	0.86	0.87	0.23	0.73	0.18
20	**Work conditions**	2.49	1.10	0.82	0.83	0.6	0.52	0.27
21	**Equipment use**	3.47	0.93	0.80	0.8	0.7	0.60	0.42

* SD: Standard deviation   **# ICC:** Intra-class correlations
** IC: Internal consistency   **## AVE:** Average variance extracted
*** CR: Construct/composite reliability   **### MSV:** Maximum shared squared variance

A total number of 9 jobs were categorized in the professional groups and 13 jobs were categorized in the non-professional groups. The mean total PWDQ score was 253.44 ± 45.05, with 80 and 365 points as minimum and maximum values, respectively. The first column of the mean and standard deviation of each of the PWDQ factors is indicated in table 3. In addition, reliability and validity test results are shown in table 3. Total internal consistency reliability for the PWDQ using Cronbach's alpha test was obtained to be equal to 0.94. Based on the main factors and items, reliability (Cronbach's alpha) for decision-making autonomy, feedback from job, specialization, and ergonomics

A χ^2 / df ratio equal to 2.0 would be desirable. In addition, CFI of higher than 0.9 indicates a good fit. SRMR was less than 0.08 and RMSEA was 0.05

was reported as less than 0.7. For factors such as decision-making autonomy, feedback from job, information processing, and ergonomics, CR was less than the desirable level. Intra-class correlations (ICC) as estimates of inter-rater reliability (IRR) can be seen in table 3. Moreover, ICC value for 13 factors was reported between 0.5 and 0.88.

CV was less than 0.5 for factors such as decision-making autonomy, feedback from job, problem-solving, social support, and ergonomics. Furthermore, information on DV test is shown in the last column of table 3. Regarding the comparison between AVE and MSV, 8 latent variables did not have a good DV.

that are acceptable (31). NFI defines zero models as model in which all correlations equal zero (32), and it is acceptable at a value of more than 0.9 (31). Results of the five models are listed in table 4.

Table 4: Goodness of fit indices based on the confirmatory factor analysis for the Persian Work Design Questionnaire related to the workers in a glass manufacturing company in Saveh, Iran, in 2016 (n = 397)

Model	NFI *	GFI **	CFI ***	SRMR #	RMSEA ##	χ^2 / df	Df ###	χ^2
4-factor	0.85	0.55	0.89	0.12	0.09	3.45	2843	9833.1
18-factor	0.92	0.74	0.95	0.064	0.051	2.04	2696	5499.5
19-factor (split interdependence)	0.92	0.74	0.96	0.062	0.049	2.01	2678	5399.9
20-factor (split autonomy)	0.92	0.74	0.96	0.063	0.050	2.01	2659	5345.0
21-factor	0.92	0.75	0.96	0.06	0.04	1.96	2639	5191.6

* NFI: Normed fit index   **# SRMR:** Standardized root-mean-square residual
** GFI: Goodness of fit index   **## RMSEA:** Root mean square error of approximation
*** CFI: Comparative fit index   **### Df:** Degree of freedom

In general, 4 factors were modeled with the 4 main factors in the questionnaire, as compared to other studied models which were at the lowest level of desirability. Moreover, in accordance with the original WDQ, the difference of the 10 factors between professional and non-professional groups was assessed (Table 5). The assumption was that professional jobs, in terms of knowledge and autonomy, are at higher levels than non-professional jobs. On the other hand, physical

demands as well as positive working conditions for non-professional jobs are in the lower level compared to professional jobs. In addition, differences between the other 11 factors were also examined in this study. It was revealed that the two groups differed in terms of the two factors of task variety (P = 0.023, mean of professional = 3.99, mean of non-professional = 3.87) and equipment use (P < 0.001, mean of professional = 3.79, mean of non-professional = 3.32).

Table 5: Means ± standard deviation of the selected job characteristics across the occupational categories related to the workers in a glass manufacturing company in Saveh, Iran, in 2016 (n = 397)

Work characteristic	Occupational category		P
	Professional	Non-professional	
Skill variety	4.06 ± 0.34	3.64 ± 0.45	< 0.001
Specialization	4.06 ± 0.36	3.40 ± 0.38	< 0.001
Work conditions	2.26 ± 0.09	2.75 ± 0.11	< 0.001
Problem solving	3.80 ± 0.23	3.58 ± 0.32	0.010
Information processing	3.93 ± 0.78	3.73 ± 0.74	0.021
Work methods autonomy	3.43 ± 0.67	3.25 ± 0.53	0.091
Decision-making autonomy	3.43 ± 0.39	3.19 ± 0.88	0.093
Job complexity	3.28 ± 0.82	3.15 ± 0.14	0.104
Work scheduling autonomy	3.52 ± 0.51	3.39 ± 0.47	0.205
Physical demands	3.89 ± 0.33	3.87 ± 0.64	0.811

The Pearson correlation coefficients regarding the relationship between factors and the number of occupational accidents are presented in table 6. It should be noted that all factors related to social characteristics were correlated with work-related accidents and, with increase in scores, occurrence of accidents was reduced by a coefficient of 0.11-0.15 (P < 0.05). Moreover, feedback from job was negatively associated with occupational accidents (P < 0.001, ρ = -0.11).

Discussion

The aim of this study was to evaluate the reliability and validity of the Persian version of the WDQ provided by Morgeson and Humphrey (18). The study was conducted among workers who were active in 22 occupational groups. Total internal consistency reliability for the PWDQ using Cronbach's alpha test was obtained to be equal to 0.94 that, compared to the reference value (0.7), was considered appropriate. In general, the PWDQ was proven to be reliable which was in line with previous researches (17, 18).

Among the 21 studied factors, the ergonomics factor (a factor that belongs to work context characteristics) with a Cronbach's alpha of 0.45 was similar to the original and Spanish versions (17, 18). It seems that reverse scoring can be a reason for this situation (33). In the PWDQ, this (α < 0.7) was also observed in the factors of decision-making autonomy (α = 0.52) and feedback from job (α = 0.63) belonging to the task characteristics, and specialization (α = 0.54) from the knowledge characteristics. The results obtained from CFA revealed that the 21-factor model was supported and was similar to the US original (18), Spanish (17), Italian (20), and German (19) versions. In addition, according to previous studies, among other studied models, the 18-factor model (autonomy and interdependence was not divided in its sub-factors), 19-factor model (interdependence was replaced with its two sub-factors), and 20-factor model (autonomy was replaced with its three sub-factors) were acceptable.

Similar to the original version, 10 factors were assessed between professional and non-professional occupational groups. The results showed that differences in autonomy (3 factors) were not significant (P > 0.05). Although the people in professional jobs had higher scores quantitatively, differences in autonomy between professional and non-professional groups in the original questionnaire (18) as well as the Spanish version (17) were significant (P < 0.05). According to the results of the present study, differences in knowledge characteristics (P < 0.05), except for job

complexity (P > 0.05), were significant and scores were higher in all the professional jobs. In the original and Spanish versions, all related factors were meaningful and professional jobs had higher scores. In the context of work characteristics, individuals in professional jobs had lower points than those in non-professional jobs (P < 0.001). It seems high expectations of individuals in professional jobs towards working conditions can be stated as a reason for this result. Unlike the other two studies in this regard (17, 18), physical demand (as a work characteristic), was not significant between the two groups in the present study (P > 0.05). Not taking full advantage of the equipment, devices, software, and up-to-date workflow processes can be considered as the cause of these differences.

It should be noted that from the perspective of psychometrics, the CV for decision-making autonomy, feedback from job, problem-solving, social support, and ergonomics was not favorable. The Spanish version (17) also showed that these 5 factors had problems; in addition, decision-making autonomy was a common factor in both studies. Factors such as work-scheduling autonomy, decision-making autonomy, work methods autonomy (autonomy), information processing, problem-solving and skill variety (knowledge characteristics), initiated interdependence (interdependence), and ergonomics (work context characteristics) did not have acceptable DV. In other words, they were ambiguous factors. Perhaps because of this status, these factors were sub-factors of the larger factors. In fact, each of these factors, coupled with other factors, made up a larger part.

Another part of the present study was devoted to investigations concerning the relationship between job characteristics and work-related accidents. The analysis conducted in this study showed that all factors of social characteristics were significantly associated with occupational accidents (P < 0.05). Based on this relationship, with increase in the scores of the job characteristics, the rate of accidents was reduced. In previous studies (17, 18), the relationship of job satisfaction and performance with task characteristics was assessed and they were associated with the majority of factors. In this study, through a macroergonomic approach and questionnaire application in order to promote safety, the relationship between working conditions and occupational accidents was investigated. The related results showed that two groups of factors, namely, social and task characteristics, as one of the technical systems in macroergonomics evaluation (8), were correlated with the accidents in the studied workplace. This result is in line with the

principles of macroergonomics because the socio-technical systems theory concept is considered as a philosophy for macroergonomic and safety (34-37).

This study had some limitations. First, it was performed in a manufacturing company. Future studies can test the questionnaire in other organizations. Secondly, since the main objective was to investigate the validity and reliability of the questionnaire, during the assessment of the relationship involving the studied factors and work-related accidents, moderator factors such as individual characteristics were not analyzed. However, for a better understanding of this field more researches are recommended in other industries and organizations.

Conclusion

Our data revealed that these initial results support the reliability and validity of the PWDQ. Thus, it can be applied as a fit tool to evaluate the characteristics of organizations. However, when using the PWDQ, attention should be paid to the two factors of decision-making autonomy and ergonomics due to poor reliability and validity. It seems that the outputs of the present study demonstrated that the PWDQ is a useful tool for accident management as well as enhancement of personal and I/O safety, organizational cost management, and productivity of Persian-language industries and organizations.

Acknowledgement

Conflict of interest: None declared.

References

1. Drown DT. Work design characteristics as moderators of the relationship between proactive personality and engagement [PhD thesis]. Portland, Oregon, United States: Portland State University; 2013. P. 15-25.

2. Habibi E, Poorabdian S, Shakerian M. Job strain (demands and control model) as a predictor of cardiovascular risk factors among petrochemical personnel. J Educ Health Promot 2015; 4:16.

3. Tang K. A reciprocal interplay between psychosocial job stressors and worker well-being? A systematic review of the "reversed" effect. Scand J Work Environ Health 2014; 40(5):441-56.

4. Butterworth P, Leach LS, Kiely KM. The relationship between work characteristics, wellbeing, depression and workplace bullying: technical findings from a survey of 32-36 year old workers in Canberra and Queanbeyan. Canberra: Safe Work Australia. 2013 June. 69 p.

5. Notelaers G, Witte HD, Einarsen S. A job characteristics approach to explain workplace bullying. European Journal of Work and Organizational Psychology 2010; 19(4):487-504.

6. Grant AM, Parker SK. 7 Redesigning work design theories: The rise of relational and proactive perspectives. Academy of Management Annals 2009; 3(1):317-75.

7. Hendrick HW. Kleiner B. Macroergonomics: theory, methods, and applications. 1st ed. Florida, United States: CRC Press; 2002.

8. Kleiner BM. Macroergonomics: analysis and design of work systems. Appl Ergon 2006; 37(1):81-9.

9. Carayon P, Hoonakker P. Macroergonomic Organizational Questionnaire Survey (MOQS). In: Stanton NA, Hedge A, Brookhuis K, Salas E, Hendrik HW, editors. Handbook of human factors and ergonomics methods. 1st ed. California, United States: CRC Press; 2004. Chapter 76.

10. Carayon P, Smith MJ. Work organization and ergonomics. Appl Ergon 2000; 31(6):649-62.

11. Taber TD, Taylor E. A review and evaluation of the psychometric properties of the job diagnostic survey. Pers Psychol 1990; 43(3):467-500.

12. Edwards JR, Scully JA, Brtek MD. The measurement of work: hierachical representation of the multimethod job design questionnaire. Pers Psychol 1999; 52(2):305-34.

13. Hackman JR, Oldham GR. Work redesign (Prentice hall organizational development series). 1st ed. New Jersey, United States: FT Press; 1980.

14. Parker SK, Wall TD, Cordery JL. Future work design research and practice: Towards an elaborated model of work design. J Occup Organ Psychol 2001; 74(4):413-40.

15. Campion MA. Interdisciplinary approaches to job design: A constructive replication with extensions. J Appl Psychol 1988; 73(3):467-81.

16. Campion MA, Thayer PW. Development and field evaluation of an interdisciplinary measure of job design. J Appl Psychol 1985; 70(1):29-43.

17. Bayona JA, Caballer A, Peiró JM. The work design questionnaire: Spanish version and validation. Journal of Work and Organizational Psychology 2015; 31(3):187-200.

18. Morgeson FP, Humphrey SE. The work design questionnaire (WDQ): developing and validating a comprehensive measure for assessing job design and the nature of work. J Appl Psychol 2006; 91(6):1321-39.

19. Stegmann S, Dick RV, Ullrich J, Charalambous J, Menzel B, Egold N, et al. The work design questionnaire - Introduction and validation of a German version. Journal of Work & Organizational Psychology 2010; 54:1-28.

20. Zaniboni S, Truxillo DM, Fraccaroli F. Validation of the Italian version of the Work Design Questionnaire (WDQ). In Hertel G, Binnewies C, Krumm S, Holling H, Kleinmann M, editors. Imagine the future world: How do we want to work tomorrow? Proceeding of the 16th EAWOP Congress; 2013 May 22-25; Munster, Germany. Miami: Münstersche Informations- und Archivsystem multim edialer Inhalte; 2013. P. 621.

21. Vigeh M, Mazaheri M, Seyedaghamiri Z. Status of occupational health and safety in Iran. JUOEH 2011; 33(4):283-91.

22. Walker JT, Maddan S. Statistics in criminology and criminal justice: Analysis and interpretation. 4th ed.

Burlington, United States: Jones & Bartlett Learning; 2012.

23. Putka DJ, Sackett PR. Reliability and validity. 1st ed. In: Farr JL, Tippins NT, editors. Handbook of employee selection. New York, United States: Routledge / Taylor & Francis Group; 2010. Chapter 2. P. 9-49.

24. Streiner DL. Starting at the beginning: an introduction to coefficient alpha and internal consistency. J Pers Assess 2003; 80(1):99-103.

25. Brians CL. Empirical political analysis. 8th ed. Abingdon-on-Thames, United Kingdom: Routledge, Taylor & Francis Group; 2010.

26. Guo B, Aveyard P, Fielding A, Sutton S. Testing the convergent and discriminant validity of the decisional balance scale of the transtheoretical model using the multi-trait multi-method approach. Psychol Addict Behav 2008; 22(2):288-94.

27. Henseler J, Ringle CM, Sarstedt M. A new criterion for assessing discriminant validity in variance-based structural equation modeling. J Acad Mark Sci 2015; 43(1):115-35.

28. Hair Jr JF, Black WC, Babin BJ, Anderson RE. Multivariate data analysis. 7th ed. Pearson Education: London, England; 2010.

29. Babyak MA, Green SB. Confirmatory factor analysis: an introduction for psychosomatic medicine researchers. Psychosom Med 2010; 72(6):587-97.

30. Eisinga R, Grotenhuis Mt, Pelzer B. The reliability of a two-item scale: Pearson, Cronbach or Spearman-Brown? Int J Public Health 2013; 58(4):637-42.

31. Awang Z. A handbook on Structural equation modeling using AMOS. 2nd ed. Selangor Darul Ehsan, Malaysia: Universiti Teknologi MARA's (UiTM); 2012.

32. Hooman HA. Structural equation modeling with LISREL application. 1st Ed. Tehran: Samt. 2006.

33. Podsakoff PM, MacKenzie SB, Lee JY, Podsakoff NP. Common method biases in behavioral research: a critical review of the literature and recommended remedies. J Appl Psychol 2003; 88(5):879-903.

34. Kleiner BM, Hettinger LJ, DeJoy DM, Huang YH, Love PE. Sociotechnical attributes of safe and unsafe work systems. Ergonomics 2015; 58(4):635-49.

35. Carayon P, Hancock P, Leveson N, Noy I, Sznelwar L, van Hootegem G. Advancing a sociotechnical systems approach to workplace safety--developing the conceptual framework. Ergonomics 2015; 58(4):548-64.

36. Robertson MM, Hettinger LJ, Waterson PE, Noy YI, Dainoff MJ, Leveson NG, et al. Sociotechnical approaches to workplace safety: Research needs and opportunities. Ergonomics 2015; 58(4):650-58.

37. Waterson P, Robertson MM, Cooke NJ, Militello L, Roth E, Stanton NA. Defining the methodological challenges and opportunities for an effective science of sociotechnical systems and safety. Ergonomics 2015; 58(4):565-99.