Original Article

The Factorial Structure and Psychometric Properties of the Persian Effort-Reward Imbalance Questionnaire

CrossMark

Mohammad Babamiri [1,*], Johannes Siegrist [2], Mehdi Zemestani [3]

[1] Research Center for Health Sciences, Department of Ergonomics, School of Public Health, Hamadan University of Medical Sciences, Hamadan, Iran
[2] Life-Science Centre, University of Düsseldorf, Düsseldorf, Germany
[3] Department of Clinical Psychology, University of Kurdistan, Sanandaj, Iran

A B S T R A C T

Background: With global changes in the current state of work and employment, the role of health-adverse psychosocial work environments has received increasing attention in developed as well as in rapidly developing countries. Thus, there is a need to apply valid measurement tools for monitoring and preventive purposes. This study aims to examine the factorial structure and psychometric properties of the Persian version of the effort-reward imbalance (ERI) questionnaire, assessing one of the internationally leading concepts of stressful work.
Methods: This descriptive cross-sectional study of a random sample of 202 white collar employees in an industrial company in Iran analyzes the ERI scales by exploratory and confirmatory factor analysis. Moreover, aspects of construct and criterion validity are tested. To this end, correlations of ERI scales with subscales of organizational injustice, a complementary work stress model, and also the correlations of ERI scales with a questionnaire assessing psychosomatic symptoms are performed.
Results: Internal consistency of the three ERI scales was satisfactory (Cronbach α effort: 0.76, reward: 0.79, overcommitment: 0.75). Fit indices of confirmatory factor analysis pointed to an adequate representation of the theoretical construct (e.g., adjusted goodness of fit index (AGFI): 0.73, goodness of fit index (GFI): 0.78). Negative correlations with subscales of organizational injustice supported the notion of construct validity of the ERI scales, and positive correlations of ERI scales with psychosomatic symptoms indicated preliminary criterion validity.
Conclusion: The Persian version of the ERI questionnaire has acceptable psychometric properties and can be used as a valid instrument in research on this topic.

1. Introduction

In recent decades, the nature of work and employment has undergone significant changes in economically advanced societies. With the advent of new technologies and new social demands, employment sectors shifted from industrial mass and lean production towards service delivery and information/communication technology-driven jobs. While on the one hand, there is a significant decline in physically hazardous work, on the other hand, there is a growth of stressful psychosocial working conditions that can threaten the health of employed people, not least in the context of aggravated economic competition, work intensification, and growing job insecurity [1]. Alongside these developments, the composition of the workforce has also been changing, marked by an increase in the number of older workers, a rise in women's participation in the labor market, and also the growth of migration. In the context of economic globalization, nowadays, these trends are also increasingly affecting working people in rapidly developing countries [2]. It is therefore important to monitor potential health-adverse working conditions in these countries, and to provide respective information to stakeholders responsible for occupational health. To this end, psychometrically validated scales measuring theoretical models of stressful work have been developed, specifically scales assessing three internationally well-established models: demand-control [3,4], effort-reward imbalance (ERI) [5,6], and organizational injustice [7].

As Iran is considered to be a rapidly developing country, the assessment of health-adverse psychosocial working conditions can

* Corresponding author. Department of Ergonomics, School of Public Health, Hamadan University of Medical Science, Hamadan, 6517838736, Iran.
  E-mail address: mohammad.babamiri@yahoo.com (M. Babamiri).

be a relevant task. This contribution sets out to test the psycho-metric properties of the Iranian version of the measurement of one of the three models mentioned, the original ERI questionnaire. To this end, the data was collected from a cross-sectional study of employees of an industrial company and then analyzed comparing the ERI scales with data on organizational injustice, a complementary model of stressful work, as well as with data on psychosomatic complaints. The first comparison was conducted in order to analyze construct validity, whereas the second one was performed to assess criterion validity within the constraints of a cross-sectional study design.

It is important to mention that the ERI model was selected due to its emphasis on the employment contract, the changes of which are at the core of current economic developments. More specifically, this model posits that employment arrangements defined by an imbalance between high efforts spent and low rewards received in turn are likely to elicit negative emotions and associated physiological stress reactions in working people, with adverse long-term effects on mental and physical health [5]. The powerful effects of this imbalance are due to the fact that it hurts evolutionary old feelings of reciprocity and justice of exchange. It is important to note that three reward dimensions are distinguished: salary or wage, promotion prospects including job security, and esteem or appreciation of accomplishments by significant others. Concerning effort, the model distinguished between its extrinsic aspects, the demands at work, and the working people's motivation to achieve. Concerning the latter, a personal pattern of coping with demands has been identified, termed overcommitment, which reflects a critical condition of recurrent excessive striving at work. In summary, three scales are defined to measure the ERI model: "effort", "reward", and "overcommitment". There is now a large empirical evidence base available that demonstrates increased relative risks of stress-related disorders among working people who score high on these scales [2].

2. Materials and methods

As mentioned, this contribution is a descriptive study testing psychometric properties of the ERI questionnaire. Ethical committee permission was received and all participants gave written informed consent. The study population consisted of all of the white collar employees in the Bidboland Gas Refinery in Behbahan, Iran who had at least 2 years of work experience in the refinery. Among the employees, 220 people were selected as the study sample, applying a simple random sampling method and using the Morgan and Kerjesy Table. Finally, 202 questionnaires were collected, with 186 male and 16 female participants. The mean age of the participants was 40.67 years (standard deviation: 9.44 years). The mean number of years of work experience of participants was 16.20 (standard deviation 9.54).

To carry out the current research, the questionnaire was first translated from English into Persian, and then it was back-translated from Persian into English, and the problems related to the translation of the items were reviewed and resolved. In a pilot study, the translated questionnaire was presented to a sample of 30 employees, and queries of inaccurate understanding were resolved by an improved language version.

The original ERI questionnaire consists of 23 Likert-scaled items, but since the existence of only one item on physical effort is not suitable for white collar employees, it was removed from the questionnaire, as recommended by the authors [6]. The first five items of the questionnaire define a scale measuring extrinsic effort to perform duties. Eleven items define the scale measuring rewards at work, and this scale is composed by the three subscales mentioned, as confirmed in several second-order factor analyses.

The remaining six items measure the intrinsic component of overcommitment by the employees. Based on the first two scales, the construction of a ratio of effort and reward has been proposed by the authors to give an approximate quantitative estimate of the respective imbalance at individual level (for details see [6]).

To analyze one aspect of construct validity, a measure of organizational injustice [8], that has good psychometric properties in the Iranian sample, was additionally applied [9,10]. Furthermore, in order to assess criterion validity, a scale measuring psychosomatic symptoms that has good psychometric properties in the Iranian sample [11] was also added. Participants were asked to answer these scales in a standardized situation of data collection. The study was approved by the university's ethic committee. All statistical analyses were performed using software SPSS-22 and AMOS-21 (IBM, United States).

3. Results

Before the analyses were carried out, univariate and multivariate outliers were examined using Box Plot and Mahalanobis statistics and the results indicated that there was no outlier within this data set. The kurtosis and skewness of the data was calculated using SPSS software, and the results indicated that the kurtosis and skewness of none of the values were more than ± 1. The assumption of the normality of data distribution was evaluated using the Kolmogorov-Smirnov test, and the results showed that this assumption was met by the data. In addition, data independence was checked and confirmed using the Durbin Watson approach. Furthermore, multicollinearity was examined using tolerance and inflation variance statistics, and the results showed that none of the tolerance values were below the limit of 0.1. Therefore, based on two proposed indicators, colinearity was not observed in the data. Given these results of testing the underlying assumptions for statistical analysis, in the next step we performed exploratory factor analysis.

3.1. Exploratory factor analysis

To extract factors from our data set, principal component analysis was used. In this analysis, the Kaiser-Meyer-Olkin (KMO) value was equal to 0.78, and the Chi-square index of Bartlett test indicated a significant effect (1388.91, with df = 231; $p \leq 0.0001$). Thus, in addition to the adequacy of sampling, the implementation of a matrix-based factor analysis was justified. To determine the number of saturated factors of the ERI questionnaire, eigenvalues indices, the proportion of variance explained by each factor, and also Scree plot were taken into account. Accordingly, three factors with eigenvalues beyond 1.0 were extracted, and these factors explained 43.68% of the variance. Table 1 reports the factorial loadings of the items relevant to the questionnaire, the alpha coefficients after item removal, and the correlations with the total score.

As can be seen, the results of this exploratory factor analysis are in line with our assumptions. None of the items needed to be removed, factor loadings were beyond 0.50, all item-total correlations were satisfactory, and the three factors displayed Cronbach α values of 0.76, 0.79, and 0.75, respectively.

3.2. Confirmatory factor analysis

To test the fit between the data of the questionnaire and the underlying theoretical construct, a confirmatory factor analysis was performed with the three main factors, effort, reward, and over-commitment (see Fig. 1). Several fit indices were calculated, based on recommendations [12,13]. These indices are displayed in Table 2. As can be seen, some of these indices met the criteria for goodness of fit, such that an overall satisfactory model fit was achieved.

Table 1
Factorial loads, correlation with total score, and alpha if item deleted

Factors	Effort			Reward			Overcommitment		
Items	Factorial loads	Correlation with total score	Alpha if item deleted	Factorial loads	Correlation with total score	Alpha if item deleted	Factorial loads	Correlation with total score	Alpha if item deleted
1	0.64	0.50	0.79						
2	0.61	0.60	0.79						
3	0.57	0.62	0.76						
4	0.71	0.60	0.77						
5	0.65	0.61	0.77						
6				0.51	0.45	0.80			
7				0.57	0.61	0.67			
8				0.71	0.48	0.71			
9				0.61	0.55	0.71			
10				0.60	0.55	0.75			
11				0.60	0.57	0.68			
12				0.57	0.52	0.58			
13				0.65	0.60	0.64			
14				0.67	0.65	0.64			
15				0.69	0.65	0.67			
16				0.73	0.64	0.67			
17							0.52	0.55	0.68
18							0.55	0.56	0.58
19							0.65	0.58	0.64
20							0.71	0.60	0.64
21							0.65	0.64	0.67
22							0.68	0.69	0.67
Alpha	0.76			0.79			0.75		
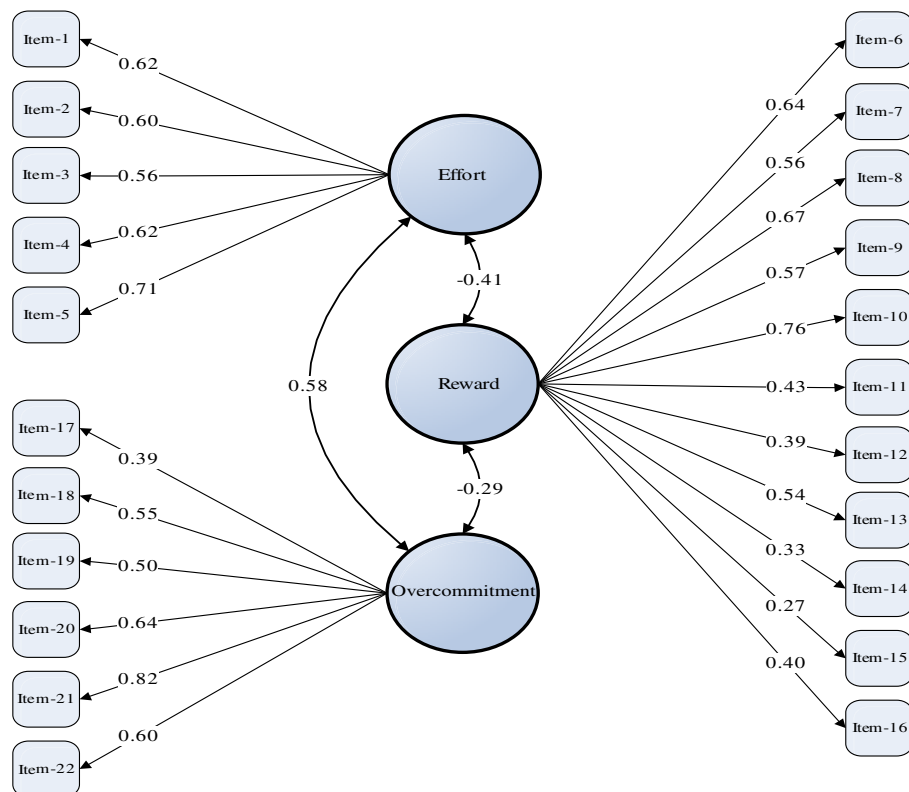
Fig. 1. Factorial structure.

Table 2
Model fit summary

RMSEA	TLI	IFI	CFI	NFI	AGFI	GFI	X^2/df	df	sig	*X^2
0.09	0.68	0.72	0.72	0.62	0.73	0.78	2.76	206	0.01	414.48

AGFI, adjusted goodness of fit index; CFI, comparative fit index; df, degree of freedom; GFI, goodness of fit index; IFI, incremental fit index; NFI, normed fit index; RMSA, root mean square error of approximation; sig, significant; TLI, Tucker-Lewis index.

3.3. Correlations of ERI scales with measures of health and occupational stress

To explore aspects of criterion validity of the ERI questionnaire, correlations of a summary measure of the extrinsic components, the effort-reward ratio (ER ratio), and those of a summary score of the intrinsic component, overcommitment, with measures of psychosomatic symptoms in a nonclinical population were explored. Moreover, to test an aspect of construct validity, respective correlations were analyzed by the four subscales of organizational injustice, measuring distributive, procedural, informational, and interpersonal injustice, using Pearson correlation coefficients (see Table 3).

Two findings are particularly noticeable from this table. First, both model components, the ER ratio and overcommitment, are moderately, but significantly associated with elevated psychosomatic symptoms. Second, consistent negative correlation coefficients are observed between the ER ratio and the four components of organizational injustice. The latter fact points to some conceptual overlap between the ERI model and aspects of organizational injustice, but supports the construct validity of the former model, given the limited amount of variance explained by these subscales.

4. Discussion

The results of this study demonstrate that an internationally established measurement of stressful psychosocial work environments in terms of ERI can be applied to (used in) research related to occupational health in Iran. It is important to mention that all three scales of the model fulfill relevant psychometric properties, and that the theoretical construct is adequately represented by the factorial structure of the scales, as documented by confirmatory factor analysis. Moreover, preliminary findings indicate criterion and construct validity, given consistent positive correlations of the ER ratio and of overcommitment with psychosomatic symptoms, and negative correlations with the subscales of a complementary work stress model, i.e., organizational injustice.

The findings of this study are in line with previous analyses of psychometric properties of the ERI scales in non-European countries with their own languages, such as Japanese [14], Chinese [15],

South Korean [16], Arabian [17], or Thai language [18]. They also confirm previous results of a study conducted in Farsi language [19]. It is noteworthy to observe that reliability and validity of these scales are not substantially threatened by cultural variations of the core theoretical notions and values underlying the different language versions of the scales. Yet, additional explorations testing cross-cultural comparability more thoroughly, e.g., by applying differential item functioning analysis, may be needed to substantiate this observation [20].

Concerning the mean scores of the ERI scales in the sample, an unexpectedly high level of overcommitment, compared to other studies of white collar employees, was observed [6,17]. Overcommitment may represent a personal pattern of coping with demands rooted in individuals' primary socialization, but can also reflect pressures of a highly competitive work environment [5]. It is not known whether such a competitive work environment was present in the gas refinery from which the study sample was recruited.

The present study suffers from several limitations. First, the cross-sectional design precludes any interpretation of the direction of effects reflected by the correlation coefficients. Second, the relatively small sample size and the small number of women included are equally critical. Conducting this type of research in the current socioeconomic situation in Iran still represents a challenge. Third, although the statistical analyses conducted are in line with current scientific standards, specifically those addressing the psychometric properties of scales, a more in-depth inquiry is desirable. For instance, in our approach it was not possible to test the interaction of extrinsic and intrinsic model components in analyzing associations with psychosomatic symptoms. A recent review of respective research indicates that there is limited support in favor of this interaction hypothesis [21]. Fourth, we did not make use of all seven stages of a repeated forward-backward translation technique in translating the questionnaire from English to Farsi (e.g., [17]). Thus, in combination with qualitative exploration, there is room for further improvement of the current version of the questionnaire.

This contribution also possesses several strengths. This is one of the first studies applying an internationally established measurement of stressful psychosocial work environments to working people in Iran, a country undergoing significant economic change. Moreover, this is one of the few studies analyzing two complementary models of stressful work, ERI and organizational injustice, in the same data set. Results support the independent role of either model, as demonstrated in an earlier study [8].

In conclusion, based on the psychometric properties of the current analysis, the Persian version of the original ERI questionnaire can be recommended for use in scientific and practical contexts in Iran. Clearly, an extension of available evidence is needed, specifically in terms of larger samples and prospective study designs.

Table 3
Mean, standard deviation (SD) and correlation matrix

	Mean	SD	1	2	3	4	5	6	7	8
ER ratio	1.00	0.37	–							
Overcommitment	17.88	4.21	0.40†	–						
Psychosomatic symptoms	41.81	14.87	0.30†	0.34†	–					
Strain	1.66	0.21	0.18*	0.04	0.06	–				
Distributive justice	15.60	4.12	−0.54†	−0.25†	−0.32†	−0.27†	–			
Procedural justice	12	3.47	−0.37†	−0.11	−0.13	−0.34†	0.56†	–		
Informational justice	18.96	5.36	−0.45†	−0.25†	−0.12	−0.35†	0.51†	0.81†	–	
Interpersonal justice	18.33	4.07	−0.40†	−0.38†	−0.15*	−0.31†	0.35†	0.59†	0.67†	–

*$p < 0.05$; $^\dagger p < 0.01$.
ER, effort-reward.

Author's contribution

All authors made significant contributions to the study design and interpretation of the data. M. Babamiri and J. Siegrist drafted the manuscript. N. Arshadi and M. Zemestani perfomed the analysis and coordination. A. Neisi edited the manuscript.

Conflicts of interest

The authors declare no conflicts of interest.

Acknowledgments

References

[1] Schnall PL, Dobson M, Rosskam E, editors. Unhealthy work: causes, consequences, cures. Amityville (NY): Baywood; 2009.

[2] Siegrist J, Wahrendorf M, editors. Work stress and health in a globalized economy: the model of effort-reward imbalance. Cham, Switzerland: Springer; 2016.

[3] Karasek RA, Theorell T. Healthy work: stress, productivity, and the reconstruction of working life. New York: Basic Books; 1992.

[4] Karasek R, Brisson C, Kawakami N, Houtman I, Bongers P, Amick B. The Job Content Questionnaire (JCQ): an instrument for internationally comparative assessments of psychosocial job characteristics. J Occup Health Psychol 1998;3:322–55.

[5] Siegrist J. Adverse health effects of high effort-low reward conditions at work. J Occup Health Psychol 1996;1:27–43.

[6] Siegrist J, Starke D, Chandola T, Godin I, Marmot M, Niedhammer I, Peter R. The measurement of effort-reward imbalance at work: European comparisons. Soc Sci Med 2004;58:1483–99.

[7] Greenberg J. Organizational injustice as an occupational health risk. Acad Manag Ann 2010;4:205–43.

[8] Kivimäki M, Vahtera J, Elovainio M, Virtanen M, Siegrist J. Effort-reward imbalance, procedural injustice and relational injustice as psychosocial predictors of health: complementary or redundant models? Occup Environ Med 2007;64:659–65.

[9] Babamiri M, Zahiri A, Neisi A, Arshadi N, Shahroui SH. Job stressors as predictors of psychosomatic symptoms. SJIMU 2014;23:45–55.

[10] Babamiri M, Zahiri A, Arshadi N, Neisi A, Shahroui SH. Investigate effort-reward imbalance and demand-control-support model in accession of psychosomatic symptoms. Health Psychol 2014;3:55–78.

[11] Babamiri M, Neisi A, Arshadi N, Mehrabizade M, Beshlide Q. Job stressors and personality characteristics as predictors of psychosomatic symptoms at staff of a company in Ahwaz. J Psychol Achiev 2014;4:187–208.

[12] Joreskog K, Sorbom D. LISREL 8: user's reference guide. Chicago (IL): Scientific Software Inc; 2003.

[13] Berkler S. Applications of covariance structure modeling in psychology: cause for concern. Psychol Bull 1990;107:260–73.

[14] Tsutsumi A, Ishitake T, Peter R, Siegrist J, Matoba T. The Japanese version of the effort-reward imbalance questionnaire: a study in dental technicians. Work Stress 2001;15:86–96.

[15] Li J, Yang W, Cheng Y, Siegrist J, Cho SI. Effort-reward imbalance at work and job dissatisfaction in Chinese healthcare workers: a validation study. Int Arch Occup Environ Health 2005;78:198–204.

[16] Eum KD, Li J, Lee HE, Kim SS, Paek D, Siegrist J, Cho SI. Psychometric properties of the Korean version of the effort–reward imbalance questionnaire: a study in a petrochemical company. Int Arch Occup Environ Health 2008;80: 653–61.

[17] Almadi T, Cathers I, Chow CM. An Arabic version of the effort-reward imbalance questionnaire: translation and validation study. Psychol Rep 2013;113:275–90.

[18] Buapetch A, Lagampan S, Faucett J, Kalampakorn S. The Thai version of Effort-Reward Imbalance Questionnaire (Thai ERIQ): a study of psychometric properties in garment workers. J Occup Health 2008;50:480–91.

[19] Yadegarfar G, Alinia T, Hosseini R, Hassannejad R, Fayaz M, Sanati J, Sanati K, Harandi J, Hajnoorozali V, Baghi MR, Mirzavand E, Majeed A. Psychometric properties of the Farsi version of effort-reward imbalance questionnaire: a longitudinal study in employees of a synthetic fibre factory in Iran. Int Arch Occup Environ Health 2013;86:147–55.

[20] Tsutsumi A, Iwata N, Watanabe N, de Jonge J, Pikhart H, Fernandez-Lopez J, Xu L, Peter R, Knutsson A, Niedhammer I, Kawakami N, Siegrist J. Application of item response theory to achieve cross-cultural comparability of occupational stress measurement. Int J Methods Psychiatr Res 2009;18: 58–67.

[21] Siegrist J, Li J. Associations of extrinsic and intrinsic components of work stress with health: a systematic review of evidence on the effort-reward imbalance model. Int J Environ Res Public Health 2016;13:432.