

Development and validation of a nursing instrument for triage in occupational health services

Elaboración y validación de un instrumento de enfermería para triaje en servicios de salud ocupacional

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Abstract

This study aimed to develop and validate an instrument for nursing triage in occupational health services (ICEST). Exploratory factor-analysis techniques were used to remove redundant or non-endorsed items and identify the factor structure of the ICEST. Validation of the items, content, construct and reliability were also performed. The final ICEST consisted of 14 indicators and 71-graduated indexes. The ICEST showed to be reliable, consistent and satisfactory structure to be applied in occupational health services.

keywords: validation studies; occupational health; nursing

Resumen

Este estudio tiene como objetivo desarrollar y validar un instrumento para el triaje de enfermería en los servicios de salud ocupacional (ICEST). Se utilizaron técnicas de análisis de factores exploratorios para eliminar los elementos redundantes o no respaldados e identificar la estructura de factores del ICEST. También se realizó la validación de los elementos, el contenido, la construcción y la fiabilidad. El ICEST final consistió en 14 indicadores y 71 índices graduados. El ICEST demostró ser una estructura fiable, coherente y satisfactoria que se aplicará en los servicios de salud ocupacional.

Palabras clave: estudios de validación; salud ocupacional; enfermería

1. Introduction

Occupational health is a segment of public health that intends to ensure safety, wellbeing, and hygiene in the workplace, with special attention to workers (Portaria MS/GM n. 1823 de 23 de Agosto de 2012. Institutes the National Worker's and Worker's Health Policy, 2012). The workplace has to be seen as a potential setting to develop several health problems including orthopaedic and mental disorders (Nilsen & Bernhardsson, 2019). Occupational Health Services (OHS) handle professional potential risks, surveillance and health promotion to workers (Lacaz, 1997). In Brazil, numerous activities of OHS are supported by the Organic Law of Health number 8,080 from 19 September 1990 (Law No. 8,080 of 19 September 1990. Provides the Conditions for the Promotion,

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Protection and Recovery of Health, the Organization and Operation of the Corresponding Services and Provides Other Measures, 1990).

The Occupational Health Surveillance understands a continuous and systematic performance, over time, to detect, know, research and analyse the determinants and conditioning factors of health problems related to work processes and environments (Vianna et al., 2017). It is also seen as a capable intervention in the factors that determine the workers' health problems (Vasconcellos, 2018).

An interdisciplinary team including work Engineers, Security Technics, Physicians, Psychologists, Physiotherapists, Occupational Therapists, Physical Educators, and Nurses develop these activities (Ordem dos Enfermeiros, 2014). However, each professional has their own diagnostic (structural, ergonomics, clinical, functional, psychological), proper assessment instruments (validated questionnaires, scales and equipment), except nursing (Refers the Systematization of Nursing Care and the Implementation of the Nursing Process in Public or Private Environments, in Which Nursing Professional Care Occurs, and Provides Other Measures, 2009).

Nurse responsibility in the interdisciplinary health team in the occupational setting is to participate actively as an important member. Since nurses promote a point of view about the social determinants of health in their university formation (Ortega et al., 2015), is their obligation to contribute with their knowledge to the health team. At the workplace, physicians give a clinical diagnostic (Silva et al., 2010), physiotherapist (Spoto & Collins, 2008), occupational therapists (Rogers & Holm, 1991) and physical educators (Jiandani & Mhatre, 2018) use their specific functional diagnostic, engineers measure the risks (Antonio & Lacaz, 2007; Paiva et al., 2013), and psychologists give mental and behaviour disorders diagnostic (Johnstone, 2017). Nurses must use their proper knowledge to contribute to the interdisciplinary diagnostic on the integral health opinion.

Innovative practices in work nursing are necessary to improve fields of action and to overcoming simplistic and little reflective practices. The complex relationship between work and health is necessary to understand in a wider perspective (Alshehry et al., 2019; Viterbo, Silva, et al., 2019). Systematic records about social and other aspects made by nurses can be useful for more complete information that provides the basis for effective actions for the workers' promotion, prevention, assessment, treatment and rehabilitation (Law No. 8,080 of 19 September 1990. Provides the Conditions for the Promotion, Protection and Recovery of Health, the Organization and Operation of the Corresponding Services and Provides Other Measures, 1990). The good practice guidelines in health suggest clarifying hypotheses and questions. This means providing a picture, noticing what is missing, prioritizing issues, selecting and planning interventions, minimizing bias by choices and decisions explicit, framing interventions, predicting responses and thinking about lack of progress. This will help the service user to feel understood and contained, and strengthening the therapeutic alliance (Spoto & Collins, 2008). All of those actions require the nurses' attention to find what a proper lack to be completed by nurses. Some aspects about workers health as a lifestyle, social network, educational level, food habits, familial conditions, work factors, sanitary environment, habitation and others require a trained view (Paiva et al., 2013). Compromised with actions, equity, and evidence, nurses need to use tools and data to contribute to the workers' health.

In Brazil, work nurse is a regulated speciality in nursing by Federal Council of Nursing according to Resolution number 358/2009 (Refers the Systematization of Nursing Care and the Implementation of the Nursing Process in Public or Private Environments, in Which Nursing Professional Care Occurs, and Provides Other Measures, 2009), but this practice is not consolidated yet. Therefore, the nursing consultation needs to be done with a critical view and based on specific nursing tools and priority interventions. Nursing studs in its regular curriculum formation a proper diagnostic triage involving primary attention to health (Ortega et al., 2015), but fail to have a guiding tool for nursing actions. This study aimed to develop and validate an instrument for nursing triage in occupational health services.

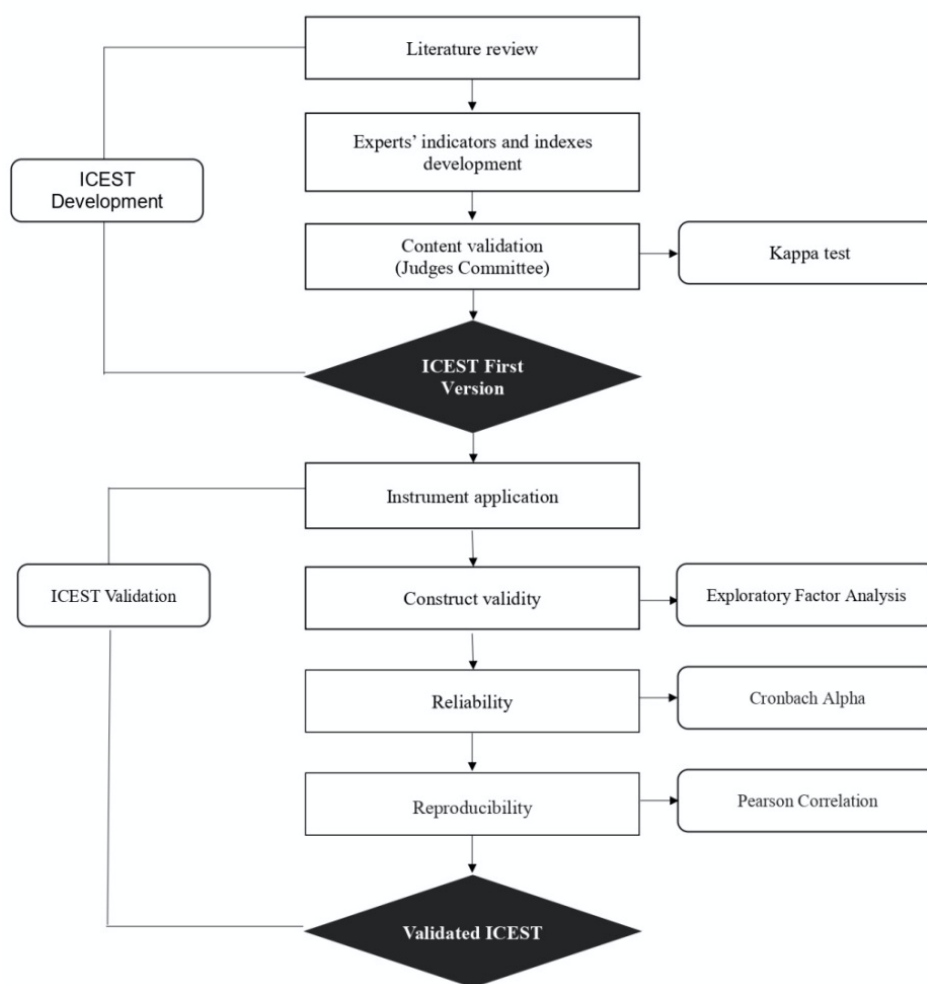
2. Methodology

2.1. Study design

Instrument development and validation study for nursing triage in occupational health services. The project was submitted and approved by the Ethical Committee of Bahiana School of Medicine and Public Health (CAAE 73271517.7.00005544). Study participants signed the informed consent form after knowing the risks and benefits. All research procedures are in accordance to 466/12 Resolution of National Brazilian Health Council and Helsinki declaration about ethics in research involving human participants (Approves Regulatory Norms of Research Involving Human Beings; National Health Council Resolution N° 466 of December 12, 2012, 2012).

The study was developed between March 2017 and October 2018, with the following stages: i) Analysis of the current Nursing Consultation structure and aspects of worker health addressed; ii) Instrument development by workers nurses; iii) *ICEST* validity assessment by the Judges Committee; iiiii) and item analysis, factor analysis, internal consistency and construct validity, applied in the worker's health service, Bahia, Brazil. Figure 1 presents the *ICEST* development and validation process.

Figure 1
Flow chart of elaboration and validation process of Instrumento de triagem para Consulta de Enfermagem em Saúde do Trabalhador - *ICEST*.



Source: Elaborated by the authors

A total of 718 medical records of Bahia oil industry workers were included. Prevailed male workers (91.2 %), with age range 50-59 years old (44.3 %). Remain workers age range is 30-39 year old (25.8 %) and bellows 29 years old (4.2 %). The majority are married (55.4 %) or single (37.2 %). Regarding education level, 64.5 % holds a complete middle school level and 20 % a university level.

2.2. Instrument development

Four occupational work nurses with an expert in occupational health services by a minimum of five years participate in this stage. A preliminary literature review about pre-existed instruments and methods was presented to the expert committee with the first version. The *ICEST* was elaborated with 10 indicators distributed in 3 dimensions with five options (0 to 4 points) in a scale: 0 – inexistent; 1 – bad; 2 – reasonable; 3 – good; and 4 – optimal.

From this first instrument version were created 15 indicators including 75-graduated indexes: (1) Work-Related Absenteeism; (2) Work Accident; (3) Social and Recreation Aspects; (4) Environmental Sanitary Conditions; (5) Noise Exposure; (6) Self-Care level; (7) Pests and Vectors; (8) Quality of Water Bottled; (9) Quality of Drinking Water; (10) Air quality; (11) Family Relationships; (12) Health Waste; (13) Chemical Waste; (14) Ergonomics Risk – Physical Aspects; (15) Ergonomics Risk – Organizational Aspects.

A judges committee composed by experts occupational nurses evaluated the first version named *Instrumento de triagem para Consulta de Enfermagem em Saúde do Trabalhador* [Nursing Instrument for Triage in Occupational Health Services] (*ICEST*). The *ICEST* was accompanied by an instruction manual with a questionnaire about relevance, pertinence and clear of items. The experts suggest improving the instrument for a second version.

2.3. Instrument validation

Item analysis was performed by the calculation of descriptive statistics and item-total and inter-item correlations (r , Pearson’s product-moment correlation) (Hair et al., 2014). Exploratory factor analysis was run to remove redundant or non-endorsed items and identify the factor structure of the instrument (Hair et al., 2014). The internal consistency reliability was assessed by the Cronbach’s coefficient alpha (α) and by the Pearson correlations among dimensions extracted by the factor analysis. These steps are described in the literature as the common use to validate instruments (Bonato et al., 2020; Nora et al., 2020; Oliveira et al., 2019; Viterbo, Dinis, Costa, et al., 2019; Viterbo et al., 2020). All statistical tests were performed by IBM® SPSS® Statistics vs.25.0 (IBM Corporation, 2018).

3. Results

The characteristics of workers are presented in Table 1.

Table 1
Descriptive statistics for respondents (n=718)

Variable	N	%
Sex		
Male	655	91.2
Female	63	8.8
Age		
>60	33	4.6
50-59	318	44.3
40-49	152	21.2
30-39	185	25.8
<29	30	4.2

Marital Status		
Divorced	30	4.2
Single	267	37.2
Stable union	21	2.9
Married	398	55.4
Other	2	0.3
Education Level		
Incomplete medium level	57	9.1
Complete medium level	403	64.5
Incomplete university level	2	0.3
Complete university level	125	20
University level with post-graduation	38	6.1
Total	718	100

Source: Authors elaboration

The first version of the *ICEST* chose by expert nurses included social determinants of health according to World Health Organization guidelines as presented in Table 2.

Table 2
Percentage of interobserver agreement
by indicators - Judges Committee

	Relevance level	Relevance of the description of each index	Statement coherence	Indicator Clarity
Indicator	(%)	(%)	(%)	(%)
1 Personal Factors	100	50	100	75
2 Environmental Components	100	75	100	75
3 Exposure to risk agents	100	50	50	50
4 Ergonomics - physical environment	100	75	100	75
5 Ergonomics - organizational aspects	100	50	75	50
6 Health Surveillance	100	75	75	75
7 Family relationships	100	100	100	100
8 Social Aspects	100	100	100	100
9 Immunization	100	100	100	100
10 Self-care level	100	100	100	100

Source: Authors elaboration.

Concordance between judges of pertinence was 100% to the four indicators (Family Relationships, Social Aspects, Immunization, and Self Care). Personal Factors and Exposition to Risk Agents, Ergonomic and Organizational Aspects have shown 50% of concordance. Ergonomic and Organizational Aspects and Surveillance presented 75% of concordance, and Risk Agents 50%. About clarity, Family Relationships, Social Aspects, Immunization and Self Care presented 100% of concordance, while Personal Factors, Environmental Components, Ergonomics Factors and Surveillance had 75%, and Risk Agents 50% of concordance. Items that presented concordance less than 75% were adjusted.

Table 3 presents the results of the Pearson correlations among items.

Table 3
Pearson correlations among items

Items	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.Noise exposure	1													
2.Ergonomic risks – physical aspects	0.060	1												
3.Ergonomic risks – organizational aspects	0.011	0.059	1											
4.Sanitary conditions of work environment	0.003	0.171**	0.109**	1										
5.Chemical waste	-0.059	-0.028	-0.012	0.023	1									
6. Pests and vectors	0.067	0.240**	-0.001	0.157**	-0.051	1								
7.Air quality	0.020	0.177**	0.062	0.106**	-0.038	0.691**	1							
8.Quality of bottled water	-0.022	-0.109**	0.004	-0.068	0.032	-0.508**	-0.629**	1						
9.Quality of drinking water	0.027	0.008	0.054	0.029	-0.051	0.245**	0.522**	-0.276**	1					
10.Work-relate absenteeism	-0.031	0.009	0.072	0.030	0.035	0.010	-0.037	0.017	-0.023	1				
11.Work accident	0.030	0.013	0.107**	0.016	-0.011	-0.032	0.021	-0.033	0.043	0.178**				
12.Family relationships	0.021	0.000	0.027	0.090*	-0.008	0.020	0.005	-0.070	-0.017	0.030	0.001	1		
13.Social aspects - leisure	0.029	-0.027	0.071	0.044	0.001	-0.079*	-0.054	0.043	-0.056	-0.017	0.080*	0.090*	1	
14.Self-care level	-0.046	-0.039	-0.032	-0.098**	-0.001	-0.007	0.001	0.002	0.011	-0.045	0.013	-0.006	0.038	1

Notes: *correlation significant at 0.05 level; **correlation significant at 0.01 level.

Source: Authors elaboration

It was noted moderated positive correlations between “Pests and Vectors” and “Quality of Air” ($r=0.691$; $p<0.01$); and “Quality of Drinking Water” and “Air quality” ($r=0.522$; $p<0.01$). An inverse correlation was observed between “Pests and Vectors” and “Quality of Bottled Water” ($r= -0.508$; $p<0.01$) and “Air quality” and “Quality of Bottled Water” ($r= -0.629$; $p<0.01$).

Exploratory factor analysis to identify the construct structure was performed considering the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO = 0.643) values as cut-point, as shown in Table 4.

Table 4
Factor loadings and internal consistency of the ICEST

Factors	ICEST Items	Factor loadings
Environmental Aspects $\alpha = 0.83$ 17.5 %	Pests and vectors	0.764
	Air quality	0.919
	Quality of bottled water	0.782
	Quality of drinking water	0.610
Occupational Risks $\alpha = 0.93$ 9.1 %	Ergonomic risks – Physical aspects	0.632
	Sanitary conditions of work environment	0.669
Organizational Risks $\alpha = 0.70$ 8.8 %	Ergonomic risks – Organizational aspects	0.558
	Work accident	0.727
	Work-related absenteeism	0.480
Social Aspects	Social aspects - leisure	0.683

$\alpha = 0.82$	Self-care level	0.498
8.2 %	Family relationships	0.546
Waste and Exposure	Chemical waste	0.650
$\alpha = 0.79$	Noise exposure	0.627
8.1 %		

Note: Extraction method - Principal components. Varimax rotation with Keiser normalization.
 Extraction criterion: Eigenvalues>1. Total variance explained by extracted components: 51.7 %; KMO=0.643;
 Bartlett's test: $\chi^2=7064.2, p<0.001$;C- Communalities; Global *ICEST* Cronbach's alpha: $\alpha=0.90$.
 Source: Authors elaboration.

Sampling Adequacy Measures considered values > 0.5. Because of this, the "Health Waste" was removed from the final model. Table 5 presents the results of the Pearson correlations among extracted factors and *ICEST*.

Table 5
 Pearson correlations among
 extracted factors and *ICEST*

Factors	<i>ICEST</i>	Environmental Aspects	Occupational Risks	Organizational Risks	Social Aspects	Waste and Exposure
<i>ICEST</i>	1					
Environmental Aspects	0.611**	1				
Occupational Risks	0.508**	0.111**	1			
Organizational Risks	0.410**	0.009	0.040	1		
Social Aspects	0.396**	0.082*	0.016	0.393**	1	
Waste and Exposure	0.353**	0.181**	0.005	0.210**	0.215**	1

Notes: *correlation significant at 0.05 level; **correlation significant at 0.01 level.
 Source: Authors elaboration.

All items are above 0.40. The final 5 dimensions, with a total of 14 items explained 51.7 % of the total variance. Factor 1 explains 17.5 % of the total variance and contains 4 items representing environmental aspects related to pests and vectors, air quality, quality of bottled water and drinking water. Factor 2 explains 9.1 % of the total variance and contains 2 items representing occupational risk related to physical ergonomic risks and sanitary conditions of the work environment. Factor 3 explains 8.8 % of the total variance and contains 3 items representing organizational risks related to organizational ergonomic risks, work accident and work-related absenteeism. Factor 4 explains 8.2 % of the total variance and contains 3 items representing social aspects related to leisure, self-care level and family relationships. Factor 5 explains 8.1 % of the total variance and contains 2 items representing waste and exposure related to chemical waste and noise exposure.

4. Discussion

In the present study, some factors of the analysed instrument – *ICEST* – were relevant in the opinion of judges: Family Relationships, Social Aspects, Immunization, Self-Care level, Ergonomic and Organizational Aspects, and Surveillance. Those factors are according to the social determinants of health (Carrapato et al., 2017; Commission on Social Determinants of Health, 2008; Graham & White, 2016; Kurbanova & Anashkina, 2007). However, with a lower agreement between judges, some biological aspects were incorporated into the second version. In practice, there is a need to look at the global instrument to assess workers health to avoid redundant questions used by other professionals of the interdisciplinary team.

Workers health is, by its nature, an interdisciplinary and multi-professional field (Antonio & Lacaz, 2007; Viterbo, Dinis, Vidal, et al., 2019). It was verified that environmental sanitary conditions presented a positive correlation with occupational risks and organizational aspects. This data confirmed the relevance of surveillance in the workplace (Oliveira et al., 2020; Ordem dos Enfermeiros, 2014). Surveillance is a quality proper of nurses

developed during their professional formation (Ortega et al., 2015), being the best skill in a health team to care about this topic. Besides that, nurses frequently suffer on their skin with incivility in the workplace, causing frustration, harming professional activities and impacting on the quality of life (Alshehry et al., 2019).

The correlation observed between items of the final version of *ICEST* aggregates dimensions frequently included in the nursing view. Workers health can be considered a valuable asset to society, individual, company and country (Carvalho et al., 2013). It guarantees the worker wellbeing, but also productivity and quality of a company.

A healthy workplace is a place where everyone works together to achieve an agreed vision for the health and wellbeing of workers and the surrounding community (World Health Organization, 2010). It provides all members of the workforce with physical, psychological, social and organizational conditions that protect and promote health and safety. It enables managers and workers to increase control over their health and to improve it, and to become more energetic, positive and contented (Burton, 2010).

One limitation of this study was a non-probabilistic sample, preventing generalization of the results. Due to this limitation, it is necessary to test this instrument in other occupational health services.

5. Conclusions

The *ICEST* is a valid and reliable instrument for nursing triage in occupational health services. As such, it can aid in the identification and quantification of health risk at the workplace. From the results obtained, the emphasis is necessary to the importance of developing a specific instrument to be used by nurses in the diagnosis of the health of workers according to their perspective. The instrument developed in the present study assesses items with accuracy and precision and may be applied in occupational health services.

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