Adaptation of the subjective mental workload scale in peruvian nurses

Adaptación de Escala Subjetiva de Carga Mental de trabajo en enfermeros asistenciales peruanos

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Abstract

Introduction: Mental workload is a set of actions that cause stress in human beings, this may be produced by the high demand in information processing to which nurses are subjected as they have multiple functions to perform during their workday and this can cause alteration in behavior that leads to deterioration in health and quality of life. Objective: To validate the hypothetical factorial structure of the Subjective Mental Workload Scale in nursing professionals who attend oncology patients. Materials and Methods: Cross-sectional study of instrument validation in which 140 nurses working in Lima hospitals participated. The confirmatory factor analysis technique was used using the principal components method and varimax rotation and Cronbach's alpha to determine reliability. Results: a version of the Subjective Mental Workload scale was obtained, with 20 items and 5 aspects (factors): cognitive demands and complexity of the task, Characteristics of the task, Temporal organization, Work rhythm, Consequences for health. The Conbrach alpha of the scale is 0.7. Likewise, the parallel components method and the Kaiser- Meyer- Olkin normalization (KMO), obtaining a value of 0.7128, with a pyloric correlation matrix constructed by 18 items and a Bartlett's test= 916.2, gl = 153, $p < 0.001$. Therefore, the instrument indicates good internal consistency. Conclusions: It is suggested that a 3-factor structure (Health Consequences, Cognitive Demands and Task Characteristics and Temporal Organization) be incorporated in the mental workload scale in order to achieve a comprehensive and accurate assessment of this problem.

Key words: Psychometric; Mental workload scale, nurses.

Resumen

Introducción: La carga mental es un conjunto de acciones que provocan tensión en los seres humanos, esta pueda estar producida por la alta demanda en el procesamiento de información a la cual está sometida enfermeros ya que tiene múltiples funciones a realizar durante su jornada laboral y esto puede provocar alteración en el comportamiento que conlleva al deterioro en la salud y la calidad de vida. **Objetivo:** Validar la estructura factorial hipotética de la escala Subjetiva de Carga Mental de trabajo en profesionales de enfermería que atiende a pacientes oncológicos. **Materiales y Métodos:** Estudio transversal de validación de instrumento en el que participaron 140 enfermeros que laboran en Hospitales de Lima, se utilizó la técnica de análisis factorial confirmatorio utilizando el método de componentes principales y rotación varimax y el alfa de Cronbach para determinar la confiabilidad. **Resultados:** se obtiene una versión de la escala Subjetiva de Carga Mental de trabajo, con 20 ítems y 5 aspectos (factores): demandas cognitivas y complejidad de la tarea, Características de la tarea, Organización temporal, Ritmo de trabajo, Consecuencias para la salud. El alfa de Conbrach de la escala es de 0.7. Asimismo, el método de componentes paralelos y la normalización de Kaiser- Meyer-Olkin (KMO), obteniendo un valor de 0.7128, con una matriz de correlaciones pilóricas construida por 18 ítems y una prueba de Bartlett= 916.2, gl = 153, $p < 0,001$. Por lo tanto, el instrumento indica una buena consistencia interna. **Conclusiones:** Se sugiere que en la escala de carga mental de trabajo se incorpore una estructura de 3 factores (Consecuencias para la salud, Demandas cognitivas y características de la tarea y organización temporal) con la finalidad de lograr evaluar en forma integral y exacta esta problemática.

Palabras claves: Psicométrica**;** Escala de carga mental, enfermeras.

Introduction

The World Health Organization (WHO) reports that there are 28 million nursing professionals in the world. However, there is still a deficit of human resources to perform nursing care activities (OMS, 2020). Likewise, the Pan American Health Organization (PAHO) indicates that nursing professionals represent 56% of these health professionals. However, there is a deficit of this human resource which is estimated to require 1.8 million by 2030 in the region of the Americas (OPS, 2022).

In view of the above, the COVID-19 health professionals have brought as a consequence fatigue due to the demands of long working hours, fear of catching the disease and infecting others. This situation has led to increased stress after this traumatic event. Health professionals have coped with this crisis with work overload, anxiety, fear, anguish and precarious safety conditions, most health personnel did not have a contingency plan for the health crisis. The pandemic not only brought pain, but also nursing professionals decided to isolate themselves and confine themselves to avoid the possibility of infecting their own families. This situation had a negative impact on the mental health of health professionals in the emotional area, in addition to the work overload, and the effects such as morbidity and mortality, which has been extremely high (Vieta et al., 2020).

The constant exposure to high mental demands that the tasks of a job require from an employee of an organization, together with the low attention paid to their mental health, can develop mental overload triggering mental problems in the short or long term, significantly affecting the exposed person (Bustamante et al., 2015). In this sense, mental workload has observed two lines that have been followed over time, the first, which depends on the requirements of the tasks to which the worker must submit and adapt, while the second refers to the relationship between the demands of the tasks and the type of resolution available to the person (Terán Villacís et al., 2021).

Thus, the mental workload is the level of tension produced by the demands of mental work (Ferreira & Ferreira, 2014), a) Quantitative, it is the amount of work that stimulates the nervous system, where the excess of work is called overload, where the demand exceeds the capacities of the people which would produce alterations in the health. While the underload produces repetitive activities (Bustamante et al., 2015) (Barrera et al., 2018), b) Quantitative, is the degree of difficulty presented by the work to be performed by the person, where knowledge, emotional and high brain activity interfere, generating variations in the state of health (Barrera et al., 2018).

The behavior of people with a mental workload affects their work performance, with mood swings, anxiety, and can increase blood pressure, heart rate during working hours (Lopez Lopez L, 2017), In the hospital area, the metal load is produced by the constant decision making that a health professional must have, since the response or recovery of another person who requires help depends on this, taking into account all the needs of these, since each human being is individual and has a different recovery from another. The type of information that is handled in the hospital area is from different sources and they handle different criteria, just as the workers also rotate according to their shifts and each professional makes decisions according to their duties and responsibilities (Villalba Crespo et al., 2019).

In this sense, nursing is characterized by providing care to people in need, being a very complex profession and one of the most demanding for the health team, it requires many skills to develop its activities (Bustamante et al., 2015), There are situations of uncertainty, when the information available is insufficient to make a decision. On the other hand, the existence of temporary pressures generates changes in the health of the patients that are so rapid that they require a prompt decision, which increases the mental burden on the professional (Terán Villacís et al., 2021).

In the work environment can affect directly or indirectly as environmental conditions that can interfere with the quality of information such as light, sound, vibration, hygienic conditions, which prevents a correct interpretation of the information (Villalba Crespo et al., 2019). In turn, it can produce positive and negative effects which are greater and can occur in the short, medium and long term and are of three forms such as psychological allusive to stress, physiological such as high blood pressure and behavioral such as bad mood, in addition to this we find mental fatigue which is one of the first manifestations (Alarcon et al., 2018).

The set of conditions to which nurses are exposed in their workplaces and the intellectual work demand inherent to the exercise of the profession, generates the need to study the mental workload experienced by these professionals in their workplace, this indicator requires an instrument adapted to the Peruvian context that has the appropriate metric properties to measure the mental workload construct, using the Subjective Mental Workload Scale (ESCAM) developed by Rolo, Diaz & Hernández (Rolo Gonzáles et al., 2009) with 5 dimensions assessing work pace, task characteristics, temporal organization, cognitive demands and task complexity, and health consequences, the aim of which is to evaluate the construct validity of the ESCAM in nursing professionals.

Therefore, adaptation, validity and reliability is one of the criteria that a measurement instrument must meet, where it refers to validity as the degree to which the instrument measures what it has to measure, which is what it has been constructed for. Reliability, which measures the quality or degree of accuracy of the measuring instrument to rule out error, does so through consistency, temporal stability and agreement among experts. (Robles Garrote & Del Carmen Rojas, 2015). The purpose of the research is to evaluate the mental workload of nurses in order to adopt strategies and improvement plans to reduce or mitigate this problem.

Methodology

Cross-sectional validation study of instruments developed between 2020-2021 (Hernandez-Sampieri & Mendoza Torres, 2018), the ethics committee of the Universidad Peruana obtained the endorsement of the (Número 2021-CE-FCS-UPeU-00213, fecha:18/05/2021); which establishes the scientific, technical and administrative guidelines for the research.

To determine validity and reliability, the Subjective Scale of Mental Workload in Nurses consists of 20 items that are measured through a Likert-type scale with scores from 1 to 5 (1 very low and 5 very high), five dimensions: Cognitive demands and task complexity (6 items), Task characteristics (4 items), Temporal organization (3 items), Work pace (3 items) and Health consequences (4 items). Sampling was probabilistic and random. The required sample size calculation was obtained according to the number of items in the instrument, considering 140 nurses working in hospitals in the city of Lima.

The participants were recruited through the survey technique, being delivered to the people who met the inclusion and exclusion criteria, after approval of informed consent, once permission was obtained, the instrument was filled out through the form programmed in the web server, this procedure lasted approximately 20 to 25 minutes.

The construct validity was performed by means of the confirmatory factor analysis technique using the principal components method and varimax rotation. Nunally and Bernstein's description was used (1995) with respect to the criteria in the evaluation of the items of the instrument with the presence of a factor loading equal to or greater than 0.3 with a communality of at least 0.1 and in the first instance no adverse effect on the reliability measures calculated by the Cronbach-Mesbah index (Hernández-Sampieri, 2018), and second, absence of strong correlation (greater than 0.8) and significance with the other items. To determine reliability by means of its level of internal consistency, Cronbach's alpha was used (Campo et al., 2008)

Results

Descriptive analysis of the items of the mental workload scale

Before performing the exploratory factor analysis of the mental workload scale, a descriptive analysis of the items was performed (Table 1). The mean scores of the items range from 2.49 to 4.23 and the standard deviations are close to 1, indicating adequate variability in the item responses. The skewness and kurtosis coefficients were greater than 1 in at least 7 items, thus evidencing that the items do not present a univariate normal distribution. The sample adequacy index was also evaluated for all items, and a cut-off point of 0.50 was considered. Thus it is observed that items 14 and 16 present values lower than 0.50, therefore, they were eliminated from the total scale.

Table 1. Descriptive of the mental workload scale

Variables	M	DE	As	K	MSA
Item1	4.19	0.81	-1.42	3.48	0.55
Item2	3.62	0.87	-0.91	1.35	0.55
Item3	3.24	0.79	-0.10	0.55	0.66
Item4	4.06	0.76	-0.87	1.51	0.62
Item5	3.04	0.87	0.06	-0.22	0.66
Item6	3.86	0.70	-0.31	0.11	0.58
Item7	3.31	1.06	-0.32	-0.35	0.67
Item8	3.15	0.82	0.03	0.63	0.80
Item9	4.16	1.01	-1.46	1.69	0.62
Item10	3.55	1.24	-0.78	-0.38	0.63
Item11	3.00	0.93	-0.38	-0.77	0.66
Item12	2.96	0.94	-0.19	-0.93	0.72
Item13	2.89	0.92	0.29	-0.41	0.67
Item14	2.60	1.07	0.75	-0.26	0.44
Item15	2.49	1.20	0.70	-0.57	0.84
Item16	3.65	1.33	-0.42	-1.30	0.40
Item17	4.23	0.96	-1.70	3.01	0.65
Item18	3.11	1.36	-0.33	-1.21	0.74
Item19	3.18	0.96	-0.12	-0.25	0.86
Item20	2.76	1.23	0.01	-1.18	0.73

Note. M = mean, SD = standard deviation, As = skewness coefficient, K = kurtosis coefficient, MSA = measure of sampling adequacy. MSA values less than 0.50 suggest that the item does not measure the same domain as the rest of the items in the set, so it should be eliminated.

Analysis of the correlation matrix

Taking into account that the items do not present univariate normality and are also ordinal in nature (Likert scale), an analysis of the adequacy of the 20-item sample was performed on a polychoric correlation matrix (Table 2), through the Kaiser-Meier-Olkin index (KMO) and the Bartlett's test of sphericity. The results show that the matrix is not adequate to perform the factor analysis (KMO index = 0.672; Bartlett's test = 1004.3, gl = 190, $p < 0.001$). However, considering the analysis of sampling adequacy measures, items 14 and 16 were eliminated and the analysis was performed again and it turned out that the matrix of polychoric correlations consisting of 18 items was acceptable to proceed with the factor analysis (KMO Index = 0.7128; Bartlett's Test = 916.2, gl = 153, $p < 0.001$).

Principal component analysis and analysis of variance explained.

Subsequently, a principal component analysis of the mental workload scale was performed. Considering the results of the principal components analysis, based on the eigenvalues greater than 1, it is observed that the mental workload scale has a structure of 7 factors or components. However, taking into account the theoretical proposal of the authors who constructed the instrument, the structure was adjusted to 5 components, where the total variance explained was 0.624 (Factor 1 = 0.269, Factor 2 = 0.133, Factor 3 = 0.080, Factor 4 = 0.075, Factor 5 = 0.066). All these values indicate that the total explained variance of the factorial structure is acceptable because it exceeds the cut-off point of 0.50 (Table 3). However, considering that the principal component analysis initially estimated 7 components, which indicates an overestimation of the factorial structure, it was decided to perform a parallel analysis.

Table 2. Matrix of polychoric correlations (20 items)

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Item1	1.00																			
Item2	0.36	1.00																		
Item3	0.15	0.46	1.00																	
Item4	0.51	0.24	0.16	1.00																
Item5	0.23	0.19	0.17	0.23	1.00															
Item6	0.44	0.30	0.09	0.36	0.45	1.00														
Item7	0.02	0.23	0.22	0.32	0.27	0.19	1.00													
Item8	0.12	0.19	0.32	0.13	0.39	0.21	0.49	1.00												
Item9	0.31	0.14	0.01	0.31	0.12	0.24	0.36	0.35	1.00											
Item10	0.02	0.11	0.01	0.28	0.31	0.22	0.34	0.17	0.17	1.00										
Item11	0.15	0.08	0.18	0.01	0.20	0.05	0.28	0.23	0.06	-0.05	1.00									
Item12	0.15	0.01	0.15	-0.01	0.14	-0.03	0.34	0.30	0.10	-0.05	0.73	1.00								
Item13	0.10	-0.02	0.12	-0.04	0.12	0.15	0.23	0.39	0.04	0.12	0.51	0.53	1.00							
Item14	-0.17	-0.15	-0.15	-0.18	-0.09	-0.25	-0.22	-0.13	-0.17	-0.20	0.23	0.10	0.12	1.00						
Item15	0.01	0.05	0.26	0.04	0.19	0.01	0.25	0.17	-0.06	0.12	0.39	0.40	0.31	0.04	1.00					
Item16	0.02	-0.01	0.16	0.07	0.03	-0.11	-0.03	0.06	-0.15	-0.13	0.04	-0.01	0.00	0.16	-0.13	1.00				
Item17	0.15	0.27	0.23	0.21	0.15	0.05	0.18	0.26	0.29	0.06	0.19	0.16	0.22	-0.26	0.16	-0.07	1.00			
Item18	0.01	0.09	0.29	0.09	0.25	-0.08	0.29	0.40	0.14	0.18	0.21	0.35	0.47	0.06	0.29	0.00	0.45	1.00		
Item19	0.16	0.15	0.32	0.20	0.42	0.22	0.36	0.49	0.21	0.23	0.30	0.33	0.35	0.02	0.31	0.02	0.38	0.55	1.00	
Item20	0.05	0.15	0.15	0.08	0.26	-0.11	0.14	0.25	0.18	0.12	0.34	0.25	0.35	0.14	0.25	-0.09	0.40	0.57	0.36	1

Matriz de correlaciones policóricas de 20 ítems (Índice de KMO = 0.672; Prueba de Bartlett = 1004.3, gl = 190, p < 0,001)

Matriz de correlaciones policóricas eliminando ítems 14 y 16 (Índice de KMO = 0.7128; Prueba de Bartlett = 916.2, gl = 153, p < 0,001)

Matrix of polychoric correlations of 20 items (KMO index = 0.672; Bartlett's test = 1004.3, gl = 190, p < 0.001). Matrix of polychoric correlations eliminating items 14 and 16 (KMO index = 0.7128; Bartlett's test = 916.2, gl = 153, p < 0.001).

Table 3. Eigenvalues and explained variance of the factors of the mental workload scale.

Variable	Autovalores	% de varianza	% varianza acumulada
Item1	4.861	0.243	0.243
Item2	2.614	0.131	0.374
Item3	1.491	0.075	0.448
Item4	1.395	0.070	0.518
Item5	1.242	0.062	0.580
Item6	1.139	0.057	
Item7	1.086	0.054	
Item8	0.898	0.045	
Item9	0.798	0.040	
Item10	0.695	0.035	
Item11	0.645	0.032	
Item12	0.525	0.026	
Item13	0.483	0.024	
Item14	0.460	0.023	
Item15	0.407	0.020	
Item16	0.369	0.018	
Item17	0.330	0.016	
Item18	0.222	0.011	
Item19	0.182	0.009	
Item20	0.159	0.008	

Note: Minimum total variance explained = 0.50.

Exploratory factor analysis

Then, considering that items 14 and 16, which corresponded to one factor, were eliminated, a factor analysis was performed with an adjusted structure of 4 oblique factors (Table 5). The results show that there are two clearly defined factors (Factors 1 and 2).

Table 5. Factor loadings of the items in a 4-factor oblique structure.

Variables	Factor 1	Factor 2	Factor 3	Factor 4	Comunalidades
Item1			0.964	-0.486	0.679
Item2			0.549		0.299
Item3	0.338				0.202
Item4			0.600		0.406
Item5				0.441	0.343
Item6	-0.328		0.571		0.513
Item7				0.615	0.435
Item8				0.496	0.444
Item9			0.316		0.207
Item10				0.630	0.296
Item11		0.901			0.705
Item12		0.905			0.758
Item13		0.507			0.440
Item15		0.358			0.250
Item17	0.653				0.412
Item18	0.762				0.706
Item19	0.362			0.392	0.518
Item20	0.631				0.433

Note: Factor loadings of less than 0.30 were omitted.

Confirmatory factor analysis

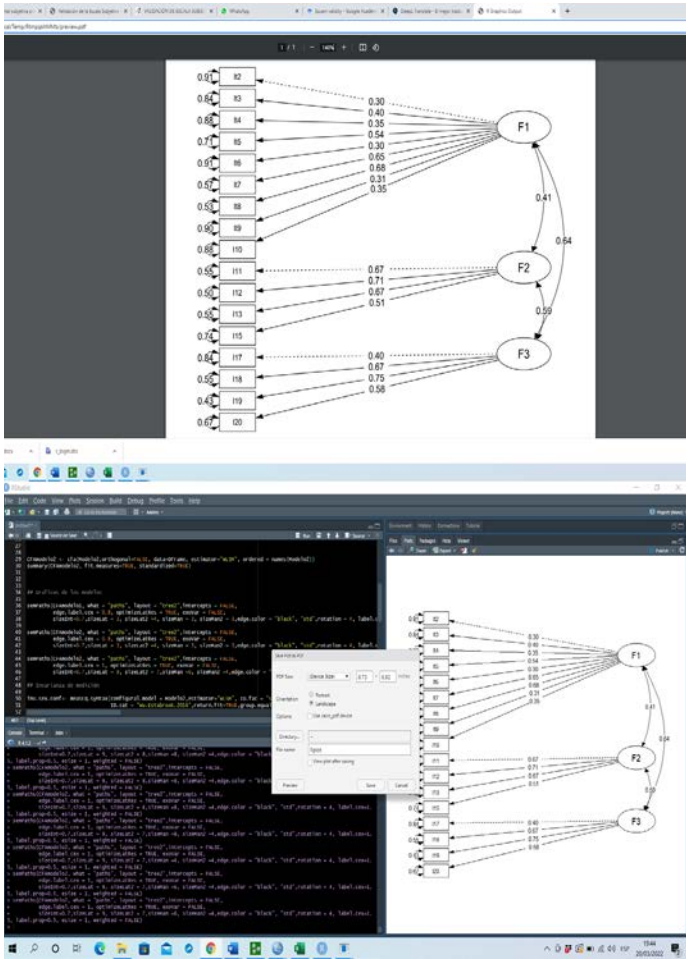
The final evaluation of the models was done through confirmatory factor analysis using structural equation modeling (SEM). Estimates were made using the weighted least squares weighted least squares adjusted mean (WLSM) robust estimation method. In turn, we used the reference values proposed by Escobedo (Escobedo Portillo et al., 2016) y Kline (2015) to evaluate the goodness-of-fit indices of a model. Thus, a model is considered to have an acceptable fit if the comparative fit index (CFI) and the Tucker-Lewis fit index (TLI) contain values ranging between 0.90 and 0.95, and an adequate fit is said to exist if the indexes are greater

than 0.95. Values ranging between 0.05 and 0.08 are also considered to indicate that a model presents an acceptable fit in the root mean squared error of approximation (RMSEA) and standardized root mean squared residual (SRMR) indices, and if the values are lower than 0.05, then it is concluded that there is an adequate fit.

With this analysis, it was determined that, of the 5 models evaluated, the goodness-of-fit indices were more satisfactory or favorable for model 3, which considers a structure of 3 correlated factors.

The third factorial structure model (Figure 2) composed of 3 factors containing 17 items (items 1, 14 and 16 eliminated) was evaluated and the goodness-of-fit indices were found to be adequate or satisfactory (X2 = 164.243, p = 0.000, CFI = 0.955, TLI = 0.947, RMSEA = 0.044 [95%CI = 0.027 - 0.059], SRMR = 0.075). In this model all factors were significantly correlated ($r > 0.4$, $p < 0.01$).

Figure 2. Confirmatory factor analysis of the 3-factor structure (17 items) of the mental workload scale.



Note. Goodness-of-fit indices (X2 = 201.942, p = 0.000, CFI = 0.920, TLI = 0.908, RMSEA = 0.058 [95%CI = 0.044 - 0.072], SRMR = 0.085).

Descriptives and reliability of the reduced mental workload scale.

Table 9 presents the psychometric properties of the reduced mental workload scale. The correlations of the items with the corrected total are higher than 0.30, which is a referential value for evaluation. Likewise, the items present reliability coefficients above 0.70, except for items 11 and 12, but their values are not negligible. Finally, the reliability coefficients for the total of the mental workload scale and the 3 factors were higher than 0.70, which indicates that the instrument with its respective factors presents a high reliability.

Table 9. Psychometric properties of the mental workload scale (17 items, α-ordinal = 0.83).

Variables	M	DE	As	K	r-itc	αordinal	αordinal
Factor 1:							
Item2	3.62	0.87	-0.90	1.25	0.48	0.72	0.74
Item3	3.24	0.79	-0.09	0.48	0.39	0.74	
Item4	4.06	0.77	-0.86	1.42	0.51	0.71	
Item5	3.04	0.88	0.06	-0.27	0.55	0.71	
Item6	3.86	0.70	-0.31	0.05	0.53	0.71	
Item7	3.31	1.07	-0.31	-0.40	0.62	0.70	
Item8	3.15	0.82	0.03	0.55	0.59	0.71	
Item9	4.16	1.01	-1.43	1.59	0.43	0.73	
Item10	3.55	1.24	-0.76	-0.43	0.40	0.73	
Factor 2:							
Item11	3.00	0.93	-0.37	-0.81	0.80	0.68	0.79
Item12	2.96	0.95	-0.18	-0.97	0.82	0.67	
Item13	2.89	0.92	0.28	-0.46	0.62	0.75	
Item15	2.49	1.20	0.69	-0.62	0.48	0.81	
Factor 3:							
Item17	4.23	0.96	-1.67	2.88	0.56	0.74	0.77
Item18	3.11	1.36	-0.33	-1.24	0.78	0.65	
Item19	3.18	0.96	-0.12	-0.30	0.62	0.73	
Item20	2.76	1.23	0.01	-1.22	0.64	0.72	

Note: M = Mean, SD = Standard deviation, As = Skewness coefficient, K = Kurtosis coefficient, r-itc = Item-total-corrected correlation, αordinal = Ordinal alpha reliability coefficient (polychoric correlation matrix).

Table 6. Reliability of the Subjective Mental Workload Scale in nurses.

Subjective Mental Workload Scale for nurses-dimensions	Alfa de Cronbach
Pace of work	0.521
Task characteristics	0.629
Temporal organization	0.625
Cognitive demands and task complexity	0.616
Health consequences	0.696

Discussion

Mental workload is a problem that arises when a worker is unable to handle the set of demands that are included in their work, these are pathological and affect the health of the individual since it requires skills and experience to be able to meet the demands that may arise during the workday. These demands also occur in the professional area of health that produces stress, mood swings, creating conflicts and an inadequate work environment (Ferreira & Ferreira, 2014).

The present study was applied to nursing graduates in their different areas of work, with 140 respondents, 94.3% of whom were female and 5.4% were male. The data obtained allow us to demonstrate the consistency of validity and reliability.

According to the Subjective Scale of Mental Workload (ESCAM) applied to nursing professionals, the instrument was submitted to 10 experts who showed high congruency in the content of the items, obtaining a V. Aiken 0.97. Subsequently, reliability was tested in a population of 140 subjects and an initial Cronbach's alpha of α=0 was obtained. 579 for 20 selected items, seeing that it has a very low result, a discriminant analysis was performed where we found that questions 18, 19, 20 has a correlation of less than 0.2 when eliminated a result of α=0.675 was obtained with which we can say that this instrument is reliable for its application, which is adequate (Hernández, et al., 2014), compared to what was found in Chile (Cevallos, et al., 2014) which resulted in an overall Cronbach's alpha of 0.73, which is similar to that obtained by us.

The demands and requirements of work in the health care area for health professionals, especially for nurses, is a problem that has been increasing in recent years, as patients and their families demand quality health services, as well as having the human resources and medical supplies essential for health care. This situation generates dissatisfaction and feelings of frustration which is transferred to health professionals, affecting interpersonal relationships, health communication and quality indicators.

On the other hand, the mental workload of the nursing professional who must provide comprehensive and holistic care in the healthcare practice is aware that this work is increasingly difficult and feels fear, trepidation and uncertainty in adverse situations due to the lack of ideal environmental conditions, the lack of resources and medical equipment for patient care, which puts at risk the guarantee of a safe and quality environment for the patient and family.

In this sense, the mental workload affects the health of the worker (Rivera, et al., 2020) these statements are consistent with Venegas, et al., (2020) who argues that mental workload indirectly affects subjective tasks, which makes it more difficult and can lead to errors that imply frustrations and affect the quality of life of health personnel.

Subsequently, a descriptive analysis was performed, where it is observed that there are mean scores between 2.49 and 4.23 variability of the response, obtaining the appropriate deviation, where the reference value is 5 (Escobedo et al., 2016). Likewise, the skewness, kurtosis coefficient is invariant above 1 coefficient which does not have a normal distribution. In addition, the adequacy of the sample of 20 items, in a correlation matrix, items 14 and 16 are below 0.50 so it is necessary to eliminate them obtaining a result in the matrix of polychoric correlations constituted by 18 items, being acceptable to proceed with the factor analysis (KMO index = 0.7128; Bartlett's test = 916.2, gl = 153, $p < 0.001$). This can be compared with the study carried out in Chile (Ceballos Vásquez et al., 2014) where we found a sample adequacy coefficient KMO of 0.647 and a Bartlett's sphericity test value of c2(190)=436.257.

Next, in the analysis of principal components and explained variance, the mental workload scale has a structure of 7 factors or components. However, taking into account the theoretical proposal of the authors who constructed the instrument, the structure was adjusted to 5 components, where the total variance explained was 0.624 (Factor 1 = 0.269, Factor 2 = 0.133, Factor 3 = 0.080, Factor 4 = 0.075, Factor 5 = 0.066). All these values indicate that the total explained variance of the factorial structure is acceptable because it exceeds the cut-off point of 0.50. These results are similar to those found in the study of Validation of the Subjective Scale of Mental Workload (ESCAM) in health professionals in Chile, where the 05 dimensions identified by the authors are as follows (Ceballos Vásquez et al., 2016).

As for the exploratory factor analysis, it was found that the structure with 3 oblique factors (Table 6) presented a better behavior of the items. Thus, items 1 - 6 were grouped with items 7 - 9 in a single factor, thus grouping them statistically; however, item 1 still measures in 2 factors, but this indicates that they are already grouped according to what it should measure.

The 3-factor model containing 17 items (items 1, 14 and 16 eliminated) was evaluated and it was found that the goodness-of-fit indices were adequate or satisfactory (X2 = 164.243, $p = 0.000$, CFI = 0.955, TLI = 0.947, RMSEA = 0.044 [95%CI = 0.027 - 0.059], SRMR = 0.075). In this model all factors were significantly correlated ($r > 0.4$, $p < 0.01$) (Escobedo et al., 2016).

It is stated that 50% of nurses working night shifts are affected by sleep while in rotating shifts the affection is greater than 66% compared to those working day shifts where only 5.2 to 11% are affected, which generates an increase in mental workload (Almudéver et al., 2019).

According to these findings, the original scale is a useful tool to evaluate the scale of mental workload required by a person who is exposed to high work demands and job demands in various areas of health care. However, changes in the structure and conformation of the dimensions are recommended.

Barrera, et al., (2018), reports that work activities related to the administration of medications is the one that generates the greatest mental workload, after administrative work. While the internal medicine service obtained the highest mental workload, the rest of the services have a moderate mental

workload. It should be noted that technology, an equitable distribution of work, assertive communication and strengthening individual capabilities should be used in order to mitigate the mental workload of nursing graduates (Vargas-Cruz, et al., 2020)

Working conditions also have an influence on mental workload, since noise, vibrations and temperature can end up affecting the activities performed, generating difficulty in concentration (Canizalez-Arreola, et al., 2018) There are many factors that determine the mental workload, including the environment, interpersonal relationships, personal characteristics, duration and complexity of the task, emotional state (Teran, et al., 2021)

Consideration should be given to the harmful and negative behaviors that are generated as a result of mental workload, such as lack of motivation, irritability, emotional instability, anxiety, low self-esteem and depression (Gallardo, et al., 2019)

Finally, the mental workload scale is a necessary instrument that requires further evaluation to achieve scale improvement in order to measure the phenomenon under study in different populations with the aim of preventing the psychological impact of this problem.

Conclusions

The mental workload scale is a relevant issue for health professionals. The pandemic has wreaked havoc due to the high demands of health services, so having a highly reliable instrument that measures this phenomenon can help us to identify in a timely manner and carry out psychological interventions to improve mental health conditions and have skills to cope with this problem.

There is an urgent need to retake the theoretical basis on individual mental workload in order to evaluate the variable in an integral way. It is a scale that offers a new structure of 3 factors (health consequences, cognitive demands and characteristics of the task and temporal organization) that contribute in the resignification of the fundamental elements to guarantee a suitable evaluation.

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