

ORIGINAL

## Validation and invariance of an Individual Work Performance Questionnaire (IWPQ-P) in Peruvian Nurses

## Validación e invarianza del Cuestionario de Desempeño Laboral Individual (IWPQ-P) en Enfermeras Peruanas

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### ABSTRACT

**Background:** performance evaluation is essential to ensure quality healthcare services, especially in the field of nursing.

**Objective:** The objective of this study was to analyze the factorial structure, reliability, and invariance by sex and age of the work performance scale in Peruvian nurses.

**Methods:** confirmatory factor analysis (CFA) was conducted to evaluate the internal structure of the scale, and psychometric properties including reliability and convergent validity were determined. Additionally, factorial invariance was evaluated according to participants' sex and age.

**Results:** the CFA supported the structure of three factors (Task Performance, Counterproductive Behaviors, Contextual Performance) and showed adequate and stable psychometric properties for a 12-item version ( $\chi^2 = 231,09$ ,  $df = 78$ ; CFI = 0,97, TLI = 0,96, RMSEA = 0,06 (90 % CI: 0,05-0,06), and SRMR = 0,03). Strict factorial invariance was demonstrated for both sex and age, and adequate internal consistency was found for each dimension, as well as convergent validity.

**Conclusions:** the work performance scale, in its 12-item version (IWPQ-P), is a valid and reliable measure for evaluating work performance in Peruvian nurses. Its factorial invariance by sex and age makes it a useful tool for future research and practical applications in nursing performance evaluation.

**Keywords:** Work Performance; Nurses; Invariance; Validation; Peruvian.

### RESUMEN

**Antecedentes:** la evaluación del desempeño es esencial para asegurar servicios de atención sanitaria de calidad, especialmente en el campo de enfermería.

**Objetivo:** el objetivo de este estudio fue analizar la estructura factorial, la fiabilidad y la invarianza por sexo y edad de la escala de desempeño laboral en enfermeros peruanos.

**Métodos:** se realizó un análisis factorial confirmatorio (AFC) para evaluar la estructura interna de la escala, y se determinaron propiedades psicométricas incluyendo la fiabilidad y la validez convergente. Adicionalmente, se evaluó la invarianza factorial según el sexo y la edad de los participantes.

**Resultados:** el AFC respaldó la estructura de tres factores (Desempeño de Tareas, Comportamientos Contraproducentes, Desempeño Contextual) y mostró propiedades psicométricas adecuadas y estables para una versión de 12 ítems ( $\chi^2 = 231,09$ ,  $df = 78$ ; CFI = 0,97, TLI = 0,96, RMSEA = 0,06 (IC del 90 %: 0,05-0,07), y SRMR = 0,03). Se demostró invarianza factorial estricta tanto para el sexo como para la edad, y se encontró una consistencia interna adecuada para cada dimensión, así como validez convergente.

**Conclusiones:** la escala de desempeño laboral, en su versión de 12 ítems (IWPQ-P), es una medida válida y fiable para evaluar el desempeño laboral en enfermeros peruanos. Su invarianza factorial por sexo y edad la convierte en una herramienta útil para futuras investigaciones y aplicaciones prácticas en la evaluación del desempeño de enfermería.

**Palabras clave:** Desempeño Laboral; Enfermeros; Invarianza; Validación; Peruano.

## INTRODUCTION

Nurses play a crucial role in healthcare systems, and improving their work performance is essential to enhance the quality of care.<sup>(1,2,3)</sup> Therefore, investigating their work performance is relevant, especially because it tends to decline in stressful or burnout situations and is related to withdrawal behaviors, absenteeism, intention to turnover, and sleep disorders.<sup>(4,5,6)</sup> In contrast, a positive impact on work performance enhances engagement, efficiency, productivity, and enables faster task completion by dedicating more time and energy to achieving organizational goals.<sup>(7,8)</sup>

Work performance refers to the execution of tasks assigned to the worker and is a collection of individual work-related behaviors that reflect knowledge, behaviors, and ethical values.<sup>(9)</sup> It can be analyzed from two perspectives: behavioral and outcome. The behavioral perspective focuses on employees' actions and behaviors during work, while the outcome perspective evaluates the results achieved.<sup>(10,11)</sup>

It is urgent to determine nurses' work performance since various factors affect their performance. Two domains have been considered for work performance: a) task performance, defined as the person's competence in performing basic or technical tasks in their work<sup>(12)</sup> and refers to behaviors that contribute to the organization, such as job skills, the quantity and quality of work performed, and job knowledge; b) contextual performance, which refers to behaviors that support the social and psychological environment of the organization in which the technical core functions, encompassing behaviors that aid the functioning of the organization, such as effort, facilitating performance among peers and team, communication, and cooperation.<sup>(13,14,15)</sup> c) counterproductive behaviors, which refer to those that harm organizational well-being, such as absenteeism, theft, substance abuse, and off-task behaviors.<sup>(16,17)</sup>

The evaluation of work performance in nurses can be a major challenge as it can be influenced by various factors, such as gender, work experience, nursing organizational culture, and specific cultural contexts.<sup>(18,19,20)</sup> The Argentine adaptation of the Individual Work Performance Questionnaire by Gabini & Salessi<sup>(21)</sup> maintained the solution of three factors: a) task performance, b) contextual performance, c) counterproductive behaviors, and coincides with the three dimensions proposed by Koopmans et al.<sup>(22)</sup> Of the 18 items proposed by Koopmans et al.<sup>(22)</sup> in the Argentine version, two items were eliminated for not reaching the established threshold of saturations in the EFA and three did not present adequate significance of the factor loadings. The ordinal alpha coefficients for each of the three dimensions were adequate, and the dimensions achieved adequate values ( $\geq .70$ ).<sup>(21)</sup> There is a gender role conflict suggesting that female nurses experience more conflict than male nurses due to gender stereotypes in society. It has been observed that the work performance of clinical nurses increases as their work experience exceeds five years.<sup>(23)</sup> This could be because nurses with more experience have more advanced knowledge and skills and confidence in their work, leading to higher work performance.<sup>(18)</sup> Although work performance has shown good psychometric properties in industrial workers,<sup>(21)</sup> its intercultural validity has not been evaluated, which is important since work performance can vary according to different cultural contexts such as Peru and specifically in nurses. There is no evidence of measurement invariance of the Spanish version. Measurement invariance is necessary to make meaningful comparisons between nursing staff from different groups (gender, age, marital status, countries, cultures, etc.), as it tests the equivalence of the meaning of items between compared groups.<sup>(24)</sup> If the instrument shows a lack of invariance, the comparisons between groups are partial and not significant, putting the validity of empirical conclusions at risk.

Currently, evidence on the cultural factors that contextualize how work performance is defined and expressed in different populations is scarce, limiting validation in other countries and populations. The absence of studies on measurement invariance is not limited solely to work performance, as the invariance in different psychological constructs has not been sufficiently analyzed either. Likewise, work performance in nurses is a crucial issue in healthcare, and it is necessary to address the different domains of work performance and analyze the behavioral and outcome perspectives that will allow the development of effective strategies to

increase the quality of care and the well-being of nurses in their work environments. With all of this in mind, the objective of the research will be to analyze the psychometric properties of a work performance scale in Peruvian nurses.

## METHODS

### Design of the Study and Participants

A validation study was carried out. The selection of participants was carried out using non-probabilistic sampling, based on the following inclusion criteria: a) employees with more than three months of employment, and b) only administrative and support personnel. To determine the sample size, the effect size was analyzed using Soper's electronic calculator.<sup>(25)</sup> This tool takes into account the number of observed and latent variables in the model, the anticipated effect size ( $\lambda = 0,3$ ), the desired statistical significance ( $\alpha = 0,05$ ), and the level of statistical power ( $1 - \beta = 0,95$ ). Based on these parameters, a recommended minimum sample of 223 participants was established. The study finally included a total of 886 nurses, aged between 20 and 65 years ( $M = 39,27$ ,  $SD = 9,461$ ). Of these, 81,3 % were women. Regarding employment status, 50,6 % of the participants were employees, while 86,6 % belonged to the support group. The latter group is dedicated to participating in processes of health promotion, recovery, and rehabilitation, focusing on the care and well-being of people (table 1).

Characteristics		n	%
Age	20 -26	448	50,6
	27 - 59	351	39,6
	27 -59	55	6,2
Sex	Female	720	81,3
	Male	166	18,7
Employment Status	Contracted	448	50,6
	Appointed	351	39,6
	Third party	55	6,2
	Tercero	32	3,6
Occupacional Group	Administrative	119	13,4
	Assistance	767	86,6

### Work Performance

To evaluate work performance, we used the adapted version of the Individual Work Performance Questionnaire (IWPQ) for Argentine workers by Gabini and Salesi,<sup>(21)</sup> based on the original English version developed by Koopmans.<sup>(26)</sup> The instrument consists of 13 items, each preceded by the phrase "in the last three months." The items are evaluated using a 5-point Likert scale, ranging from 1 ("never") to 5 ("always"), and are designed to measure the three dimensions of work performance: task performance, contextual performance, and counterproductive work behaviors. Coefficients of internal consistency were calculated using Cronbach's Alpha for each of the dimensions, obtaining results that meet the established parameters: task performance ( $\alpha = ,74$ ), contextual performance ( $\alpha = ,72$ ), and counterproductive behaviors ( $\alpha = ,70$ ).

### Procedure

The privacy and confidentiality of the data collected in this study were ensured. The research was approved by the Ethics Committee for Research of a Peruvian university (Code: 2022-CEUPeU-028). After obtaining approval, participants were invited to complete the questionnaire between October 2 and December 30, 2022. The questionnaire was administered through Google Forms, which facilitated its online distribution. Before data collection, confidentiality guidelines and the guidelines established in the Helsinki Declaration were taken into account. Participants were also informed about the purpose of the research and asked for their informed consent. In this way, compliance with ethical regulations and the protection of the rights of participants were guaranteed throughout the research process.

### Data analysis

A descriptive analysis of the scale was conducted, calculating the mean, standard deviation, skewness, kurtosis, and corrected item-test correlation. Skewness (g1) and kurtosis (g2) values between  $\pm 1,5$  were considered adequate.<sup>(27)</sup> The corrected item-test correlation analysis was taken into account for the elimination

of items if  $r(i\text{-}tc) \leq ,2$  or multicollinearity ( $i\text{-}tc) \leq ,2$ .<sup>(28)</sup>

For the CFA, the three-factor structure proposed by Gabini and Salessi<sup>(21)</sup> was established: task performance, counterproductive behaviors, and contextual performance. A confirmatory factor analysis (CFA) was performed using the weighted least squares mean- and variance-adjusted (WLSM) method, given the categorical nature of the items and its ability to detect structural relationships with mild or moderate skewness.<sup>(29,30)</sup> To assess model fit, the chi-square test ( $\chi^2$ ), confirmatory fit index ( $CFI \geq 0,95$ ), Tucker-Lewis index ( $TLI \geq 0,95$ ),<sup>(31)</sup> root mean square error of approximation ( $RMSEA \leq 0,05$ ), and standardized root mean square residual ( $SRMR \leq 0,05$ )<sup>(28)</sup> were considered. Convergent validity evidence was obtained through the average variance extracted (AVE), considering values greater than 0,50 as satisfactory.<sup>(32)</sup> Additionally, item retention was evaluated through factor loadings ( $\lambda > 0,70$ ).<sup>(33)</sup>

Regarding reliability, it was calculated using ordinal alpha coefficient<sup>(34)</sup> and the construct reliability through McDonald's omega coefficient,<sup>(35)</sup> expecting magnitudes higher than 0,80.<sup>(36,37)</sup>

In the third stage, the factorial invariance of the labor performance scale was evaluated according to the gender (men and women) of the participants, through a sequential evaluation<sup>(38)</sup> of configural invariance (M1) as a reference model, without restrictions on the factorial structure; metric invariance (M2), which evaluates the equality of the factorial loads; scalar invariance (M3), which evaluates the factorial loads and intercepts; and residual invariance (M4), which evaluates the factorial loads, intercepts, and residuals. For evaluation, changes in  $\chi^2$  were considered, given that it is sensitive to the sample size. Changes in CFI ( $\Delta CFI \leq 0,01$ ) were also taken into account as appropriate criteria for accepting invariance.<sup>(39)</sup>

The statistical analysis was carried out using the free software R 4.1.1 (R Foundation for Statistical Computing, Vienna, Austria; <http://www.R-project.org>).

## RESULTS

### Descriptive statistics of the items of work performance

Descriptive statistics are shown in table 2, where item 1 ( $M = 4,21$ ) had the highest mean, while the lowest was found in item 8 ( $M = 0,93$ ). Item 7 ( $SD = 1,12$ ) showed greater variability compared to the others. Skewness ( $g1$ ) and kurtosis ( $g2$ ) fluctuated between values lower than  $\pm 1,5$  in all items, except for items 8, 9, and 10, indicating a non-normal multivariate distribution. Additionally, the scale showed item-total correlations between 0,46 and 0,78, greater than the acceptable limit of 0,30, indicating high homogeneity. The internal consistency, measured through Cronbach's alpha, was acceptable ( $>0,80$ ) for each item.

Table 2. Descriptive statistics and reliability

Items	M	SD	g1	g2	r.cor	$\alpha$
1	4,21	0,78	-0,83	0,84	0,75	0,89
2	3,74	0,92	-0,29	-0,55	0,71	0,89
3	3,97	0,86	-0,35	-0,71	0,74	0,89
4	4,02	0,90	-0,64	0,03	0,78	0,89
5	3,83	0,93	-0,45	-0,26	0,76	0,89
6	1,31	1,11	0,84	0,30	0,46	0,90
7	1,35	1,12	0,79	0,20	0,52	0,90
8	0,93	0,93	1,37	2,58	0,54	0,89
9	0,99	0,93	1,24	2,06	0,47	0,90
10	3,85	1,01	-1,07	1,64	0,66	0,89
11	3,99	0,85	-0,56	0,09	0,77	0,89
12	3,92	0,88	-0,63	0,20	0,61	0,89
13	3,94	0,83	-0,41	-0,18	0,76	0,89

Note: g1= skewness, g2= kurtosis, r.cor= item-total correlations,  $\alpha$ = Cronbach's alpha.

### Validity evidence related to internal structure

The CFA was conducted by hypothesizing the three-factor model initially proposed by Gabini & Salessi. The fit indices for the first model were:  $\chi^2 = 231,09$ ,  $df=78$ ;  $CFI = 0,97$ ,  $TLI = 0,96$ ,  $RMSEA = 0,06$  (90 % CI: 0,05-0,06),  $SRMR = 0,03$ . However, there are significant aspects that suggest the need for considering a new model. Specifically, the main discrepancy lies in the value of RMSEA, which is reported as 0,06, with a 90 % confidence interval of 0,05 to 0,06. According to the established criteria for the evaluation of fit, an RMSEA equal to or less than 0,05 is considered indicative of a good fit, implying that the current model slightly exceeds the desirable

threshold. Furthermore, all  $\lambda$  were greater than 0,7, except for item number 12, which was therefore removed. The fit indices for the second model were  $\chi^2 = 181,02$ ,  $df=51$ ; CFI = 0,97, TLI = 0,96, RMSEA = 0,05 (90 % CI: 0,05-0,06), SRMR = 0,03, indicating that the Peruvian version of the model fits the observed data adequately. The second model's AVE values are adequate (AVE > 0,50), indicating that the latent factors are adequately explained by their observed variables. Additionally, regarding reliability, the obtained values were high (alpha  $\alpha$  and  $\omega$  > 0,70).

Items	Model 1			Model 2		
	F1	F2	F3	F1	F2	F3
1	0,79			0,79		
2	0,74			0,74		
3	0,78			0,78		
4	0,86			0,86		
5	0,81			0,81		
6		0,76			0,76	
7		0,80			0,8	
8		0,86			0,86	
9		0,77			0,77	
10			0,72			0,72
11			0,86			0,86
12			0,69			
13			0,84			0,82
$\alpha$				0,90	0,87	0,84
$\omega$				0,90	0,87	0,84
F1				0,64	0,34	0,97
F2					0,64	0,28
F3						0,61

**Note:** F1= Task performance; F2 = Counterproductive behavior; F3= Contextual performance;  $\alpha$ = Cronbach's alpha;  $\omega$  = Omega; AVE= Average Variance Extracted on the diagonal; above the diagonal are the correlations between factors.

### Analysis of invariance

Invariance models according to gender and age were evaluated progressively. First, configural invariance (M1), which imposes no restrictions on factor loadings, was analyzed, and adequate fit indices were found for both groups. When comparing the values of M1 and M2 (metric invariance), a minimal difference was observed:  $\Delta CFI < 0,01$ , indicating that there are no significant differences between these two models and that factor loadings are equivalent (table 4). Subsequently, strong invariance (M3), which imposes restrictions on factor loadings and intercepts, was evaluated. This model reported similar fit indices to M2, and when compared to M1, minimal differences ( $\Delta \leq 0,01$ ) were obtained, suggesting that intercepts are invariant across groups. Finally, model M4 (strict invariance), which imposes restrictions on factor loadings, intercepts, and residuals, was tested. The results showed invariance in all of these aspects, supporting the comparability of results across different gender and age groups.

	$\chi^2$	df	RMSEA	[IC 90 %]	p	SRMR	TLI	CFI	$\Delta CFI$
Gender									
M1	256,3	102	0,05	0,05-0,06	<,001	0,03	0,95	0,96	
M2	260,6	111	0,05	0,04-0,06	<,001	0,03	0,96	0,96	<,001
M3	273,1	120	0,05	0,04-0,06	<,001	0,03	0,96	0,96	<,001
M4	276,7	132	0,05	0,04-0,05	<,001	0,03	0,97	0,97	-0,01
Age									
M1	378,6	153	0,07	0,06-0,07	<,001	0,03	0,94	0,95	

M2	402,1	171	0,06	0,05-0,07	<,001	0,03	0,95	0,95	<,001
M3	416,3	189	0,06	0,05-0,07	<,001	0,03	0,95	0,95	<,001
M4	414,2	213	0,05	0,04-0,06	<,001	0,03	0,96	0,96	-0,01
Note: M1: Configural, M2: Metric, M3: Scalar, M4: Strict.									

DISCUSSION

The aim of this research was to analyze the factorial structure, reliability, and invariance according to sex and age of the work performance scale. The results suggest that this instrument is promising for evaluating work performance in nurses. Confirmatory factor analysis (CFA) supported the proposed three-factor structure: task performance, counterproductive behaviors, and contextual performance.<sup>(21)</sup> In addition, adequate internal consistency was found in each dimension, as well as concurrent validity and factorial invariance according to sex and age.

The three-factor structure found in a sample of Peruvian nurses is consistent with the proposal by Gabini & Salessi,<sup>(40)</sup> and like the studies by Ramos-Villagrasa et al.<sup>(41)</sup> and Campos,<sup>(42)</sup> it provides a rich context for discussing CFA in relation to the theoretical elements of factor analysis, factor loadings, and item removal. CFA was used to evaluate the factorial structure of a proposed three-factor model, finding an acceptable fit after the removal of items with low factor loadings, specifically item 12. This process is in line with previous practices, where item removal is based on statistical and theoretical criteria to improve the quality of the instrument.<sup>(29,33)</sup> Moreover, the need to remove items to improve the RMSEA suggests a peculiarity in the nursing context that may not be present in more general populations. This highlights the importance of considering the specific work context when applying and adapting performance models. Subsequently, the fit indices obtained from the second model, specifically the RMSEA, CFI, and TLI, suggest a good fit of the model to the data, aligning with the findings of Campos,<sup>(42)</sup> who also reported significant improvements in the indices after adjustments based on modification indices and the removal of redundant items or those with low load. This process of adjustment and comparison underscores the importance of a rigorous methodology in confirming theoretical models through CFA.

On the other hand, our findings indicate that the second model evaluated presents AVE values above the recommended threshold of 0,50,<sup>(32)</sup> suggesting an adequate explanation of the latent factors by their observed variables and high reliability, an aspect not addressed in the study by Gabini & Salessi.<sup>(40)</sup> The research by Ramos-Villagrasa et al.<sup>(41)</sup> also reported adequate levels of reliability for the dimensions evaluated, although it did not perform an AVE analysis. Our findings are comparable in terms of including AVE in our study, providing a more comprehensive analysis of the scale's construct validity.

The 12-item version indicated that the Cronbach's alpha ( $\alpha$ ), and McDonald's omega ( $\omega$ ) coefficient values were above the recommended levels, making the job performance scale a reliable tool. However, unlike other studies, the omega coefficient, which reflects the proportion of variance in scale scores associated with a global factor,<sup>(43)</sup> reflecting the construct's influence, were calculated in the global model and subsamples. The higher their magnitude, the better represented it is.<sup>(44)</sup> These coefficients are considered better estimators than alpha, which tends to underestimate reliability. The values of the corrected item-total correlations were good, indicating adequate homogeneity.

Moreover, for the first time, the factorial invariance of the job performance scale was reported in a sample of nurses, both men and women, as well as by age. In the current study, from configural to strict invariance was acceptable, indicating that it can be evaluated with the same accuracy among groups by sex and age. The importance of these analyses allows for considering the characteristics of men and women, as the psychological characteristics of these groups may differently affect their behavior. Given a gender role conflict that suggests that nurses experience more conflict than male nurses due to gender stereotypes in society,<sup>(23)</sup> having an invariant instrument could help evaluate two population groups regarding their job performance. Likewise, performance can differ according to age. In addition, future studies should explore strict invariance in other populations, as well as explore other groups, such as socioeconomic status, cultures, and clinical groups.

Implications

The study provides a promising instrument for evaluating the work performance of nurses and can be used to generate reliable and valid data for research on this topic. Additionally, for nursing practice and management, the IWPQ-P can be used to assess the work performance of nurses, identify areas for improvement, and provide feedback for professional development. Furthermore, the invariance across gender and age suggests that the instrument can be used to evaluate performance equitably across different groups of nurses. This may be particularly important in addressing gender biases and stereotypes that exist in society and ensuring that nurses receive the appropriate recognition and support for their work.

## Limitations

Despite the results showing adequate psychometric properties for the Peruvian version of the Work Performance Questionnaire (IWPQ-P), this study has some limitations. Firstly, the sample was convenience-based, which may limit the generalization of the results to other populations of nurses. Additionally, the study design was cross-sectional, making it difficult to establish causal relationships between variables and not allowing for the evaluation of the temporal stability of scale scores, which makes it necessary to include a longitudinal design and the assessment of test-retest reliability in future research. Another limitation lies in the use of self-report techniques, which may be subject to biases such as social desirability, limited introspection, and memory distortion, which could affect the accuracy of participants' responses. Future studies could incorporate multiple sources of information, such as evaluation by supervisors or colleagues, as well as the use of objective records of work performance. Finally, although factorial invariance by sex and age was examined, it would be interesting to explore invariance based on other sociodemographic and contextual variables, such as level of education, work experience, socioeconomic status, or culture, to better understand how these characteristics may influence work performance and the validity of the scale in different contexts.

## CONCLUSIONS

The evaluation of the internal structure of the Work Performance Questionnaire (IWPQ-P) revealed a satisfactory three-factor structure, presenting adequate and stable psychometric properties in a 12-item version. In addition, strict factorial invariance was established based on sex and age, which represents a significant contribution to the field of work performance measurement. Consequently, the Work Performance Questionnaire is considered a valid and reliable tool for assessing work performance in the field of nursing.

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