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Psychometric Review of the Burnout Assessment Tool-12 (BAT-12) in a Sample of Employees in Puerto Rico

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Resumen

Objetivo: Este estudio examina sus propiedades psicométricas en una muestra de empleados puertorriqueños.

Materiales y Métodos: Se realizó un estudio de las propiedades psicométricas del BAT-12 con una muestra de 488 empleados puertorriqueños, evaluando su estructura factorial, confiabilidad, invarianza de medición y validez. Se probaron cuatro modelos factoriales: modelo unidimensional, de cuatro factores, de segundo orden y bifactorial.

Resultados: Los resultados indican que el modelo bifactorial presentó el mejor ajuste, sugiriendo que el agotamiento se conceptualiza mejor como un constructo general con cuatro dimensiones interrelacionadas: Agotamiento, Distancia Mental, Deterioro Cognitivo y Deterioro Emocional. El BAT-12 mostró una alta confiabilidad (ω = .91), invarianza de medición entre género y edad, y asociaciones esperadas con variables laborales (e.g., demandas laborales, control del trabajo, autoeficacia).

Conclusión: Estos hallazgos respaldan el uso del BAT-12 para la evaluación del burnout en entornos ocupacionales. Se recomienda investigar su validez predictiva, estabilidad longitudinal y validez discriminante frente a la depresión.

Palabra clave: *BAT-12, Agotamiento, Análisis de Factores Confirmatorio, Estructura Interna, Invarianza de Medición, Propiedades Psicométricas*

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Abstract

Aim: This study examines its psychometric properties in a sample of Puerto Rican employees.

Materials and methods: A study to examine the psychometric properties of the BAT-12 in a sample of 488 Puerto Rican employees, assessing its factor structure, reliability, measurement invariance, and validity. Four competing models were tested: one-factor, four-factor, second-order, and bifactor models.

Results: Findings suggest that the bifactor model provided the best fit, indicating that burnout is primarily a general construct with four distinct but interrelated dimensions: Exhaustion, Mental Distance, Cognitive Impairment, and Emotional Impairment. The BAT-12 demonstrated strong reliability (ω = .91), measurement invariance across gender and age, and expected associations with workplace variables (e.g., job demands, job control, self-efficacy).

Conclusion: These findings support the use of BAT-12 for burnout assessment in occupational settings. Future research should examine its predictive validity, longitudinal stability, and discriminant validity from depression.

Keywords: *BAT-12, Burnout, Confirmatory Factor Analysis, Internal Structure, Measurement Invariance, Psychometric Properties*

Introduction

Burnout is a growing concern in organizational settings, particularly in high-stress work environments (e.g., Lepore, 2021; Maslach & Leiter, 2016; Moss2021). Although the popularity of burnout is easily demonstrated by searching for "burnout" in Google Scholar, which yields more than 1,900,000 results, burnout was not recognized as a medical condition until recently. Instead, it was recently classified as an "occupational phenomenon" in the 11th revision of the International Classification of Diseases (World Health Organizational; WHO, 2019).

The gold standard measure of burnout is the Maslach Burnout Inventory (MBI; Maslach & Jackson, 1981) because it has been estimated that the MBI has been used in 88% of all publication related to burnout (Boudreau et al., 2015). The MBI contains three factors, which originally labelled as emotional exhaustion, depersonalization, and personal accomplishment. In addition, different versions of the MBI have been created or adapted to other occupations that do not necessarily provide human services, such as teachers (MBI-Educator Survey) and general occupations (MBI-General Survey).

Despite the popularity of the MBI, there are authors who indicate that the MBI has several deficiencies (e.g., Schaufeli et al., 2020; Schaufeli & De Witte, 2023). First, the burnout conceptualization is problematic because it was developed inductively based on interviews with human service professionals as stated by some authors (e.g., Maslach & Schaufeli, 1993) and the literature in psychometric recommends that test should be develop using a deductive approach (e.g., Spector, 1992). Second, the MBI suffers of psychometric shortcomings, such as low reliability coefficients of the depersonalization and personal accomplishment scales and the inability to have an overall burnout score because the scores of the three MBI scales cannot be added together because the score of the personal accomplishment scale cannot be inverted because it creates artifact problems (Schaufeli & Salanova, 2007). Finally, because the MBI does not produce a single burnout score that can be indicative for overall burnout (Maslach et al., 2017), its usefulness for individual burnout assessment is rather poor. Moreover, the Manual of the MBI does not report burnout cutoff scores and, therefore, no attempt has been made to determine at what point a score denotes burnout, which is important to practitioners.

Description of the Burnout Assessment Tool

Based on the above shortcomings, Schaufeli et al. (2020) developed the Burnout Assessment Tool (BAT) for individual and group-based assessment of burnout. The BAT conceptualizes burnout as a syndrome, which implies that the BAT should produce both a composite score that refers to the burnout syndrome, as well as different subscale scores that refers to each of the four symptoms dimensions. This conceptual model was guided and interpreted because of their interview results from the 50 professionals that deal with burnout employees daily (Schaufeli et el., (2020). This resulted in a conceptual model with four core dimensions: (1) exhaustion (i.e., a severe loss of energy that results in feelings of both physical and mental exhaustion); (2) mental distance (i.e., a strong reluctance or aversion to work, indifference, and cynicism); (3) cognitive impairment (i.e., memory problems, attention and concentration deficits, and poor cognitive performance); and (4) emotional impairment (i.e., intense emotional reaction such as anger or sadness, and feeling overwhelmed by one's emotions). Besides the four dimensions of burnout, BAT covers two secondary symptoms subscales: psychological distress (i.e., anxiety and sleep symptoms) and psychosomatic disorders (i.e., muscular and gastrointestinal disorders, headaches). Thus, the original version of BAT included 33 items measuring the core components (23 items) and the secondary symptoms (10 items). The BAT has been adapted and translated to several languages around the world (e.g., Androulakis et al., 2023; Lazauskaite-Zabielske et al., 2023; Santin et al., 2025) including Spanish (Vinueza-Solórzano et al., 2021).

Moreover, a condensed version of the BAT, called the BAT-12, was created using Rasch analysis and include three items for each of the four core dimensions of burnout syndrome (Consiglio et al., 2021). Short form psychological measures have proven to be very useful in research activities and practices, offering the benefits of saving respondents' time and energy as well as increasing the rate of compliance. This helps to overcome the lower compliance, lack of concern, and temporary and retrospective perceived burden that come with long measures (Eisele et al., 2020). Nevertheless, only few studies (e.g., Androulakis et al., 2023; Mazzatti et al., 2022; Santin et al., 2025; Vinueza-Solórzano et al., 2021) have examined the psychometric properties of BAT-12 and no study has done so in Puerto Rico. Therefore, the current study explores the psychometric properties of the BAT-12 with a sample of employees in Puerto Rico.

Objectives of the Study

The aims that guided the current study were as follow: (1) to examine the internal structure of the BAT-12; (2) to examine the measurement invariance by gender and age group; (3) to examine validity evidence on the relationship with other variables; (4) to examine the realibility of the BAT-12 via internal consistency using Cronbach's alpha and McDonald's omega with their respectives confidence intervals and their descriptive statistics, such as the mean, standard deviation, among others.

Method

Participants

A total of 488 protocols from four different research conducted in Puerto Rico (Arroyo-Vélez, 2024; Flores-Bonano, 2023; González-Portalatín, 2023; Monroig-González, 2024). Protocols were collected from employees of different organizations in Puerto Rico and selected through a non-probabilistic sample for this instrumental research design (Ato et al., 2013). They were selected based on availability and their voluntariness, anonymity and the right to abandon the investigation were guaranteed when they considered it necessary. Table 1 shows the description of the sociodemographic characteristics of this sample. Of the total sample, 55.3% (270) of the people were female, and 57.2% (279) were between 31-50 years of age, which can be considered to be in the prime of their working careers.

Table 1

Sociodemographic characteristics of the sample

Variable	f	%
Gender		
Male	218	44.7
Female	270	55.3
Age		
21-30	102	20.9
31-50	279	57.2
≥ 51	96	19.7

Nota. n = 488.

Measures

We measured burnout using the short version of BAT-12 translated and adapted into Spanish by Vinueza-Solórzano et al. (2021) for the Ecuadorian workers. Participants answer the items on a scale of 1 (Never) to 5 (Always). The reliability coefficient via internal consistency of BAT-12 in the original study was very good (α=.92; Hadzibajramovic et al., 2022). In the Ecuadorian study the BAT-12 obtained the following internal consistency reliability: α=.87 and ω=.86. Meanwhile, the dimensions obtained the following reliability coefficients: Exhaustion (α =.84 & ω=.84), Mental Distance (α=.52 & ω=.53), Cognitive Impairment (α=.86 & ω=.86), and Emotional Impairment (α=.82 & ω=.88). Regarding its internal structure of the BAT-12, a second-order-four factor solution obtained excellent fit indices (Vinueza-Solórzano et al., 2023) when compared to the unifactorial solution.

We used the Demand-Control-Support Model Inventory (DCSMI) to measure work demands, job control, and job support (Rosario-Hernández & Rovira-Millán, 2014). The DCSMI contains three second-order factors which are Work Demands, Job Control and Job Support, which has 29 items and is a Likert-agreement response format ranging from '1' (Totally Disagree) to '6' (Totally Agree). The Job Demands factor has three dimensions which are Psychological Demands, Emotional Demands and Physical Demands with six, four and five items respectively. The Job Control factor has two dimensions which are Autonomy and Skills which have three items each. Whereas the Job Support factor has two dimensions which are Co-Worker Support and Supervisory Support with four items each. Factor analyses support the second-order hierarchical three-dimensional internal structure with seven first-order factors. Reliability coefficients using Cronbach's alpha ranged from 0.63 to 0.95.

We used the Work-Related Rumination Scale (WRRS; Cropley et al. (2012), but the Spanish Version (WRRS-SV) translated and validated by Rosario-Hernández et al., 2021) in Puerto Rico. The WRRS has originally 15 questions using a 5-point Likert scale (1 = very seldom or never, 2 = seldom, 3 = sometimes, 4 = often, and 5 = very often or always). Rosario-Hernández and collaborators retained 11 of the 15 items in the WRRS-SV, four items of the affective rumination and problem-solving pondering subscales and three items of the detachment subscale. As conceptualized by Cropley and collaborators, results with a Puerto Rican sample of workers support a three-factor internal structure of the WRRS-SV (Rosario-Hernández et al., 2021) and authors reported that reliability ranged between .72 to .87 via Cronbach's alpha and McDonald's omega.

To measure self-efficacy, we used the General Self-Efficacy Scale adapted into Spanish by Baessler and Schwarzer (1996). This instrument is designed to measure participants' perception of their own level of self-efficacy in the work environment. It consists of 10 items that participants must rate on a Likert scale ranging from 1 (Not at all confident) to 4 (Completely confident). Item scores range from 10 to 40 points, and responses are provided on a four-point Likert-type scale, where participants choose between the options: not true (1); barely true (2); somewhat true (3); or true (4). A higher score indicates higher perceived general self-efficacy. According to Baessler and Schwarzer, the scale exhibits a good internal consistency, with a Cronbach's alpha coefficient of .81, and shows a high level of convergent and discriminant validity.

Finally, to measure task performance, the Self-Assessment of Task Performance Scale developed by Rosario-Hernández et al. (2023) was used. It is used to assess participants' perception of their own work performance. It consists of five items that participants must rate on a Likert scale ranging from 1 = Never to 5 = Always. The authors indicate that factor analyses support an internal one-factor structure. Reliability has been examined through internal consistency using the Cronbach's alpha and McDonald's omega techniques and in both coefficients were equal to .890.

Procedures

First, authorization to carry out the research were requested to the Institutional Review Board of Pontifical Catholic University of Puerto Rico (PCUPR) and Ponce Health Sciences University (PHSU) by their respective principal investigator. Three protocols were from PCUPR (Protocol #: CC-23-24-04; CC-23-24-18; CC-23-24-19) and one from PHSU (Protocol #: 2307158417).

In order to estimate descriptive statistics, item analysis, reliability analysis, and correlation, the data were initially examined using the IBM-SPSS version 29.0 program. In addition, we used the "lavaan" package of the R4.4.3 program (Rosseel, 2012) to perform the confirmatory factors analyses and invariance testing by gender and age group. First, we performed describtive statistics analyses to obtain sociodemographic characteristics of the sample. Also, we conducted descriptive analyzes of the scale's items, such as the mean, standard deviation, skewness, and kurtosis. An item analysis was also performed to obtain the discrimination index which is also known as "item-total correlation" or "rbis". Second, BAT-12 items were subjected to CFA using the structural equation modeling to confirm its internal structure using the weighted least squares-mean and variance adjusted (WLSMV) estimator, which robustly deals with potentially non-nomal data and items are treated as ordinal (Li, 2016a, 2016b). To evaluate the fit of our measurement models, we applied a percentile-based approach to interpret the fit indices, as recommended by recent methodological advancements (e.g., Howard et al., 2025) given the dichotomous cutoff values are overly simplistic and do not account for nuanced model quality. This approach provides a deeper understanding of model performance by classifying fit indices into percentile-based categories of Very Weak, Weak, Moderate, Strong, and Very Strong fit. Kline (2016) recommends the use of at least four fit indices, although more can be reported. One of the indices that is reported is Chi-Square (χ2); however, given that the χ2 is sensitive to the sample size and therefore the probability of rejecting the hypothesized model increases when the sample size increases, it is recommended to take into account other indices (Marsh et al., 1996) and for this reason it was reported but not taken into consideration as a fit index. Thus we assessed the fit of the models using commonly recommended fit indices: Root Mean Square Error of Approximation (RMSEA), Standardized Root Mean Square Residual (SRMR), Comparative Fit Index (CFI), and Tucker-Lewis Index (TLI). These indices were compared against empirically derived percentile-based ranges to facilitate contextualized interpretation (see table 2):

Table 2

Guidelines for model fit interpretation using percentile ranges following Howard et al. (2025) recommendations

Interpretation (Percentile)	Fit Index			
	SRMR	RMSEA	CFI	TLI
Very Weak (<10)	> .100	> .100	< .900	< .900
Weak (10 - 33)	.081 - .100	.081 - .100	.900 - .920	.900 - .920
Moderate (34 - 66)	.061 - .080	.061 - .080	.921 - .950	.921 - .950
Strong (67 - 90)	.030 - .060	.030 - .060	.951 - .980	.951 - .980
Very Strong (>90)	< .030	< .030	> .980	> .980

We assessed measuring invariance of the BAT-12 among gender and age groups. We tested configural invariance, metric invariance, and scalar invariance as suggested by some of the literature (e.g., Byrne, 2016; Muthén & Muthén, 1998-2012; Wang & Wang, 2012). We conducted hierarchical tests for invariance of measurement parameters. First, we examined the configured invariance model or pattern invariance, which imposes no equality restrictions on model parameters. This is a necessary condition for testing invariance by comparing it with other invariance models based on fit indices. Second, we examined the weak invariance model or metric invariance. In this model, the factor loadings are treated as invariant across groups. This ensures that the measures are on the same scale across groups for making valid comparisons. Third, we examined the strong invariance model. This model imposes invariance on both factor loadings and item intercept across groups. This is to ensure the underlying factors can be compared across groups. We used the SRMR, RMSEA, CFI, and TLI indices to evaluate measurement invariance. These indices have been shown to be more stable and less sensitive to factors such as sample size or model complexity, making them ideal for this purpose (Howard et al., 2025; Hu & Bentler, 1999). Furthermore, their interpretation based on percentiles allows for a more nuanced evaluation of the model compared to traditional cutoff-based approaches. We capitalized on fit index differences for SRMR, RMSEA, CFI and TLI (i.e., ΔCFI & ΔTLI ≤-.01, ΔSRMR & ΔRMSEA ≥ .03 for metric invariance & ≥.015 for scalar invariance) reference points as recommended by Cheung and Rensvold (2002), who found in a Monte Carlo study that these indices were equally sensitive to all types of invariances. Notably, as the X2 is known to

be highly influenced by the sample size (e.g., Rigdon, 1995), it was reported but not considered as fit index for the invariance testing. Fourth, we examined the convergent and divergent validity of the BAT-12 by correlating scores on these with each other and with other supposedly different constructs. Finally, we performed descriptive, reliability, and correlation analyses for the BAT-12 to estimate means, standard deviation, and internal consistency via Cronbach's alpha and McDonald's omega.

Results

Item Response Frequencies, Descriptive Statistics and Discrimination Index

Table 3 presents the item-level analysis for the BAT-12, including response frequencies, descriptive statistics (mean, standard deviation, skewness, and kurtosis), and the item discrimination index (rbis). The analysis provides insights into the distribution of responses and the ability of each item to differentiate between individuals with different levels of burnout. Items BAT1 to BAT5 have relatively higher mean values (M>2.5), indicating that these burnout symptoms are more frequently reported. Items BAT10 to BAT12 have the lowest means (M<2.0), suggesting that these symptoms occur less frequently. The discrimination index (rbis) is high for most items (rbis >.7), meaning they effectively distinguish between high and low burnout individuals. Skewness and kurtosis values indicate a slightly skewed distribution for some items (e.g., BAT11 has a high positive skew of 1.422), suggesting that lower-frequency responses are more common.

Table 3

Item univariate analysis and discrimination index (r_{bis}) of the Burnout Assessment Tool-12 (BAT-12)

Item	Frequencies of Response Options (BAT)					Descriptive Statistics and Discrimination Index (r_{bis})				
	Never	Rarely	Sometimes	Often	Always	M	SD	Sk	Ku	r_{bis}
BAT1	26	75	216	133	38	3.17	0.961	-.175	-.085	.758
BAT2	37	117	172	120	42	3.03	1.065	-.002	-.599	.732
BAT3	45	141	176	96	30	2.85	1.039	.145	-.499	.765
BAT4	58	108	146	100	76	3.06	1.235	.009	-.929	.561
BAT5	129	119	156	62	22	2.44	1.141	.316	-.714	.656
BAT6	217	112	82	52	25	2.09	1.223	.856	-.370	.505
BAT7	152	181	103	36	16	2.15	1.046	.788	.118	.854
BAT8	127	205	100	40	16	2.21	1.023	.777	.196	.870
BAT9	159	226	73	21	9	1.97	0.902	1.029	1.202	.728
BAT10	187	206	66	20	9	1.89	0.915	1.124	1.296	.686
BAT11	272	149	49	14	4	1.63	0.841	1.422	1.904	.747

Validity Evidence Based on the Internal Structure

Table 4 presents the fit indices, factor loadings, and ancillary statistics for the competitive models of the Burnout Assessment Tool-12 (BAT-12), assessing the adequacy of different factorial structures. This analysis compares four primary models: (1) the one-factor model, which assumes that burnout is a single, unified construct; (2) the four-factor model, which conceptualizes burnout as a combination of four distinct but interrelated dimensions - Exhaustion, Mental Distance, Cognitive Impairment, and Emotional Impairment; (3) the second-order model, which posits that these four dimensions are explained by a higher-order general burnout factor; and (4) the bifactor model, which incorporates a general burnout factor alongside specific factors, accounting for unique variance in each dimension. The table reports key fit indices including χ2, RMSEA, SRMR, CFI, and TLI, while bifactor-specific indices (ECV, Omega H, H, and ARPB) assess the contribution of the general factor in the bifactor model. This comparison is crucial for identifying the most appropriate model for conceptualizing burnout in the analyzed sample. Applying Howard et al. (2025)'s percentile-based approach to fit index interpretation, the one-factor model exhibits poor fit, as its SRMR and RMSEA values fall within the <25th and <10th percentiles, indicating an unacceptable model structure despite a seemingly good CFI and TLI (85th percentile), which is misleading due to the poor RMSEA (Kenny et al., 2014). In contrast, the four-factor model demonstrates an excellent fit, with SRMR and RMSEA values in the 90th and 95th percentiles, respectively, and near-perfect CFI and TLI scores in the 99th percentile. The second-order model also shows strong fit, with SRMR and RMSEA in the 85th percentile and CFI and TLI nearing perfection at the 98th percentile. Finally, the bifactor model exhibits the best overall fit, as all fit indices exceed the 90th and 95th percentile thresholds, making it the most statistically robust representation of burnout.

Table 4

Fit indices, factor loadings, and ancillary statistics of the BAT-12 competitive models

Scale/ Fit Index	Item	Competitive Models															
		One-Factor	Four-Factor				2nd Order with Four-Factor				Bifactor					IECV	ARPB
			1	2	3	4	1	2	3	4	GF	1	2	3	4		
Exhaustion (Exh)	bat1	.825	.912				.912				.757	.461				.729	.090
	bat2	.755	.840				.840				.690	.464				.689	.094
	bat3	.780	.853				.853				.670	.598				.557	.164
Mental Distance (MD)	bat4	.619		.729				.732			.632		.293			.823	.021
	bat5	.700		.828				.828			.712		.689			.516	.017
	bat6	.622		.740				.736			.662		.167			.940	.060
Cognitive Impairment (CI)	bat7	.937			.957				.956		.734			.587		.610	.277
	bat8	.933			.958				.959		.728			.668		.543	.282
	bat9	.773			.860				.861		.748			.365		.808	.033
Emotional Impairment (EI)	bat10	.767				.873				.874	.782				.310	.864	.019
	bat11	.824				.908				.909	.785				.460	.744	.050
	bat12	.737				.812				.810	.673				.557	.593	.095
$\bar{\lambda}$		.773	.868	.766	.925	.864					.714	.508	.383	.540	.442		
			Interfactor Correlation				Factors correlation with BO										
			Exh	MD	CI	EI	Exh	MD	CI	EI							
Exh			1														
MD			.775	1													
CI			.632	.637	1												
EI			.656	.739	.732	1											
Burnout (BO)							.812	.872	.793	.870							
χ^2 (df)		1055.872* (54)		101.168* (48)				144.053* (50)						83.722* (42)			
χ^2Relative		19.55		2.11				2.88						1.99			
SRMR		.116		.038				.046						.038			
RMSEA (CI)		.195 (.185 - .204)		.048 (.035 - .072)				.062 (.050 - .074)						.045 (.031 - .059)			
CFI		.973		.999				.997						.999			
TLI		.967		.998				.997						.998			
Bifactor Indices																	
ECV											.678	.344	.304	.362	.260		
PUC											.818						
Omega H											.902	.341	.247	.350	.260		
H											.929	.524	.507	.598	.452		
ARPB											.100						

Note. n = 488.

Measurement Invariance by Gender and Age Groups

Table 5 evaluates the measurement invariance of the BAT-12 across gender and age groups. Three levels of invariance were tested: configural (same factor structure), metric (equal factor loadings), and scalar (equal item intercepts). Results show that the BAT-12 meets configural, metric, and scalar invariance criteria for both gender and age, meaning that burnout is measured equivalently across these groups due to the minimal changes in fit indices.

Table 5

Measurement invariance of the Burnout Assessment Tool by gender and age

	Model	χ^2 (df)	SRMR	RMSEA	CFI	TLI	Reference Model	$\Delta\chi^2$	ΔSRMR	$\Delta RMSEA$	ΔCFI	ΔTLI
				Gender (Male/Female)								
1.	Configural	117* (84)	.044	.040	.999	.999	-----					
2.	Metric	170* (103)	.052	.052	.998	.998	1	+53	+.008	+.012	-.001	-.001
3.	Scalar	157 (134)	.046	.027	.999	.999	2	-13	-.006	-.025	+.001	+.001
				Age (21-30/31-50/≥51)								
1.	Configural	119* (126)	.043	.000	1.00	1.00	-----					
2.	Metric	204* (164)	.054	.039	.999	.999	1	+85	+.011	+.039	-.001	-.001
3.	Scalar	211* (224)	.047	.000	1.00	1.00	2	+7	-.007	-.039	+.001	+.001

Note. *p < .05; df = degree of freedom.

Validity Evidence Based on the Correlation with Other Variables

Table 6 presents the correlations among the BAT-12 total score and its four subscales (Exhaustion, Mental Distance, Cognitive Impairment, Emotional Impairment). It includes both observed and latent construct correlations. The total BAT-12 score strongly correlates with all subscales (r > .80), confirming a strong general burnout construct. The highest subscale correlations are between Mental Distance and Exhaustion (r = .775), suggesting these dimensions often co-occur. Cognitive Impairment and Emotional Impairment are moderately correlated with other dimensions, indicating that they may reflect distinct burnout effects.

Table 6

Correlation matrix of the Burnout Assessment Tool-12 (BAT-12) and its subscales

	Scale/Subscale	1	2	3	4	5
1.	BAT-12	1	.821**	.837**	.823**	.813**
2.	Exhaustion	.812**	1	.671**	.548**	.523**
3.	Mental Distance	.872**	.775*	1	.529**	.571**
4.	Cognitive Impairment	.793**	.632**	.637**	1	.640**
5.	Emotional Impairment	.870**	.656**	.739**	.732**	1

Note. n = 488, *p < .05, **p < .01; values above the diagonal are the observed scores correlation coefficients and values below the diagonal are the correlation coefficients of the latent constructs.

Table 7 examines the validity of the BAT-12 by correlating it with key workplace variables: job demands, job control, job support, affective rumination, self-efficacy, and task performance. Positive associations with job demand (r=.541) and affective rumination (r=.655) confirm that burnout is higher in demanding jobs and in those who ruminate about work. Negative correlations with self-efficacy (r=−.386) and task performance (r=−.343) indicate that burnout is associated with lower confidence and productivity. Job control has a weak association (r=−.068), suggesting that autonomy alone may not be a strong protective factor against burnout.

Table 7

Relation with other variables validity evidence of the Burnout Assessment Tool-12 (BAT-12)

Scale/Subscale	BAT-12	Exhaustion	Mental Distance	Cognitive Impairment	Emotional Impairment
Job Demands	.541**	.603**	.407**	.304**	.462**
Job Control	-.068	-.041	-.004	-.126	-.064
Job Support	-.318**	-.325**	-.239**	-.206**	-.276**
Affective Rumination	.655**	.640**	.487**	.541**	.484**
Self-Efficacy	-.386**	-.221**	-.246**	-.439**	-.388**
Task Performance	-.343**	-.176*	-.303**	-.329**	-.337**

Note. n = 488, *p < .05, **p < .01.

BAT-12 Reliability and Descriptive Statistics

Table 8 presents the mean, standard deviation, and reliability estimates (Cronbach's alpha and McDonald's omega) for the BAT-12 and its subscales. Highest burnout levels are seen in Exhaustion (M = 3.01) and Mental Distance (M = 2.53). Lowest burnout scores are found in Emotional Impairment (M = 1.77), suggesting that emotional impairment is less frequent in this sample. Reliability estimates (α and ω) are excellent for the total scale (>.90) and strong for most subscales (>.80), except Mental Distance (α=.745), which is acceptable.

Table 8

Descriptive statistic and reliability of the Burnout Assessment Tool-12 (BAT-12)

Scale/Subscale	M	SD	Range	Reliability $\propto$ (CI)	ω (CI)
BAT-12	2.36	0.736	1 - 5	.912 (.897 - .924)	.909 (.891 - .922)
Exhaustion	3.01	0.911	1 - 5	.869 (.841 - .891)	.870 (.845 - .893)
Mental Distance	2.53	0.977	1 - 5	.745 (.695 - .784)	.752 (.713 - .789)
Cognitive Impairment	2.11	0.911	1 - 5	.906 (.887 - .923)	.917 (.901 - .931)
Emotional Impairment	1.77	0.777	1 - 5	.847 (.807 - .880)	.847 (.808 - .882)

Note. n = 488; M = Mean, SD = Standard Deviation, CI = Confidence Interval; $\propto$ = Cronbach's alpha, ω = McDonald's omega.

Discussion

Internal Structure

This study compared four competing models of the BAT-12's factor structure: a one-factor model, a four-factor model, a second-order model with four factors, and a bifactor model. The one-factor model (all 12 items loading on one burnout factor) showed a poor fit, indicating that a unidimensional structure cannot adequately capture the data. In contrast, the four-factor model, corresponding to the theorized dimensions of Exhaustion, Mental Distance, Cognitive Impairment, and Emotional Impairment, exhibited excellent fit, supporting the conceptualization of burnout as a multidimensional construct. The second-order model (four first-order factors under a higher-order "burnout" factor) also fit the data well, suggesting that while the four dimensions are distinct, they can be explained by an overarching burnout construct. The bifactor model emerged as the best-fitting solution, outperforming all other structures. This model, which includes both a general burnout factor and four specific factors, showed the lowest χ^2 and RMSEA values and near-perfect fit indices (CFI and TLI = .999). These results indicate that while each BAT-12 item taps into a specific burnout dimension, they also strongly reflect a dominant general burnout factor, which accounts for most of the variance. As ancillary statistics suggest, the general factor's Explained Common Variance (ECV = .678) and omega hierarchical (ωH = .902) indicate that a single burnout factor underlies responses, while specific omega hierarchical values (ωH ranging from .247 to .350) suggest some limited independence of the subfactors. These findings align with prior research, demonstrating that burnout is best represented as a general syndrome with distinct but correlated symptoms (Schaufeli et al., 2020; Mazzetti et al., 2022).

Measurement Invariance

A crucial quality of the BAT-12 is its consistency across different groups. The instrument demonstrated measurement invariance across key demographics; therefore, results supported configural, metric, and scalar invariance across gender (male vs. female) and across age groups. In other words, the BAT-12 maintained the same factor structure for men and women and for younger and older workers, with equal factor loadings and item intercepts across groups. The changes in fit indices between unconstrained and constrained models were negligible (ΔCFI = 0, ΔRMSEA < 0.01), indicating that respondents interpret and respond to the BAT-12 items in a comparable manner regardless of gender or age. This invariance finding is important for practical use because it confirms that any differences in burnout scores between, say, male and female employees or between age cohorts reflect true differences in burnout levels rather than measurement bias. These results are consonant with other studies in which measurement invariance have been examined (e.g., Mazzetti et al., 2022; Redinghuys & Morgan, 2023; Santin et al., 2025).

Convergent and Divergent Validity

Additionally, the BAT-12 exhibited strong convergent and divergent validity, correlating positively with job demands (r = .54) and affective rumination (r = .66), and negatively with job support (r = –.32), self-efficacy (r= –.39), and task performance (r = –.34). This pattern aligns with the Job Demands-Resources model, confirming that burnout is linked to high work demands and low resources (e.g., Bianchi et al., 2018; Rosario-Hernández et al., 2024; Testoni et al., 2023; Wilkes et al., 2018), while also predicting decreased productivity (e.g., Halbesleben & Buckley, 2004; Maslach, 1982; Wright & Bonett, 1997).

Reliability and Descriptive Statistics

The BAT-12 total scale and its subscales demonstrate strong reliability, with all reliability coefficients (α & ω) above the acceptable threshold of 0.70 (DeVellis & Thorpe, 2022), especially when considering the small number of items on the four subscales of BAT-12 (Ponterotto & Ruckdeschel, 2007). The overall reliability of the BAT-12 was higher than most of the reliability obtained by other studies (e.g., Androulakis et al., 2023; Mazzettti et al., 2022; Oprea et al., 2021; Sinval et al., 2022; Vinueza-Solórzano et al., 2021), except for the study of De Beer et al. (2023) in Norway. Regarding the reliability of the four core dimensions, the reliability coefficients obtained in our study were similar to other studies (e.g., Androulakis et al., 2023; Mazzettti et al., 2022; Oprea et al., 2021; Sinval et al., 2022; Vinueza-Solórzano et al., 2021); however, the reliability of the Cognitive Impairment subscale was higher when compared to those obtained in other studies (e.g., Androulakis et al., 2023; De Beer et al., 2024; Mazzettti et al., 2022; Oprea et al., 2021; Sinval et al., 2022; Vinueza-Solórzano et al., 2021). Nevertheless, one could claim that factor loadings are extremely similar because both coefficients were fairly similar in the BAT-12 and the four subscales. It is presumed that any differences in the factorial loadings were negligible and had no discernible impact on the distance between the two coefficients because of the similarity of the coefficients (Hayes & Coutts, 2020). Although the other subscales and the global burnout scoring can be used for individual decisions, when necessary, the slightly lower reliability of Mental Distance suggests that this subscale may benefit from further refinement to increase consistency. However, the possibility of measurement error can still be regarded as high because Mental Distance is below the .85 threshold (Ponterotto & Ruckdeschel, 2007). However, it remains sufficiently reliable for research and practical applications. Overall, the BAT-12 is a reliable tool for assessing burnout and its multidimensional components in this sample. Exhaustion emerges as the most prevalent symptom of burnout in this sample, while Emotional Impairment appears to be the least reported.

In terms of descriptive statistics of BAT-12, Exhaustion emerges as the most prevalent symptom of burnout in this sample, suggesting that physical and emotional depletion is the most prominent experience among employees facing chronic work-related stress. This aligns with existing burnout literature, which consistently identifies exhaustion as the core component of burnout (Schaufeli et al., 2020). Conversely, Emotional Impairment appears to be the least reported symptom, indicating that while employees may feel drained and disengaged, their ability to regulate emotions may not yet be severely compromised. This pattern suggests that burnout may initially manifest as physical fatigue and psychological withdrawal (Mental Distance) before progressing to cognitive and emotional dysfunction (Maslach & Leiter, 2016). From a workplace perspective, the high prevalence of Exhaustion underscores the need for interventions targeting workload management, rest, and recovery strategies to prevent escalation to more severe burnout symptoms as some research have suggested (e.g., Sawyer et al., 2023).

Reliability and Descriptive Statistics

The findings contribute to burnout theory and measurement in several ways. First, the strong support for the bifactor model aligns with emerging research suggesting that burnout has both a general component and distinct subdimensions (e.g., Schaufeli et al., 2020). This highlights the importance of using total burnout scores while still considering individual dimensions when necessary. Second, the measurement invariance across gender and age reinforces the robustness of the BAT-12 as a tool that can be used in comparative studies in diverse workforces as gender and age groups, which is consonant with some other studies (e.g., De Beer et al., 2022; Mazzatti et al., 2022; Santin et al., 2025; Vinueza-Solórzano et al., 2021). The strong correlations with external variables validate the job demands-resources (JD-R) model, supporting the role of job demands and lack of resources in predicting burnout levels (e.g., Bianchi et al., 2018; Rosario-Hernández et al., 2024; Testoni et al., 2023; Wilkes et al., 2018).

In terms of practical implications, the study's findings have direct applications for organizations, HR professionals, and policymakers. First, the BAT-12 can be used confidently for burnout screening in Puerto Rican employees, facilitating early detection and intervention strategies (e.g., De Beer & Schaufeli, 2024; Ong et al., 2021; Schaufeli et al., 2020). Since Exhaustion and Mental Distance showed the highest mean scores, organizations should prioritize interventions that address emotional fatigue and psychological disengagement, such as workload management, job crafting, and stress reduction programs (e.g., Andina-Díaz et al., 2025; Bes et al., 2023; Hayes et al., 2004; Morse et al., 2012; Tims et al., 2013). Second, the strong relationship between burnout and job demands suggests that workplace redesign strategies (e.g., reducing workload, increasing job control, and fostering job support) could be effective in mitigating burnout risks (e.g., Bes et al., 2023). The negative correlation with self-efficacy underscores the importance of employee empowerment programs aimed at enhancing resilience and coping skills to counteract burnout effects (e.g., Amiri et al., 2019; Rogala et al., 2016).

Limitations and Future Research Recommendations

Despite the strengths of this validation study, several limitations should be acknowledged. First, the sample of 488 participants was drawn entirely from Puerto Rico (aggregating data from four studies), which limits the generalizability of the findings to other cultural and organizational contexts. While the BAT-12 has been validated in multiple countries, this study's participants may not fully represent the broader workforce in terms of industries, organization types, and occupations in Puerto Rico. As a result, findings should be interpreted with caution when applied to different work environments or economic sectors. A second key limitation, also noted in prior research (e.g., De Beer et al., 2024), is the study's cross-sectional design, which captures burnout and workplace factors at a single point in time. While our results confirm expected correlations between burnout, job demands, and workplace outcomes, this design prevents causal inferences. For example, while high job demands correlate with increased burnout, it remains unclear whether work stressors cause burnout or whether burnout shapes perceptions of job demands. Longitudinal research is necessary to examine how burnout develops over time and whether high BAT-12 scores predict future turnover, performance declines, or health issues (e.g., Edú-Valsania et al., 2022; Wright & Cropanzano, 1998). A third limitation involves unexamined aspects of validity. While the BAT-12 was assessed for factor structure, reliability, invariance, and convergent validity, its discriminant validity or ability to distinguish burnout from related constructs such as depression and occupational stress, was not directly tested. Given the substantial symptom overlap between burnout and depression (e.g., emotional exhaustion, dysregulation), previous researchers have emphasized the need for clear differentiation between the two constructs (e.g., Bianchi et al., 2018; Schonfeld et al., 2019). Future studies should explicitly assess whether the BAT-12 measures work-related burnout as a distinct construct rather than a subtype of depression. Additionally, predictive validity remains untested, we did not examine whether BAT-12 scores forecast key workplace outcomes such as absenteeism or turnover. Prior meta-analytic research (Swider & Zimmerman, 2010) has found that mental distance (cynicism) strongly predicts turnover intentions, while exhaustion is the best predictor of absenteeism. Testing whether BAT-12 scores similarly predict real-world occupational outcomes would strengthen its utility as a practical screening tool. Furthermore, while the scale demonstrated high internal consistency, test-retest reliability was not evaluated, leaving the question of whether BAT-12 scores remain stable over time unanswered.

To enhance the external validity of the BAT-12, future studies should replicate and extend these findings in more diverse populations. Although the BAT-12 has demonstrated cross-national measurement invariance in countries such as Brazil, Portugal, and across European and Asian samples (e.g., De Beer et al., 2020; Sinval et al., 2022), researchers recommend further cross-validation studies in different industries (e.g., healthcare, education, corporate sectors) to confirm whether the tool maintains its predictive utility across varying job roles and organizational structures. Moreover, employing larger and more representative samples, including employees from diverse socioeconomic backgrounds, industries, and educational levels, would ensure that the BAT-12 accurately reflects burnout experiences across a broad spectrum of workforce populations (e.g., De Beer et al., 2022). Longitudinal research is particularly critical for establishing causal relationships between burnout and workplace outcomes (e.g., De Beer et al., 2022). Preliminary evidence suggests that high job demands predict increased burnout scores over time, while job resources mitigate burnout risks (e.g., De Vries & Bakker, 2022). However, recent meta-analyses indicate that burnout may also influence employees' perceptions of their job demands, creating a reciprocal relationship that requires further investigation (e.g., Guthier et al., 2020). Future research should apply cross-lagged panel models to determine whether burnout precedes work-related stressors or whether employees experiencing burnout begin to perceive their workloads as more demanding over time. Further studies should also refine the BAT-12's discriminant validity by comparing it with constructs such as depression, anxiety, and occupational stress. Given that burnout shares key symptoms with these conditions, testing its independence using multitrait-multimethod (MTMM) approaches or structural equation modeling (SEM) will help confirm whether BAT-12 truly captures a distinct work-related syndrome (e.g., Schonfeld et al., 2019; Schaufeli et al., 2020). Lastly, future research should continue assessing the predictive validity of BAT-12 scores in relation to job performance, absenteeism, and turnover intentions, further confirming its practical application as an early detection tool for workplace well-being interventions (e.g., Swider & Zimmerman, 2010).

Conclusion

This study provides strong empirical evidence supporting the psychometric robustness of the BAT-12 in a sample of Puerto Rican employees. The findings confirm that burnout is best conceptualized as a general construct with distinct subdimensions, and the scale demonstrates strong reliability, validity, and measurement invariance across demographic groups. These results suggest that the BAT-12 is a reliable and effective tool for both research and practical applications, helping organizations assess and address burnout-related challenges in diverse workplace settings. Future research should expand these findings by testing the BAT-12 in broader workforce populations, ensuring its cross-industry applicability, and further exploring its predictive validity for workplace outcomes. Additionally, longitudinal studies are needed to clarify causal relationships between burnout and job-related factors, while advanced statistical modeling (e.g., structural equation modeling, cross-lagged panel designs) can further establish the BAT-12's discriminant validity from related constructs like depression and occupational stress. In sum, while the BAT-12 has demonstrated strong psychometric properties, continued research will enhance its utility as a standardized burnout measure. Addressing these methodological and theoretical gaps will ensure that the BAT-12 remains a gold standard tool for burnout assessment, guiding both organizational interventions and scientific advancements in occupational health research.

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