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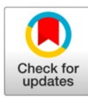

Thai Burnout Assessment Tool (T-BAT): Translation, validity, and reliability testing in nurses

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Abstract

Background: The Burnout Assessment Tool (BAT), an instrument for measuring burnout among healthcare professionals, was originally developed in English and remains unadopted and unvalidated within the Thai healthcare context. Despite its widespread international use, cultural and linguistic variations necessitate rigorous contextual validation.

Objective: This study aimed to translate the BAT into Thai (T-BAT) and evaluate its psychometric properties among Thai nurses, addressing critical gaps in cross-cultural burnout assessment.

Methods: A cross-sectional survey was conducted among 1,005 nurses from two government hospitals in Thailand, employing a multistage sampling with quota-based convenience selection. Participant inclusion criteria comprised full-time nursing employment, a minimum bachelor's degree in nursing, and at least three months of hospital work experience. The BAT underwent a back-translation process to ensure linguistic and cultural equivalence. The psychometric evaluation encompassed descriptive statistical analysis, internal consistency assessment, known-group validity testing through hypothesis, and construct validation via confirmatory factor analysis (CFA). Finally, Rasch analysis, evaluating item performance and measurement precision, was used.

Results: The T-BAT exhibited robust psychometric characteristics, including internal consistency (Cronbach's alpha = 0.93), known-group validity (significant score variations across nurse subgroups), and construct validity (confirmatory factor analysis validating the proposed four-factor model). Finally, Rasch analysis demonstrated optimal item performance, including fit statistics within acceptable ranges (Infit: 0.78-1.40; Outfit: 0.73-1.41). Person and item reliability indices consistently exceeded 0.80, indicating high reliability of the scale.

Conclusion: The study substantiates the T-BAT as a reliable and valid instrument for assessing burnout among Thai nurses. This culturally adapted tool provides a context-specific approach to understanding burnout, potentially enabling more targeted interventions by healthcare policymakers, hospital administrators, and nursing leaders.

Keywords

Cross-cultural translation; nurse burnout; psychometrics; reliability; Thai healthcare; validity

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Background

Burnout has emerged as a critical occupational health issue, particularly in high-stress professions such as healthcare. Among healthcare professionals, nurses are disproportionately affected, as they often serve on the frontline of patient care, facing constant emotional and interpersonal demands. Globally, this phenomenon has drawn increasing concern, and in Thailand, the situation is exceptionally pressing. Nurses in Thailand comprise approximately 30% of all hospital personnel and frequently face long working hours, chronic staff shortages, communication barriers, and rigid hierarchical structures (Jun et al., 2021). These workplace stressors contribute to high rates of burnout: a recent national survey found that 62% of Thai nurses report symptoms of burnout, far exceeding the 40% prevalence in the general population (Villarante et al., 2023). Beyond its toll on nurses' mental and physical well-being, burnout can significantly undermine patient safety, care quality, and healthcare system sustainability by increasing absenteeism, reducing productivity, and fueling high turnover rates (Castillo González et al., 2024; Guastello et al., 2024; Wannarit et al., 2023).

Accurate burnout measurement is critical for both research and intervention. Existing instruments, including the Maslach Burnout Inventory (MBI), Copenhagen Burnout Inventory (CBI), and Oldenburg Burnout Inventory (OLBI), demonstrate

some methodological limitations (Edú-Valsania et al., 2022). These tools predominantly focus on emotional exhaustion while neglecting crucial dimensions such as cognitive and emotional impairment. Moreover, their applicability is substantially constrained by linguistic and cultural barriers, particularly in non-Western research contexts.

To address these measurement challenges, Schaufeli et al. (2020) developed the Burnout Assessment Tool (BAT), introducing a more theoretical approach to burnout assessment. The BAT innovatively integrates both core symptoms (emotional and physical exhaustion, mental distance) and secondary symptoms (cognitive and emotional impairment), providing a more holistic conceptualization of burnout. Its psychometric performance across diverse populations, substantiated by robust internal consistency, factorial validity, and cross-cultural reliability, positions the BAT as a promising international diagnostic instrument (De Beer et al., 2022). The tool's open-access and non-commercial design further enhances its utility, particularly in resource-constrained healthcare environments.

Despite its expanding global implementation, the BAT remains untranslated and unvalidated within the Thai healthcare context—a significant methodological and clinical research gap. Distinctive Thai cultural attributes, including collectivist social structures, characteristically indirect emotional expression, and pronounced hierarchical norms, potentially modulate nurses' experiences and reporting of burnout. Consequently, developing a culturally contextualized and rigorously psychometrically validated BAT version becomes imperative for precise assessment and interpretation.

Comprehensive validation necessitates advanced statistical methodologies. Confirmatory Factor Analysis (CFA) systematically evaluates the congruence between empirical data and hypothesized structural models, thereby reinforcing construct validity (Sathyanarayana & Mohanasundaram, 2024). Complementarily, Rasch analysis, an approach grounded in item response theory, provides evaluation of individual item performance, assesses one-dimensionality, and transforms ordinal responses into interval-level data. Critically, Rasch modeling facilitates differential item functioning (DIF) analysis, ensuring the instrument's fairness and generalizability across subgroup populations (Tesio et al., 2024a; Tesio et al., 2024b). This framework substantially enhances both structural and item-level reliability.

While preliminary research substantiated the BAT's original four-factor structure through CFA (De Beer et al., 2024; De Beer et al., 2022; Kalani et al., 2024; Schaufeli et al., 2020; Sinval et al., 2022), recent research has proposed alternative model configurations, including second-order and bifactor models (Androulakis et al., 2023; De Beer et al., 2022; Redelinghuys & Morgan, 2023). In practical applications, the BAT is frequently employed to generate a total burnout score, implicitly presuming one-dimensionality to simplify interpretative processes. However, extant literature reflects limited critical examination of this fundamental assumption (Hadzibajramovic et al., 2020, 2022), consequently perpetuating uncertainty regarding the validity of utilizing a singular summary score—particularly within screening and monitoring contexts where such metrics potentially influence critical intervention and resource allocation decisions.

This study aims to translate the Burnout Assessment Tool into Thai and comprehensively evaluate its psychometric properties among Thai nurses. By developing a culturally adapted version (T-BAT), the research seeks to establish a robust, contextually sensitive instrument for accurately identifying and addressing burnout within the Thai healthcare ecosystem.

Methods

Study Design and Participants

This cross-sectional study employed a multi-stage sampling approach. The sampling process involved two primary stages:

First Stage - Institutional Selection: A comprehensive population of 90 government hospitals under the Ministry of Public Health was systematically stratified by service level, distinguishing between general hospitals and advanced medical centers. Through randomized selection, one hospital was chosen from each stratum, ensuring methodological breadth and institutional variability. This approach mitigates potential single-institution bias and enhances the generalizability of research findings.

Second Stage - Unit-Level Sampling: Within each selected hospital, a quota-based convenience sampling method was implemented to achieve proportional representation across major nursing units. Specifically, the sampling targeted key clinical areas including Inpatient wards, Intensive Care Units (ICUs), and Outpatient departments.

Participant selection criteria were full-time registered nurses, holding a minimum bachelor's degree in nursing, possessing at least three months of continuous hospital employment. Exclusion Criteria: Nurses were excluded if they were currently on maternity leave, medical leave, or academic leave. Recruitment was facilitated by nurse coordinators, who assisted in identifying and approaching potential participants while maintaining institutional and professional protocols.

To determine the minimum sample size for Confirmatory Factor Analysis (CFA) and Rasch analysis, researchers recommend a participant-to-item ratio of 10 to 20 to minimize sampling error (Kyriazos, 2018; Müller, 2020). Ideal sample sizes typically range between 500 and 1,000 participants. Adhering to these methodological guidelines, this study included a total of 1,005 registered nurses from two tertiary government hospitals in Thailand.

Instruments

The translation and cultural adaptation of the T-BAT followed Brislin's translation model (Brislin, 1970) and Beaton et al.'s guidelines (Beaton et al., 2000). Three independent, bilingual translators with expertise in healthcare and linguistic translation initially produced separate Thai renditions of the original English BAT. During a collaborative meeting, investigators from nursing and health sciences synthesized these translations, developing a reconciled version that prioritized conceptual equivalence and cultural appropriateness.

A rigorous back-translation process followed. Three additional bilingual translators, blinded to the original BAT and uninvolved in the forward translation, independently back-translated the reconciled Thai version to English. These translators, with backgrounds in health sciences and

linguistics, emphasized semantic and conceptual fidelity. The research team meticulously compared the back-translations with the original BAT, examining each item for preservation of meaning, linguistic clarity, and cultural relevance. Inconsistencies were resolved through expert discussions, ensuring the final version maintained both theoretical integrity and linguistic accuracy.

To further enhance conceptual and cultural equivalence, a multidisciplinary panel of Thai experts in healthcare, psychology, and linguistics conducted a comprehensive review. They carefully refined linguistic nuances, strategically adapting terminology to resonate with cultural contexts.

The revised version underwent pre-testing with 30 registered nurses from diverse clinical settings, including medical-surgical wards, intensive care units, emergency departments, and outpatient services across two hospital types. Participants provided critical feedback on clarity, comprehension, and cultural appropriateness, leading to further refinements of terms like "staying focused" and "concentrating" to better align with Thai professional communication norms.

Ethical Considerations

This study was approved by the Sawanpracharak Hospital Institutional Review Board (SPR-IRB) (Research Project Code No. 26/2024; approval date: 10 April 2024). As the other hospital had not established an IRB at the time of this study, the research protocol was approved by its director, based on prior approval from the IRB of the hospital. All participants provided informed consent after receiving information about the study's purpose, procedures, and their right to withdraw without consequences. The study involved minimal risk, as it required only anonymous self-reporting of occupational experiences, with potential benefits including contributions to burnout prevention efforts. Data were securely collected via an encrypted online platform, anonymized during processing, and accessible only to the lead researcher. In compliance with institutional policy, all data will be retained for five years post-study completion and permanently destroyed thereafter.

Data Collection

Following formal approval from hospital administrators and nursing departments, data collection was facilitated through the assistance of nurse coordinators or head nurses at each hospital. They distributed survey packages to eligible participants, which included a participant information sheet, an informed consent form, and a QR code linking to the online questionnaire. Participants were thoroughly informed about the study's purpose, procedures, potential risks and benefits, confidentiality, and their right to withdraw at any time. After providing written informed consent, participants accessed and completed the online questionnaire, which took approximately 15 to 20 minutes to complete. The researchers then securely received and compiled the responses for further analysis.

Data Analysis

All analyses were conducted using R statistical software (version 4.5.1) to examine the psychometric properties of the T-BAT. Internal consistency was evaluated using Cronbach's alpha and McDonald's omega, as implemented in the *psych* package. Confirmatory factor analysis (CFA) was performed with the *lavaan* package and visualized through *semPlot*. Rasch analysis, conducted with the *TAM* package, assessed item fit and measurement precision, while person–item distributions were illustrated using *WrightMap*.

Content validity: Eight experts holding master's or doctoral degrees in psychiatry, health sciences, or nursing science evaluated the T-BAT. Each item was rated for relevance using a four-point scale (1 = not relevant, 2 = somewhat relevant, 3 = quite relevant, 4 = highly relevant), and the experts also offered suggestions to improve item clarity. The content validity index (CVI) was then calculated, with a threshold of 0.80 or above considered acceptable (Lynn, 1986).

Internal consistency: The T-BAT and its subscales was assessed using Cronbach's alpha and McDonald's omega (ω). Values ≥ 0.70 indicated acceptable reliability (Malkewitz et al., 2023; Morera & Stokes, 2016). Corrected item–total correlations were also examined, with a threshold of ≥ 0.30 to ensure each item contributed meaningfully to its scale and to avoid redundancy (Zijlmans et al., 2019).

Known-group validity: It was assessed by examining differences in burnout scores across groups categorized by age, gender, years of work experience, monthly personal income, and work unit (Chinawong et al., 2024; Dugger, 2024; Robinson et al., 1991). These variables were selected based on existing empirical evidence supporting their association with burnout (Alzahrani et al., 2024; Dugger, 2024; Li et al., 2024; Zhou et al., 2022). Independent *t*-tests and one-way ANOVA were used to assess group differences in burnout scores, supporting known-group validity. When ANOVA revealed significant differences, Tukey's HSD post-hoc tests were performed to identify specific group contrasts contributing to the overall effect.

Construct validity: Both CFA and Rasch analysis were employed. CFA was used to test the original four-factor model—exhaustion, mental distance, cognitive impairment, and emotional impairment—proposed by the original (Schaufeli et al., 2020), as well as alternative models suggested in prior research (Hadzibajramovic et al., 2020, 2022; Schaufeli et al., 2020). This multidimensional structure reflects the theoretical understanding of burnout as a syndrome comprising distinct yet interrelated dimensions. In parallel, a unidimensional Rasch analysis was conducted based on the practical consideration that the T-BAT is often used as a total score in applied settings, requiring verification that the items function consistently as indicators of a single latent trait.

The combination of CFA and Rasch analysis provides a broader validation strategy. CFA evaluates how well the observed data fit the proposed latent structure and allows for model comparisons based on theory. Rasch analysis, grounded in item response theory, examines whether the scale satisfies fundamental measurement properties under a unidimensional assumption. This includes evaluating item fit, targeting, and reliability, supporting the validity of summed scores. Rather than conflicting, these approaches serve complementary purposes: CFA confirms theoretical structure, while Rasch assesses item-level functioning when the scale is interpreted as a single construct.

CFA was performed using the robust maximum likelihood estimator (MLR), which adjusts for nonnormality using Huber–White standard errors and the Yuan–Bentler correction (Li, 2021). Model fit was evaluated based on established

thresholds: $\chi^2/df < 5.00$, CFI and TLI ≥ 0.90, RMSEA ≤ 0.08, and SRMR ≤ 0.08. Standardized factor loadings ≥ 0.40 were considered acceptable (Goretzko et al., 2024; Hair, 2010), and model comparisons were based on AIC values.

For Rasch analysis, the polytomous rating scale model was applied. Item fit was assessed using INFIT and OUTFIT MNSQ statistics (acceptable range: 0.5–1.5) (Müller, 2020), and floor/ceiling effects were below 15% (Arslan & Benke, 2023; Liu & Wang, 2021). DIF analysis examined item bias across demographic variables. Person reliability (≥ 0.80), item separation (≥ 2.0), and Wright map visualization supported measurement precision and construct validity (Tesio et al., 2024a; Tesio et al., 2024b).

Results

Demographic Data

A total of 1,005 nurses participated in the survey, with no missing data or outliers. Participants were predominantly female (95.8%) with a mean age of 36.4 years (SD = 10.9). Most respondents were single (51.0%) and held bachelor's degrees (93.0%). They had an average of 13.0 years of work experience (SD = 10.9) and earned a monthly salary of 36,121 THB (SD = 13,398.3). In terms of employment, most participants were government employees (n = 827, 82.3%). Professionally, 55.9% were registered nurses at the professional level, with the majority working in inpatient care units (52.1%), followed by emergency room and intensive care units (34.0%) and outpatient care units (13.8%).

Content Validity

The T-BAT demonstrated exceptional content validity, as reflected by a Scale-level Content Validity Index (S-CVI) of 0.99 across all 12 items. Expert reviewers reached a unanimous consensus regarding the relevance of each item, affirming that the instrument comprehensively captured the conceptual dimensions of burnout.

Floor/Ceiling Effects of the T-BAT

In the current study, only 0.60% of participants (n = 6) obtained the lowest possible total score, while 0.80% (n = 8) achieved the highest possible score. Both of these proportions were well below the 15% threshold, thus confirming the absence of significant floor or ceiling effects (Arslan & Benke, 2023; Liu & Wang, 2021).

Internal Consistency

The T-BAT demonstrated excellent internal consistency, as reflected by a Cronbach's alpha of 0.93 (95% CI = 0.93-0.94) and McDonald's omega (ω) of 0.94, indicating high scale reliability (Morera & Stokes, 2016). Item-deletion analysis showed minimal variation in reliability estimates (α = 0.92-0.93; ω = 0.93-0.94), suggesting that no single item disproportionately influenced internal consistency. All item-total correlations were positive and ranged from 0.52 to 0.81, exceeding the recommended minimum of 0.30 (Bonett & Wright, 2015; Zijlmans et al., 2019), thereby confirming that each item contributed meaningfully to the scale's coherence. These findings affirm the strong reliability of the T-BAT for use in the Thai context (**Table 1**).

Table 1 Internal consistency of the T-BAT (N = 1005)

Items	Mean ± SD	Corrected item-Total correlation	If item deleted	
			Cronbach's alpha	McDonald's ω
T-BAT 1	3.39 ± 0.94	0.62	0.93	0.93
T-BAT 2	3.00 ± 1.03	0.67	0.93	0.93
T-BAT 3	3.40 ± 0.98	0.58	0.93	0.93
T-BAT 4	3.16 ± 1.01	0.52	0.93	0.94
T-BAT 5	1.97 ± 1.03	0.73	0.93	0.93
T-BAT 6	1.93 ± 1.04	0.77	0.92	0.93
T-BAT 7	2.08 ± 0.99	0.81	0.92	0.93
T-BAT 8	2.08 ± 0.98	0.78	0.92	0.93
T-BAT 9	1.85 ± 0.86	0.73	0.93	0.93
T-BAT 10	1.90 ± 0.89	0.74	0.93	0.93
T-BAT 11	1.71 ± 0.88	0.77	0.92	0.93
T-BAT 12	1.90 ± 0.91	0.75	0.92	0.93
T-BAT Cronbach's alpha = 0.93 (95% CI = 0.93 - 0.94), and McDonald's ω = 0.94				

Known-Group Validity of the T-BAT

Burnout levels, as assessed by the T-BAT, varied significantly across demographic and occupational subgroups within the nursing cohort. Younger nurses reported higher levels of burnout compared to their older counterparts (t = 2.92, p <0.05, d = 0.19), and male nurses exhibited significantly greater burnout than female nurses (t = 2.89, p <0.05, d = 0.46). Nurses with fewer years of clinical experience also reported elevated burnout levels relative to those with longer tenure (t = 3.59, p <0.05, d = 0.25). Income was a significant determinant, with lower-income nurses exhibiting higher burnout (F = 4.74, p <0.05, η^2 = 0.01); post hoc comparisons revealed that individuals earning between 15,000 and 35,000 THB reported significantly more burnout than those earning over 55,000 THB (q = 2.86, p <0.05). Work setting also emerged as a contributing factor (F = 4.80, p <0.05, η^2 = 0.01), with nurses in inpatient wards reporting higher burnout than those in emergency/intensive care and outpatient units. Tukey's HSD tests indicated that nurses in emergency and intensive care units experienced significantly more burnout than those in outpatient departments (q = 3.09 and 2.91, p <0.05), and higher levels than those in inpatient wards (q = 2.28, p <0.05) (see **Table 2**).

Table 2 Known-group validity of the T-BAT (N = 1005)

Characteristics	*n* (%)	Burnout scores	*p*-value	Tukey's method		
Age (years)						
20 - 40 years	642 (63.9%)	2.41 ± 0.77	t = 2.92*			
41 - 60 years	363 (36.1%)	2.27 ± 0.64	d = 0.19			
Gender						
Male	42 (4.2%)	2.68 ± 0.87	t = 2.89*			
Female	936 (95.8%)	2.35 ± 0.72	d = 0.46			
Number of years working (years)						
1 - 20 years	715 (71.1%)	2.42 ± 0.77	t = 3.59*			
21 - 40 years	290 (28.9%)	2.23 ± 0.62	d = 0.25			
Monthly personal income (THB)				**1**	**2**	**3**
15000 - 35000 (1)	556 (56.3%)	2.42 ± 0.78	F = 4.74*		1.81	2.86*
35001 - 55000 (2)	328 (32.6%)	2.33 ± 0.66	η^2 = 0.01			1.56
> 55000 (3)	111 (11.0%)	2.20 ± 0.62				
Working unit				**1**	**2**	**3**
ER + ICU (1)	342 (34.0%)	2.36 ± 0.73	F = 4.80*		-0.94	2.28*
In-Patient wards (2)	524 (52.1%)	2.41 ± 0.73	η^2 = 0.01			3.09*
Out-Patient department (3)	139 (13.8%)	2.19 ± 0.71				

Note: *significant level at p <0.05

Construct Validity of the T-BAT

Confirmatory factor analysis of the T-BAT

To assess the construct validity of the T-BAT, two competing models were evaluated using CFA: a correlated four-factor model based on the original study (Model 1), and a correlated four-factor model with residual correlations (Model 2). The final set of items and their factor loadings are presented in Figure 1. The original four-factor model demonstrated acceptable fit, with a normed chi-square of 8.25, CFI of 0.95, TLI of 0.93, RMSEA of 0.09, and SRMR of 0.05, supporting the multidimensional structure of the BAT. Although the chi-square test was significant—a result expected given the large sample size (N = 1,005) and its known sensitivity to sample size—this does not indicate poor model fit. The model incorporating residual correlations (Model 2) exhibited slightly improved fit, yielded a lower normed chi-square (χ^2/df = 7.18), higher CFI (0.96), higher TLI (0.94), and a lower RMSEA (0.08 compared to 0.09 in Model 1), as well as a lower AIC (23700.64 vs. 23773.14), while maintaining a comparable SRMR (0.05) (Table 3). These findings indicate that the inclusion of residual correlations enhances model fit and suggest that the T-BAT effectively captures the multidimensional construct of burnout, with Model 2 offering a more refined representation of the latent structure.

Table 3 Test statistics and model fit indices of the CFA for the T-BAT (N = 1005)

Model	χ^2	χ^2/df	CFI	TLI	RMSEA	SRMR	AIC
4-factor model from the original study (Model 1)							
Model 1	p < 0.001	8.25	0.95	0.93	0.09	0.05	23773.14
4-factor models with residual correlation (Model 2)							
Model 2	p < 0.001	7.18	0.96	0.94	0.08	0.05	23700.64

Note. Chi-square (χ^2), Normed chi-square (χ^2/df), Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Root-mean-square error of approximation (RMSEA), Standardized Root Mean Square Residual (SRMR), Akaike Information Criteria (AIC)

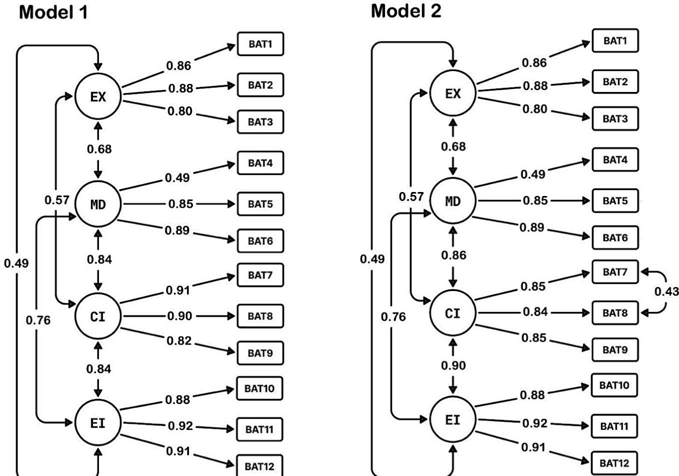

Figure 1 CFA and standardized factor loading. Model 1: 4-factor model from the original study, and Model 2: 4-factor model with residual correlation

Note. EX = exhaustion, MD = mental distance, CI = cognitive impairment, EI = emotional impairment

Rasch Analysis of the T-BAT

Results from the Rasch analysis demonstrated that all items exhibited acceptable fit statistics. Infit mean-square values ranged from 0.78 to 1.40 and outfit values from 0.73 to 1.41—well within the commonly accepted threshold of 1.5—indicating that all items aligned with model expectations and contributed meaningfully to measuring the latent trait (Crocker & Algina, 1986; Müller, 2020).

The Wright map showed that items BAT1–BAT4 had logit values below 2, suggesting they were frequently endorsed and effective at detecting early or mild burnout symptoms. No items exceeded +2 logits, indicating an absence of overly difficult or rarely endorsed items and enhancing the scale's sensitivity to subtle differences in burnout levels (**Figure 2**).

Person separation reliability was high (0.92, p <0.001), meeting established standards for measurement precision (Boone, 2016). These results collectively support the T-BAT's internal reliability and measurement accuracy across different scale lengths (**Table 4**).

Differential item functioning (DIF) analysis indicated systematic differences in item responses by age, gender, and work experience. Younger respondents found 10 of 12 items (T-BAT1-3, 5-6, 8-12) significantly easier to endorse than older participants (p = 0.00-0.03). Male participants were more likely to endorse items T-BAT1, 4, 7, 9, 10, and 12 (p = 0.00-0.03), revealing gender-based DIF. Similarly, participants with fewer years of work experience perceived items T-BAT1-3, 5-9, 11, and 12 as easier to endorse compared to those with longer tenure (p = 0.00-0.02). In contrast, no significant DIF was observed across educational levels, indicating that item functioning remained consistent regardless of participants' educational background (**Table 5**).

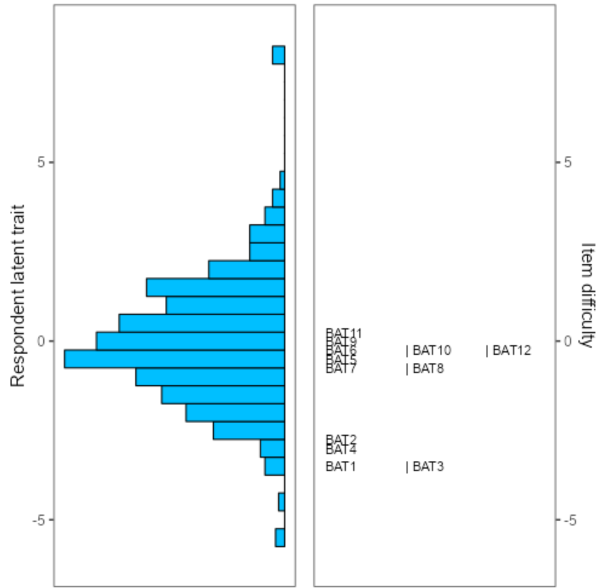

Figure 2 Wright Map (Person-Item Map) of T-BAT

Table 4 Item statistics for the T-BAT (N = 1005)

Items	Measure	S.E. Measure	Infit MNSQ	Outfit MNSQ
T-BAT 1	-3.47	0.05	1.03	1.05
T-BAT 2	-2.65	0.05	1.03	1.02
T-BAT 3	-3.49	0.05	1.21	1.22
T-BAT 4	-2.99	0.05	1.40	1.41
T-BAT 5	-0.41	0.05	1.11	1.06
T-BAT 6	-0.33	0.05	1.03	0.92
T-BAT 7	-0.68	0.05	0.78	0.76
T-BAT 8	-0.68	0.05	0.82	0.83
T-BAT 9	-0.12	0.05	0.81	0.82
T-BAT 10	-0.23	0.05	0.83	0.85
T-BAT 11	0.27	0.05	0.83	0.73
T-BAT 12	-0.25	0.05	0.83	0.79

Note. Measure = item difficulty; S.E. Measure = Standard Error measure; Infit MNSQ = Information-weighted mean square statistic; Outfit MNSQ = Outlier-sensitive means square statistic

Table 5 Differential item functioning (DIF) for the T-BAT (N = 1005)

Differential item functioning	Result
Age (20-40, 41-60 years) (χ^2 = 23.30, p = 0.00)	Items T-BAT1, 2, 3, 5, 6, 8, 9, 10, 11, and 12 were perceived as easier to agree with by participants aged ≤ 40 years (p = 0.03, 0.00, 0.00, 0.00, 0.02, 0.00, 0.00, 0.02, 0.01, and 0.00, respectively).
Gender (Male, Female) (χ^2 = 21.03, p = 0.00)	Items T-BAT1, 4, 7, 9, 10, and 12 were perceived as easier to agree with by male participants, with statistically significant differences (p = 0.03, 0.00, 0.02, 0.01, 0.02, and 0.00, respectively).
Number of years working (1-20, 21-40 years) (χ^{22} = 27.01, p = 0.00)	Items T-BAT1, 2, 3, 5, 6, 7, 8, 9, 11, and 12 were perceived as easier to agree with by participants with ≤ 20 years of work experience (p = 0.01, 0.00, 0.00, 0.00, 0.00, 0.02, 0.00, 0.02, 0.02, and 0.00, respectively).
Education (Bachelor's or higher) (χ^2 = 3.37, p = 0.19)	No DIF

Discussion

Translation Process and Cross-Cultural Adaptation

The translation and cross-cultural adaptation of the T-BAT offered critical insights into the complexities of preserving psychometric validity across cultural contexts. Achieving conceptual equivalence proved particularly challenging in a setting where emotional experiences are often internalized or indirectly expressed (Burnard & Naiyapatana, 2004; Guptarak et al., 2020). For example, the shift from "emotional impairment" to "emotional depletion" reflected not merely a linguistic change, but an alignment with Thai norms of emotional restraint (Anjum & Aziz, 2024; Burnard et al., 2006). This underscored how language and cultural norms jointly shape emotional expression. The adaptation also revealed issues of content equivalence within hierarchical and collectivist healthcare settings, requiring reinterpretation of certain items to fit local professional roles and expectations (Epstein et al., 2015; Zhang et al., 2022). Semantic equivalence could not always be achieved through direct translation, as some English terms lacked precise Thai counterparts. Creative lexical choices were thus essential to preserve both accuracy and cultural resonance. Engaging Thai nurses during pre-testing proved invaluable in uncovering culturally embedded communication styles and professional values that might have otherwise been overlooked. Overall, the adaptation process demonstrated that cross-cultural validation is not a linear translation exercise, but an iterative negotiation revealing the cultural dimensions of psychological constructs and enriching the tool's theoretical depth.

Content Validity

The T-BAT exhibited a high Scale-level Content Validity Index (S-CVI) of 0.99, with expert reviewers consistently agreeing on the relevance of the items (Zamanzadeh et al., 2015). These findings indicate that the tool adequately measures key aspects of burnout and is well adapted to the cultural and professional context of Thai nurses. This provides empirical evidence supporting the appropriateness of the instrument and further validates the translation and cultural adaptation process (Polit & Beck, 2021).

Internal Consistency

The T-BAT demonstrated strong internal consistency, with a Cronbach's alpha of 0.93 and McDonald's ω of 0.94. These values indicated that the items were conceptually cohesive and measured a single underlying construct without redundancy (Morera & Stokes, 2016). The high reliability of the full scale supports its use in both diagnostic and research settings. Retaining the original item set without modification further supports the cultural and linguistic appropriateness of the Thai adaptation. Overall, the results affirmed the scale's reliability for assessing burnout in both clinical and organizational contexts, striking a balance between psychometric rigor and practical utility (Zijlmans et al., 2019). The consistency of these psychometric findings with those from international validations in Iran, Spain, and Italy (Kalani et al., 2024; Mazzetti et al., 2022; Osca et al., 2024) further reinforced the cross-cultural applicability of the BAT framework. This alignment strengthens confidence in the T-BAT's use in diverse healthcare settings, supporting its role in global efforts to monitor and mitigate occupational burnout.

Known-Group Validity

The known-group validity of both versions of the T-BAT was supported by significant differences in burnout levels across demographic and occupational subgroups of Thai nurses. Younger nurses reported higher levels of burnout than older nurses (d = 0.19), though the small effect size suggests limited practical significance. Still, early-career nurses may face unique stressors, including limited experience, insufficient support, and the pressure to meet institutional expectations for resilience and conformity (Moya-Salazar et al., 2023; Zheng et al., 2025; Zhou et al., 2022). Burnout was also higher among nurses with fewer years of clinical experience (d = 0.25). Although the effect size remained small, the findings point to potential early-career vulnerabilities, such as heavier workloads, reduced autonomy, and less job security, especially in temporary roles (Dugger, 2024; Li et al., 2024). Lower-income nurses showed slightly elevated burnout levels, with a small effect size (η^2 = 0.01), indicating minimal practical impact despite statistical significance. Financial strain may have contributed, though other factors were likely involved. Male nurses reported significantly higher burnout than female nurses (d = 0.46), nearing a medium effect size. This difference may reflect gender-role tensions in Thailand's predominantly female nursing workforce, where masculine norms may discourage emotional expression and help-seeking (Alenezi et al., 2024; Chinawong et al., 2024). These dynamics may meaningfully shape burnout experiences and merit further study. Burnout also varied by work setting. Nurses in inpatient wards reported slightly higher burnout than those in emergency/intensive care or outpatient units. While statistically significant, the small effect size (η^2 = 0.01) warrants cautious interpretation. The increased burnout may relate to heavier patient loads, greater emotional demands, and expectations for relational care, though the effects appeared modest (Bruyneel et al., 2025; Ru-Wen et al., 2020; Walohtae et al., 2024).

Construct Validity

Confirmatory Factor Analysis

The construct validity of the T-BAT was supported through CFA comparing two models: a correlated four-factor model and an improved version with residual correlations. Both models demonstrated acceptable fit, but the latter showed slightly better indices (e.g., lower χ^2/df and AIC), indicating enhanced model precision without altering its theoretical structure. This suggests that the T-BAT reliably captures the multidimensional nature of burnout across its core dimensions: exhaustion, mental distance, cognitive impairment, and emotional impairment (De Beer et al., 2024; De Beer et al., 2022; Mazzetti et al., 2022; Schaufeli et al., 2020). In the Thai cultural and linguistic context, this refinement is particularly meaningful. A number of item pairs—such as BAT7 ("I have trouble staying focused.") and BAT8 ("I have trouble concentrating.")—are interpreted almost interchangeably, as "focus" and "concentration" are often perceived as synonymous in Thai. Incorporating residual correlations between such items addresses semantic overlap, thereby reducing redundancy and improving model fit.

Despite a significant chi-square, all items statistically had significant standardized loadings, supporting their validity in capturing the intended constructs (Hair, 2010). Taken together, the findings support T-BAT as a comprehensive tool for assessing burnout in healthcare professionals.

Rasch Analysis

Rasch modeling was used to assess item-level functioning and confirm the unidimensionality of the T-BAT, supporting the validity of the total score. Overall fit statistics fell within recommended thresholds (Tesio et al., 2024b), indicating that the scale effectively measures a coherent latent construct of burnout. One caution is that one item (T-BAT4) had borderline fit statistics (Infit = 1.40, Outfit = 1.41), which approach the upper limits of acceptable fit and may indicate some degree of misfit. Although this did not substantially affect the overall model fit in the current analysis, the item warrants closer examination and further evaluation in future validation studies to ensure its psychometric robustness (Tesio et al., 2024a).

Person separation reliability further supported the T-BAT's measurement precision, supporting its use for diagnostic and research applications (Boone, 2016). This balance between brevity and precision underscores the tool's flexibility across various settings. The Wright map revealed that most items clustered around lower burnout levels, which enhances its sensitivity to early or moderate symptoms (Redelinghuys & Morgan, 2023; Sinval et al., 2022). However, the absence of high-difficulty items suggests limited coverage of severe burnout, indicating a potential area for future refinement.

Differential item functioning (DIF) analysis revealed significant non-invariance across age, gender, and work experience. Younger, male, and less experienced respondents were more likely to endorse several items, suggesting demographic influences on response patterns. These findings diverge from earlier studies reporting minimal DIF (De Beer et al., 2022), and extend (Schaufeli et al., 2020), who identified demographic trends without conducting item-level analysis. No DIF was observed across educational levels, indicating consistent item interpretation regardless of educational background. While DIF does not invalidate the scale, it highlights the need for context-aware interpretation to avoid biased comparisons across groups. When applied with demographic sensitivity, the T-BAT remains a reliable and adaptable tool for burnout assessment.

These findings collectively affirm the structural validity and psychometric soundness of the Thai version of the BAT. The confirmatory factor analysis supported the theoretically grounded four-factor structure—exhaustion, mental distance, cognitive impairment, and emotional impairment—consistent with the original conceptualization of burnout (Schaufeli et al., 2020). Complementing these results, Rasch analysis was employed to evaluate the unidimensionality of the scale, specifically to justify the use of a total score. All items demonstrated acceptable fit within the Rasch model, indicating coherent measurement across the construct. The alignment between CFA and Rasch findings underscores the robustness of the T-BAT and supports its use at both the total and subscale levels. This dual-level structure enhances its practical utility across various settings, from broad population screenings to targeted assessments in high-risk occupational groups such as nurses, where early detection and intervention are especially critical.

Limitations

This study was limited by its focus on nurses from government tertiary hospitals in Thailand, which may restrict the generalizability of the findings to other healthcare settings and cultural contexts. The pre-testing involved 30 participants, although an acceptable sample size according to COSMIN guidelines for content validity (10-29 = fair; 30-49 = acceptable; ≥50 = very good) (Mokkink et al., 2010), it may have been insufficient to fully capture variations in responses across different groups. Additionally, potential biases related to challenges in cultural adaptation and the exclusive use of self-reported data may have influenced the accuracy and reliability of the results. Future research should validate the T-BAT across diverse healthcare settings and roles, examine predictive validity using a longitudinal or mixed-methods design, and investigate potential bias across age, gender, and experience. Refinement, particularly of T-BAT4, through cognitive interviews, is recommended to enhance clarity, relevance, and overall construct validity.

Implications

The T-BAT demonstrated strong reliability in assessing nurse burnout across clinical and organizational contexts, with sensitivity to early and subtle symptoms that allow for timely identification of at-risk individuals. This supports the implementation of targeted interventions—such as workload adjustment, resilience training, and psychological support—to mitigate burnout and promote workforce well-being (Lee & Cha, 2023). Beyond individual-level application, the T-BAT offers valuable insights for institutional policy by informing evidence-based strategies in staffing, resource allocation, and retention planning. Its integration into routine monitoring can help healthcare organizations track burnout trends and guide preventive actions. Moreover, its use in cross-sectional and longitudinal research enhances its utility for studying burnout and intervention outcomes across healthcare settings.

Conclusion

The T-BAT, specifically developed for use among nurses within the Thai healthcare system, demonstrated strong reliability and validity as a tool for assessing burnout. It can be used to identify burnout, particularly in its early stages, thereby enabling timely intervention and reducing adverse outcomes such as psychiatric problems and staff turnover. To strengthen the T-BAT, further research should focus on refining items that show potential misfit and on evaluating its predictive validity.

Declaration of Conflicting Interest

There are no conflicts of interest to declare.

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Authors' Contributions

Conceptualization: VP, WS, PT, CJ; Methodology: VP, WS, PT, CJ; Validation: VP, WS, PT, CJ; Formal analysis: VP, WS; Investigation: VP, WS, PT, CJ; Data curation: VP, WS; Writing the original draft: VP, WS, PT, CJ; Reviewing and editing: VP, WS, PT, CJ; Supervision: WS, PT, CJ; Project administration: VP, WS.

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Data Availability

The datasets produced in this study can be obtained from the corresponding author upon reasonable request.

Declaration of Use of AI in Scientific Writing

During the preparation of this work, the authors used ChatGPT and Grammarly to enhance the language. After employing these tools, the authors reviewed and edited the content as necessary, taking full responsibility for the publication's content.

References

Alenezi, L., Gillespie, G. L., Smith, C., & Davis, K. G. (2024). Gender differences in burnout among US nurse leaders during COVID-19 pandemic: An online cross-sectional survey study. *BMJ Open*, *14*(11), e089885. https://doi.org/10.1136/bmjopen-2024-089885

Alzahrani, H. M., Alanazi, E. F., & Almutairi, S. M. (2024). Burnout among nurses in Intensive Care Unit in Saudi Arabia: implications for nursing management. *British Journal of Nursing Studies*, *4*(2), 01-09. https://doi.org/10.32996/bjns.2024.4.2.1

Androulakis, G. S., Georgiou, D. A., Lainidi, O., Montgomery, A., & Schaufeli, W. B. (2023). The Greek burnout assessment tool: Examining its adaptation and validity. *International Journal of Environmental Research and Public Health*, *20*(10), 5827. https://doi.org/10.3390/ijerph20105827

Anjum, G., & Aziz, M. (2024). Advancing equity in cross-cultural psychology: Embracing diverse epistemologies and fostering collaborative practices. *Frontiers in Psychology*, *15*, 1368663. https://doi.org/10.3389/fpsyg.2024.1368663

Arslan, J., & Benke, K. (2023). Statistical analysis of ceiling and floor effects in medical trials. *Applied Biosciences*, *2*(4), 668-681. https://doi.org/10.3390/applbiosci2040042

Beaton, D. E., Bombardier, C., Guillemin, F., & Ferraz, M. B. (2000). Guidelines for the process of cross-cultural adaptation of self-report measures. *Spine*, *25*(24), 3186-3191. https://doi.org/10.1097/00007632-200012150-00014

Bonett, D. G., & Wright, T. A. (2015). Cronbach's alpha reliability: Interval estimation, hypothesis testing, and sample size planning. *Journal of Organizational Behavior*, *36*(1), 3-15. https://doi.org/10.1002/job.1960

Boone, W. J. (2016). Rasch analysis for instrument development: Why, when, and how? *CBE—Life Sciences Education*, *15*(4), rm4. https://doi.org/10.1187/cbe.16-04-0148

Brislin, R. W. (1970). Back-translation for cross-cultural research. *Journal of Cross-Cultural Psychology*, *1*(3), 185-216. https://doi.org/10.1177/135910457000100301

Bruyneel, A., Dello, S., Dauvergne, J. E., Kohnen, D., & Sermeus, W. (2025). Prevalence and risk factors for burnout, missed nursing care, and intention-to-leave the job among intensive care unit and general ward nurses: A cross-sectional study across six European countries in the COVID-19 era. *Intensive and Critical Care Nursing*, *86*, 103885. https://doi.org/10.1016/j.iccn.2024.103885

Burnard, P., & Naiyapatana, W. (2004). Culture and communication in Thai nursing: A report of an ethnographic study. *International Journal of Nursing Studies*, *41*(7), 755-765. https://doi.org/10.1016/j.ijnurstu.2004.03.002

Burnard, P., Naiyapatana, W., & Lloyd, G. (2006). Views of mental illness and mental health care in Thailand: A report of an ethnographic study. *Journal of Psychiatric and Mental Health Nursing*, *13*(6), 742-749. https://doi.org/10.1111/j.1365-2850.2006.01028.x

Castillo González, A., Velando-Soriano, A., De La Fuente-Solana, E. I., Martos-Cabrera, B. M., Membrive-Jiménez, M. J., Lucía, R. B., & Cañadas-De La Fuente, G. A. (2024). Relation and effect of resilience on burnout in nurses: A literature review and meta-analysis. *International Nursing Review*, *71*(1), 160-167. https://doi.org/10.1111/inr.12838

Chinawong, C., Adunwatanasiri, P., & Anukulpiphat, P. (2024). Predicting factors of burnout among frontline nurses during the COVID-19 pandemic. *Journal of Health Sciences and Wellness*, *28*(2), 133-148. https://he01.tci-thaijo.org/index.php/HCUJOURNAL/article/view/265294

Crocker, L., & Algina, J. (1986). *Introduction to classical and modern test theory*. Texas: Holt, Rinehart, and Winston.

De Beer, L. T., Christensen, M., Sørengaard, T. A., Innstrand, S. T., & Schaufeli, W. B. (2024). The psychometric properties of the Burnout Assessment Tool in Norway: A thorough investigation into construct-relevant multidimensionality. *Scandinavian Journal of Psychology*, *65*(3), 479-489. https://doi.org/10.1111/sjop.12996

De Beer, L. T., Schaufeli, W. B., & De Witte, H. (2022). The psychometric properties and measurement invariance of the Burnout Assessment Tool (BAT-23) in South Africa. *BMC Public Health*, *22*(1), 1555. https://doi.org/10.1186/s12889-022-13978-0

Dugger, J. (2024). Predictive and associated factors of burnout in nursing faculty: An integrative review. *Nurse Educator*, *49*(3), E142-E146. https://doi.org/10.1097/NNE.0000000000001533

Edú-Valsania, S., Laguía, A., & Moriano, J. A. (2022). Burnout: A review of theory and measurement. *International Journal of Environmental Research and Public Health*, *19*(3), 1780. https://doi.org/10.3390/ijerph19031780

Epstein, J., Santo, R. M., & Guillemin, F. (2015). A review of guidelines for cross-cultural adaptation of questionnaires could not bring out a consensus. *Journal of Clinical Epidemiology*, *68*(4), 435-441. https://doi.org/10.1016/j.jclinepi.2014.11.021

Goretzko, D., Siemund, K., & Sterner, P. (2024). Evaluating model fit of measurement models in confirmatory factor analysis. *Educational and Psychological Measurement*, *84*(1), 123-144. https://doi.org/10.1177/00131644231163813

Guastello, A. D., Brunson, J. C., Sambuco, N., Dale, L. P., Tracy, N. A., Allen, B. R., & Mathews, C. A. (2024). Predictors of professional burnout and fulfilment in a longitudinal analysis on nurses and healthcare workers in the COVID-19 pandemic. *Journal of Clinical Nursing*, *33*(1), 288-303. https://doi.org/10.1111/jocn.16463

Guptarak, M., Conway, J., Stone, T. E., Fongkaew, W., Settheekul, S., & Baxter, E. (2020). Health beliefs of nurses in Northern Thailand: A Q-methodology study. *Journal of Transcultural Nursing*, *31*(4), 350-359. https://doi.org/10.1177/1043659619865589

Hadzibajramovic, E., Schaufeli, W., & De Witte, H. (2020). A Rasch analysis of the burnout assessment tool (BAT). *PloS One*, *15*(11), e0242241. https://doi.org/10.1371/journal.pone.0242241

Hadzibajramovic, E., Schaufeli, W., & De Witte, H. (2022). Shortening of the Burnout Assessment Tool (BAT)—from 23 to 12 items using content and Rasch analysis. *BMC Public Health*, *22*(1), 560. https://doi.org/10.1186/s12889-022-12946-y

Hair, J. F. (2010). *Multivariate data analysis: A global perspective* (7th ed.). Upper Saddle River, N.J.: Pearson Education.

Jun, J., Ojemeni, M. M., Kalamani, R., Tong, J., & Crecelius, M. L. (2021). Relationship between nurse burnout, patient and organizational outcomes: Systematic review. *International Journal of Nursing Studies*, *119*, 103933. https://doi.org/10.1016/j.ijnurstu.2021.103933

Kalani, S., Esfahani, M. D., & Khanlari, P. (2024). A Persian validation of the burnout assessment tool. *BMC Public Health*, *24*(1), 1849. https://doi.org/10.1186/s12889-024-19314-y

Kyriazos, T. A. (2018). Applied psychometrics: Sample size and sample power considerations in factor analysis (EFA, CFA) and SEM in general. *Psychology*, *9*(08), 2207. https://doi.org/10.4236/psych.2018.98126

Lee, M., & Cha, C. (2023). Interventions to reduce burnout among clinical nurses: Systematic review and meta-analysis. *Scientific Reports*, *13*(1), 10971. https://doi.org/10.1038/s41598-023-38169-8

Li, C.-H. (2021). Statistical estimation of structural equation models with a mixture of continuous and categorical observed variables. *Behavior Research Methods*, *53*(5), 2191-2213. https://doi.org/10.3758/s13428-021-01547-z

Li, L., Fan, J., Qiu, L., Li, C., Han, X., Liu, M., Zhao, S., & Wang, Y. (2024). Prevalence and factors associated with job burnout among nurses in China: A cross-sectional study. *Nursing Open*, *11*(6), e2211. https://doi.org/10.1002/nop2.2211

Liu, Q., & Wang, L. (2021). t-Test and ANOVA for data with ceiling and/or floor effects. *Behavior Research Methods*, *53*(1), 264-277. https://doi.org/10.3758/s13428-020-01407-2

Lynn, M. R. (1986). Determination and quantification of content validity. *Nursing Research*, *35*(6), 382–385. https://psycnet.apa.org/doi/10.1097/00006199-198611000-00017

Malkewitz, C. P., Schwall, P., Meesters, C., & Hardt, J. (2023). Estimating reliability: A comparison of Cronbach's α, McDonald's ωt and the greatest lower bound. *Social Sciences & Humanities Open*, *7*(1), 100368. https://doi.org/10.1016/j.ssaho.2022.100368

Mazzetti, G., Consiglio, C., Santarpia, F. P., Borgogni, L., Guglielmi, D., & Schaufeli, W. B. (2022). Italian validation of the 12-item version of the Burnout Assessment Tool (BAT-12). *International Journal of Environmental Research and Public Health*, *19*(14), 8562. https://doi.org/10.3390/ijerph19148562

Mokkink, L. B., Terwee, C. B., Knol, D. L., Stratford, P. W., Alonso, J., Patrick, D. L., Bouter, L. M., & De Vet, H. C. W. (2010). The COSMIN checklist for evaluating the methodological quality of studies on measurement properties: A clarification of its content. *BMC Medical Research Methodology*, *10*(1), 22. https://doi.org/10.1186/1471-2288-10-22

Morera, O. F., & Stokes, S. M. (2016). Coefficient α as a measure of test score reliability: Review of 3 popular misconceptions. *American Journal of Public Health*, *106*(3), 458-461. https://doi.org/10.2105/AJPH.2015.302993

Moya-Salazar, J., Buitrón, L. A., Goicochea, E. A., Salazar, C. R., Moya-Salazar, B., & Contreras-Pulache, H. (2023). The age of young nurses is a predictor of burnout syndrome during the care of patients with COVID-19. *Nursing Reports*, *13*(2), 721-730. https://doi.org/10.3390/nursrep13020063

Müller, M. (2020). Item fit statistics for Rasch analysis: Can we trust them? *Journal of Statistical Distributions and Applications*, *7*(1), 5. https://doi.org/10.1186/s40488-020-00108-7

Osca, A., Barrado, J., & Millán, L. (2024). Validation of the burnout assessment tool-core symptoms in Spanish veterinarians, sex invariance, and cutoff points. *Frontiers in Veterinary Science*, *11*, 1454775. https://doi.org/10.3389/fvets.2024.1454775

Polit, D. F., & Beck, C. T. (2021). *Nursing research: Generating and assessing evidence for nursing practice* (11th ed.). Amsterdam: Wolters Kluwer.

Redelinghuys, K., & Morgan, B. (2023). Psychometric properties of the Burnout Assessment Tool across four countries. *BMC Public Health*, *23*(1), 824. https://doi.org/10.1186/s12889-023-15604-z

Robinson, S. E., Roth, S. L., Keim, J., Levenson, M., Flentje, J. R., & Bashor, K. (1991). Nurse burnout: Work related and demographic factors as culprits. *Research in Nursing & Health*, *14*(3), 223-228. https://doi.org/10.1002/nur.4770140309

Ru-Wen, L., Mei-Ling, Y. E. H., Kuan-Chia, L. I. N., & Kwua-Yun, W. (2020). A hierarchical model of occupational burnout in nurses associated with job-induced stress, self-concept, and work environment. *Journal of Nursing Research*, *28*(2), e79. https://doi.org/10.1097/JNR.0000000000000348

Sathyanarayana, S., & Mohanasundaram, T. (2024). Fit indices in structural equation modeling and confirmatory factor analysis: reporting guidelines. *Asian Journal of Economics, Business and Accounting*, *24*(7), 561-577. https://doi.org/10.9734/ajeba/2024/v24i71430

Schaufeli, W. B., Desart, S., & De Witte, H. (2020). Burnout Assessment Tool (BAT)—development, validity, and reliability. *International Journal of Environmental Research and Public Health*, *17*(24), 9495. https://doi.org/10.3390/ijerph17249495

Sinval, J., Vazquez, A. C. S., Hutz, C. S., Schaufeli, W. B., & Silva, S. (2022). Burnout assessment tool (BAT): Validity evidence from Brazil and Portugal. *International Journal of Environmental Research and Public Health*, *19*(3), 1344. https://doi.org/10.3390/ijerph19031344

Tesio, L., Caronni, A., Kumbhare, D., & Scarano, S. (2024a). Interpreting results from Rasch analysis 1. The "most likely" measures coming from the model. *Disability and Rehabilitation*, *46*(3), 591-603. https://doi.org/10.1080/09638288.2023.2169771

Tesio, L., Caronni, A., Simone, A., Kumbhare, D., & Scarano, S. (2024b). Interpreting results from Rasch analysis 2. Advanced model applications and the data-model fit assessment. *Disability and Rehabilitation*, *46*(3), 604-617. https://doi.org/10.1080/09638288.2023.2169772

Villarante, D. M., O'Donoghue, S. C., Medeiros, M., Milton, E., Walsh, K., O'Donoghue, A. L., Celi, L. A., Hayes, M. M., & Dilibero, J. (2023). A national survey of stress and burnout in critical care nurses: A prepandemic study. *Dimensions of Critical Care Nursing*, *42*(5), 248-254. https://doi.org/10.1097/DCC.0000000000000598

Walohtae, F.-i., Nimu, N., Doloh, S., & Maropi, A. (2024). Burnout among registered nurses working at a tertiary care hospital of southern region. *Princess of Naradhiwas University Journal*, *16*(2), 217-236. https://li01.tci-thaijo.org/index.php/pnujr/article/view/261650

Wannarit, K., Ratta-Apha, W., Pariwatcharakul, P., & Pukrittayakamee, P. (2023). Burnout study during the COVID-19 pandemic in Thailand: Psychometric evaluation of the Maslach Burnout Inventory–Human Services Survey for Medical Personnel. *Health Psychology and Behavioral Medicine*, *11*(1), 2268694. https://doi.org/10.1080/21642850.2023.2268694

Zamanzadeh, V., Ghahramanian, A., Rassouli, M., Abbaszadeh, A., Alavi-Majd, H., & Nikanfar, A.-R. (2015). Design and implementation content validity study: Development of an instrument for measuring patient-centered communication. *Journal of Caring Sciences*, *4*(2), 165-178. https://doi.org/10.15171/jcs.2015.017

Zhang, F., Xie, J., & Luo, L. (2022). Deep cross-cultural reconstruction process in the context of cultural potential: A qualitative study. *Frontiers in Psychology*, *13*, 727616. https://doi.org/10.3389/fpsyg.2022.727616

Zheng, X., Song, J., Shi, X., Kan, C., & Chen, C. (2025). The effect of authoritarian leadership on young nurses' burnout: The mediating role of organizational climate and psychological capital. *BMC Health Services Research*, *25*(1), 1-11. https://doi.org/10.1186/s12913-025-12403-7

Zhou, L.-L., Zhang, S.-E., Liu, J., Wang, H.-N., Liu, L., Zhou, J.-J., Bu, Z.-H., Gao, Y.-F., Sun, T., & Liu, B. (2022). Demographic factors and job characteristics associated with burnout in Chinese female nurses during controlled COVID-19 period: A cross-sectional study. *Frontiers in Public Health*, *9*, 757113. https://doi.org/10.3389/fpubh.2021.757113

Zijlmans, E. A. O., Tijmstra, J., Van der Ark, L. A., & Sijtsma, K. (2019). Item-score reliability as a selection tool in test construction. *Frontiers in Psychology*, *9*, 2298. https://doi.org/10.3389/fpsyg.2018.02298

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