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Psychometric Properties and Item Functioning of the Paykel Suicide Risk Scale in University Students from Metropolitan Lima: A Cross-Sectional Psychometric Study

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Abstract

Background

Suicidal behavior constitutes a major public health issue among young adults and requires brief screening instruments with sufficient psychometric evidence for initial detection. The objective of this study was to examine the psychometric properties and item functioning of the Paykel Suicide Risk Scale among university students in Metropolitan Lima.

Methods

Participants were 1,000 students aged 18 to 35 years (72.8% female and 27.2% male) from various universities in Metropolitan Lima. The internal structure was evaluated using confirmatory factor analysis for dichotomous indicators; reliability was assessed using KR-20 and categorical omega; item functioning was analyzed using one- and two-parameter logistic item response theory models (1PL and 2PL); equivalence by sex was evaluated via measurement invariance and differential item functioning; and relationships with suicidal ideation, depressive symptoms, and psychological well-being were examined.

Results

The unidimensional model demonstrated adequate fit, $\chi^2(5) = 5.29$, p=.382, CFI = 1.000, TLI = 1.001, RMSEA=.008, and SRMR=.012, with standardized factor loadings ranging between .822 and .910. Reliability was adequate (KR-20=.828; categorical ω = .840). The 2PL model outperformed the 1PL model, with discrimination parameters ranging from 2.495 to 3.853; the maximum scale information was located at θ = 0.73. The strong sex invariance was supported, and no DIF was detected after Holm correction. PSRS scores were positively correlated with suicidal ideation (ρs=.662) and depressive symptoms (ρs=.604), and negatively correlated with psychological well-being (ρs = − .245), all at p<.001.

Conclusions

These findings support the interpretation of a unidimensional and reliable score for the PSRS in university students from Metropolitan Lima, featuring highly discriminating items, comparability of core measurement parameters across males and females, and a coherent pattern of external relations. Consequently, the scale proves useful as a research tool and as a supportive measure in initial screening processes, without substituting a comprehensive clinical assessment.

Background

Suicide remains a public health priority. The World Health Organization estimates that 727,000 people died by suicide in 2021, making it the third leading cause of death among individuals aged 15 to 29 years [1]. In Peru, 6,910 cases of intentional self-poisoning or self-harm were treated at health facilities during 2024; 73% corresponded to females and 40.4% to young adults aged 18 to 29 years [2]. These data highlight young adults -a group that encompasses a large portion of the university population-as a crucial target for early risk detection.

Suicidal behavior is a multifactorial phenomenon shaped by psychological, social, and contextual conditions. A systematic review with meta-analysis focusing on university students confirmed the relevance of this problem in this population sector [3], where various studies have documented associations with depression and anxiety [4], problematic alcohol consumption [5], academic difficulties, and emotional regulation issues [6], as well as family factors and other vulnerability conditions [7, 8]. This complexity underscores the need for brief instruments capable of identifying distinct manifestations of suicidal behavior without reducing them to a non-specific indicator of psychological distress.

The Paykel Suicide Risk Scale (PSRS) was developed based on studies investigating suicidal feelings and behaviors in the general population [9]. Its five items assess experiences over the past year, including feelings that life is not worth living, death wishes, implicit suicidal ideation, suicidal thoughts or planning, and past suicide attempts. Its brevity and dichotomous format facilitate its use as a preliminary screening tool in time-constrained settings [10].

Existing cumulative evidence has predominantly supported a unidimensional structure across diverse samples, including Spanish [11] and Peruvian adolescents [12], Colombian students [13], perinatal women [14], Salvadoran adults [15], institutionalized older adults [16], and Mexican adolescents [17]. Recent studies have extended this evidence using item response theory and measurement invariance, demonstrating that items do not necessarily provide equal amounts of information across the latent trait spectrum, and that measurement equivalence must be verified prior to making group comparisons [16, 17].

Despite these advances, psychometric evidence among Peruvian university students remains limited. To the best of our knowledge, an integrated evaluation encompassing categorical factor structure, model-based reliability, item response theory functioning, conditional precision, measurement invariance, and differential item functioning (DIF) by sex -alongside relevant external correlates- has not been reported in this population. This integrated approach allows for determining not only whether the scale retains a general factor, but also where and with what degree of precision it yields information, as well as whether its items function comparably across demographic groups.

Therefore, the objective of the present study was to evaluate the psychometric properties and item functioning of the Paykel Suicide Risk Scale among university students in Metropolitan Lima. Specifically, we examined internal structure and reliability; item discrimination, location, and information;

measurement invariance and differential item functioning by sex; and the associations between scale scores and suicidal ideation, depressive symptoms, and psychological well-being.

Methods

Design and Participants

A cross-sectional psychometric study was conducted following the classification of instrumental designs proposed by Ato et al. [18]. The sample comprised 1,000 university students from Metropolitan Lima, Peru, aged 18 to 35 years (M = 20.63, SD = 2.93), of whom 728 were female (72.8%) and 272 were male (27.2%). The participants were recruited from various public and private universities in Metropolitan Lima. They were at different stages of their academic training, with the highest representation from the 3rd–4th academic terms (41.2%), followed by 1st–2nd terms (27.1%) and 7th–8th terms (26.0%).

Non-probability sampling was employed via an online snowball recruitment strategy. The survey link was distributed to university students, who were asked to forward it to peers meeting the inclusion criteria. Inclusion criteria required participants to be of legal age (older than18 years), currently enrolled in a university, and residing in Metropolitan Lima. The final dataset contained 1,000 complete submissions; no records were excluded. Due to the decentralized nature of online dissemination, response rates could not be calculated.

Instruments

Paykel Suicide Risk Scale (PSRS): The Spanish version used by Fonseca-Pedrero et al. [11] was administered. The scale comprises five items with a dichotomous (Yes/No) response format inquiring about experiences over the past year. Responses were recoded as 0 = No and 1 = Yes for analysis, yielding a total score ranging from 0 to 5, where higher scores indicate greater presence of suicidal behavior manifestations. The scale has demonstrated an essentially unidimensional structure across various populations [11–17].

Roberts Suicidal Ideation Scale: Originally developed by Roberts and Chen [19], the version adapted for Mexican university students by Padrós-Blázquez et al. [20] was utilized. It consists of four items assessing the frequency of thoughts and experiences related to suicidal ideation over the past week. Items are scored from 0 to 3, with total scores ranging from 0 to 12. The Mexican validation confirmed a unidimensional structure and adequate internal consistency [20]. In the current sample, Cronbach's alpha was .852.

Patient Health Questionnaire-9 (PHQ-9): The Spanish version of the PHQ-9, a nine-item instrument developed by Kroenke et al. [21] to assess the frequency of depressive symptoms over the preceding two weeks, was administered. Each item is scored from 0 to 3, resulting in total scores from 0 to 27, with higher scores reflecting greater depressive severity. Sound psychometric properties have been

documented for this instrument in Peruvian university students [22]. In the current sample, Cronbach's alpha was .900.

Psychological Well-Being Scale for Adults (BIEPS-A): Developed by Casullo and Castro Solano [23], the BIEPS-A is grounded in the multidimensional model of psychological well-being [24, 25]. The version used was the adaptation for Peruvian university students by Domínguez-Lara [24]. It comprises 13 items with a 3-point response scale (1 = Disagree, 2 = Neither agree nor disagree, 3 = Agree) evaluating acceptance/control, autonomy, relationships, and life projects, based on thoughts and feelings during the past month. Theoretical total scores range from 13 to 39, with higher scores indicating greater psychological well-being. In the present sample, Cronbach's alpha for the total score was .901.

Procedure

Data collection took place between September and December 2025 using Google Forms. Prior to accessing the questionnaires, participants viewed an informed consent form and were required to electronically confirm their voluntary participation. The protocol collected sociodemographic information followed by the four measurement scales, requiring approximately 15 minutes to complete.

The dataset used for analysis was de-identified and contained no names, email addresses, or other direct identifiers. The data were verified for missing values; total scores for PSRS, Roberts, PHQ-9, and BIEPS-A matched the exact sums of their respective item responses across all 1,000 cases.

The study received ethical approval from the Ethics Committee of the School of Psychology at César Vallejo University (Approval No. 0091-2025/CEI-PSI) and was conducted in accordance with the principles of the Declaration of Helsinki. All participants were of legal age and provided electronic informed consent prior to responding.

Data Analysis

The analytical approach followed the framework for accumulating validity and reliability evidence outlined in the Standards for Educational and Psychological Testing [26]. Statistical analyses were performed using Jamovi (version 2.6) and R (version 4.4), primarily relying on the lavaan, semTools, mirt, and cocor packages.

First, item frequencies, means, standard deviations, and corrected item-total correlations were inspected. Internal structure was evaluated using single-factor confirmatory factor analysis (CFA). The five items were specified as ordered categorical indicators, and the model was estimated using mean- and variance-adjusted weighted least squares (WLSMV) with robust standard errors in lavaan [27].

The model fit indices were interpreted conjointly considering χ^2, CFI, TLI, RMSEA, and SRMR, rather than relying on a single cutoff point [28]. Regarding score reliability for the PSRS, estimations were performed

using KR-20 and model-based categorical omega (ω), following the model-based reliability framework for categorical indicators [29].

For the item response theory (IRT) modeling, unidimensional one- and two-parameter logistic models (1PL and 2PL) were compared using mirt [30]. Model selection was guided by likelihood ratio tests, AIC, and BIC, alongside the $M2$ statistic and its associated fit indices (RMSEA, SRMSR, CFI, and TLI). For the selected model, item discrimination (a), location (b), individual item fit via $S\text{-}X^2$ [31], local dependence via $Q3$ [32], item information, and the total test information function were estimated. $Q3$ residuals were evaluated relative to the average pattern of residual correlations, avoiding the isolated interpretation of high negative values as evidence of local dependence.

Measurement equivalence by sex was evaluated using multigroup CFA for categorical indicators following Wu and Estabrook's identification approach [33]. For dichotomous indicators, strong invariance was tested by jointly constraining thresholds, factor loadings, and intercepts to equality across groups; strict invariance further imposed equality constraints on residual variances.

Changes in CFI, RMSEA, and SRMR (ΔCFI, ΔRMSEA, ΔSRMR) were evaluated considering index sensitivity [34]. As a complementary analysis, differential item functioning (DIF) was examined using a multigroup 2PL IRT model, simultaneously testing discrimination ($a1$) and intercept (d) parameters (the latter related to item location). Adjusted p-values were calculated using Holm's procedure [35].

Relationships with external variables were evaluated using Spearman's rank correlation coefficient (ps). Rank-based partial correlations were calculated controlling for age and sex. To maintain consistency with Spearman correlations, variables were rank-transformed, and the PSRS–Roberts and PSRS–PHQ-9 correlations were statistically compared using Steiger's test for dependent rank correlations [36]. A two-tailed significance level of $\alpha = .05$ was adopted.

Use of Generative Artificial Intelligence Tools

During manuscript preparation, ChatGPT (OpenAI) was utilized to assist with language editing, structural organization, and clarity of statistical presentation. All analyses were executed and verified by the authors. The AI tool was not used to generate participants, raw data, or empirical results. All methodological decisions and scientific interpretations remain the sole responsibility of the authors.

Results

Preliminary Analysis of the Items

Table 1
Descriptive statistics and item-total correlations for the items on the Paykel Suicide Risk Scale

Item	M	SD	Affirmative response (%)	r item-total
P1	0.379	0.485	37.9	0.612
P2	0.399	0.490	39.9	0.651
P3	0.426	0.495	42.6	0.609
P4	0.210	0.408	21.0	0.641
P5	0.212	0.409	21.2	0.629

Note: M = mean; SD = standard deviation; r item-rest = corrected correlation between each item and the score composed of the remaining items.

The proportion of affirmative responses ranged from 21.0% to 42.6% (Table 1). Question 3 had the highest frequency of affirmative responses, while Questions 4 and 5 had the lowest proportions. Item-total correlations ranged from 0.609 to 0.651, with no evidence to justify removing any item.

Internal Structure and Reliability

Table 2
Parameters of the One-Dimensional Factor Model and Reliability of the Paykel Suicide Risk Scale
Panel A. Factorial parameters

Item	λ	CI 95%	R^2	τ
Q1	0.822	[0.777, 0.867]	0.676	0.308
Q2	0.880	[0.844, 0.917]	0.775	0.256
Q3	0.830	[0.787, 0.873]	0.689	0.187
Q4	0.910	[0.871, 0.950]	0.829	0.806
Q5	0.890	[0.849, 0.930]	0.792	0.800

Panel B. Global fit and reliability

χ^2(gl)	p	CFI	TLI	RMSEA [IC 95%]	SRMR	KR-20	ωcat
5.29 (5)	0.382	1.000	1.001	0.008 [0.000, 0.045]	0.012	0.828	0.840

Note: λ = standardized factor loading; R^2 = coefficient of determination; τ = threshold; KR-20 = Kuder-Richardson 20; ωcat = omega based on the categorical model. The AFC was estimated using WLSMV and robust standard errors.

The unidimensional model showed an adequate fit (Table 2). The standardized factor loadings were high (0.822–0.910), and the coefficients of determination ranged from 0.676 to 0.829. The scale demonstrated adequate reliability, with a KR-20 of 0.828 and a categorical omega of 0.840.

Item Functioning based on the Item Response Theory

Table 3
Fitting and parameters of the Two-Parameter Logistic Model (2PL) Panel A. Comparison of models

Model	AIC	BIC	M2 (gl)	p	RMSEA [IC 95%]	SRMSR	CFI
1PL	5198.004	5222.542	638.682 (10)	< 0.001	0.251 [0.234, 0.267]	0.347	0.745
2PL	4677.755	4726.832	4.808 (5)	0.440	0.000 [0.000, 0.043]	0.014	1.000

Panel B. Parameters and individual adjustment of the items

Item	a	b	S-X²	p	θ(I máx.)	I máx.
Q1	2.495	0.374	1.600	0.449	0.37	1.557
Q2	3.271	0.290	2.175	0.337	0.29	2.675
Q3	2.622	0.223	2.991	0.224	0.22	1.719
Q4	3.853	0.884	3.836	0.147	0.88	3.710
Q5	3.469	0.895	1.462	0.481	0.89	3.008

Note: a = discrimination; b = location; S-X² = item fit statistic; I = information. The 1PL-2PL comparison was significant, $\Delta\chi^2(5) = 530.249$, $p < 0.001$.

The 2PL model showed a substantially better fit than the 1PL model, $\Delta\chi^2(5) = 530.249$, $p < 0.001$ (Table 3). The discrimination parameters were high (a = 2.495–3.853); P4 showed the highest discrimination and maximum information. The localization parameters placed Q1–Q3 closer to the center of the continuum, while Q4 and Q5 shifted toward higher values of θ. No item showed significant misfit based on S-X², and no relevant signs of local dependence were observed. La información total alcanzó su máximo en θ = 0.73, I(θ) = 10.257, con SE = 0.312. La precisión fue mayor aproximadamente entre niveles centrales y moderadamente elevados del rasgo: SE ≤ 0.50 entre θ = -0.22 y 1.40, y SE ≤ 0.45 entre θ = -0.11 y 1.32.

Note

Panel A: Item characteristic curves. Panel B: Information functions by item. Panel C: Total information function for the scale. The total function reaches its maximum at approximately θ = 0.73.

Figure 1 illustrates the shift of P4 and P5 toward higher values of θ and the greater individual information contributed by P4; the total information reaches its maximum around θ = 0.73.

Measurement invariance and differential functioning by sex

Table 4
Measurement invariance and differential item functioning by sex Panel A. Factorial invariance

Model	χ^2(gl)	p	CFI	RMSEA	SRMR	ΔCFI	ΔRMSEA	ΔSRMR
Configural	8.99 (10)	0.533	1.000	0.000	0.017	—	—	—
Strong	13.15 (13)	0.437	1.000	0.005	0.018	0.000	0.005	0.000
Strict	24.38 (18)	0.143	0.999	0.027	0.028	-0.001	0.022	0.011

Panel B. Differential Item Functioning (DIF)

Item	χ^2 DIF	gl	p	p adjusted (Holm)	Result
Q1	2.486	2	0.289	0.577	Sin DIF
Q2	0.187	2	0.911	0.911	Sin DIF
Q3	5.823	2	0.054	0.272	Sin DIF
Q4	4.633	2	0.099	0.394	Sin DIF
Q5	3.798	2	0.150	0.449	Sin DIF

Note: The multi-group sample consisted of 272 men and 728 women. For dichotomous indicators, the Wu-Estabrook categorical identification method was used. The p-values for the DIF were adjusted using the Holm method.

The configural model showed satisfactory fit, and the imposition of strong invariance constraints resulted in minimal changes (ΔCFI = 0.000, ΔRMSEA = 0.005, and ΔSRMR < 0.001) (Table 4), supporting the equivalence of the fundamental measurement parameters between men and women. Although the strict model maintained good absolute fit, the increase in RMSEA and SRMR was greater; therefore, this level was interpreted as mixed evidence. The multi-group TRI analysis did not identify significant DIF in any of the five items after Holm's correction.

Relationships with other variables

Table 5
Relationships between PAYKEL scores and external variables

External variable	ρs	p	ρ partial [1]	p partial
Suicidal ideation - Roberts	0.662	< 0.001	0.662	< 0.001
Symptoms of Depression - PHQ-9	0.604	< 0.001	0.604	< 0.001
Psychological well-being - BIEPS-A	-0.245	< 0.001	-0.246	< 0.001

Note: ρs = Spearman's rho. [1] Partial correlation based on ranks, controlling for age and sex. The difference between PAYKEL-Roberts and PAYKEL-PHQ-9 was Δρ = 0.058, Steiger's z = 2.854, p = 0.004.

PAYKEL showed positive associations with suicidal ideation and depressive symptoms, and an inverse association with psychological well-being (Table 5). The relationship with Roberts was significantly stronger than that observed with the PHQ-9 (z = 2.854, p = 0.004). The partial correlations adjusted for age and sex remained virtually unchanged.

Discussion

Overall, the results support a unidimensional and reliable interpretation of the Paykel Suicide Risk Scale scores among university students in Metropolitan Lima. The convergence observed among categorical CFA, IRT modeling, sex equivalence analyses, and relationships with external variables provides complementary evidence regarding both the factor structure and the functioning of its five items. This demonstrates that integrating these analytical approaches expands the available psychometric evidence for the PSRS within a Latin American university population.

The unidimensional structure was consistent with the empirical evidence reported in Spanish and Peruvian adolescents [11, 12], Colombian students [13], Salvadoran adults [15], and other populations [14, 16, 17]. In the present study, the single-factor model achieved adequate fit without requiring residual covariances, in contrast to the Peruvian validation in adolescent samples where correlating error terms between certain items was necessary [12]. This discrepancy may be attributable to differences in sample characteristics or testing contexts, underscoring the importance of verifying the scale's internal structure in each target population. Furthermore, reliability estimates corroborated this structural evidence, aligning with previous studies.

The IRT analysis stands out as one of the primary contributions of this study. The superior fit of the 2PL model indicated that the items vary in their discriminative capacity and location along the latent trait continuum. Items P4 and P5 -which assess content related to suicide planning and past attempts- were located at higher levels of the trait, whereas items P1 through P3 provided information in regions closer to the mean. This pattern is consistent with a recent validation conducted in Mexico [17], demonstrating that the measurement precision of the PSRS is primarily concentrated at moderate to elevated levels of the latent trait. This conditional precision identifies where the scale measures with lower measurement error, but it should not be construed as evidence of a clinical cutoff, sensitivity, or specificity.

Group comparisons yielded favorable evidence supporting score comparability by sex. Strong (scalar) invariance was supported, and no items exhibited differential item functioning (DIF) after adjusting for multiple comparisons, aligning with prior findings in Peruvian and Mexican adolescents [12, 17]. Conversely, strict invariance resulted in a noticeable deterioration of RMSEA and SRMR fit indices; thus, it is more prudent to assume equivalence of the core measurement parameters without assuming equality of residual variances.

Regarding relationships with external variables, the PSRS exhibited a strong positive correlation with another measure of suicidal ideation, a slightly lower positive correlation with depressive symptoms, and a weak inverse association with psychological well-being. Furthermore, the correlation with the Roberts scale was significant and statistically higher than that observed with the PHQ-9, remaining virtually unchanged after controlling for age and sex. These findings are consistent with a closer conceptual proximity between the PSRS and suicidal ideation, without implying measurement redundancy between the two instruments. This pattern aligns with previous studies where the PSRS demonstrated significant associations with depression, suicidal ideation, hopelessness, and life satisfaction, thereby confirming the expected theoretical network [16, 17].

From the perspective of its application, the brevity of the PAYKEL, as well as its dichotomous format, make it particularly suitable for use as a research tool and to support initial assessment processes in university settings [10], given that these findings do not allow for the establishment of clinical cutoff points or justify its use as a standalone diagnostic instrument. Furthermore, responses indicating suicidal planning or attempts require further professional assessment that takes into account intent, history, context, and protective factors.

Regarding the limitations, it is important to note that, since the study was conducted using non-probabilistic snowball sampling, the generalizability of the results is limited to college students in Metropolitan Lima only, without accounting for a response rate due to the dissemination procedure. Furthermore, all instruments were self-report measures; therefore, variance associated with this common method of administration cannot be ruled out. On the other hand, the cross-sectional design prevented an examination of the scale's temporal stability and predictive capacity, while the absence of an external clinical criterion made it impossible to estimate sensitivity, specificity, or cutoff points. Furthermore, the higher representation of women must be taken into account when interpreting the analyses by sex. Finally, it is important to emphasize that the PHQ-9 includes an item regarding thoughts of death or self-harm, which may partially increase its overlap with the content of the PAYKEL scale.

Conclusions

The Paykel Suicide Risk Scale demonstrated favorable psychometric properties among college students in Metropolitan Lima. Its unidimensional structure and adequate reliability support the interpretation of a total score, while the 2PL model revealed items with high discrimination and complementary information across different regions of the trait. Strong invariance and the absence of DIF provided evidence of the

comparability of key parameters between men and women, and the relationships with suicidal ideation, depressive symptoms, and psychological well-being followed a theoretically consistent pattern. These findings support the use of PAYKEL as a brief measure in research and as an aid to initial assessment among college students, without replacing an integral clinical evaluation.

Abbreviations

PSS
Paykel Suicide Risk Scale
CFA
confirmatory factor analysis
ITR
item response theory
1PL
one-parameter logistic model
2PL
two-parameter logistic model
WLSMV
mean- and variance-adjusted weighted least squares
CFI
comparative fit index
TLI
Tucker-Lewis index
RMSEA
root mean square error of approximation
SRMR
standardized root mean square residual
SRMSR
standardized root mean square residual in **IRT**
KR-20
Kuder-Richardson 20
DIF
differential item functioning
PHQ-9
Patient Health Questionnaire-9
BIEPS-A
Psychological Well-Being Scale for Adults
AIC
Akaike Information Criterion
BIC

Bayesian Information Criterion

SE

standard error.

Declarations

Ethics approval and consent to participate

The study was approved by the Ethics Committee of the School of Psychology at César Vallejo University (Ruling No. 0091-2025/CEI-PSI). All participants were of legal age and provided electronic informed consent prior to participation. The procedures were conducted in accordance with the principles of the Declaration of Helsinki.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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Author Contribution

RMCV: conceptualization, methodology, research, data curation, formal analysis, drafting of the original manuscript, and supervision. EREA: conceptualization, methodology, formal analysis, validation, and manuscript review. PPDG: research, data curation and organization, statistical analysis, visualization, and manuscript review. ERPV: methodology, formal analysis, interpretation of results, validation of psychometric procedures, and review and editing of the manuscript. KPTC: supervision, project management, interpretation of results, critical review, and final validation.All of the authors read and approved the final version of the manuscript and take responsibility for its content.

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Data Availability

Additional InformationRepositoryZENODOhttps://doi.org/10.5281/zenodo.23267991

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Figures

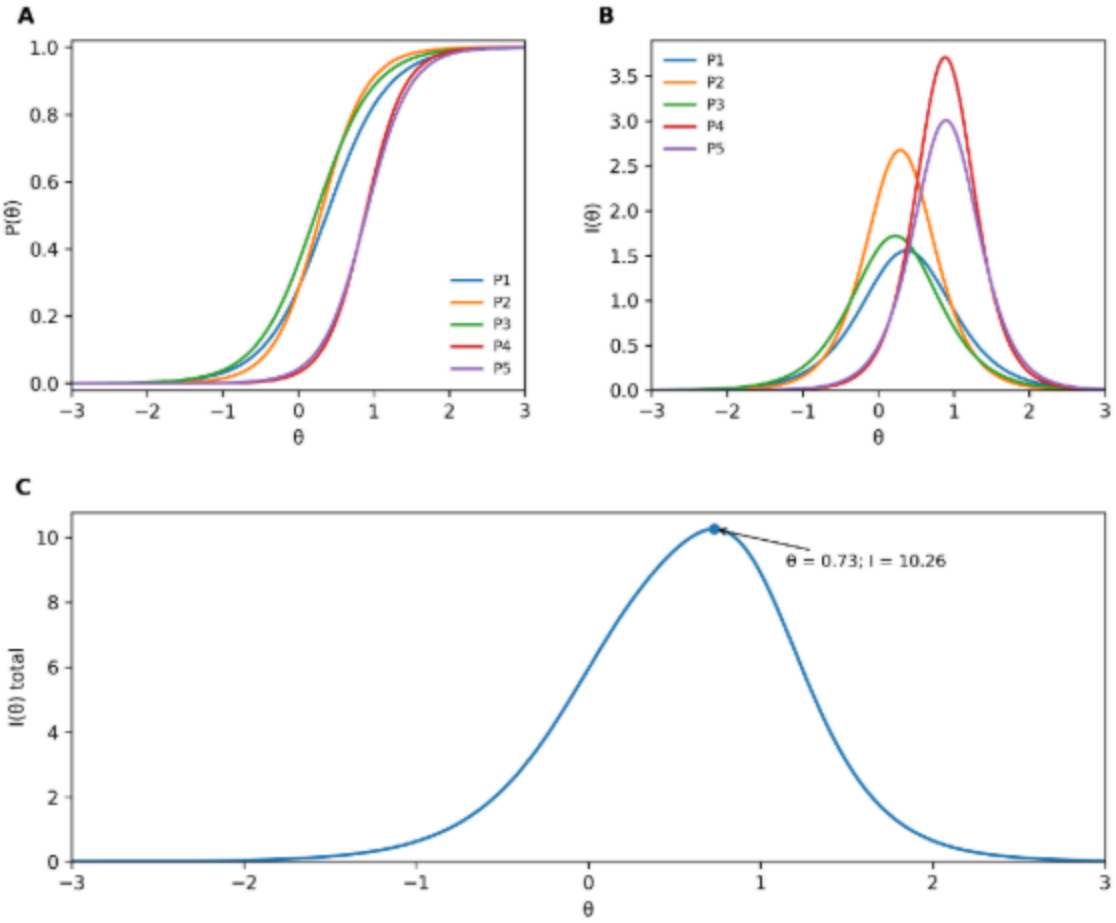


Figure 1

Item Functioning and Accuracy of the Paykel Suicide Risk Scale.

Note. Panel A: Item characteristic curves. Panel B: Information functions by item. Panel C: Total information function for the scale. The total function reaches its maximum at approximately θ = 0.73.

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