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Validation of the Portuguese version of the Gaming Disorder and Hazardous Gaming Scale: Psychometric properties and measurement invariance based on ICD-11

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ABSTRACT

Objective: Gaming Disorder is characterized by persistent and recurrent gaming behavior that takes precedence over daily activities, whereas Hazardous Gaming refers to gaming patterns that increase the risk of mental and physical harm. This study aimed to adapt the Gaming Disorder and Hazardous Gaming Scale to Portuguese, based on ICD-11 criteria, and to examine its psychometric properties. **Method:** In Study 1, exploratory and confirmatory factor analyses were conducted to examine the scale's factorial structure and to test measurement invariance across sex, educational level, age, and gaming duration. Study 2 assessed associations between gaming-related problems and psychological symptoms using the Brief Symptom Inventory. **Results:** The scale demonstrated robust psychometric properties and evidence of measurement invariance across the examined groups. Greater gaming duration and older age were associated with higher disorder scores. Between 7% and 18% of participants reported gaming-related functional impairments. The association between somatization symptoms and gaming disorder/hazardous gaming was moderated by sex, with stronger effects observed in men. **Conclusion:** The Portuguese version of the scale represents a valid and reliable instrument for assessing gaming-related problems, supporting its use in both research and clinical settings.

Keywords: Gaming disorder; hazardous gaming; ICD-11 criteria; GDHGS.

Validación de la versión portuguesa de la Gaming Disorder and Hazardous Gaming Scale: Propiedades psicométricas e invarianza de medida basada en el marco de la CIE-11

RESUMEN

Objetivo: El trastorno por videojuegos se caracteriza por un patrón persistente y recurrente de juego que pasa a ocupar un lugar prioritario frente a las actividades cotidianas, mientras que el juego peligroso (*hazardous gaming*) se refiere a patrones de juego que incrementan el riesgo de daño mental y físico. El presente estudio tuvo como objetivo adaptar al portugués la *Gaming Disorder and Hazardous Gaming Scale*, basada en los criterios de la CIE-11, y examinar sus propiedades psicométricas. **Método:** En el Estudio 1 se realizaron análisis factoriales exploratorios y confirmatorios para examinar la estructura factorial de la escala y evaluar la invarianza de medida en función del sexo, el nivel educativo, la edad y la duración del juego. En el Estudio 2 se analizaron las asociaciones entre los problemas relacionados con el juego y los síntomas psicológicos mediante el *Brief Symptom Inventory*. **Resultados:** La escala mostró propiedades psicométricas sólidas y evidencia de invarianza de medida entre los grupos examinados. Una mayor duración del juego y una mayor edad se asociaron con puntuaciones más elevadas en trastorno por videojuegos. Entre el 7% y el 18% de los participantes informaron de deterioro funcional relacionado con el juego. La asociación entre los síntomas de somatización y el trastorno por videojuegos/juego peligroso estuvo moderada por el sexo, observándose efectos más intensos en los hombres. **Conclusión:** La versión portuguesa de la escala constituye un instrumento válido y fiable para la evaluación de problemas relacionados con el juego, lo que respalda su uso tanto en contextos de investigación como clínicos.

Palabras clave: Trastorno por videojuegos; juego peligroso; criterios CIE-11; GDHGS.

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Introduction

Gaming disorder (GD) is the second officially recognized mental health condition related to digital technology, following gambling disorder (Ropovik et al., 2023). GD, included in the ICD-11 by the World Health Organization (WHO, 2019), is defined by patterns of gaming that involve diminished control, prioritization of gaming over other activities, and continued gaming despite negative consequences. Diagnosis requires significant impairment in daily life, persisting for at least 12 months. Hazardous gaming, in contrast, refers to risky gaming behaviors that don't meet the criteria for GD but still pose health risks. The American Psychiatric Association (2022) recognizes Internet Gaming Disorder (IGD) as a condition requiring further research.

The inclusion of GD in the ICD-11 has not been without controversy. Some scholars question the distinctiveness of the disorder from high engagement or argue that underlying issues (e.g., depression, social anxiety) may be primary (Aarseth et al., 2017). This debate underscores the complexity of the construct and highlights the necessity for rigorously validated assessment tools that can reliably differentiate clinically significant impairment from non-pathological high engagement.

A global prevalence of 3% for GD and 6.7% for both GD and IGD has been reported (Stevens et al., 2021; Zhou et al., 2024). The etiology and maintenance of gaming-related problems are multifaceted. Established risk factors include extended gaming time, escapism motivations, and pre-existing or comorbid psychological distress such as depression and anxiety (Dieris-Hirche et al., 2020; Giardina et al., 2024; Melodia et al., 2020; Moore et al., 2022). Problematic gaming is strongly linked to psychological distress, often serving as a maladaptive coping mechanism, which can create a cyclical relationship where distress exacerbates gaming and vice-versa (Anthony et al., 2020; Wong et al., 2020). This pattern is further reinforced by shared cognitive vulnerabilities, such as avoidance and negative self-evaluation, common to both behavioral addictions and internalizing disorders (André et al., 2020; Cudo et al., 2020; Cudo et al., 2024). The impact manifests across life domains, including academic and occupational failure, social withdrawal, and family conflict (Bussone et al., 2020; Tullett-Prado et al., 2021). Protective factors, conversely, include self-esteem, intelligence, and supportive family relationships (Ropovik et al., 2023).

Contextual factors significantly moderate these relationships. Gender is a critical variable, with men and women differing in prevalence rates, gaming motivations, coping styles, and the expression of gaming-related distress (Di Bianca & Mahalik, 2022; Farhane-Medina et al., 2022). The type of game a person plays significantly shapes how gaming fits into their routine. For instance, the deep involvement required by immersive genres like Massively Multiplayer Online Role-Playing Games (MMORPGs) contrasts sharply with the flexible, brief sessions of casual games. Furthermore, broader cultural views on gaming and leisure determine whether these behaviors are seen as a harmonious part of daily life or a disruptive force (Arbeau et al., 2020; Sachu et al., 2022). Despite these known risks, individuals with pathological gaming behaviors often avoid professional help, highlighting the need for better screening, prevention tools, and a nuanced understanding of these contextual influences (Kewitz et al., 2023).

Several instruments assess gaming-related problems. Most are based on the DSM-5 criteria for IGD, such as the self-reported Internet Gaming Disorder Scale-Short Form (Pontes & Griffiths, 2016). A distinct advancement is the clinician-rated Gaming Disorder and Hazardous Gaming Scale (GDHGS) by Balhara et al. (2020). This tool is the first designed specifically to operationalize the ICD-11 framework, which differentiates between GD and Hazardous Gaming.

Validating the GDHGS for the Portuguese population is essential due to cultural variations in social norms, values, and lifestyles that influence gaming behaviors and their psychological impact (Chan et al., 2022). A culturally adapted version ensures it accurately reflects the specific expressions of these behaviors and related mental health challenges in Portugal (Pontes et al., 2021). Direct translation without proper validation could lead to misinterpretations, affecting the scale's reliability (Cheung et al., 2020). Furthermore, reliance on self-report data, while necessary, introduces limitations such as potential recall and social desirability biases that must be acknowledged (Heirene et al., 2022). Linguistic and contextual validation ensures that Portuguese respondents understand and respond to items as intended (Mellinger & Hanson, 2020).

A validated Portuguese GDHGS improves its reliability and validity as a diagnostic and research tool, enabling more accurate identification of symptoms, prevalence measurement, and severity assessment of GD (Karhulahti et al., 2023). It enhances diagnostic accuracy, supports quality research, and provides a foundation for evidence-based practice (Tang et al., 2022). A validated version also allows meaningful comparisons across cultures, enriching cross-cultural research (Blandón-Castaño et al., 2024). Furthermore, a reliable GDHGS can inform public health initiatives and policy development in Portugal, facilitating resource allocation and targeted prevention programs (Kewitz et al., 2023).

This research includes two aims: to (1) validate the Portuguese adaptation of the GDHGS by examining its factor structure, reliability, and measurement invariance across key demographics, and (2) assess the real-world impact of GD and hazardous gaming on participants' lives by exploring their specific relationships with psychopathological symptoms, including an examination of potential gender differences.

Methods

Procedures

The original GDHGS: ICD-11 Framework (Balhara et al., 2020) was translated and culturally adapted into European Portuguese following international guidelines for the translation and adaptation of psychological instruments. Initially, two independent bilingual translators, whose native language was European Portuguese, performed forward translations of the original English version. These translations were compared and synthesized into a single preliminary version by the research team. Subsequently, a back-translation was conducted by two independent bilingual translators, blinded to the original version, whose native language was English. The back-translated versions were compared with the original scale to assess semantic, conceptual, and cultural equivalence. Discrepancies were discussed and resolved by an expert committee composed of psychologists with expertise in behavioral addictions and psychometric assessment, resulting in a pre-final European Portuguese version of the scale. A pilot test was then conducted with a small sample of individuals from the Portuguese population to evaluate clarity, comprehension, and cultural relevance of the items. Minor linguistic adjustments were made based on participant feedback, yielding the final European Portuguese version.

Data were collected from the Portuguese population between March and April 2025 using a non-probabilistic convenience sampling method. Participants were recruited through social media platforms and completed the questionnaires online via a computer or mobile device. Prior to participation, all individuals provided informed consent for both their participation and the publication of the results, with voluntary participation and confidentiality guaranteed. No identifying information was collected, maintaining anonymity throughout the entire process. The researchers were not present during questionnaire completion.

This study was conducted in accordance with the ethical standards set forth in the 1964 Declaration of Helsinki and its subsequent amendments or comparable ethical standards. Ethical approval was obtained from the Institutional Review Board of Universidade Católica Portuguesa.

Participants

The sample consists of 792 Portuguese participants resident in Portugal, of which 645 (81.2%) are male. The average age is 28.25 years (SD = 8.12; range 18 - 61). According to Arnett's developmental stages (2000), 485 (61.2%) belongs to emerging adults, 219 (27.7%) to young adults, and 88 (11.1%) to middle-aged adults. Socio-economic status was not directly assessed; however, educational attainment is reported as a proxy variable. The majority of participants (439 or 55.4%) have a university education. The vast majority of the sample (560 or 70.7%) play digital games (online and offline) between 5 and 7 days per week, while the remaining participants play between 1 and 4 days per week.

To carry out an exploratory factor analysis and a confirmatory factor analysis, the sample was randomly divided into two groups. The sample used for the exploratory factor analysis consists of 396 participants, of which 331 (83.6%) are male (mean age = 25.91 years, SD = 7.53, range = 18 – 61). Based on Arnett's stages (2000), 297 participants (75.0%) are emerging adulthood, 74 (18.7%) young adults, and 25 (6.3%) middle-aged adults. Most participants (229 or 57.8%) have a university education. The majority (286 or 72.2%) play digital games (online and offline) between 5 and 7 days per week. The sample used for the confirmatory factor analysis includes 396 participants, of whom 314 (79.63%) are male (mean age = 30.59 years, SD = 8.01, range = 18 – 61); 188 participants (47.5%) are emerging adults, 145 (36.6%) young adults, and 63 (15.9%) middle-aged adults. Most participants (210 or 53.0%) have a university education. The majority (274 or 69.2%) play digital games (online and offline) between 5 and 7 days per week. There are no statistically significant differences between the two samples randomly divided concerning sex, education, or gaming frequency; however, there are statistically significant differences in age [$t(790) = -8.473$; $p < .001$; $d = -0.602$].

Instruments

Socio-demographics and gaming frequency. The survey included questions related to sex, age, and education level. It also included a question that examined gamers weekly time spent playing (online and offline), distinguished between those that play four days a week or less and those who play five or more days a week.

The Gaming Disorder and Hazardous Gaming Scale (GDHGS, Balhara et al., 2020). The GDHGS is a clinician-rated five-item scale for measuring GD and hazardous gaming according to ICD-11. It examines both online and offline digital gaming activity occurring over the period of the last 12 months. The first 4 items were adapted from the three ICD-11 core criteria of GD. The second criteria of GD were split into two questions assessing the preoccupation with gaming. The fifth item assess the ICD-11 criteria for hazardous gaming. All the items are rated in a five-point scale, 'never' (not even once in the last 12 months) to 'daily or almost daily' (5-7 days per week). Severity is assessed by summing the scores on the first four items, while the fifth item assesses hazardous gaming. The significant impairment caused by GD is obtained by summing the scores on the sixty items. The internal consistency measured by the Cronbach´s alpha was of .91.

Internet Gaming Disorder Scale (IGDS, Pontes et al., 2014). In this study we used the Portuguese version of the Internet Gaming Disorder Scale – Shor Form (IGDS-SF) by Pontes and Griffiths (2016), that is a self-report scale composed by 9 items, reflecting the 9 core criteria for IGD (APA, 2013), using a 5-point scale: 1 (never), 2 (rarely), 3 (sometimes), 4 (often), and 5 (very often). It assesses the severity of IGD (both online and offline) and its detrimental consequences. The sum score can range from 9 to 45, with higher scores indicating higher degree of gaming disorder. The Portuguese version presented adequate internal consistency levels (Cronbach´s alpha = .87).

The Brief Symptoms Inventory – 18 (BSI-18; Derogatis, 2001). The BSI-18 is composed by 18 items in a four Likert scale (0 = 'not at all' to 4= 'extremely') which assesses three symptom scales: somatization, depression, and anxiety. Higher scores are indicative of psychiatric conditions. A global severe index assesses overall psychological distress level. In the study, we used the Portuguese version of the instrument (Canavarro et al., 2017) which showed adequate internal consistency (Cronbach´s alpha > .80).

Statistical analysis

Descriptive statistics were computed for all variables. Data distribution was assessed through skewness (values within ±3) and kurtosis (values within ±11; Kline, 2023), with no significant departures from normality detected. The variance inflation factor (VIF) (< 10) and tolerance (> 0.1) were examined to ensure the absence of multicollinearity (Belsley et al., 1980). Reliability was assessed using Cronbach's alpha (> .70). For multidimensional structures, McDonald's omega was also calculated. Composite reliability (CR > .70) and average variance extracted (AVE > .50) were used to evaluate the reliability and convergent validity of the constructs. Discriminant validity was assessed using the square root of the AVE (Fornell & Larcker, 1981).

An exploratory factor analysis (EFA) was conducted to investigate the underlying structure of the GDHGS. Given the ordinal nature of the 5-point Likert scale items, a polychoric correlation matrix was used. The suitability of the data for factor analysis was confirmed using the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy (> .70) and Bartlett's test of sphericity ($p <$ .05). To extract the factor structure, robust unweighted least squares (ULS) estimation based on the polychoric matrix was employed. A principal axis factoring (PAF) method with varimax rotation was applied to the retained component. Factors with eigenvalues greater than 1 were retained, and items with factor loadings ≥ 0.50 were considered to have a strong association with the factor. Communalities were examined, with values ≥ 0.50 considered ideal. The extracted factors were expected to explain ≥ 60% of the total variance for a satisfactory model (Thurstone, 1940).

A confirmatory factor analysis (CFA) was performed to validate the factor structure identified in the EFA. Consistent with the EFA, the CFA was conducted on the polychoric correlation matrix. The model was estimated using the Diagonally Weighted Least Squares (DWLS) estimator, which is robust and recommended for ordinal data. Model fit was evaluated using the following indices: the Tucker-Lewis Index (TLI), the Comparative Fit Index (CFI), the Root Mean Square Error of Approximation (RMSEA), and the Standardized Root Mean Square Residual (SRMR). A good model fit was indicated by CFI and TLI values > 0.90, RMSEA < 0.08, and SRMR < 0.08 (Bentler, 1990).

Measurement invariance across sex, age, education, and gaming frequency was tested using multi-group CFA with the same DWLS estimator. Invariance was assessed sequentially at four levels: configural, metric, scalar, and strict (error) invariance. The following criteria were used to establish invariance: for metric invariance, $\Delta CFI \leq .01$, $\Delta RMSEA \leq .015$, and $\Delta SRMR \leq .030$; for scalar and strict invariance,

ΔCFI $\leq$ .01, ΔRMSEA $\leq$ .015, and ΔSRMR $\leq$ .010 (Chen, 2007).

Group differences were analyzed using independent samples *t*-tests. Relationships between continuous variables were examined using Pearson correlation coefficients (for normally distributed data) and Spearman's rank-order correlations (for ordinal or non-normal data) where appropriate. A moderation analysis was conducted to examine whether sex moderated the relationship between somatization and GDHGS scores, using Model 1 of the PROCESS macro for SPSS (Hayes, 2013).

Results

The following section presents the results related to the first objective, focusing on the validation of the Portuguese adaptation of the GDHGS by examining its factor structure, reliability, and measurement invariance across key demographics.

Description and Reliability of the GDHGS

The items from the GDHGS present kurtosis values between -0.30 and 10.40 and skewness values between 0.86 and 3.04, ensuring their normal distribution. They exhibit tolerance values ranging from .46 to .70 and VIF between 1.44 and 2.17, ensuring the absence of multicollinearity. The item with the highest mean is item 2 (M = 1.37, SD = 1.27), while the item with the lowest average is item 1 (M = 0.29, SD = 0.69). The average of the scale is 3.26 (SD = 3.69; ranging from 0 to 20).

The Cronbach's alpha value is .82 and the McDonald's Omega is .83. The values of composite reliability (CR, .89), average variance extracted (AVE, .61), and the square root of AVE (.78) are above the benchmark values. Additionally, GDHGS correlates positively and significantly with the IGDS (r = .75; p < .001).

Exploratory factor analysis

No missing values and no outliers were found. The items are positively correlated with each other, ranging between r = .36 and r = .66. The determinant of the correlation matrix was calculated to evaluate the suitability of the data for factor analysis and was found to be 0.104. Also, the diagonal values of the anti-image correlation matrix range from .83 to .89, suggesting that most items are sufficiently correlated with the overall factor solution. The suitability of the data for factor analysis was also assessed using the KMO and Bartlett's Test of Sphericity. The KMO value was .86, indicating a good level of sampling adequacy, and Bartlett's test was significant (χ^2(10) = 865.57, p < .001), suggesting that the correlation matrix was not an identity matrix.

The values of the communalities range between .44 and .74. Principal axis factoring was used as the extraction method. The number of factors to extract was determined based on the eigenvalues greater than 1 rule, which indicated a one-factor solution. Factor loadings range from .66 and .86. The single factor accounted for 64.04% of the total variance in the dataset.

Confirmatory factor analysis

The hypothesized model was based on the results of the EFA, which suggested a unifactorial structure. The model was estimated using the Diagonally Weighted Least Squares (DWLS) estimator. The goodness-of-fit indices were examined to evaluate the adequacy of the model fit: Chi-Square (χ^2): 31.21, df = 5, p < .001; TLI: .917; CFI: .959; RMSEA: .115 (90% CI: .079 - .125); and SRMR: .041. The model demonstrated a good fit to the data, with CFI value above .950 and TLI above .910 and an SRMS value below .060, indicating an acceptable level of fit. However, RMSEA is above the recommended value (.070).

Modification indices indicated that allowing the error terms of items 2 and 3 to covary would lead to a better model fit, with a modification index value of 16.868. The model was re-estimated, and the modified model fit indices were χ^2 (4): 13.77, p < .001; TLI: .975; CFI: .990; RMSEA: .064 (90% CI: .016 - .113); and SRMR: .022. The model demonstrated an excellent fit to the data. Standardized regression weights range from .55 to .80 (Figure 1).

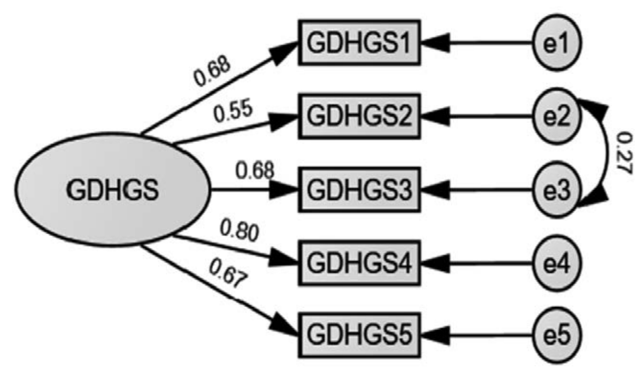

Figure 1. Confirmatory factor analysis model for GDHGS with standardized regression weights

Note. The figure displays the single-factor structure of the GD-HGS. Standardized factor loadings (λ) for each of the five items (GDHGS1–GDHGS5) are shown on their respective arrows (e.g., λ = 0.55 for GDHGS1). The values on the arrows from the circles (e1–e5) represent the error variances for each item. All loadings were statistically significant (p < .001).

Table 1. Multigroup CFAs of GDHGS according to sociodemographic variables and time spent gaming (n = 792)

Sex	χ^2	df	χ^2/df	RMSEA	CI	CFI	IFI	SRMR	Comparisons	ΔRMSEA	ΔCFI	ΔSRMR
Configural invariance	26.58	8	3.32	.054	.032-.078	.988	.988	.025	NA	NA	NA	NA
Metric invariance	31.14	12	2.60	.045	.026-.065	.988	.988	.026	configural *vs* metric	.009	.000	.001
Scalar invariance	38.42	13	2.96	.050	.032-.068	.984	.984	.030	metric *vs* scalar	.005	.004	.004
Error invariance	6.69	19	3.19	.053	.038-.068	.973	.973	.032	scalar *vs* error	.003	.011	.002
Age	χ^2	df	χ^2/df	RMSEA	CI	CFI	IFI	SRMR	comparisions	ΔRMSEA	ΔCFI	ΔSRMR
Configural invariance	1.75	8	1.34	.022	.000-.053	.998	.998	.013	NA	NA	NA	NA
Metric invariance	19.18	12	1.60	.029	.000-.053	.995	.995	.017	configural *vs* metric	.007	.003	.004
Scalar invariance	39.25	13	3.02	.054	.035-.073	.981	.981	.038	metric *vs* scalar	.025	.016	.021
Error invariance	111.99	19	5.89	.083	.069-.099	.934	.934	.015	scalar *vs* error	.029	.047	.024
Education	χ^2	df	χ^2/df	RMSEA	CI	CFI	IFI	SRMR	comparisions	ΔRMSEA	ΔCFI	ΔSRMR
Configural invariance	3.28	8	3.79	.059	.038-.083	.986	.986	.027	NA	NA	NA	NA
Metric invariance	36.36	12	3.03	.051	.032-.070	.984	.985	.028	configural *vs* metric	.008	.002	.001
Scalar invariance	36.51	13	2.81	.048	.030-.067	.985	.985	.028	metric *vs* scalar	.003	.001	.000
Error invariance	79.40	19	4.18	.063	.049-.078	.962	.962	.041	scalar *vs* error	.015	.023	.013
Time spent gaming	χ^2	df	χ^2/df	RMSEA	CI	CFI	IFI	SRMR	comparisions	ΔRMSEA	ΔCFI	ΔSRMR
Configural invariance	29.56	8	3.70	.058	.037-.082	.985	.985	.041	NA	NA	NA	NA
Metric invariance	37.35	12	3.11	.052	.033-.071	.982	.982	.049	configural *vs* metric	.006	.003	.008
Scalar invariance	111.81	13	8.60	.098	.082-.115	.930	.931	.181	metric *vs* scalar	.046	.052	.132
Error invariance	297.34	19	15.65	.136	.123-.150	.804	.804	.093	scalar *vs* error	.038	.126	.088

Note. GDHGS: Gaming Disorder and Hazardous Gaming Scale; χ^2= qui-squared; DF = degrees of freedom; IFI = incremental fit index; CFI = comparative fit index; RMSEA = root mean square error of approximation; CI = confidence interval; SRMS = standard root mean square; Δ RMSEA = change in RMSEA compared with the previous model (expressed in absolute values); Δ CFI = change in CFI compared with the previous model (expressed in absolute values); Δ SRMR = change in SRMR compared with the previous model (expressed in absolute values). NA = Not applicable. All models are significant at $p < .001$.

Measurement invariance across sex, age, education and gaming

The results of the measurement invariance analysis for the GDHGS across sociodemographic characteristics and time spent gaming are presented in Table 1. Configural invariance for sex was confirmed. This pattern held for metric, scalar, and error invariance, although the difference in CFI between scalar and error invariance slightly exceeded the cutoff value (.010). For age and time spent gaming, configural and metric invariance were achieved, but scalar and error invariance were not. Regarding education, configural, metric, and scalar invariance were established, but error invariance was not (Table 1).

Differences between GDHGS' means according to sociodemographic variables and time spend gaming

There are no significant differences in the average value of GDHGS according to sex [$t(790) = -0.40$; $p = .689$; $d = -0.04$], nor according to education [$t(790) = -0.66$; $p = .511$; $d = -0.05$]. However, there are statistically differences in the average value of GDHGS according to the time spend gaming [$t(790) = -5.68$; $p < .001$; $d = -0.44$], with participants who spend more time gaming showing higher values of GDHGS ($M = 3.73$, $SD = 4.02$) than those who spend less time ($M = 2.13$, $SD = 2.37$). Age correlates negatively with GDHGS ($r = -.12$; $p < .001$).

The following section presents the results related to the second objective, examining the real-world impact of GD and hazardous gaming on participants' lives, including their specific relationships with psychopathological symptoms and potential gender differences.

Description and correlations of the GDHGS' impairment and BSI

The GDHGS includes a question aimed at evaluating the significant impairment. In this study, 145 participants (18.3%) reported an occupational impact from gaming, 135 (17%) social impact, 120 (15.2%) educational impact, 77 (9.7%) personal impact, 66 (8.3%) family impact, and 53 (6.7%) other forms of impact. Also, occupational impact correlates positively with the total of the GDHGS ($\rho = .34$; $p < .001$), as well as social impact ($\rho = .35$; $p < .001$), educational impact ($\rho = .37$; $p < .001$), personal impact ($\rho = .44$; $p < .001$), family impact ($\rho = .42$; $p < .001$) and other forms of impact ($\rho = .30$; $p < .001$).

The GDHGS correlates positively with the total BSI ($r = .35$; $p < .001$), somatization ($r = .29$; $p < .001$), depression ($r = .33$; $p < .001$), and anxiety ($r = .31$; $p < .001$). Also, all dimensions affected by GDHGS show a positive correlation with the BSI and its subscales (Table 2). To examine whether the significant positive correlations between the GDHGS and psychological symptoms were independent of age, a series of partial correlations was conducted, controlling for participant age. The relationships remained significant and of similar magnitude: GDHGS with BSI Total ($r = .34$, $p < .001$), somatization ($r = .28$, $p < .001$), depression ($r = .34$, $p < .001$), and anxiety ($r = .33$, $p < .001$). This indicates that the association between gaming disorder/hazardous gaming and psychological distress is not merely an artifact of age differences within the sample.

Table 2. Correlations between BSI-18 and GDHGS' impacted dimensions

	Personal	Familial	Social	Educational	Ocupational	Other
Total BSI	.28**	.23**	.24**	.25**	.23**	.20**
Somatization	.25**	.16**	.18**	.21**	.21**	.17**
Depression	.27**	.24**	.25**	.24**	.21**	.20**
Anxiety	.23**	.20**	.20**	.23**	.19**	.17**

Note. ** significant at the .01 level (2-tailed). GDHGS: Gaming Disorder and Hazardous Gaming Scale; BSI: Brief Symptoms Inventory

To explore whether the relationship between somatization (independent variable) and GDHGS (dependent variable) is moderated by sex (moderator variable), a moderation analysis was conducted. A multiple regression analysis was performed using the PROCESS macro (Model 1) developed by Hayes (2013). The results indicated a significant main effect of somatization on GDHGS ($B = -3.12$, $SE = 0.32$, $t(788) = 9.67$, $p < .001$), and a significant main effect of sex ($B = 2.41$, $SE = 0.16$, $t(788) = 14.93$, $p < .001$). Importantly, the interaction between GDHGS and sex was significant ($B = -2.32$, $SE = 0.54$, $t(788) = -4.31$, $p < .001$), suggesting that the effect of somatization on GDHGS varies by sex. Simple slopes analysis revealed that for men somatization significantly predicted GDHGS ($B = 3.12$, $p < .001$), whereas for women this relationship was not significant ($B = 0.80$, $p = .070$).

Discussion

This research pursues a dual objective: first, the psychometric validation, i.e., factor structure, reliability and invariance of the Portuguese GDHGS and second, the analysis of how GDHGS relates to psychopathological symptoms in practice, including a focused examination of gender differences.

This study provides the first validation of the GDHGS for the Portuguese population, based on the ICD-11 framework. The findings support the psychometric robustness of the adapted scale and offer new insights into the relationships between gaming behaviors, demographic factors, and psychological distress in this cultural context. The exploratory and confirmatory factor analyses confirmed a unidimensional structure for the Portuguese GDHGS, consistent with the original validation (Balhara et al., 2020). This reinforces the notion that the ICD-11 criteria for GD and hazardous gaming represent a cohesive construct. Crucially, the scale demonstrated full measurement invariance across sex and scalar invariance across educational levels. This indicates that the instrument measures the same underlying construct in the same way across men and women and individuals with different educational backgrounds, allowing for valid group comparisons on these variables—a fundamental prerequisite for both research and clinical assessment.

However, for age and self-reported gaming frequency (days per week), only configural and metric invariance were achieved. The lack of scalar invariance suggests that while the factor structure is perceived similarly, the thresholds for endorsing items may differ across these groups. This could be due to generational differences in the perception of gaming norms or the fact that individuals who game more frequently may normalize certain behaviors, leading to differential item functioning (Švelch, 2024). This limitation necessitates caution when directly comparing mean scores across age groups or using the scale to make absolute severity judgments based on these demographics alone.

Our results align with established models of behavioral addiction, showing that higher self-reported gaming frequency was associated with increased scores on the GDHGS. This is consistent with research identifying extended time spent gaming as a core risk factor for developing problematic patterns (Dieris-Hirche et al., 2020; Giardina et al., 2024). The engagement required by prolonged gaming sessions can facilitate psychological dependence and reinforce escapism motives, central components in the development of gaming disorder. Contrary to some epidemiological trends, we found a negative correlation between age and GDHGS scores. This may reflect a cohort effect or indicate that the negative consequences of gaming in our adult sample manifest in different, perhaps more severe, life domains (e.g., occupational or familial) compared to the academic and social domains typically impacted in younger populations (Chan et al., 2022). This finding underscores the importance of life-stage context in assessing gaming-related impairment.

The functional impact assessment revealed that a notable minority of participants (6.7% to 18.3%) reported gaming-related impairments across various life domains, with personal and family impacts showing the strongest correlations with overall disorder scores. This pattern of impairment underscores the significant real-world consequences associated with elevated GDHGS scores. The variation in reported impact likely reflects the interplay of individual vulnerability factors, such as impulsivity or pre-existing psychological challenges (Ropovik et al., 2023; Wang et al., 2020), with contextual elements like the immersive nature of certain game genres (Sachu et al., 2022) and cultural attitudes toward leisure and responsibility (Arbeau et al., 2020). Furthermore, the finding that impairment manifests differentially aligns with research highlighting the distinct profiles and co-occurrence of specific (e.g., gaming) versus generalized problematic internet use, which may be influenced by cultural and developmental factors in Southern European contexts (Sánchez-Fernández & Borda-Mas, 2025).

Supporting the robust link between behavioral dysregulation and mental health, GDHGS scores were positively correlated with overall psychological distress and specific dimensions of somatization, depression, and anxiety - a relationship that held even after controlling for participant age. This aligns with a large body of research conceptualizing problematic gaming as both a cause and a consequence of psychological distress (Anthony et al., 2020; de la Iglesia, 2024; Wong et al., 2020). Gaming may serve as a maladaptive coping strategy for negative affect, yet its excessive use can exacerbate symptoms by leading to social withdrawal, sleep disruption, and neglect of responsibilities, thereby creating a self-perpetuating cycle (Bussone et al., 2020; Tullett-Prado et al., 2021). Shared underlying vulnerabilities, such as maladaptive cognitive patterns involving avoidance and negative self-evaluation, may further explain this comorbidity (André et al., 2020; Cudo et al., 2024).

A key finding was the moderating role of sex in the relationship between somatization and GDHGS scores, with a significant association present only for men. This result resonates with literature on gender differences in coping and the expression of distress (Di Bianca &

Mahalik, 2022; Farhane-Medina et al., 2022). Men may be more likely to externalize psychological distress through prolonged, immersive activities like gaming, and may also be more prone to somatize stress, which could be exacerbated by the physical strain of excessive gaming. Conversely, women may employ different coping strategies or have greater access to social support networks, potentially buffering the physical manifestations of gaming-related stress (McLean et al., 2023). This highlights the need for gender-sensitive approaches in both the assessment and intervention for gaming-related problems.

This study has several limitations that should be considered when interpreting the results. First, while the adapted scale demonstrated configural and metric invariance, the lack of full scalar invariance across age groups and gaming duration suggests that direct comparisons of absolute scores (e.g., mean severity) between these groups may be biased. This limits conclusions about whether older individuals or more frequent gamers truly have higher levels of the disorder, or if differential item functioning influences their responses.

Second, the reliance on self-reported data is susceptible to biases such as social desirability and recall inaccuracy, particularly for sensitive behaviors like problematic gaming. Third, the socio-demographic characterization of the sample is incomplete. Although educational level was assessed, direct indicators of socio-economic status (e.g., household income, occupational prestige) were not collected. This restricts our ability to examine how economic factors may confound or moderate the relationships between gaming behaviors and psychopathology.

Fourth, the measurement of gaming engagement as “days per week” is a significant constraint. This metric captures frequency but not volume, providing a less precise and potentially misleading indicator of actual time investment, a core clinical feature of gaming disorder. Consequently, analyses involving “gaming duration” (e.g., group comparisons, invariance testing) may lack granularity and underestimate the strength of association between total gameplay time and disorder severity.

Finally, the cross-sectional design precludes causal inferences about the relationships observed between gaming disorder, hazardous gaming, and psychological symptoms.

Future research should prioritize the development and validation of scales that achieve full scalar invariance across key demographics to enable unbiased group comparisons. Employing multi-method assessments, including objective behavioral data (e.g., logged gameplay hours) and clinician interviews, would strengthen validity and reduce self-report bias. Cross-cultural replications are needed to test the generalizability of the Portuguese GDHGS and to explore how cultural norms influence the expression and measurement of gaming-related problems. Longitudinal studies are essential to elucidate the temporal and potentially causal pathways linking gaming behaviors, psychological distress, and functional impairment. Furthermore, incorporating comprehensive socio-economic measures and more precise behavioral metrics will allow for a more nuanced investigation of risk and protective factors.

In conclusion, this study validates the Portuguese adaptation of a scale for GD and hazardous gaming, confirming its reliability for gender and educational comparisons. It achieved invariance across genders and education levels but faced challenges with age and gaming duration. The study highlights the link between GD and psychological distress, with gender differences, especially the stronger link between somatization and GD in men. These findings suggest the need for tailored approaches in research and clinical settings. Future research should address measurement limitations, incorporate objective data, and explore cultural and psychological factors influencing gaming disorder.

Conflict of interest

The authors have no conflicts of interest to disclose.

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