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Breaking the Barriers: Development and Psychometric Validation of the Physical Activity Barriers Scale for Oncology Patients

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Abstract

Background. Physical activity is an essential component of comprehensive oncological care due to its beneficial effects on physical functioning, psychological well-being, quality of life, and long-term health outcomes. Despite international recommendations, most cancer patients do not achieve recommended levels of physical activity. This may be explained by complex biological, psychological, social, and organizational barriers. However, no standardized multidimensional instrument specifically designed for oncology populations is currently available.

Aim. The aim of this study was to develop and validate the Physical Activity Barriers Scale for Oncology Patients (PABSOP), a multidimensional instrument for assessing barriers to physical activity among cancer patients.

Material and methods. A methodological validation study was conducted according to COSMIN recommendations. The development process included a literature review, expert evaluation, cognitive interviews, pilot testing, and psychometric validation. A total of 342 adult oncology patients participated. Structural validity was assessed using exploratory and confirmatory factor analyses, reliability using Cronbach's alpha, McDonald's

omega, and test–retest analysis, while convergent validity was evaluated through correlations with physical activity, fatigue, quality of life, self-efficacy, psychological distress, and social support. Item Response Theory analysis was also performed.

Results. The analyses confirmed a six-factor structure explaining 68.4% of the total variance. The model demonstrated good fit indices (CFI = 0.958, TLI = 0.952, RMSEA = 0.051, SRMR = 0.046). Internal consistency was excellent (α = 0.95; ω = 0.96), and test–retest reliability was high (ICC = 0.89). Correlations with external measures supported convergent validity.

Conclusions. The PABSOP demonstrated satisfactory psychometric properties, including good validity, high reliability, and temporal stability. Its multidimensional structure enables comprehensive assessment of physical activity barriers among oncology patients and may support clinical practice and future research.

Keywords: cancer, physical activity, barriers to exercise, psychometric validation, questionnaire development, oncology rehabilitation.

1. Introduction

Cancer remains one of the most important challenges of contemporary public health. Advances in diagnostic procedures, systemic therapies, surgical treatment, and radiotherapy have contributed to a substantial increase in cancer survival rates, resulting in a growing population of individuals living with cancer or surviving after oncological treatment (Siegel, Giaquinto, Jemal, 2024; Wagle, Nogueira, Devasia, et al, 2025). Consequently, issues related to quality of life, functional capacity, reduction of treatment-related sequelae, and long-term health promotion have become increasingly important. Modern oncology care therefore extends beyond disease treatment itself and includes comprehensive rehabilitation, health promotion, and support for behaviors that facilitate the maintenance of the highest possible level of functioning (Mayer & Engle, 2022; Stout, Santa Mina, Lyons, et al., 2021).

Physical activity is one of the best-documented supportive interventions in oncology care. Numerous studies have demonstrated that regular physical activity positively affects both physical and psychological functioning among cancer patients (Mishra, Scherer, Geigle, et al., 2012). Appropriate exercise interventions have been shown to reduce cancer-related fatigue, improve cardiorespiratory fitness, limit muscle mass loss, enhance sleep quality, and improve overall quality of life and psychological well-being (Bergerot, Bergerot, Philip, et al, 2024). In various cancer populations, physical activity has also been associated with improved functional performance, reduced symptoms of anxiety and depression, and better adaptation to disease and treatment (Campbell, Winters-Stone, Wiskemann, et al, 2019; Soong, Low, Ong, et al, 2025). Furthermore, growing evidence suggests that physical activity may contribute to reducing the risk of recurrence of selected cancers and decreasing both all-cause and cancer-specific mortality.

For these reasons, international scientific and clinical organizations recommend the integration of physical activity as a fundamental component of comprehensive cancer care. Current guidelines emphasize the importance of individually tailoring the type, intensity, and volume of physical activity according to patients' clinical status, treatment stage, comorbidities, and functional capacity (Campbell, Winters-Stone, Wiskemann, et al, 2019; Ligibel, Bohlke, May, et al, 2022). At the same time, it is recognized that even modest increases in physical activity levels may provide substantial health benefits. Despite these recommendations, the proportion of cancer patients meeting physical activity guidelines remains unsatisfactory. Studies conducted in different populations indicate that many patients reduce or completely discontinue physical activity immediately after diagnosis, and decreased activity levels often persist long after treatment completion. These findings suggest that awareness of the health benefits of exercise alone is insufficient to promote regular physical activity. Health-related behaviors are influenced by a complex interaction of biological, psychological, social, and environmental factors (Inayama, Yamaguchi, Mizuno, et al, 2025; Misiąg, Piszczyk, Szymańska-Chabowska, et al., 2022).

In the scientific literature, physical activity barriers are defined as factors that limit or prevent the initiation and maintenance of regular exercise behavior (Azemmour, Boutayeb, Beddaa, et al, 2022). In oncology populations, these barriers are particularly complex and multifactorial. They include disease-related symptoms such as chronic fatigue, pain, dyspnea, and reduced physical performance, as well as treatment-related consequences including neuropathy, balance disorders, muscle weakness, and impaired mobility. Psychological factors also play a significant role and include fear of health deterioration, concerns about treatment-related complications, depressed mood, reduced motivation, and low self-efficacy (Clifford, Mizrahi, Sandler, et al, 2018; Doughty, Hill, Riley, et al., 2013). In addition, physical activity

may be limited by insufficient social support, organizational difficulties, limited access to specialized rehabilitation programs, and inadequate education regarding safe exercise participation (Gildea, Spence, Jones, et al, 2023).

Previous research indicates that these barriers do not operate independently. Rather, they constitute an interconnected system of factors influencing decisions related to physical activity participation. For example, a patient experiencing severe fatigue may simultaneously suffer from low mood, fear deterioration of health status, and receive insufficient guidance from healthcare professionals (Doughty, Hill, Riley, et al, 2023). This may result in the development of a vicious cycle of physical inactivity, leading to further functional decline, increased fatigue, and reduced quality of life. This mechanism corresponds to the well-described cycle of inactivity observed in many chronic diseases (Brawley, Rejeski, King, 2003).

Despite increasing scientific interest in physical activity among cancer patients, important limitations remain regarding the assessment of barriers to exercise participation. Most currently available instruments focus on measuring physical activity levels, exercise motivation, or selected aspects of psychological functioning. Instruments developed for the general population often fail to capture the unique experiences of cancer patients, including treatment-related adverse effects, fear of exercise, and barriers associated with healthcare organization (Doughty, Hill, Riley, et al, 2023; Chan, Ports, Neo, et al, 2022). Similarly, questionnaires designed for specific clinical populations usually address only selected categories of barriers and do not allow for a comprehensive assessment of the multidimensional nature of the phenomenon.

Only a limited number of standardized instruments are currently available for assessing barriers to physical activity among oncology patients. The most frequently used measure is the Exercise Benefits/Barriers Scale (EBBS), developed by Sechrist, Walker, and Pender (1987), which assesses perceived benefits and barriers associated with physical activity participation in the general population. Despite its strong psychometric properties, the EBBS was not specifically designed for individuals with cancer and does not adequately capture many barriers characteristic of oncological treatment and survivorship, such as cancer-related fatigue, peripheral neuropathy, lymphedema, treatment-related side effects, concerns about health deterioration, or limitations resulting from ongoing therapy (Sechrist et al., 1987). In response to this limitation, Subburaj and Sharma (2023) developed a questionnaire intended for cancer survivors that assesses knowledge, barriers, facilitators, and preferences related to physical activity participation. Although this instrument demonstrated satisfactory psychometric properties, it was validated exclusively in a population of Indian cancer survivors and adopts a multidimensional approach in which barriers represent only one of several assessed domains. Consequently, currently available instruments do not provide a comprehensive and cancer-specific assessment of physical activity barriers applicable across different cultural contexts. This highlights the need for the development and validation of instruments specifically focused on identifying barriers to physical activity among oncology patients while incorporating both clinical and psychosocial determinants.

The lack of a standardized instrument enabling comprehensive assessment of physical activity barriers limits both scientific research and the development of effective clinical interventions. Identification of predominant barriers may facilitate the individualization of rehabilitation programs, health education strategies, and psychological support interventions. Furthermore, such assessment may support monitoring of intervention effectiveness and identification of areas requiring organizational improvements within oncology care systems.

In response to this research gap, the present study aimed to develop the Physical Activity Barriers Scale for Oncology Patients (PABSOP) in Polish origin name: Skala Barier Aktywności Fizycznej Pacjentów Onkologicznych (SBAPO), a novel instrument designed to comprehensively assess barriers limiting physical activity among individuals diagnosed with cancer. The development process included item generation, content validity assessment, evaluation of factorial structure, reliability testing, assessment of temporal stability, examination of convergent validity, and psychometric evaluation using Item Response Theory methods.

1.1. Aim of the study

The primary objective of this study was to develop and psychometrically validate the Physical Activity Barriers Scale for Oncology Patients (PABSOP) as a multidimensional instrument for assessing barriers to physical activity in individuals with cancer. The validation process aimed to evaluate the content validity, structural validity, internal consistency, temporal stability, and convergent validity of the instrument. Particular attention was paid to verifying whether the proposed six-factor model adequately reflected the multidimensional nature of physical activity barriers experienced by oncology patients. Furthermore, the study examined the relationships between PABSOP scores and selected psychological and health-related constructs, including physical activity level, fatigue, quality of life, self-efficacy, psychological distress, and social support. It

was hypothesized that higher levels of perceived barriers would be associated with lower physical activity, poorer quality of life, lower self-efficacy and social support, as well as greater fatigue and psychological distress. Additionally, the psychometric properties of individual questionnaire items were evaluated using the Item Response Theory framework to determine their discriminatory capacity and measurement performance.

2. Research materials and methods

2.1. Participants

The study included 342 adult patients with a confirmed diagnosis of cancer who were either undergoing oncological treatment or had completed treatment. Participants were recruited through collaboration with oncology centers and patient organizations. Participation was voluntary and anonymous. The inclusion criteria were: age ≥18 years, confirmed cancer diagnosis, ability to complete the questionnaire independently, and provision of informed consent. Exclusion criteria included severe clinical condition preventing participation, cognitive impairment interfering with questionnaire comprehension, and incomplete questionnaire responses exceeding the predefined threshold. The sample size was considered adequate for psychometric validation analyses. For the initial 30-item version of the questionnaire, the participant-to-item ratio was 11.4:1, exceeding the commonly recommended minimum of 5–10 participants per item in factor analytic studies. Based on psychometric recommendations, the minimum required sample size ranged from 150 to 300 participants, depending on the adopted criterion. To reduce the risk of model overfitting and in accordance with psychometric validation guidelines, the total sample was randomly divided into two independent subsamples. The first subsample (n = 171) was used for exploratory factor analysis (EFA), whereas the second subsample (n = 171) was used for confirmatory factor analysis (CFA). No significant differences between subsamples were observed regarding age, sex, cancer type, or treatment status ($p > 0.05$). The study was conducted in accordance with the Declaration of Helsinki and received approval from the appropriate institutional ethics committee. All participants provided informed consent before participation.

2.2. Procedure and instruments

The study was designed as a multi-stage methodological project aimed at the development and psychometric validation of a novel patient-reported outcome measure (PROM). The development and validation process followed recommendations for psychological scale construction and the COSMIN guidelines for health measurement instruments (DeVellis & Thorpe, 2021; Mokkink, Terwee, Patrick, 2010). The development procedure consisted of several sequential stages. First, a comprehensive literature review and analysis of existing instruments assessing physical activity barriers in oncology populations were performed to establish the theoretical framework and generate an initial item pool. Subsequently, the preliminary version of the questionnaire was evaluated by an expert panel comprising eight specialists in psycho-oncology, oncology, physiotherapy, psychometrics, and public health. Content validity, clinical relevance, and comprehensibility were assessed, resulting in modifications and elimination of insufficiently relevant items. The next stage involved cognitive interviews with representatives of the target population to evaluate comprehensibility, clarity, and relevance of questionnaire items. Following revision, pilot testing was conducted to assess item performance and identify potential administration problems. Finally, a validation study was performed to evaluate the factorial structure, reliability, and validity of the instrument. The theoretical framework of the Physical Activity Barriers Scale for Oncology Patients (PABSOP) was based on the biopsychosocial model of health. The model assumed that barriers to physical activity arise from interactions between biological, psychological, social, and environmental determinants (Engel, 1977). Six theoretically distinct but interrelated dimensions were identified: physical barriers, cognitive barriers related to safety, emotional and motivational barriers, low self-efficacy, social and organizational barriers, and systemic and informational barriers. The initial item generation process was based on a systematic review of the literature published between January 2000 and March 2025 in PubMed/MEDLINE, Scopus, Web of Science, and PsycINFO databases. A total of 1,268 records were identified, of which 74 publications met the inclusion criteria and were used for item development. The preliminary pool consisted of approximately 65 items, which were reduced to a final pilot version containing 30 statements. The final version of PABSOP consists of 30 items grouped into six subscales, each containing five items. Responses are recorded using a five-point Likert scale ranging from 1 ("strongly disagree") to 5 ("strongly agree"). Higher scores indicate greater severity of barriers to physical activity. Total scores range from 30 to 150 points, whereas each subscale score ranges from 5 to 25 points (Supplementary material S1). To assess convergent validity, additional validated instruments measuring physical activity level, fatigue, quality of life, psychological distress, self-efficacy, and social support were administered, including the IPAQ-SF, FACIT-F,

EORTC QLQ-C30, HADS, and standardized measures of self-efficacy and social support.

2.3. Data collection and analysis

2.3.1. Statistical software

Statistical analyses were performed using dedicated psychometric and statistical software packages StatSoft Statistica 13.1. Exploratory and confirmatory factor analyses, reliability analyses, validity assessment, and Item Response Theory analyses were conducted using validated statistical procedures commonly recommended for psychometric instrument development. Statistical significance was set at $p < 0.05$.

2.3.2. AI

AI was utilized for two specific purposes in this research. Text analysis of clinical reasoning narratives to identify linguistic patterns associated with specific logical fallacies. Assistance in refining the academic English language of the manuscript, ensuring clarity, consistency, and adherence to scientific writing standards. AI were used for additional linguistic refinement of the research manuscript, ensuring proper English grammar, style, and clarity in the presentation of results. It is important to emphasize that all AI tools were used strictly as assistive instruments under human supervision. The final interpretation of results, classification of errors, and conclusions were determined by human experts in clinical medicine and formal logic. The AI tools served primarily to enhance efficiency in data processing, pattern recognition, and linguistic refinement, rather than replacing human judgment in the analytical process.

2.3.3. Statistical methods

Statistical analyses were conducted according to established procedures for psychometric validation studies. Descriptive statistics were calculated for all questionnaire items, including means, standard deviations, medians, skewness, kurtosis, missing data frequencies, and floor and ceiling effects. Item discrimination was evaluated using corrected item-total correlations. Structural validity was assessed using exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). Prior to EFA, the adequacy of the correlation matrix was evaluated using the Kaiser-Meyer-Olkin (KMO) measure and Bartlett's test of sphericity. The number of factors was determined based on parallel analysis, scree plot inspection, eigenvalues, and theoretical interpretability. Oblique rotation was applied due to the expected correlations among latent dimensions. The fit of the confirmatory factor model was evaluated using the Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA), and Standardized Root Mean Square Residual (SRMR) (Lloret-Segura, Ferreres-Traver, Hernández-Baeza, et al., 2014). Internal consistency was assessed using Cronbach's alpha and McDonald's omega coefficients. Temporal stability was evaluated using the test-retest method and intraclass correlation coefficients (ICC) in a subgroup of 72 participants reassessed after a three-week interval. Convergent validity was examined using Pearson's or Spearman's correlation coefficients, depending on data distribution. It was hypothesized that higher barrier scores would be associated with lower physical activity levels, poorer quality of life, greater fatigue and psychological distress, and lower self-efficacy and social support. Additionally, Item Response Theory (IRT) analyses were performed using the Graded Response Model to evaluate item discrimination parameters and response category functioning across different levels of the latent construct (Hu, Bentler, Hu, 2009). All statistical tests were two-tailed, and statistical significance was established at $p < 0.05$.

3. Research results

A total of 342 oncology patients were included in the study. The mean age of participants was 58.4 years (SD = 11.7). Women accounted for 63.2% of the sample, whereas men represented 36.8%. The most common cancer diagnoses were breast cancer (34.5%), colorectal cancer (18.4%), prostate cancer (11.7%), lung cancer (10.5%), and other malignancies (24.9%). At the time of assessment, 54.1% of participants were undergoing active oncological treatment, while the remaining participants had completed treatment. The mean time since cancer diagnosis was 2.8 ± 2.1 years (Table 1). Missing data accounted for less than 1.2% of responses for each questionnaire item. Due to the low proportion of missing values, mean imputation within the corresponding subscale was applied only in cases of isolated missing responses. No participant was excluded due to excessive missing data.

Table 1. Characteristics of the study sample

Variable	n	%
Female	216	63.2
Male	126	36.8
Under active treatment	185	54.1
After completion of treatment	157	45.9

Content validity was assessed by a panel of eight experts with clinical and research experience in psycho-oncology, oncology, physiotherapy, psychometrics, and public health. The average Scale-Level Content Validity Index (S-CVI/Ave) was 0.95, whereas Item-Level Content Validity Index (I-CVI) values ranged from 0.88 to 1.00. Based on expert feedback, two items underwent minor linguistic modifications before inclusion in the final version of the questionnaire (Table 2).

Table 2. Content validity of the PABSOP

Indicator	Value
Number of experts	8
Mean I-CVI	0.94
S-CVI/Ave	0.95
Items requiring revision	2

I-CVI – Item-Level Content Validity Index; S-CVI/Ave – Scale-Level Content Validity Index based on the average approach.

No significant floor or ceiling effects were observed. All questionnaire items demonstrated satisfactory variability. Mean item scores ranged from 2.21 to 4.18, whereas standard deviations ranged from 0.84 to 1.29. Item distributions demonstrated acceptable psychometric properties, with skewness values ranging from −0.82 to 0.64 and kurtosis values ranging from −1.01 to 0.86. Corrected item-total correlations ranged from 0.53 to 0.81, exceeding the recommended threshold of 0.30. No item met the criteria for elimination, and all items demonstrated satisfactory discriminatory power and appropriate correlations with total scores. Consequently, all 30 items were retained for subsequent analyses.

Prior to exploratory factor analysis, the suitability of the dataset for factor analysis was examined. The obtained values confirmed the appropriateness of conducting exploratory factor analysis, with a Kaiser-Meyer-Olkin measure of sampling adequacy of 0.93 and a statistically significant Bartlett's test of sphericity ($\chi^2 = 4812.34$, $df = 435$, $p < 0.001$) (Table 3).

Table 3. Indicators of data adequacy for the PABSOP

Indicator	Value
KMO	0.93
Bartlett's test of sphericity (χ^2)	4812.34
df	435
p-value	<0.001

KMO – Kaiser-Meyer-Olkin measure of sampling adequacy; χ^2 – chi-square statistic; df – degrees of freedom.

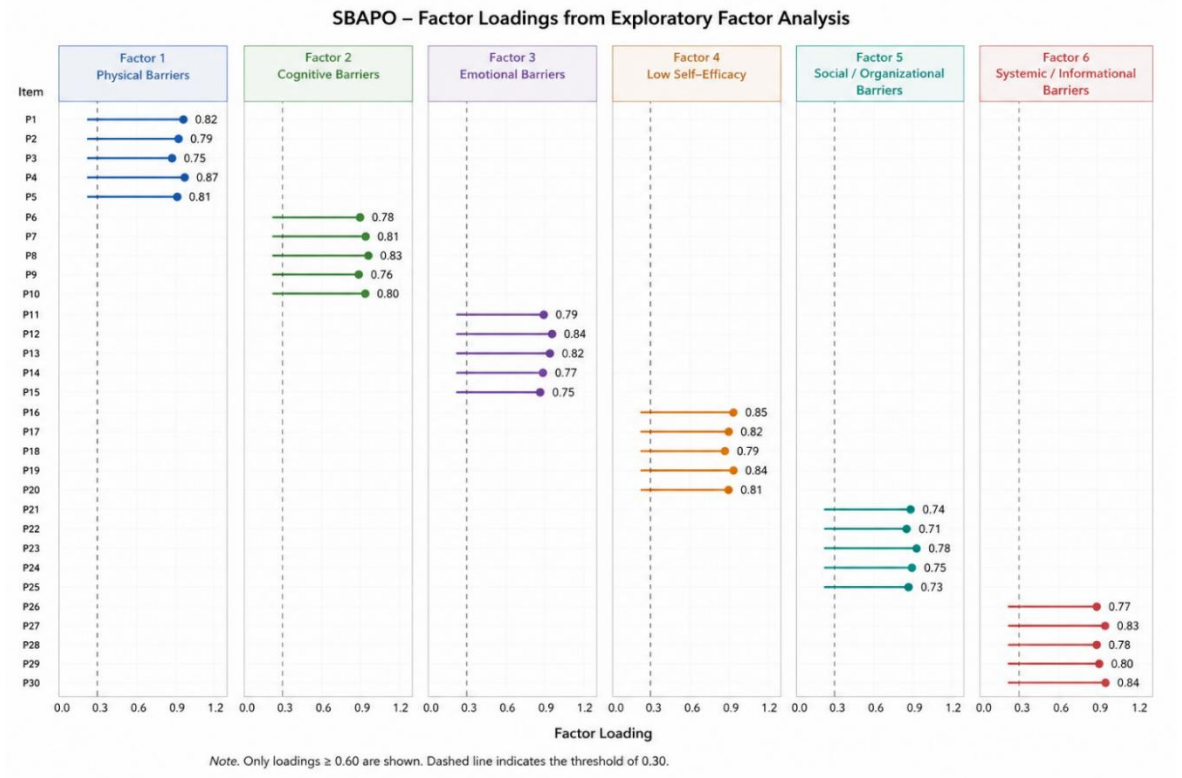
Parallel analysis and scree plot inspection supported a six-factor solution consistent with the proposed theoretical framework. The six factors jointly explained 68.4% of the total variance. The proportions of explained variance were 24.8% for physical barriers, 11.6% for cognitive barriers related to safety, 9.8% for emotional and motivational barriers, 8.5% for low self-efficacy, 7.2% for social and organizational barriers, and 6.5% for systemic and informational barriers (Table 4).

Table 4. Variance Explained by the Exploratory Factor Analysis (EFA)

Factor	Variance Explained (%)
Physical Barriers	24.8
Cognitive Barriers Related to Safety	11.6
Emotional and Motivational Barriers	9.8
Low Self-Efficacy	8.5
Social and Organizational Barriers	7.2
Systemic and Informational Barriers	6.5

All factor loadings exceeded 0.60, and no substantial cross-loadings were identified. The proposed six-factor model demonstrated satisfactory structural properties and theoretical interpretability.

Figure 1. Factor loadings of the Physical Activity Barriers Scale for Oncology Patients (PABSOP).



Confirmatory factor analysis demonstrated good model fit. The obtained fit indices were within the recommended ranges, including $\chi^2/df = 1.89$, CFI = 0.958, TLI = 0.952, RMSEA = 0.051, and SRMR = 0.046 (Table 5). Furthermore, convergent validity of the individual dimensions was assessed using Composite Reliability (CR) and Average Variance Extracted (AVE). All subscales demonstrated CR values exceeding 0.70 and AVE values above 0.50, confirming satisfactory convergent validity of the construct (Table 6).

Table 5. Model Fit Indices for the Confirmatory Factor Analysis (CFA)

Index	Value
χ^2/df	1.89
CFI	0.958
TLI	0.952
RMSEA	0.051
SRMR	0.046

χ^2/df – chi-square to degrees of freedom ratio; CFI – Comparative Fit Index; TLI – Tucker-Lewis Index; RMSEA – Root Mean Square Error of Approximation; SRMR – Standardized Root Mean Square Residual.

Table 6. Composite Reliability (CR) and Average Variance Extracted (AVE) for the PABSOP Subscales

Subscale	CR	AVE
Physical Barriers	0.92	0.69
Cognitive Barriers Related to Safety	0.90	0.65
Emotional and Motivational Barriers	0.91	0.67
Low Self-Efficacy	0.93	0.72
Social and Organizational Barriers	0.88	0.60
Systemic and Informational Barriers	0.90	0.66

CR – Composite Reliability; AVE – Average Variance Extracted.

Reliability analysis demonstrated excellent internal consistency of the developed instrument. Cronbach's alpha coefficients for the individual subscales ranged from 0.85 to 0.91, whereas McDonald's omega coefficients ranged from 0.86 to 0.92. The total score achieved values of α = 0.95 and ω = 0.96, indicating very high homogeneity of the questionnaire items. Additionally, analyses of "alpha if item deleted" coefficients and corrected item-total correlations did not identify any items requiring removal, confirming the stability of the internal structure of the PABSOP (Table 7).

Table 7. Reliability of the PABSOP

Subscale	Cronbach's α	McDonald's ω
Physical Barriers	0.90	0.91
Cognitive Barriers Related to Safety	0.87	0.88
Emotional and Motivational Barriers	0.89	0.90
Low Self-Efficacy	0.91	0.92
Social and Organizational Barriers	0.85	0.86
Systemic and Informational Barriers	0.88	0.89
Total score	0.95	0.96

α – Cronbach's alpha coefficient; ω – McDonald's omega coefficient.

As hypothesized, higher levels of perceived barriers were associated with lower physical activity levels (r = −0.58) and lower self-efficacy (r = −0.64). Significant correlations were also observed with fatigue (r = 0.62), quality of life (r = −0.49), psychological distress (r = 0.55), and social support (r = −0.41). All observed relationships were consistent with the proposed theoretical framework and supported the convergent validity of the instrument (Table 8).

Table 8. Convergent Validity of the PABSOP

Variable	r	95% CI	p-value
IPAQ-SF	-0.58	-0.65 to -0.50	<0.001
FACIT-F	0.62	0.55 to 0.68	<0.001
EORTC QLQ-C30	-0.49	-0.57 to -0.40	<0.001
HADS	0.55	0.47 to 0.62	<0.001
Self-efficacy	-0.64	-0.70 to -0.57	<0.001
Social support	-0.41	-0.50 to -0.31	<0.001

r – correlation coefficient (Pearson's or Spearman's, depending on data distribution); CI – confidence interval; IPAQ-SF – International Physical Activity Questionnaire–Short Form; FACIT-F – Functional Assessment of Chronic Illness Therapy–Fatigue; EORTC QLQ-C30 – European Organisation for Research and Treatment of Cancer Quality of Life Questionnaire-Core 30; HADS – Hospital Anxiety and Depression Scale.

Temporal stability assessed after a three-week interval demonstrated excellent reproducibility of measurements, with an intraclass correlation coefficient of ICC = 0.89 (95% CI: 0.84–0.93; p < 0.001) based on repeated assessment of 72 participants (Table 9).

Table 9. Test–Retest Reliability of the PABSOP

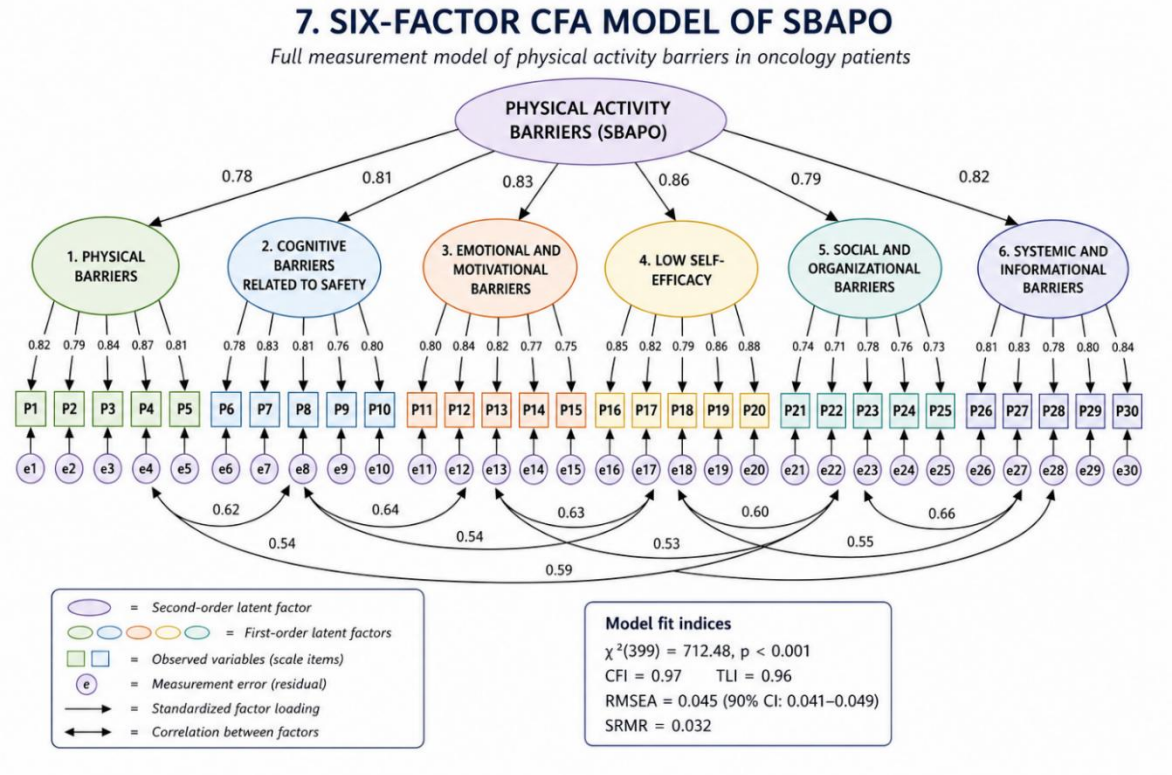
Parameter	Value
Number of participants	72
Time interval between assessments	21 days
ICC (95% CI)	0.89 (0.84–0.93)
p-value	<0.001

ICC – Intraclass Correlation Coefficient; CI – confidence interval.

Item Response Theory analysis using the Graded Response Model demonstrated satisfactory psychometric performance of all questionnaire items. Item discrimination parameters ranged from 1.42 to 2.86, indicating good ability to distinguish individuals with different levels of physical activity barriers. The test information function demonstrated the

highest measurement precision within the range of −0.5 to +2.0 standard deviations of the latent trait, corresponding to patients with moderate to high levels of perceived barriers. Threshold parameters for the response categories were ordered according to model expectations, indicating appropriate functioning of the five-point response scale. No threshold reversals were identified.

Figure 2. Theoretical structure of the PABSOP according to the Item Response Theory model.



Overall, the psychometric analyses confirmed the proposed six-factor structure of the PABSOP. The instrument demonstrated high content validity, excellent internal consistency, satisfactory model fit, and strong evidence of convergent validity. The findings indicate that the PABSOP is a reliable and valid instrument for assessing barriers to physical activity among oncology patients. Further studies should focus on confirming the psychometric properties of the instrument in independent clinical populations and evaluating measurement invariance across different patient groups.

4. Discussion

The present study aimed to develop and psychometrically validate the Physical Activity Barriers Scale for Oncology Patients (PABSOP), a novel multidimensional instrument designed to assess barriers limiting physical activity among individuals diagnosed with cancer. The findings demonstrate that the proposed instrument possesses satisfactory psychometric properties, including high content validity, a stable factorial structure, excellent internal consistency, good temporal stability, and satisfactory convergent validity. Collectively, these results support the use of the PABSOP as a reliable and valid measure of physical activity barriers in oncology populations.

The exploratory factor analysis confirmed the existence of six interrelated dimensions of physical activity barriers: physical barriers, cognitive barriers related to safety, emotional and motivational barriers, low self-efficacy, social and organizational barriers, and systemic and informational barriers. This multidimensional structure is consistent with the biopsychosocial model of health and contemporary theories of health behavior, which emphasize that engagement in physical activity among individuals with chronic diseases is determined by a complex interaction of biological, psychological, social, and environmental factors (Michie, van Stralen, West, 2011; Schmitz, Campbell, Stuiver, et al, 2019). The identification of these six dimensions supports the assumption that barriers to physical activity in oncology patients cannot be adequately explained by a single domain of functioning.

Particular attention should be paid to the excellent internal consistency demonstrated by both the overall scale and its individual subscales. The high values of Cronbach's alpha and McDonald's omega coefficients indicate that the items within each dimension measure coherent psychological constructs while maintaining sufficient differentiation between domains. These findings suggest that the PABSOP achieves an appropriate balance between internal homogeneity and multidimensionality, which is considered a desirable characteristic of patient-reported outcome measures.

The confirmatory factor analysis further supported the adequacy of the proposed six-factor structure. The obtained model fit indices met commonly accepted psychometric criteria, confirming that the theoretical assumptions underlying the instrument correspond well with empirical observations. From a clinical perspective, this multidimensional structure enables not only the calculation of an overall barrier score but also the identification of specific domains requiring intervention. Such an approach may facilitate individualized rehabilitation planning and contribute to the development of targeted interventions aimed at increasing physical activity participation among cancer patients.

An important aspect of the validation process was the confirmation of convergent validity. As hypothesized, higher levels of perceived barriers were associated with lower physical activity participation, greater fatigue, poorer quality of life, lower self-efficacy, and reduced social support. These findings are consistent with previous studies demonstrating that cancer-related fatigue, fear of exercise, and concerns regarding exercise safety constitute some of the most important determinants of reduced physical activity in oncology populations. Furthermore, the observed associations with self-efficacy support the assumptions of social cognitive theory, according to which beliefs regarding one's ability to engage in and maintain physical activity play a fundamental role in health behavior adoption and maintenance (Bandura 2004).

One of the most distinctive features of the PABSOP is the identification of a separate factor representing systemic and informational barriers. In most existing instruments assessing barriers to physical activity, issues related to healthcare accessibility, professional guidance, and patient education are either underrepresented or assessed using only a limited number of items. In the present instrument, these barriers were conceptualized as an independent dimension, which may substantially increase the practical utility of the scale. This approach acknowledges the growing recognition that healthcare system factors and access to evidence-based information play an essential role in promoting physical activity among individuals affected by cancer (Cormie, Zopf, Zhang, et al, 2017; Schmitz, Campbell, Stuiver, et al, 2019).

The practical implications of the PABSOP are considerable. The instrument may facilitate the identification of dominant barriers preventing engagement in physical activity and thereby support clinicians in designing individualized interventions. Patients presenting with high scores in the physical barriers domain may require modifications of exercise prescriptions and physiotherapy consultations, whereas elevated cognitive or emotional barrier scores may indicate the need for psychoeducational or psychological interventions. Similarly, high scores in the systemic barriers domain may suggest the necessity of improving access to physical activity counseling, rehabilitation services, or educational resources within oncology care systems. Consequently, the PABSOP may serve not only as a research instrument but also as a clinically relevant

assessment tool supporting multidisciplinary cancer rehabilitation.

Despite the promising psychometric properties demonstrated in the present study, several limitations should be acknowledged. First, participant recruitment was based on convenience sampling, which may limit the generalizability of the findings. Second, the cross-sectional design did not allow for the assessment of changes in perceived barriers over time. Therefore, future studies should include external validation in independent clinical populations representing different cancer diagnoses and treatment stages. Furthermore, the assessment of measurement invariance across demographic and clinical subgroups, including sex, age, cancer type, and treatment status, represents an important direction for future research.

Longitudinal studies should also be conducted to evaluate the responsiveness of the PABSOP to changes occurring during cancer treatment and rehabilitation. If the instrument proves sensitive to intervention effects, it may become a valuable outcome measure for evaluating programs designed to promote physical activity among cancer patients and survivors. Additionally, future research should focus on establishing normative values and clinically meaningful cut-off points for both the total score and individual subscales.

In conclusion, the present findings suggest that the Physical Activity Barriers Scale for Oncology Patients (PABSOP) represents a valid and reliable multidimensional instrument for assessing barriers to physical activity among individuals with cancer. The proposed scale captures barriers related not only to disease and treatment consequences but also to psychological, social, organizational, and systemic factors. Therefore, the PABSOP may constitute a valuable tool for both scientific research and clinical practice, contributing to the development of more personalized and effective strategies for promoting physical activity in oncology populations.

5. Conclusions

The findings of the present study indicate that the Physical Activity Barriers Scale for Oncology Patients (PABSOP) demonstrates satisfactory psychometric properties, including high content validity, good structural validity, excellent internal consistency, and strong temporal stability. The observed associations with physical activity level, fatigue, quality of life, self-efficacy, and social support provide evidence supporting the convergent validity of the instrument. The multidimensional structure of the PABSOP enables a comprehensive assessment of physical activity barriers among oncology patients and may support the planning of rehabilitation, psychoeducational, and organizational interventions. Further studies should focus on external validation in independent clinical populations, as well as on the assessment of measurement invariance and responsiveness to change.

Supplementary Materials. The final version of the PABSOP questionnaire is available as Supplementary Material S1.

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Informed Consent Statement. Informed consent was obtained from all subjects involved in the study.

Data Availability Statement. The datasets generated and/or analyzed during the current study are not publicly available due to privacy and ethical restrictions but are available from the corresponding author on reasonable request

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