Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

Latent profiles of kinesiophobia and associated factors in older patients after hip arthroplasty: a cross-sectional study

jiayu zhou
Suining Central Hospital
Xin Ling
Suining Central Hospital
Jia Yao
Suining Central Hospital
Lijun Xiang
Suining Central Hospital
Xu Peng
Suining Central Hospital
Yi Yin
18192330230@qq.com

Suining Central Hospital

Research Article

Keywords: Older adults, Hip arthroplasty, Kinesiophobia, Latent profile analysis, Associated factors, Cross-sectional study

Posted Date: September 3rd, 2026

DOI: https://doi.org/10.21203/rs.3.rs-10548619/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License. Read Full License

Additional Declarations: No competing interests reported.

Abstract

Background

Kinesiophobia is a common psychological barrier to early rehabilitation after hip arthroplasty (HA) in older patients. This study aimed to identify latent profiles of kinesiophobia in older patients after HA and to examine their associated factors, with the goal of informing individualized perioperative interventions.

Methods

Using convenience sampling, older patients who underwent HA in the Department of Joint and Sports Medicine of a tertiary grade-A general hospital in Sichuan Province, China, between April 2025 and April 2026 were enrolled. Participants completed a general information questionnaire, the 11-item Tampa Scale for Kinesiophobia (TSK-11), the Groningen Orthopaedic Social Support Scale (GO-SSS), the Self-Efficacy for Rehabilitation Outcome Scale (SER), the Chinese version of the Tilburg Frailty Indicator (TFI), and the Numerical Rating Scale (NRS). Latent profile analysis (LPA) and multinomial logistic regression were used for data analysis.

Results

A total of 307 valid questionnaires were collected (valid response rate, 90.94%). The prevalence of kinesiophobia was 58.6%. Three latent profiles were identified: a cognitively healthy-behaviorally adaptive group (31.9%), a cognitively shifted-behaviorally withdrawn group (39.4%), and a cognitively catastrophic-behaviorally restricted group (28.7%). Previous surgical history, self-care ability, body mass index (BMI), preoperative comorbidities, postoperative nausea and vomiting, social support, rehabilitation self-efficacy, frailty, and pain were associated with latent profile membership (all $P < 0.05$).

Conclusions

Kinesiophobia is highly prevalent and heterogeneous among older patients after HA. Healthcare professionals should implement profile-specific, targeted perioperative interventions to reduce kinesiophobia and promote postoperative recovery.

Background

Hip arthroplasty (HA) is the treatment of choice for traumatic and end-stage hip disease [1], with approximately one million procedures performed worldwide each year, of which older patients account for approximately 80% [2, 3]. Nevertheless, postoperative rehabilitation outcomes remain suboptimal: within the first year after surgery, 50% of older patients experience disability, 20% die from various complications, and only 8% of those aged 80 years or older regain independent mobility [4, 5]. Postoperative rehabilitation exercise is central to functional reconstruction and early restoration of walking ability after HA; however, patients frequently develop psychological distress in response to pain, exercise-related discomfort, or functional impairment, and kinesiophobia-an irrational and excessive fear of physical activity-is a common barrier to early rehabilitation [6]. Previous studies have reported a kinesiophobia prevalence of 60.0% among older patients after HA [7].

Kinesiophobia not only predisposes to postoperative disability and increases the risk of deep vein thrombosis, but can also elicit negative emotions such as anxiety and depression and, in severe cases, lead to disuse syndrome [8, 9]; it therefore constitutes a major obstacle to patients' return to society.

Accordingly, clarifying the current status of kinesiophobia and its associated factors in older patients after HA is essential for identifying high-risk individuals, developing targeted interventions, and improving rehabilitation outcomes. However, most existing studies have examined kinesiophobia and its influencing factors at the group level, overlooking heterogeneity across patient subgroups [10], which limits the delivery of precise and effective interventions. Latent profile analysis (LPA) can identify unobserved subgroups on the basis of individuals' responses to observed indicators, grouping individuals with similar characteristics into the same class, and thereby enables healthcare professionals to deliver precise, group-level interventions [11]. Therefore, the present study used LPA to identify latent profiles of kinesiophobia in older patients after HA and examined their associated factors from demographic, physiological, psychological, and social perspectives, aiming to provide evidence for individualized perioperative interventions that reduce kinesiophobia and promote postoperative rehabilitation.

Methods

Study design and participants

A cross-sectional survey using convenience sampling was conducted in the Department of Joint and Sports Medicine of a tertiary grade-A general hospital in Sichuan Province, China. Older patients who underwent HA between April 2025 and April 2026 were recruited. Inclusion criteria were: (1) aged 60 years or older; (2) unilateral HA with the patient in the postoperative rehabilitation phase; (3) postoperative imaging confirming appropriate prosthesis placement, i.e., acetabular anteversion angle of (15 ± 10)°, acetabular abduction angle of (40 ± 10)°, and femoral stem anteversion of 5°-10° [12], with a stable joint and eligibility for routine rehabilitation exercise; and (4) normal verbal communication and cognitive function. Exclusion criteria were: (1) complications or other diseases that precluded normal ambulation or indicated severe disability; and (2) concurrent participation in other studies.

Measures

General information questionnaire. A self-designed questionnaire was used to collect demographic and clinical data, including sex, age, place of residence, marital status, educational level, occupation, average monthly household income per capita, medical payment method, BMI, primary caregiver, history of surgery, fall risk score at admission, self-care ability score at admission, occurrence of postoperative nausea and vomiting, living status, and comorbidities.

TSK-11. The TSK-11 was developed by Woby et al. [13] and adapted into Chinese through cross-cultural validation by Cai et al. [14] in 2019. The scale comprises 11 items across three dimensions, with each item scored from 1 to 4 and total scores ranging from 11 to 44; higher scores indicate more severe kinesiophobia. The Cronbach's α coefficient was 0.883, item-total correlations ranged from 0.424 to 0.757, and the test-retest reliability was 0.798, indicating satisfactory reliability and validity.

GO-SSS. The GO-SSS, developed by van den Akker-Scheek et al. [15] and adapted into Chinese by Sheng et al. [16], assesses social support in patients after hip or knee arthroplasty. It consists of 12 items across two dimensions-perceived social support (7 items) and instrumental support (5 items)-rated on a 4-point Likert scale (0 = "never" to 3 = "often"), with total scores ranging from 0 to 36; higher scores indicate greater social support. The Cronbach's α coefficient was 0.863.

SER. The SER is a disease-specific instrument for assessing self-efficacy in patients undergoing hip or knee surgery. It was developed by Waldrop et al. [17] and adapted into Chinese by Wang et al. [18]. The scale comprises 12 items across two dimensions-rehabilitation exercise self-efficacy (5 items) and coping self-efficacy (7 items)-which measure patients' confidence in rehabilitation outcomes and the rehabilitation process, respectively. Each item is scored on an 11-point scale from 0 ("completely unable") to 10 ("without any difficulty"), with total scores ranging from 0 to 120; higher scores indicate stronger rehabilitation self-efficacy. The Cronbach's α coefficient was 0.942.

TFI. The Chinese version of the TFI, developed by Gobbens et al. [19] in 2010 on the basis of the integrative frailty model and adapted into Chinese by Xi et al. [20] in 2013, comprises 15 items across three dimensions (physical, psychological, and social), with total scores ranging from 0 to 15. A total score greater than 5 indicates frailty, and higher scores indicate more severe frailty.

NRS. Pain intensity was assessed with the NRS, on which patients rate their current pain from 0 ("no pain") to 10 ("worst imaginable pain"). Scores of 1–3, 4–6, and 7–10 indicate mild (tolerable), moderate (affecting sleep but tolerable), and severe (intolerable) pain, respectively [21].

Data collection

Data were collected by four investigators (one postgraduate nursing student and three senior charge nurses) after uniform training. Before the survey, investigators received systematic training on the application of the inclusion and exclusion criteria, standardized instructions, communication skills, and questionnaire completion standards. When a participant's condition was stable (after the attending physician had ordered out-of-bed activity) and no examination was scheduled within 30 min, the investigators explained the purpose and content of the study, in accordance with the principles of confidentiality and voluntary participation. After written informed consent was obtained, paper questionnaires were distributed with an explanation of the completion standards; for participants unable to complete the questionnaire independently, the investigators read the questions aloud and recorded the answers. Questionnaires were checked on site after collection, and invalid questionnaires (e.g., those completed in a clearly patterned manner) were excluded.

Statistical analysis

Statistical analyses were performed using SPSS version 27.0. Normally distributed continuous variables are presented as mean ± standard deviation and were compared across groups using one-way analysis of variance; non-normally distributed continuous variables are presented as median (interquartile range) and were compared using the Kruskal-Wallis H test; categorical variables are presented as n (%) and were compared using the χ^2 test, with the Fisher-Freeman-Halton test used when required.

Latent profile models were fitted using Mplus version 8.3. Beginning with a one-class baseline model, the number of classes was increased progressively, and models with different numbers of classes were compared on fit indices, with the optimal model selected on the basis of goodness of fit and clinical interpretability. Fit indices included the Akaike information criterion (AIC), the Bayesian information criterion (BIC), the sample-size-adjusted BIC (aBIC), the Lo-Mendell-Rubin adjusted likelihood ratio test (LMRT), the bootstrap likelihood ratio test (BLRT), and entropy. In general, smaller AIC, BIC, and aBIC values indicate better model fit; entropy values closer to 1 indicate higher classification accuracy, with entropy ≥ 0.8 corresponding to > 90% classification accuracy; and significant LMRT and BLRT results ($P < 0.05$) indicate that a K-class model fits better than the (K − 1)-class model.

Multinomial logistic regression was used to examine factors associated with latent profile membership, with the significance level set at $\alpha = 0.05$.

Results

General characteristics and current status of kinesiophobia

A total of 337 questionnaires were distributed, and 307 valid questionnaires were returned (valid response rate, 90.94%). Of the 307 participants, 141 (45.9%) were male; 147 (47.9%) were aged 80 years or older; 198 (64.5%) resided in urban areas; 276 (89.9%) were married; 225 (73.3%) had an educational level of primary school or below; 75 (24.4%) had an average monthly household income per capita of less than 3000 CNY; 164 (53.4%) had a normal BMI; 133 (43.3%) reported a fall within the previous year; 137 (44.6%) had a history of surgery; 141 (45.9%) had good preoperative self-care ability; 141 (45.9%) experienced postoperative nausea and vomiting; 171 (55.7%) had preoperative comorbidities; and 237 (77.2%) had a fixed caregiver. The remaining general characteristics are shown in Table 1. The prevalence of kinesiophobia was 58.6%.

Table 1 General characteristics of older patients after hip arthroplasty and univariate analyses of kinesiophobia latent profiles (n = 307)

Variable	Category	Total (n = 307)	C1 (n = 98)	C2 (n = 121)	C3 (n = 88)	Test statistic	P value
Sex	Male	141 (45.9)	43 (43.9)	67 (55.4)	31 (35.2)	8.569a	0.014
	Female	166 (54.1)	55 (56.1)	54 (44.6)	57 (64.8)		
Age	60-79 years	160 (52.1)	63 (64.3)	72 (59.5)	25 (28.4)	28.281a	<0.001
	≥ 80 years	147 (47.9)	35 (35.7)	49 (40.5)	63 (71.6)		
Place of residence	Urban	198 (64.5)	59 (60.2)	75 (62.0)	64 (72.7)	3.726a	0.155
	Rural	109 (35.5)	39 (39.8)	46 (38.0)	24 (27.3)		
Marital status	Married	276 (89.9)	89 (90.8)	113 (93.4)	74 (84.1)	4.717b	0.087
	Unmarried/divorced/widowed	31 (10.1)	9 (9.2)	8 (6.6)	14 (15.9)		
Educational level	Primary school or below	225 (73.3)	73 (74.5)	85 (70.2)	67 (76.1)	1.568b	0.826
	Junior high school	67 (21.8)	21 (21.4)	28 (23.1)	18 (20.5)		
	High school/technical secondary school or above	15 (4.9)	4 (4.1)	8 (6.6)	3 (3.4)		
Average monthly household income per capita	< 3000 CNY	75 (24.4)	24 (24.5)	27 (22.3)	24 (27.3)	1.241a	0.971
	3000-5000 CNY	160 (52.1)	51 (52.0)	67 (55.4)	42 (47.7)		
	> 5000 CNY	72 (23.5)	23 (23.5)	27 (22.3)	22 (25.0)		
BMI	Normal	164 (53.4)	63 (64.3)	68 (56.2)	33 (37.5)	13.988a	<0.001
	Underweight/overweight/obese	143 (46.6)	35 (35.7)	53 (43.8)	55 (62.5)		
Fall in the previous year	Yes	133 (43.3)	35 (35.7)	44 (36.4)	54 (61.4)	16.362a	<0.001
	No	174 (56.7)	63 (64.3)	77 (63.6)	34 (38.6)		
History of previous surgery	Yes	137 (44.6)	54 (55.1)	40 (33.1)	43 (48.9)	11.545a	0.003

	No	170 (55.4)	44 (44.9)	81 (66.9)	45 (51.1)		
Self-care ability	Good	141 (45.9)	74 (75.5)	50 (41.3)	17 (19.3)	60.658a	<0.001
	Poor	166 (54.1)	24 (24.5)	71 (58.7)	71 (80.7)		
Postoperative nausea and vomiting	Yes	141 (45.9)	25 (25.5)	51 (42.1)	65 (73.9)	44.800a	<0.001
	No	166 (54.1)	73 (74.5)	70 (57.9)	23 (26.1)		
Preoperative comorbidities	Yes	171 (55.7)	33 (33.7)	69 (57.0)	69 (78.4)	37.747a	<0.001
	No	136 (44.3)	65 (66.3)	52 (43.0)	19 (21.6)		
Primary caregiver	Fixed caregiver	237 (77.2)	78 (79.6)	85 (70.2)	74 (84.1)	6.015a	0.049
	Non-fixed caregiver	70 (22.8)	20 (20.4)	36 (29.8)	14 (15.9)		
GO-SSS score Median (IQR)		-	36 (34, 36)	25 (17, 36)	14 (12, 35)	116.333c	<0.001
SER score Median (IQR)		-	86 (80, 93)	63 (53, 91)	33 (16, 88)	125.695c	<0.001
TFI score Median (IQR)		-	4 (2, 10.1)	5 (4, 12)	11 (8, 15)	99.923c	<0.001
NRS score Median (IQR)		-	3 (3, 8)	4 (2, 8)	7 (5, 10)	83.318c	<0.001

C1: cognitively healthy-behaviorally adaptive group; C2: cognitively shifted-behaviorally withdrawn group; C3: cognitively catastrophic-behaviorally restricted group. Data are presented as n (%) or median (interquartile range). a χ^2 test; b Fisher-Freeman-Halton test; c Kruskal-Wallis H test. BMI: body mass index; GO-SSS: Groningen Orthopaedic Social Support Scale; IQR: interquartile range; NRS: Numerical Rating Scale; SER: Self-Efficacy for Rehabilitation Outcome Scale; TFI: Tilburg Frailty Indicator.

Latent profile analysis of kinesiophobia

Using the dimension scores of the Chinese version of the TSK-11 as observed indicators, one- to four-class latent profile models were fitted sequentially; the fit indices are presented in Table 2. AIC, BIC, and aBIC decreased progressively as the number of classes increased, and entropy exceeded 0.8 in all models, indicating good classification accuracy. However, in the four-class model, one class had a probability of less than 0.05, indicating insufficient distinctiveness. Combining fit indices with clinical interpretability, the three-class model was selected as the final solution.

The distributions of the three classes across the TSK-11 dimension scores are shown in Fig. 1. Class 1 comprised 98 participants (31.9%) with low scores on all three dimensions (activity cognition, activity behavior, and activity attitude), indicating objective activity cognition, well-adapted behavior, and the lowest level of kinesiophobia; this class was named the cognitively healthy-behaviorally adaptive group. Class 2 comprised 121 participants (39.4%) with intermediate scores on all dimensions, reflecting a degree of cognitive shift and behavioral withdrawal and a moderate level of kinesiophobia; this class was named the cognitively shifted-behaviorally withdrawn group. Class 3 comprised 88 participants (28.7%) with high scores on all dimensions, particularly activity cognition, indicating marked cognitive catastrophizing and behavioral restriction and the highest level of kinesiophobia; this class was named the cognitively catastrophic-behaviorally restricted group.

Table 2 Fit indices of the latent profile models of kinesiophobia in older patients after hip arthroplasty (n = 307)

Model	AIC	BIC	aBIC	Entropy	P value (LMRT)	P value (BLRT)	Class probabilities
1	4627.804	4650.165	4631.136	-	-	-	-
2	4296.638	4333.906	4302.191	0.954	<0.001	<0.001	0.691/0.309
3	4152.771	4204.947	4160.545	0.894	<0.001	<0.001	0.319/0.394/0.287
4	4089.673	4156.756	4099.668	0.924	<0.001	<0.001	0.029/0.380/0.331/0.260

AIC: Akaike information criterion; aBIC: sample-size-adjusted Bayesian information criterion; BIC: Bayesian information criterion; BLRT: bootstrap likelihood ratio test; LMRT: Lo-Mendell-Rubin adjusted likelihood ratio test. "-" indicates not applicable.

Factors associated with the latent profiles of kinesiophobia

Multinomial logistic regression was performed with the three latent profiles as the dependent variable and the cognitively healthy-behaviorally adaptive group as the reference category; variables with statistically significant differences in the univariate analyses were entered as independent variables. Total GO-SSS, SER, and TFI scores and NRS scores were entered as raw scores, and the coding of the remaining variables is shown in Table 3. The regression results are presented in Table 4.

Table 3 Coding of the independent variables

Variable	Coding
Age	Aged 60-79 years = 1; aged ≥ 80 years = 2
Place of residence	Urban = 1; rural = 2
BMI	Normal = 1; abnormal = 2
Fall in the previous year	Yes = 1; no = 2
History of previous surgery	Yes = 1; no = 2
Self-care ability	Good = 1; poor = 2
Postoperative nausea and vomiting	Yes = 1; no = 2
Preoperative comorbidities	Yes = 1; no = 2
Primary caregiver	Fixed caregiver = 1; non-fixed caregiver = 2

BMI: body mass index.

Table 4 Multinomial logistic regression analysis of factors associated with kinesiophobia latent profiles (n = 307)

Variable	B	SE	Wald χ^2	OR	95% CI	P value
Cognitively shifted-behaviorally withdrawn group vs. cognitively healthy-behaviorally adaptive group						
Constant	4.984	1.106	20.288	-	-	-
History of previous surgery	-0.950	0.366	6.739	0.387	(0.189, 0.792)	0.009
Self-care ability	-1.019	0.372	7.528	0.361	(0.174, 0.747)	0.006
Preoperative comorbidities	0.772	0.350	4.862	2.163	(1.090, 4.295)	0.027
GO-SSS score	-0.083	0.022	14.435	0.920	(0.881, 0.960)	<0.001
SER score	-0.029	0.009	9.364	0.971	(0.954, 0.990)	0.002
Cognitively catastrophic-behaviorally restricted group vs. cognitively healthy-behaviorally adaptive group						
Constant	3.177	1.717	3.426	-	-	-
BMI	-1.533	0.620	6.111	0.216	(0.064, 0.728)	0.013
Self-care ability	-1.332	0.674	3.900	0.264	(0.070, 0.990)	0.048
Postoperative nausea or vomiting	1.281	0.602	4.530	3.601	(1.107, 11.715)	0.033
Preoperative comorbidities	1.519	0.616	6.089	4.568	(1.367, 15.264)	0.014
GO-SSS score	-0.183	0.036	26.416	0.832	(0.776, 0.893)	<0.001
SER score	-0.070	0.014	23.421	0.933	(0.907, 0.959)	<0.001
TFI score	0.197	0.092	4.582	1.217	(1.017, 1.458)	0.032
NRS score	0.747	0.158	22.497	2.111	(1.550, 2.874)	<0.001

The cognitively healthy-behaviorally adaptive group served as the reference category. B: regression coefficient; CI: confidence interval; OR: odds ratio; SE: standard error; other abbreviations as in Table 1.

Discussion

Heterogeneity of kinesiophobia among older patients after hip arthroplasty

The prevalence of kinesiophobia in this study was 58.6%, which is consistent with previous findings [22, 23] and warrants close attention from clinical staff. The latent profile analysis identified three clearly heterogeneous profiles: the cognitively healthy-behaviorally adaptive group, the cognitively shifted-behaviorally withdrawn group, and the cognitively catastrophic-behaviorally restricted group.

Cognitively healthy-behaviorally adaptive group (31.9%). Patients in this class scored low on all TSK-11 dimensions, indicating a relatively positive mindset and the ability to view postoperative rehabilitation objectively and adhere to exercise programs. For these patients, healthcare professionals may: (1) use peer modeling to present them as positive exemplars in ward-based peer rehabilitation sharing [24]; (2) provide standardized rehabilitation education to their fixed caregivers to sustain high-quality family support, prevent declines in support, and consolidate improvements in negative cognition and behavior [25]; and (3) appropriately reduce the frequency of bedside psychological and rehabilitation interventions, adopting lightweight, staged follow-up management to conserve medical resources [26].

Cognitively shifted-behaviorally withdrawn group (39.4%). Patients in this class scored at intermediate levels on all TSK-11 dimensions, suggesting an unstable rehabilitation mindset whose adherence fluctuates with somatic symptoms. For these patients, healthcare professionals may: (1) apply cognitive restructuring interventions designed for populations with low health literacy, such as video-feedback methods that use pictures, graphics, and short videos to progressively explain the physiological patterns of postoperative pain and correct cognitive bias [27]; (2) provide rehabilitation guidance to both patients and their caregivers, encouraging families to offer sustained psychological encouragement while conveying rehabilitation knowledge, thereby fully activating family support [28]; and (3) establish dynamic risk screening and stepped follow-up mechanisms, increasing the frequency of bedside rehabilitation and psychological assessments during hospitalization and continuing follow-up after discharge, and escalating intervention intensity promptly when negative emotions or rehabilitation problems are detected to prevent progression to severe kinesiophobia [10].

Cognitively catastrophic-behaviorally restricted group (28.7%). Patients in this class scored highest on all TSK-11 dimensions and had the most severe kinesiophobia; routine rehabilitation guidance or psychological support may be insufficient, and a comprehensive "high-intensity, multidimensional, stepped" intervention strategy is required. Specifically, preoperatively, "prehabilitation" strategies should be implemented rigorously [29], including systematic frailty assessment [30], rehabilitation function guidance, and nutritional support to improve baseline functional status [31], together with cognitive behavioral therapy to help patients establish reasonable expectations of postoperative pain and the rehabilitation process and reduce pre-existing catastrophic cognition [32]. Postoperatively, bedside intensive rehabilitation supervision should be delivered under professional guidance, using repeated on-site demonstration, timely feedback, and positive reinforcement to progressively build patients' confidence in movement [33], while high-frequency pain monitoring and individualized pre-emptive

analgesia keep pain within tolerable limits and create conditions for rehabilitation exercise [34]. Within 72 h after discharge, the first follow-up should be completed and follow-up should continue at least weekly thereafter, with continuous monitoring of pain levels, exercise adherence, and emotional status, and prompt initiation of video, outpatient, or home visits when abnormalities are detected [23].

Factors associated with the latent profiles of kinesiophobia

Roles of previous surgical history, self-care ability, BMI, social support, and rehabilitation self-efficacy

Univariate and multivariate analyses showed that patients with a history of previous surgery, good self-care ability, normal BMI, high social support, and strong rehabilitation self-efficacy were more likely to belong to the cognitively healthy-behaviorally adaptive group. Among these factors, previous surgical history was protective for membership in this group (OR = 0.387). Alberti et al. [35] reported that previous surgical experience can reduce preoperative psychological stress, possibly because patients who have experienced perioperative pain, medical procedures, and postoperative rehabilitation develop psychological expectations and a rational understanding of the process; this "prior experience" attenuates fear of the unknown, enabling patients to face the current HA with greater psychological tolerance and coping capacity. However, other studies have reported that a history of surgery may predict higher surgical fear [36]; the discrepancy may reflect differences in study populations and types of fear, indicating that the direction of the effect of surgical history on psychological status is modulated by multiple factors and requires targeted investigation in HA populations. Therefore, for older patients after HA, healthcare professionals may strengthen preoperative cognitive interventions according to individual circumstances, explaining in detail the discomfort that may occur postoperatively and the corresponding coping strategies, to reduce negative emotions arising from uncertainty.

Good self-care ability was protective for membership in the cognitively healthy-behaviorally adaptive group (OR = 0.361 and 0.264 for the cognitively shifted-behaviorally withdrawn and cognitively catastrophic-behaviorally restricted groups, respectively), because self-care ability reflects preoperative functional reserve and physical activity capacity. Patients with better preoperative self-care ability have relatively stronger muscle strength, balance function, and endurance for daily activities and tolerate physical discomfort better during early postoperative ambulation, thereby reducing kinesiophobia triggered by physical activity restriction [37]. Morri et al. [38] similarly confirmed in a prospective cohort of 269 patients who underwent total hip replacement that poorer preoperative self-care ability was significantly associated with higher postoperative kinesiophobia. These findings suggest that for patients with weak preoperative self-care ability or existing functional dependence, prehabilitation targeting functional reserve should be initiated before surgery, optimizing functional status through preoperative rehabilitation training, such as independent washing of the face, brushing teeth, eating, and defecating in bed [39]; postoperative rehabilitation should follow a progressive, individualized approach, transitioning gradually from in-bed muscle-strengthening exercises to out-of-bed activities [40]. In addition, simultaneous training of caregivers should be emphasized, teaching them skills such as assisting with transfers and using walking aids to ensure safe support during activity [41].

Normal BMI was protective for membership in the cognitively catastrophic-behaviorally restricted group (OR = 0.216), indicating that overweight or obese older patients are more likely to develop severe kinesiophobia. Previous studies have also found that BMI is a significant predictor of kinesiophobia trajectory groups after arthroplasty, suggesting that body weight status is closely related to the longitudinal evolution of postoperative

kinesiophobia [42]. The mechanisms may be twofold. On the one hand, obesity increases mechanical loading on the hip joint and induces chronic low-grade inflammation and metabolic disturbances, aggravating postoperative pain and functional limitation, so that patients experience pain and discomfort earlier and more intensely during rehabilitation, reinforcing catastrophic cognition and avoidant behavior. On the other hand, overweight or obese patients often have lower levels of physical activity and muscle strength reserve, and their tolerance of exercise load declines after surgery, further undermining their confidence and ability to resume early out-of-bed activity. Long-term follow-up studies have also shown that, although obese patients achieve functional improvement after surgery, their physical function at follow-up is generally poorer than that of normal-weight patients [43]. Therefore, for older HA patients with abnormal preoperative BMI, perioperative weight management should be strengthened, combining nutritional support with progressive rehabilitation training to reduce joint loading while improving functional reserve, thereby creating conditions for early postoperative activity and functional reconstruction.

With regard to psychosocial factors, higher GO-SSS scores (OR = 0.920 and 0.832) and higher SER scores (OR = 0.971 and 0.933) significantly increased the probability of membership in the cognitively healthy-behaviorally adaptive group. Social support is an important buffer against external stress: good family and caregiver support not only directly assists patients in completing rehabilitation training, but also alleviates anxiety through emotional comfort and enhances motivation and confidence for rehabilitation [28]. As an intrinsic motivator, rehabilitation self-efficacy determines the extent to which patients persist in the face of pain and difficulty; patients with high self-efficacy tend to regard pain during rehabilitation as a "necessary process" rather than a "danger signal" and therefore show fewer avoidant behaviors and negative emotions. For patients with weak social support or low self-efficacy, motivational interviewing is recommended, using empathy, open-ended questions, and other techniques to help patients identify and resolve ambivalence toward behavior change and stimulate intrinsic motivation [44]; peer education can also help patients rebuild rehabilitation confidence through the modeling effect of successful cases [45]. In addition, health education for caregivers should be strengthened so that they can provide sustained and effective behavioral and emotional support [41].

Roles of preoperative comorbidities, postoperative nausea and vomiting, frailty, and pain

Preoperative comorbidities, postoperative nausea and vomiting, frailty, and pain were risk factors for membership in the cognitively shifted-behaviorally withdrawn and cognitively catastrophic-behaviorally restricted groups. Preoperative comorbidities were risk factors for membership in both profiles (OR = 2.163 and 4.568, respectively). The possible explanation is that patients with preoperative comorbidities have lower functional reserve and tend to perceive themselves as physically frail, leading to excessive vigilance and avoidance of postoperative rehabilitation activities. A study of patients after HA showed that the risk of developing a persistently high kinesiophobia trajectory was 6.471 times higher in patients with comorbidities than in those without [46]. For such patients, a multidisciplinary team should develop individualized perioperative care plans, delivering progressive rehabilitation training while controlling underlying diseases; interventions based on Meleis' transition theory may also be applied to help patients complete the psychological transition from the "sick role" to the "recovery role", thereby reducing kinesiophobia and improving adherence to rehabilitation exercise after HA [47].

Postoperative nausea and vomiting was a risk factor for membership in the cognitively catastrophic-behaviorally restricted group (OR = 3.601). Nausea and vomiting are common adverse reactions after HA in older patients,

resulting from the combined effects of anesthesia, postoperative analgesic drugs, and surgical trauma. The associated subjective discomfort may be catastrophically interpreted by patients as "the surgery went wrong" or "something is seriously wrong with my body"; such negative experiences may generalize into anxiety about and fear of the entire rehabilitation process, aggravating activity avoidance [48]. For patients who develop postoperative nausea and vomiting, nurses should administer antiemetics promptly and provide symptom explanation and psychological comfort, helping patients understand that these reactions are transient and controllable, to prevent adverse experiences from generalizing into fear of rehabilitation activity.

Frailty was a risk factor for membership in the cognitively catastrophic-behaviorally restricted group (OR = 1.217). Frailty is a clinical state characterized by multisystem physiological decline, manifesting as muscle weakness, reduced physical activity, and easy fatigability [49]. In the frail state, older patients lack confidence in their physical capacity and remain highly vigilant toward any activity that may cause discomfort, tending to stop activity at the slightest pain or discomfort. For such patients, systematic assessment using the FRAIL scale [50] and the Modified Frailty Index-5 (mFI-5) [51] is recommended preoperatively, and prehabilitation programs should combine nutritional support [52] with progressive rehabilitation training [30] to improve baseline functional status.

Pain is the most direct trigger of kinesiophobia. In this study, a higher NRS pain score significantly increased the probability of membership in the cognitively catastrophic-behaviorally restricted group (OR = 2.111). Previous studies have also shown that higher pain scores are an independent risk factor for kinesiophobia, and pain intensity is positively correlated with kinesiophobia severity [48]. As a strong negative somatic signal, pain is readily catastrophically interpreted by patients as "the activity damaged the joint" or "the prosthesis has a problem", leading to erroneous associations between normal rehabilitation pain and danger signals; once such erroneous cognition becomes entrenched, patients unconsciously avoid all activities that may elicit pain, ultimately resulting in muscle atrophy, joint stiffness, and delayed functional recovery. For patients with prominent postoperative pain, multimodal analgesia is recommended; on the basis of adequate analgesia, cognitive behavioral interventions should help patients correctly distinguish "rehabilitative pain" from "injurious pain", breaking the vicious cycle of pain-fear-avoidance-functional decline. In addition, preoperative video-based education can visually demonstrate the normal pain reactions that may occur during postoperative rehabilitation, establishing reasonable pain expectations in advance and reducing catastrophic cognition triggered by sudden pain experiences.

Limitations

This study has several limitations. First, convenience sampling and recruitment from a single tertiary grade-A hospital in Sichuan Province limit the representativeness of the sample, and the generalizability of the findings requires caution. Second, the cross-sectional design precludes inferences about causal relationships between the examined factors and kinesiophobia. Third, kinesiophobia, social support, and rehabilitation self-efficacy were self-reported and may be subject to reporting bias. Future multicenter, large-sample longitudinal studies incorporating objective activity monitoring are warranted to further validate the stability of the latent profiles and the long-term effects of the intervention strategies.

Conclusions

Kinesiophobia is highly prevalent (58.6%) among older patients after HA and shows marked population heterogeneity, with three latent profiles identified: the cognitively healthy-behaviorally adaptive group, the cognitively shifted-behaviorally withdrawn group, and the cognitively catastrophic-behaviorally restricted group. Previous surgical history, good self-care ability, normal BMI, and higher social support and rehabilitation self-efficacy were protective factors, whereas preoperative comorbidities, postoperative nausea and vomiting, frailty, and pain were risk factors. Healthcare professionals should implement precise, stratified perioperative interventions tailored to the characteristics and associated factors of each latent profile to reduce kinesiophobia and promote postoperative recovery.

Abbreviations

AIC: Akaike information criterion; aBIC: sample-size-adjusted Bayesian information criterion; BIC: Bayesian information criterion; BLRT: bootstrap likelihood ratio test; BMI: body mass index; CI: confidence interval; GO-SSS: Groningen Orthopaedic Social Support Scale; HA: hip arthroplasty; IQR: interquartile range; LMRT: Lo-Mendell-Rubin adjusted likelihood ratio test; LPA: latent profile analysis; mFI-5: Modified Frailty Index-5; NRS: Numerical Rating Scale; OR: odds ratio; SER: Self-Efficacy for Rehabilitation Outcome Scale; TFI: Tilburg Frailty Indicator; TSK-11: 11-item Tampa Scale for Kinesiophobia.

Declarations

Ethics approval and consent to participate

This study was performed in accordance with the Declaration of Helsinki. Ethical approval was obtained from the Ethics Committee of Suining Central Hospital (approval number: KYLLKS20260050). Written informed consent was obtained from all participants before enrollment.

Consent for publication

Not applicable.

Availability of data and materials

The datasets generated and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Authors' contributions

[Please specify each author's contributions using initials, for example: JZ: conceptualization, investigation, data curation, and writing-original draft; XL, JY, LJX, YY, and XP: investigation and data collection; YY: supervision and project administration; XP: methodology and writing-review and editing. All authors read and approved the final manuscript.]

Acknowledgements

Not applicable.

References

1. Fan X, Zhou Y, Zhou T, Cobb JP, Yu T. The choice of hip arthroplasty: HRA or THA? revealed by meta-analysis. Orthop Surg. 2025;17(6):1577–88. 10.1111/os.70019.
2. Frydendal T, Christensen R, Mechlenburg I, Mikkelsen LR, Varnum C, Graversen AV, et al. Total hip replacement or resistance training for severe hip osteoarthritis. N Engl J Med. 2024;391(17):1610–20. 10.1056/NEJMoa2400141.
3. Lenguerrand E, Ben-Shlomo Y, Rangan A, Beswick A, Whitehouse MR, Deere K, et al. Inequalities in provision of hip and knee replacement surgery for osteoarthritis by age, sex, and social deprivation in England between 2007–2017: a population-based cohort study of the National Joint Registry. PLoS Med. 2023;20(4):e1004210. 10.1371/journal.pmed.1004210.
4. Ghanimeh J, Abusaq I, Villatte G, Descamps S, Boisgard S, Erivan R. Unipolar hip hemiarthroplasty in geriatric patients: a prospective study and analysis of clinical and radiological outcomes. Geriatr Orthop Surg Rehabil. 2024;15:21514593241228670. 10.1177/21514593241228670.
5. Li C, Wu D, He W, Wang T, Guo H, Yang Z, et al. Loss of walking independence one year after primary total hip arthroplasty for osteonecrosis of the femoral head: incidence and risk prediction model. J Orthop Surg Res. 2024;19(1):580. 10.1186/s13018-024-05071-6.
6. Soliman G, Fortinsky RH, Mangione K, Beamer BA, Magder L, Binder EF, et al. Impact of psychological resilience on walking capacity in older adults following hip fracture. J Am Geriatr Soc. 2022;70(11):3087–95. 10.1111/jgs.17930.
7. Guo K, Zhou L, Zhang M, Hu X, Han Y, Hou J, et al. Postoperative kinesiophobia in elderly patients with femoral neck fractures: a prospective study of psychological and social determinants. Front Psychol. 2025;16:1622585. 10.3389/fpsyg.2025.1622585.
8. Al-Amiry B, Rahim A, Knutsson B, Mattisson L, Sayed-Noor A. Kinesiophobia and its association with functional outcome and quality of life 6–8 years after total hip arthroplasty. Acta Orthop Traumatol Turc. 2022;56(4):252–5. 10.5152/j.aott.2022.21318.
9. Xie Y, Liu S, Li C, Luo Y, Chen R, Wu W, et al. The effect of an early ambulation program based on cognitive behavioral therapy for elderly patients with kinesiophobia after total hip arthroplasty. Front Med (Lausanne). 2026;13:1741605. 10.3389/fmed.2026.1741605.
10. Cao Y, Lan X, Li C, Xiang Y, Xu Q, Zhang R, et al. Identifying kinesiophobia subtypes and their determinants in patients with hip fractures: a latent profile analysis. Front Psychiatry. 2026;16:1697341. 10.3389/fpsyt.2025.1697341.

11. Doorenbos A, Mathew A. Latent profile analysis: an emerging advanced statistical approach to subgroup identification. Indian J Contin Nurs Educ. 2022;23(2):127–33. 10.4103/ijcn.ijcn_24_22.
12. Lewinnek GE, Lewis JL, Tarr R, Compere CL, Zimmerman JR. Dislocations after total hip-replacement arthroplasties. J Bone Joint Surg Am. 1978;60(2):217–20.
13. Woby SR, Roach NK, Urmston M, Watson PJ. Psychometric properties of the TSK-11: a shortened version of the Tampa Scale for Kinesiophobia. Pain. 2005;117(1–2):137–44. 10.1016/j.pain.2005.05.029.
14. Cai L, Liu Y, Woby SR, Genoosha N, Cui M, Guo L. Cross-cultural adaptation, reliability, and validity of the Chinese version of the Tampa Scale for Kinesiophobia-11 among patients who have undergone total knee arthroplasty. J Arthroplasty. 2019;34(6):1116–21. 10.1016/j.arth.2019.01.076.
15. van den Akker-Scheek I, Stevens M, Spriensma A, van Horn JR. Groningen Orthopaedic Social Support Scale: validity and reliability. J Adv Nurs. 2004;47(1):57–63. 10.1111/j.1365-2648.2004.03065.x.
16. Sheng XJ, Chen WY, Fu QM. [Chinese adaptation of the Groningen Orthopaedic Social Support Scale and its reliability and validity in patients after hip and knee arthroplasty]. J Nurs (China). 2019;26(14):51 – 4. Chinese. 10.16460/j.issn1008-9969.2019.14.051
17. Waldrop D, Lightsey OR Jr, Ethington CA, Woemmel CA, Coke AL. Self-efficacy, optimism, health competence, and recovery from orthopedic surgery. J Couns Psychol. 2001;48(2):233–8. 10.1037/0022-0167.48.2.233.
18. Wang HY, Xu YL, Hu SL, et al. [Reliability and validity of the Chinese version of the Self-Efficacy for Rehabilitation Outcome Scale]. Chin J Mod Nurs. 2014;20(3):268–70. 10.3760/cma.j.issn.1674-2907.2014.03.007. Chinese.
19. Gobbens RJ, van Assen MA, Luijkx KG, Wijnen-Sponselee MT, Schols JM. The Tilburg frailty indicator: psychometric properties. J Am Med Dir Assoc. 2010;11(5):344–55. 10.1016/j.jamda.2009.11.003.
20. Xi X, Guo GF, Sun J. [Reliability and validity of the Chinese version of the Tilburg Frailty Indicator]. J Nurs (China). 2013;20(16):1–4. Chinese.
21. Cancer Council Australia. Cancer pain management in adults: clinical practice guideline. Sydney: Cancer Council Australia. 2024 (updated 2026 May 6). https://www.guidelinecentral.com/guideline/4567348/. Accessed 30 Jul 2026.
22. Alpalhao V, Cordeiro N, Pezarat-Correia P. Kinesiophobia and fear avoidance in older adults: a systematic review on constructs and related measures. J Geriatr Phys Ther. 2022;45(4):207–14. 10.1519/JPT.0000000000000354.
23. Dong S, Guo X, Zhou Y, Chen Y, Wang C, Peng S, et al. Construction and validation of a predictive model for post-operative kinesiophobia in total hip arthroplasty patients. Front Med (Lausanne). 2025;12:1699157. 10.3389/fmed.2025.1699157.
24. Crotty M, Prendergast J, Battersby MW, Rowett D, Graves SE, Leach G, et al. Self-management and peer support among people with arthritis on a hospital joint replacement waiting list: a randomised controlled trial. Osteoarthritis Cartilage. 2009;17(11):1428–33. 10.1016/j.joca.2009.05.010.
25. Marmouta P, Marmouta L, Tsounis A, Tzavara C, Malliarou M, Fradelos E, et al. Effect of kinesiophobia and social support on quality of life after total hip arthroplasty. Healthc (Basel). 2025;13(12):1366. 10.3390/healthcare13121366.
26. Li KY, Chan PK, Yeung SS, Cheung A, Chan WKV, Luk MH, et al. The role of telemedicine in joint replacement surgery? An updated review. Arthroplasty. 2023;5(1):39. 10.1186/s42836-023-00196-1.

27. Ren H, Wang S, Yin X, Li P, Li X, Xue Y, et al. Effectiveness of the video teach-back method in reducing kinesiophobia among patients following unilateral total hip arthroplasty: a quasi-experimental study. Ann Behav Med. 2025;59(1):kaae090. 10.1093/abm/kaae090.
28. Tang M, Pan J, Feng J, Liu Y, Jiang M, Yang X. Family function and kinesiophobia in patients after hip replacement surgery: a cross-sectional study on the mediating role of illness perception. J Vis Exp. 2026;232e71471. 10.3791/71471.
29. Svinoy OE, Nordbo JV, Pripp AH, Risberg MA, Bergland A, Borgen PO, et al. The effect of prehabilitation for older patients awaiting total hip replacement: a randomized controlled trial with long-term follow-up. BMC Musculoskelet Disord. 2025;26(1):227. 10.1186/s12891-025-08468-4.
30. Khalid T, Ben-Shlomo Y, Bertram W, Culliford L, Henderson EJ, Jepson M, et al. Prehabilitation for frail patients undergoing hip and knee replacement in the UK: Joint PREP feasibility study for a randomised controlled trial. BMJ Open. 2024;14(9):e084678. 10.1136/bmjopen-2024-084678.
31. Okpara C, Negm A, Adachi JD, Armstrong D, Atkinson S, Avram V, et al. Getting fit for hip and knee replacement: the Fit-Joints multimodal intervention for frail patients with osteoarthritis - a pilot randomized controlled trial. J Frailty Aging. 2025;14(2):100028. 10.1016/j.tjfa.2025.100028.
32. Kazarian GS, Anthony CA, Lawrie CM, Barrack RL. The impact of psychological factors and their treatment on the results of total knee arthroplasty. J Bone Joint Surg Am. 2021;103(18):1744–56. 10.2106/JBJS.20.01479.
33. Kenney SG, Shah KS, Tabbaa JM, Evans AS, Bugbee WD, Copp SN. Effectiveness of a supervised patient ambulation program in reducing fall risk following total joint arthroplasty. JAAOS Glob Res Rev. 2025;9(3):e2400407. 10.5435/JAAOSGlobal-D-24-00407.
34. Wainwright TW, Gill M, McDonald DA, Middleton RG, Reed M, Sahota O, et al. Consensus statement for perioperative care in total hip replacement and total knee replacement surgery: Enhanced Recovery After Surgery (ERAS) Society recommendations. Acta Orthop. 2020;91(1):3–19. 10.1080/17453674.2019.1683790.
35. Alberti LR, Daian MR, Petroianu A. Does a previous surgical experience interfere on psychic stress in patients submitted to major surgery? Rev Col Bras Cir. 2014;41(1):43–8. 10.1590/S0100-69912014000100009.
36. Dimitriadou I, Kaperda A, Toska A, Fradelos EC, Souliotis K, Papathanasiou IV, et al. Surgical fear, anxiety, and satisfaction with nursing care: a cross-sectional study of hospitalized surgical patients. Nurs Rep. 2025;15(10):365. 10.3390/nursrep15100365.
37. Aleksic M, Selakovic I, Tomanovic Vujadinovic S, Kadija M, Milovanovic D, Meissner W, et al. Understanding kinesiophobia: predictors and influence on early functional outcomes in patients with total knee arthroplasty. Geriatr (Basel). 2024;9(4):103. 10.3390/geriatrics9040103.
38. Morri M, Venturini E, Franchini N, Ruisi R, Culcasi A, Ruggiero A, et al. Is kinesiophobia a predictor of early functional performance after total hip replacement? A prospective prognostic cohort study. BMC Musculoskelet Disord. 2020;21(1):724. 10.1186/s12891-020-03748-7.
39. Laza-Cagigas R, Larumbe-Zabala E, Rampal T, Seijo M, Naclerio F. Effect of prehabilitation programmes on functional capacity in patients awaiting oncological resections: a systematic review and meta-analysis of randomised controlled trials. Support Care Cancer. 2024;32(10):667. 10.1007/s00520-024-08875-8.
40. Wang X, Wang D. Phased rehabilitation nursing improves hip function, reduces complications, and enhances quality of life following total hip arthroplasty: a prospective quasi-experimental cohort study. Med (Baltim).

2026;105(28):e49093. 10.1097/MD.0000000000049093.
41. Smith TO, Khoury R, Hanson S, Welsh A, Grant K, Clark AB, et al. Hospital-based caregiver intervention for people following hip fracture surgery (HIP HELPER): multicentre randomised controlled feasibility trial with embedded qualitative study in England. BMJ Open. 2023;13(12):e073611. 10.1136/bmjopen-2023-073611.
42. Yan Z, Wu Y, Liu M, Wang X, Wang J, Wang Z, et al. Heterogeneous trajectories of kinesiophobia and their effects on rehabilitation outcomes after total knee arthroplasty: a prospective cohort study. J Orthop Surg Res. 2023;18(1):449. 10.1186/s13018-023-03881-8.
43. Vincent HK, Horodyski M, Gearen P, Vlasak R, Seay AN, Conrad BP, et al. Obesity and long term functional outcomes following elective total hip replacement. J Orthop Surg Res. 2012;7:16. 10.1186/1749-799X-7-16.
44. Kubat Bakir G, Goktas S. The effects of motivational interviews about activities of daily living on physical adjustment and quality of life in elderly total knee arthroplasty patients: a randomised-controlled trial. Healthc (Basel). 2024;12(23):2472. 10.3390/healthcare12232472.
45. Ocokoljic A, Stuhlreyer J, Paschke-Dahl L, Elsenbruch S, Rolvien T, Beil FT, et al. Optimising preoperative expectations to reduce postoperative pain and disability in total hip arthroplasty: a study protocol for a randomised controlled trial. BMJ Open. 2025;15(11):e108899. 10.1136/bmjopen-2025-108899.
46. Liu Y, Wang H, Zhang L et al. [Potential categories and influencing factors of kinesiophobia trajectories in patients after total hip arthroplasty]. West China Med J. 2024;39(11):1685-92. Chinese. 10.7507/1002-0179.202406050
47. Ko YJ, Lee JH, Oh EG, Choi MN, Kim CO, Sung KW, et al. Older adults with hip arthroplasty: an individualized transitional care program. Rehabil Nurs. 2019;44(4):203–12. 10.1097/rnj.0000000000000120.
48. Zuo XL, Zhang JW, Li J, Wen Y, Zhao SX. Risk factors for kinesiophobia after total hip arthroplasty: a prospective observational study. Front Nurs. 2026;13(1):25–31. 10.2478/fon-2026-0004.
49. Fried LP, Tangen CM, Walston J, Newman AB, Hirsch C, Gottdiener J, et al. Frailty in older adults: evidence for a phenotype. J Gerontol Biol Sci Med Sci. 2001;56(3):M146–56. 10.1093/gerona/56.3.M146.
50. Song Y, Wu Z, Zhao A, Zhou J, Zhao P. Association between preoperative frailty to adverse postoperative outcomes in older people undergoing elective spinal surgery: a prospective cohort study. BMC Geriatr. 2025;25(1):696. 10.1186/s12877-025-06352-3.
51. Wei Z, Jiang L, Zhang M, Chen X. Development and validation of a risk prediction model for severe postoperative complications in elderly patients with hip fracture. PLoS ONE. 2024;19(11):e0310416. 10.1371/journal.pone.0310416.
52. Wilson JM, Boissonneault AR, Schwartz AM, Staley CA, Schenker ML. Frailty and malnutrition are associated with inpatient postoperative complications and mortality in hip fracture patients. J Orthop Trauma. 2019;33(3):143–8. 10.1097/BOT.0000000000001386.

Figures

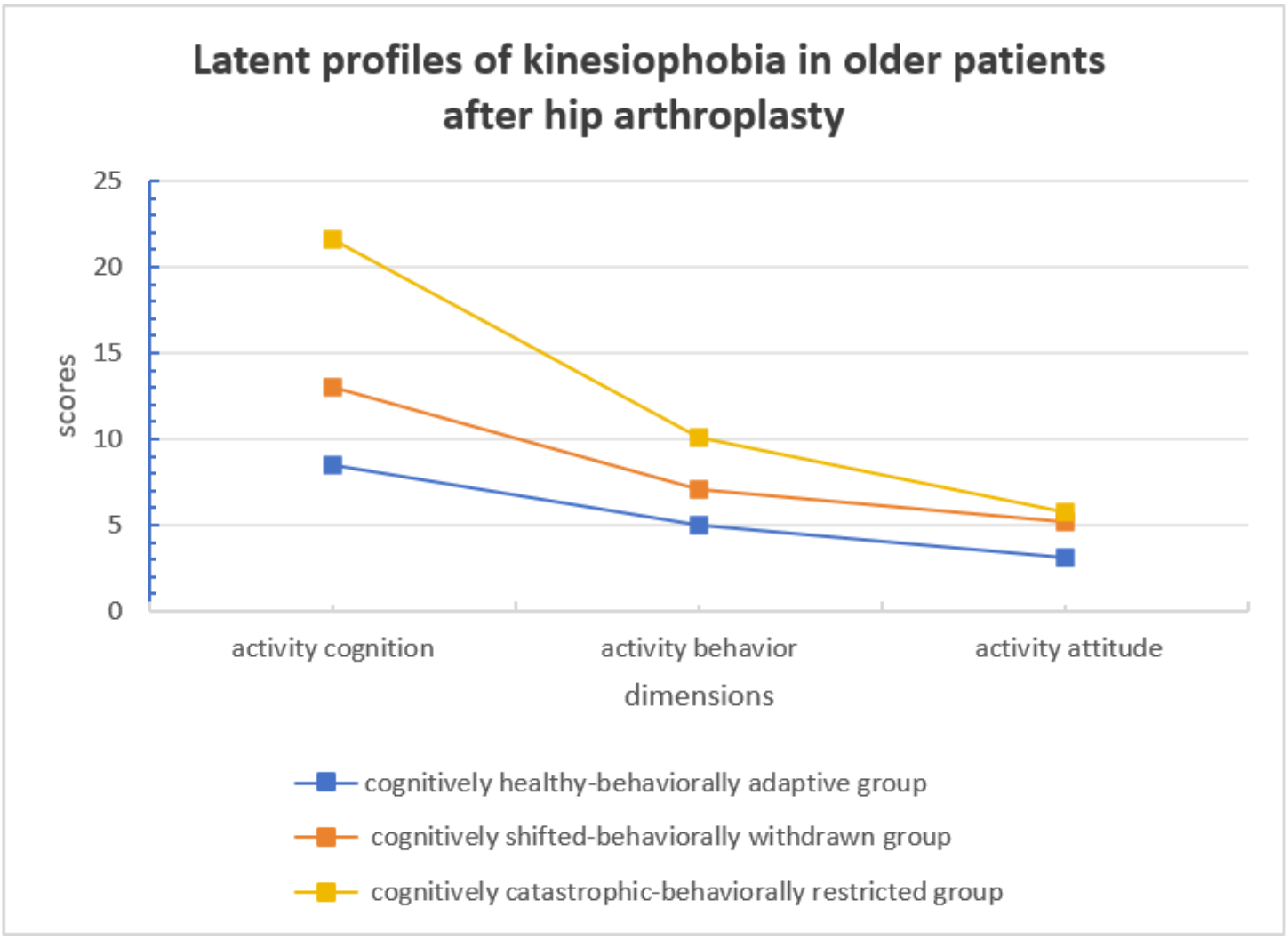


Figure 1

Distribution of TSK-11 dimension scores across the three latent profiles of kinesiophobia in older patients after hip arthroplasty