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RHD-HA-9: A scale for nurses to assess readiness for hospital discharge in older adults following hip arthroplasty—development and psychometric testing

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Abstract

Background: Designing an instrument to assess discharge readiness post-hip surgery is essential due to trends showing poor patient outcomes, such as pain management issues, mobility challenges, and insufficient home support. A structured assessment tool would help ensure patients are better prepared for recovery, reducing the risk of complications and readmission.

Objective: To develop and test the psychometric properties of the Readiness for Hospital Discharge Scale (RHD-HA-9) for hip arthroplasty.

Methods: Items were generated from a comprehensive literature review and individual, face-to-face interviews with experts and patients. A cross-sectional study was conducted across four tertiary governmental hospitals to evaluate the psychometric properties of the scale. Data were collected from a total of 200 older adults who had undergone hip arthroplasty between June 2020 and February 2021. Exploratory Factor Analysis (EFA) was performed on data from 100 older adults to identify the underlying factor structure, followed by Confirmatory Factor Analysis (CFA) on a separate 100-patient dataset to validate the model. The questionnaire's internal consistency, corrected item-total correlations, inter-rater reliability, construct, concurrent, and predictive validity were assessed.

Results: The RHD-HA-9 included nine items, categorized into two factors: the physical performance of hip function and barriers to physical activity. EFA and CFA confirmed these factors, explaining 62% of the total variance. Model fit indices were acceptable (CFI = 0.97, TLI = 0.96, SRMR = 0.04), though RMSEA was 0.12. Chi-square was significant ($\chi 2$ = 0.056, df = 24, p <0.001). The scale showed excellent internal consistency (Cronbach's α = 0.89) and stability (ICC = 0.94). ROC analysis identified a cutoff of 9.5, with a sensitivity of 90.7%, specificity of 70.6%, and AUC of 0.89.

Conclusion: The RHD-HA-9 demonstrated strong psychometric properties for assessing discharge readiness in older adults following hip arthroplasty. It identifies patients who need additional support during their transition home. Nurses can use this tool to accurately assess patient needs and implement effective post-discharge care, thereby enhancing patient outcomes.

Keywords

hip arthroplasty; hospital discharge; physical activity; psychometrics; reliability; factor analysis; ROC analysis; patient discharge; patient readmission; nurses

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Background

Hip fractures are a significant public health concern, particularly among older adults. The highest incidence is observed in individuals aged 85 years or older, with women representing the majority of patients (Amarilla-Donoso et al., 2020; Lee et al., 2020; Moon et al., 2011). Risk factors such as frailty, declining eyesight, reduced bone density, decreased skeletal muscle mass, and poorer cognitive function increase the risk of hip fractures (Kanis et al., 2012; Liu et al., 2015). Surgical interventions, such as arthroplasty, hemiarthroplasty, and total joint replacement, are often necessary to restore hip function and reduce pain, thus improving patients' ability to perform daily activities (DeWit et al., 2016). Effective discharge readiness assessment is essential, particularly for older adults recovering from hip arthroplasty. Insufficient discharge preparation can lead to post-operative complications, hospital readmissions, and increased mortality rates, underscoring the importance of comprehensive discharge planning (Okoniewska et al., 2015; Pollack et al., 2016). However, current discharge planning practices may overlook potential post-discharge issues, such as inadequate recovery, limited mobility, and limited access to community resources, making effective discharge readiness assessment a critical aspect of care, especially following hip arthroplasty (Meleis, 2010; Pollack et al., 2016).

Ineffective discharge management can have serious consequences, including an increased risk of complications such as falls and hip dislocation, which may result in hospital readmissions (Okoniewska et al., 2015; Pollack et al., 2016). Additionally, caregivers who are not adequately prepared may encounter responsibilities for which they are not physically or mentally ready, leading to stress and challenges within the family dynamic, which can negatively affect the patient's recovery process (Heine et al., 2004). Inefficient discharge planning also contributes to increased healthcare costs due to readmissions and the need to manage complications at home, which can strain patients and the healthcare system. Thus, effective discharge readiness assessments are vital for reducing these risks and ensuring patients recover safely and efficiently at home (Youthao et al., 2024).

Developing a new discharge readiness scale for older adults undergoing hip arthroplasty in Thailand is essential due to several key factors. With an aging population, Thailand has seen a rising incidence of hip fractures, with recent data showing an increase in crude incidence rates from 146.7 per 100,000 in 2019 to 146.9 per 100,000 in 2022 (Charatcharoenwitthaya et al., 2024). The healthcare system in Thailand faces significant resource constraints, including limited budgets, shortages of hospital beds, and insufficient healthcare staff, making effective discharge planning crucial to optimizing care and alleviating pressures on healthcare services (Youthao et al., 2024). Additionally, cultural and religious factors play a major role in shaping social structures, support systems, and health-seeking behaviors in Thailand, which must be considered when planning for patient discharge (Che Hasan et al., 2021).

Existing tools, such as the Readiness for Hospital Discharge Scale (RHDS), which assesses patients' perceptions of their readiness, focusing on knowledge, coping ability, and anticipated support (Weiss & Piacentine, 2006), and the Quality of Discharge Teaching Scale (QDTS), which evaluates the quality of discharge education based on content and delivery (Weiss et al., 2008), are used extensively. However, these tools are designed for diverse conditions and may not address the specific requirements of older adults recovering from hip arthroplasty, such as mobility challenges and pain management (Lutz & Bowers, 2000; Weiss et al., 2008). Furthermore, most existing discharge readiness assessments have been developed outside of Thailand and may not adequately capture the cultural nuances and healthcare needs specific to the Thai population. Therefore, there is a need for a culturally sensitive and precise assessment tool that can effectively serve older adults recovering from hip arthroplasty in Thailand (Lutz & Bowers, 2000).

The RHD-HA-9 scale was developed specifically for nurses to assess the discharge readiness of older adults following hip arthroplasty. Nurses play a critical role in evaluating patient conditions and planning post-discharge care, making them the primary users of this tool. The significance of developing a reliable discharge readiness scale lies in its ability to help nurses identify patient needs more accurately, implement targeted interventions, and improve patient outcomes, thereby enhancing the overall efficiency of discharge planning and resource management within Thailand's healthcare system. Therefore, this study aims to develop and validate the RHD-HA-9 scale by evaluating internal consistency, inter-rater reliability, construct validity, concurrent validity, and predictive validity to ensure its effectiveness in clinical practice.

Methods

Study Design

The scale development process was conducted according to the guidelines by Grove et al. (2012), Polit and Yang (2016), and Srisatidnarakul (2012). According to the authors, the scale development process contains two phases: Phase I is scale development, including steps 1 to 4, and Phase II is psychometric testing of the tool, which includes three steps (see **Figure 1**).

Step 1. Item generation: Concept synthesis combined insights from a literature review and expert interviews to identify the core elements of discharge readiness specific to older adults undergoing hip arthroplasty.

1.1 Literature review: An electronic search was conducted across databases including PubMed, Science Direct, and CINAHL from 1997 to 2018, using keywords including "scale development," "psychometric testing," "discharge readiness scale," and "aging or older adults with hip arthroplasty." The key attributes for assessing discharge readiness included physical mobility, rehabilitation, informational, and social factors. The literature review also provided insights into the steps of scale development and psychometric testing derived from existing theoretical knowledge. Based on these findings, interview questions were developed to gather expert input, refining the assessment tool to focus on essential components of discharge readiness in the Thai context.

1.2 Experts interview: Individual face-to-face interviews with eight experts were conducted using a semi-structured guide developed based on insights from the literature review. Content analysis was then performed. Experts included two orthopedic surgeons, two advanced practice nurses (APN), two rehabilitation medicine experts, and two patients who had undergone hip arthroplasty. Including patients as part of the expert group was a strategic decision, as their experiential insights contributed to developing a more practical and patient-centered assessment tool (Bombard et al., 2018). The primary aim was to identify critical indicators for evaluating hospital discharge readiness in older adults after hip arthroplasty, specifically within the Thai context. For example, "What would you consider the essential components of a discharge readiness assessment tool for hip arthroplasty patients?"

1.3 Item pool development: Each item was designed to represent defined attributes, resulting in a 9-item scale covering essential aspects such as mobility (sitting, standing, walking, transfers), hip function precautions, rehabilitation, pain management, and caregiving. Expert validation ensured these items were theoretically sound and practically relevant for assessing safe discharge.

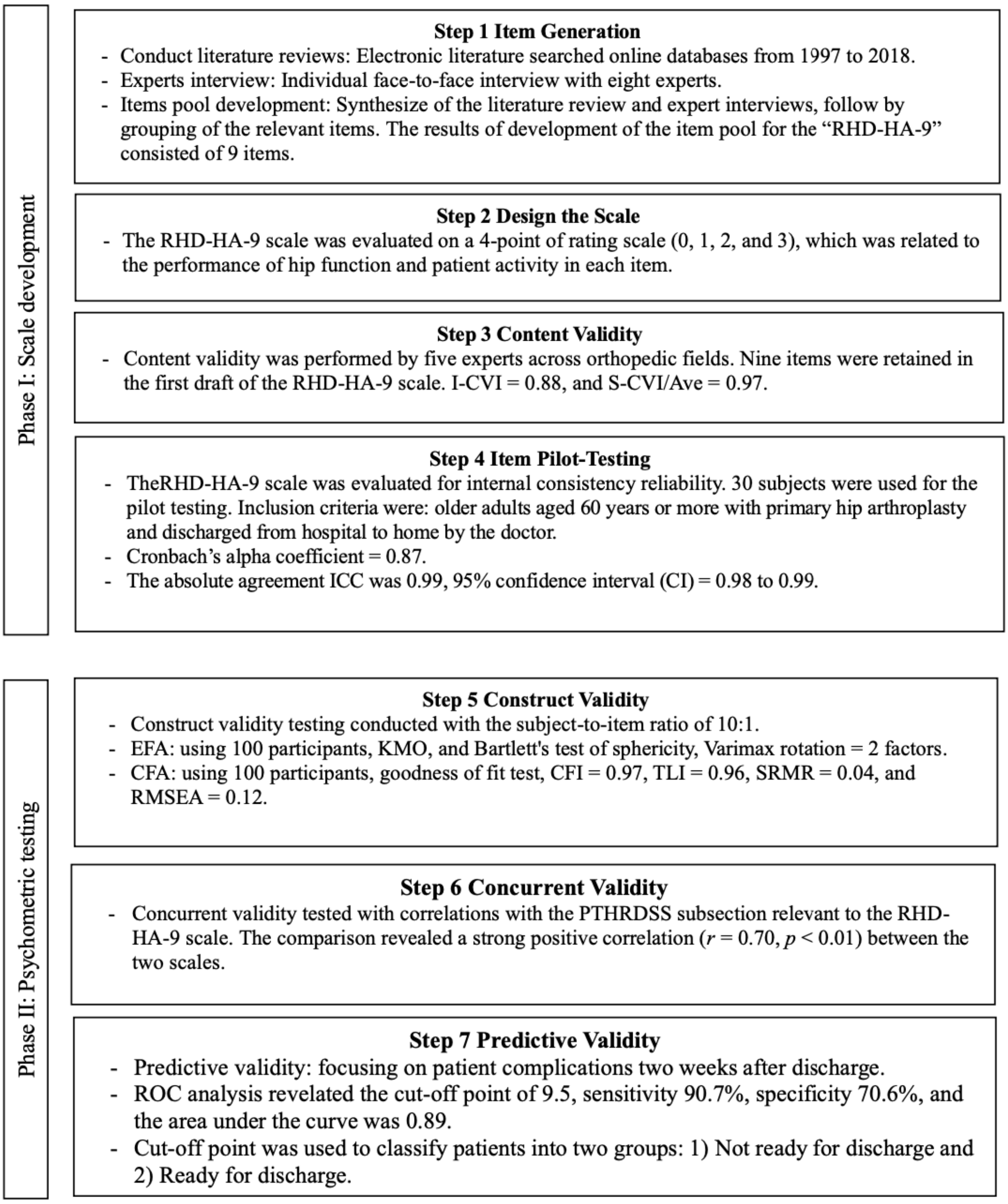

Figure 1 The process of RHD-HA-9 development and psychometric testing

Step 2. Design the Scale: The RHD-HA-9 scale evaluates discharge readiness across nine items, using a 4-point rating that relates to the performance of hip function and patient activity in each item. For example, item 4-transfer from bed to chair: 0 = Unable to transfer, 1 = Transfers with help and an assistive device, 2 = Transfers with help or an assistive device, and 3 = Transfers independently. A neutral choice is unnecessary as we want the nurse to decide based on the patient's current status. The variation in response formats across items is intentional, reflecting the unique attributes of each task, such as sitting, standing, walking, and transferring. Tailoring the response options to specific challenges allows the scale to capture subtle differences in patient abilities, ensuring a comprehensive assessment of functional readiness for discharge. The scale's four distinct levels help determine a patient's functional ability, guiding discharge decisions. Each item score ranges from 0 to 3, giving a possible total score range of 0 to 27 across all nine items. Higher scores indicate a greater level of independence and readiness for discharge.

Step 3. Content Validity: The initial draft of the RHD-HA-9 scale was reviewed to combine overlapping items and remove irrelevant ones related to discharge readiness after hip arthroplasty. Five experts, including two orthopedic surgeons, one advanced practice nurse, one experienced orthopedic nurse, and one measurement specialist, assessed content validity using the Item-level Content Validity Index (I-CVI) and Scale-level Content Validity Index (S-CVI). Items rated as valid by a majority of experts (scores of 3.0 or 4.0) resulted in I-CVI values exceeding 0.80 for all items (Polit & Yang, 2016; Srisatidnarakul, 2012).

Step 4. Item Pilot-Testing. The RHD-HA-9 scale was tested for internal consistency reliability using a pilot study with 30 participants, all older adults (aged 60 years or older) discharged from the hospital after primary hip arthroplasty. A sample size of 20-30 is often sufficient for pilot studies to assess the feasibility, reliability, and validity of new tools (Burns, 2014). This range helps identify issues and allows for adjustments without the complexity of larger trials. Testing with 30 participants also ensures efficient data collection and management in a controlled setting, such as a single hospital ward (Hogan, 2003). The Cronbach's α coefficient was 0.87. Additionally, inter-rater reliability was assessed using the Intraclass Correlation Coefficient (ICC) to measure the agreement among different raters. The study took place in the orthopedic ward of a government hospital, where five registered nurses evaluated the same five subjects and calculated the percentage of agreement (Burns, 2014; Hogan, 2003; Koo & Li, 2016).

Step 5. Construct Validity. Construct validity was assessed using Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA). Exploratory Factor Analysis, conducted with Principal Component Analysis (PCA), identified factors by evaluating normality, multicollinearity, Kaiser-Meyer-Olkin (KMO) (>0.5), and Bartlett's Test of Sphericity. Varimax rotation was applied to refine factors with loadings above 0.40. CFA was then used to confirm and validate the factor structure, with model fit verified by indices including CFI (>0.95), TLI (>0.95), SRMR (<0.05), and RMSEA (<0.05) (Hair et al., 2010).

Step 6. Concurrent Validity. The Post Total Hip Replacement Discharge Scoring Scale (PTHRDSS) was used to assess concurrent validity. Pearson's correlation coefficient was employed to measure the relationship between the RHD-HA-9 and PTHRDSS scores. Developed by Wong et al. (1999), the PTHRDSS includes nine components with 16 items, scoring 0, 1, or 2 based on ability. The test-retest method and Cronbach's α were evaluated for reliability. The PTHRDSS was assessed on the fourth day of post-surgery and on a one-month home visit, which showed a high correlation coefficient (Cronbach's α = 0.74, r = 0.62). The researchers focused on a PTHRDSS subsection relevant to the RHD-HA-9 scale, covering seven similar items: hip function, daily living activities, transfer, toileting, adherence to hip precautions, participation in a home exercise program, and social support.

Step 7. Predictive Validity: This study assessed predictive validity by examining patient complications two weeks after discharge. The researchers visited and interviewed patients during their first follow-up appointment at the hospital. The receiver-operating characteristic (ROC) curve was used to identify the cutoff point for clinical prediction, plotting the False Positive Rate (FPR) against the True Positive Rate (TPR) for all possible values from 0 to 1 (Polit & Yang, 2016). This cutoff point was then used to categorize patients into two groups: 1) Not ready for discharge and 2) Ready for discharge.

Samples/Participants

The study focused on older adults aged 60 and older who had undergone hip arthroplasty and were scheduled for discharge to home. Eligibility requirements included the ability to communicate effectively. In this study, a multi-stage random sampling technique was employed to select hospitals and participants. First, four tertiary care government hospitals in the Bangkok Metropolitan Region were chosen based on their capacity to perform procedures such as total hip replacement, hip hemiarthroplasty, or internal repairs using screws. The four tertiary care government hospitals were selected through a random sampling process. Participants were randomly selected from the orthopedic wards within these hospitals for data collection.

Participants were randomly assigned into two equal groups for EFA and CFA. The subject-to-item ratio of 10:1 was maintained for both EFA and CFA, following recommended guidelines to ensure an adequate sample size for factor analysis (Polit & Yang, 2016; Srisatidnarakul, 2012; Tabachnick et al., 2019).

Data Collection

Data were collected from older adults who had undergone hip arthroplasty between June 2020 and February 2021. The researcher and research assistants approached the target samples in their hospital rooms and explained the study. Patients were evaluated twice: first, before discharge, under the doctor's supervision, using the RHD-HA-9 scale, administered on paper by the researcher or research assistants and typically required 15 to 20 minutes for completion. The second time was the follow-up two weeks after discharge, which was the first appointment with the doctor to assess the complications after hip arthroplasty.

Statistical Analysis

IBM SPSS version 26 was used to analyze the descriptive statistics, which were calculated to summarize the sample demographic characteristics. Chi-square tests assessed whether the two groups had statistically significant differences. The results presented the socio-demographic, illness, and surgical characteristics of participants allocated for EFA. The MPLUS version 8.5 (STBA80008421) program was used to investigate the confirmatory factor analysis, which explored factors loading and the goodness-of-fit in the factors model.

Ethical Considerations

Approval was obtained from the Ethical Review Subcommittee for Research Involving Human Research Subjects at Thammasat University no.3 (COA No. 033/2563). The study followed the Declaration of Helsinki, the Belmont Report, CIOMS guidelines, and the International Practice (ICH-GCP). All participants provided written informed consent before participating.

Results

Participant Characteristics

The study included 200 patients, randomly divided into two equal groups for EFA and CFA. Both groups had similar socio-demographic profiles (**Table 1**). The sample comprised 68% females and 32% males, aged 60-98 years (mean = 75, SD = 10.03). About 80% of participants reported falls as the primary issue, with fractures mainly on the femur neck and acetabulum (75%) and the rest on the intertrochanteric region (25%). Surgical procedures were nearly evenly split between total hip arthroplasty and hemiarthroplasty. Around half of the participants had a hospital stay of about two weeks (EFA: 46%, CFA: 56%).

Table 1 Socio-demographic, illness, and surgical characteristics of participants for EFA (*n* = 100) and CFA (*n* = 100)

Patient Characteristics	EFA Frequency (%)	CFA Frequency (%)	$\chi 2$ *p*-value
Age			
60-69	36 (52.2)	33 (47.8)	1.853
70-79	31 (55.4)	25 (44.6)	*p* = 0.410
≥80	33 (44.0)	42 (56.0)	
Chief complaint			
Falling	83 (48.5)	88 (51.5)	1.008
Accident	17 (58.6)	12 (41.4)	*p* = 0.422
Fracture site			
Neck of femur and acetabulum	79 (51.3)	75 (48.7)	0.452
Intertrochanteric	21 (45.7)	25 (54.3)	*p* = 0.615
Surgical type			
ORIF (open reduction internal fixation)	22 (45.8)	26 (54.2)	0.469
Hemiarthroplasty	38 (52.1)	35 (47.9)	*p* = 0.816
Total hip arthroplasty	40 (50.6)	39 (49.4)	
Length of Stay			
≤7 days	24 (57.1)	18 (42.9)	2.918
8-14 days	44 (46.0)	56 (56.0)	*p* = 0.248
>14 days	32 (55.2)	26 (44.8)	

Content Validity Index

Content validity was completed with five experts in rehabilitation, geriatrics, medicine, and nursing (Polit & Beck, 2017; Srisatidnarakul, 2012). Broader expertise would help refine items and address potential gaps, ensuring the scale's robustness across diverse contexts. Overall, the RHD-HA-9 scale had I-CVI scores that ranged from 0.80-1.00, indicating a high level of agreement among the experts on the relevance and appropriateness of the items. The S-CVI for the total scale was 0.97, indicating strong content validity of the items included in the RHD-HA-9 scale.

Construct Validity

The EFA was conducted once using Principal Component Analysis with Promax rotation. The analysis yielded two distinct factors, which together explained 49.08% of the total variance. The Kaiser-Meyer-Olkin (KMO) measure was 0.80, indicating sampling adequacy, and Bartlett's test was statistically significant ($\chi 2$ = 444.21, df = 36, *p* <0.001), confirming the suitability of the data for factor analysis. Factor 1, labeled "Physical Performance of Hip Function," comprised seven items with factor loadings ranging from 0.64 to 0.83. These items included sitting, standing and balance, walking, and transferring, reflecting core aspects of physical functionality post-hip arthroplasty. Factor 2, named "Barriers to Physical Activity," consisted of two items (pain and caregiving) with loadings from 0.60 to 0.76 (**Table 2**). The rotation converged in three iterations, and no items were deleted during the EFA process. This analysis helped establish the preliminary structure of the RHD-HA-9 scale, which was later validated through CFA.

Table 2 Factor loading of the RHD-HA-9 scale with the maximum-likelihood method and Promax rotation (*n* = 100)

Pattern Matrix	Component 1	Component 2
R4 Transfer from bed to chair	0.833	
R3 Walking	0.830	
R9 Important rehabilitation	0.824	
R5 Transfer from a chair to the toilet	0.804	
R2 Standing and balance	0.787	
R8 Hip function precautions	0.764	
R1 Sitting	0.644	
R7 Caregiver		0.765
R6 Pain		0.604

Note: Extraction Method-Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization. Rotation converged in 3 iterations.
R refers to "readiness item".

The CFA was performed once on a separate group of 100 participants to validate the two-factor structure found in the EFA. The CFA required four rounds of adjustments to optimize the model fit. After these modifications, the analysis confirmed the two-factor structure, labeled as Factor 1 ("Physical performance of hip function") and Factor 2 ("Barriers to physical activity"). The model demonstrated acceptable fit indices: CFI = 0.97, TLI = 0.96, and SRMR = 0.04. Although the RMSEA value was 0.12, above the traditional threshold of ≤0.05 for a good fit, other indices indicate that the model is generally well-fitted (Hu & Bentler, 1999). The chi-square results ($\chi 2$ = 0.056, df = 24, *p* <0.001) further support the model fit. After these modifications, the analysis confirmed the two-factor structure. The parameter estimates of the CFA model are presented in **Figure 2**.

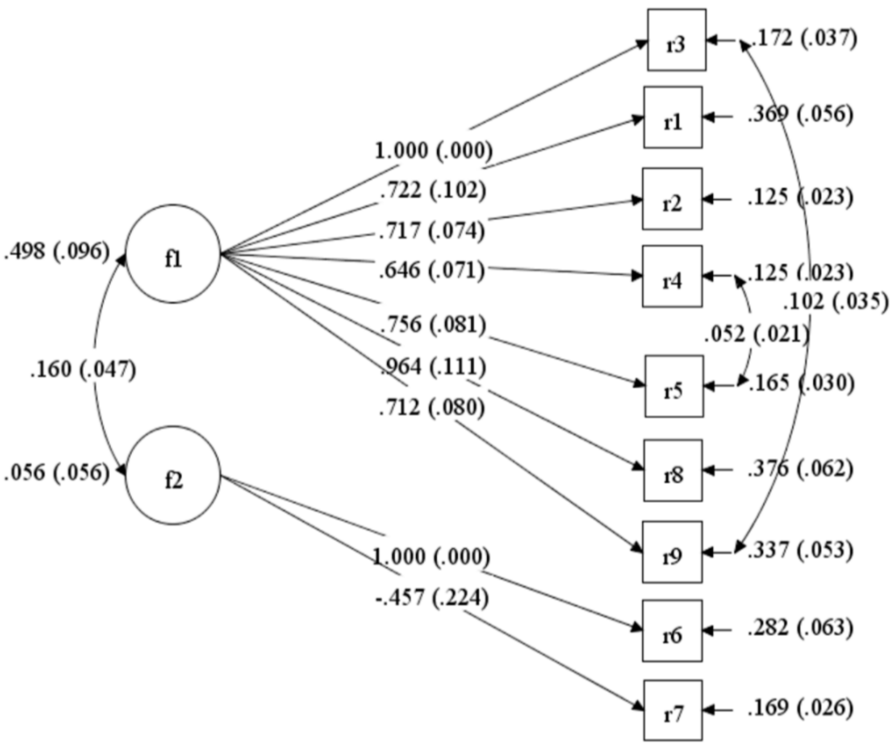

Figure 2 CFA model result for the RHD-HA-9

Internal Consistency Reliability

Cronbach's α coefficients ranging from 0.81 to 0.89 in the item pilot-testing and psychometric test phases demonstrate that the RHD-HA-9 scale has strong internal consistency.

Inter-Rater Reliability

Intraclass coefficient values were calculated to determine the level of agreement among the nurses' ratings. Five registered nurses evaluated the same subjects, and an ICC was calculated (Burns, 2014; Hogan, 2003; Koo & Li, 2016). The results showed the single-measurement ICC was 0.96 (95% Confidence interval [CI]). Therefore, the RHD-HA-9 scale demonstrated excellent inter-rater reliability.

Concurrent Validity

The concurrent validity of the RHD-HA-9 scale was assessed by comparing its total scores (excluding pain) with the PTHRDSS. Eight matching items between the RHD-HA-9 and five from the PTHRDSS, covering aspects like gait, transfers, hip precautions, rehabilitation, and caregiver support, were analyzed. Pain was not included for comparison as it is not included in the PTHRDSS scale. A strong positive correlation (r = 0.70, p <0.01) was found between the two scales. The final RHD-HA-9 consists of 9 items grouped into two factors comprising physical performance (7 items) and barrier factors (2 items), with the total score indicating discharge readiness, as seen in **Table 3**.

Predictive Validity

The receiver operating characteristic (ROC) curve was used to assess the model's performance. The total score was 27, with a cutoff point value of 0.9, indicating sensitivity (90.7%), specificity (70.6%), and accuracy (89.0%) (**Figure 3**). The area under the curve (AUC) was 0.893 (95% CI = 0.821 – 0.965), p <0.001. Consequently, the optimal cutoff point was indicated as one point with a score of 9.5, which categorized patients into two groups. A readiness score of 0-9 means the patient is not ready for discharge, and a score of 10-27 indicates readiness for discharge. The study found that patient unreadiness for hospital discharge was 29 (14.50%), while readiness for discharge was 171 (85.50%).

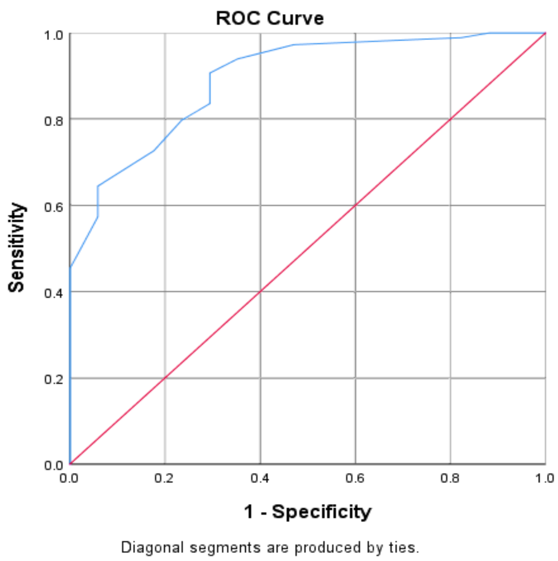

Figure 3 ROC curves for predicting the complications within 2 weeks post-discharge using RHD-HA-9 (Cut-off point of readiness score = 9.5, Sensitivity = 0.907, and Specificity = 0.706)

Table 3 Final version of the patient's readiness for hospital discharge scale for hip arthroplasty (RHD-HA-9)

Criteria/Items	Response Format
Factor 1: Physical performance of hip functions	
R1. Sitting - High chair (barstool): A tall chair with long legs; the flexion of the hip joint is no more than 90 degrees after sitting. - Normal chair: A general chair; the flexion of the hip joint is around 90 degrees after sitting.	0 = Unable to sit comfortably on any chair. 1 = Sits on a high chair* (bar stool) for at least 5 minutes. 2 = Sits on a normal chair* for at least 15 minutes. 3 = Sits on a normal chair* for more than 15 minutes.
R2. Standing and balance	0 = Unable to stand and remain balanced. 1 = Stands and balances with help and assistive device for less than 5 minutes. 2 = Stands and balances with help or uses an assistive device for more than 5 minutes. 3 = Stands and balances independently.
R3. Walking Assistive device* = Pick-up walker, crutches, and cane	0 = Unable to walk. 1 = Walks with help and assistive device* for at least 5 minutes. 2 = Walks with help and assistive device* for at least 10 minutes. 3 = Walks with assistive device* only at least 10 minutes.
R4. Transfer from bed to chair	0 = Unable to transfer. 1 = Transfers with help and an assistive device. 2 = Transfers with help or an assistive device. 3 = Transfers independently.
R5. Transfer from a chair to the toilet	0 = Unable to transfer. 1 = Transfers with help and an assistive device. 2 = Transfers with help or the assistive device only. 3 = Transfers independently.
R8. Hip functions precautions (depends on the surgical approach) *For a posterior surgical approach 1) Hip flexion (<90o): Do not bend over at the waist, and do not sit with the hips lower than the knees. 2) Hip internal rotation: Do not turn the operative leg inward (pigeon toe). 3) Hip adduction: Do not cross the operative leg over the other leg. *For anterior and lateral surgical approach 1) Hip flexion (<90o): Do not bend over at the waist, and do not sit with the hips lower than the knees. 2) Hip external rotation: Do not turn the operative leg outward. 3) Hip abductions.	Please remark ✓ on the patient's operation type. ……. Posterior approach ……. Lateral approach ……. Anterior approach 0 = Unfamiliar with any precautions. 1 = Describes one precaution. (Please remark…..……) 2 = Describes two precautions. (Please remark………..) 3 = Describes all 3 precautions.
R9. Important rehabilitation 1) Appropriate use of the assistive device for home discharge: walker, crutches, cane. 2) Gait training on flat surfaces and stairs with an appropriate assistive device. 3) Therapeutic exercises include ankle pumps, quadriceps exercises, and gluteal exercises.	0 = Unfamiliar with any recommendations. 1 = Describes one rehabilitation recommendation. (Please remark………..) 2 = Describes two rehabilitation recommendations. (Please remark………..) 3 = Describes all rehabilitation recommendations.
Factor 2: Barriers to physical activity	
R6. Hip pain The severity of hip pain	0 = Worst pain—Maybe immobile, Require prescription pain medication. 1 = Moderate pain—Moderate limitations of activities, may require prescription pain medication. 2 = Mild pain—Some limitations of activities, may require pain management without medication. 3 = No pain—Unrestricted activities.
R7. Caregiving The person who is the major care provider after discharge to the home.	0 = Lives alone, cares for self. 1 = Paid caregiver provides care. 2 = Family member, with training from the nurse, provides care 3 = Family member and paid caregiver, with training from the nurse, provide care
Total score (range of scores 0-27)	☐

Note: R refers to "readiness item."

Discussion

Summary of the Findings

Postoperative readiness for discharge after hip arthroplasty is crucial for ensuring efficient care and patient safety. This study aimed to develop and psychometrically test the RHD-HA-9, an instrument designed to assess the readiness of older adults for discharge after hip arthroplasty. Considering the nature of the population and the higher proportion of female participants (68%) aligns with trends in hip arthroplasty, where women are more frequently affected due to higher osteoporosis and hip fracture rates (Cummings & Melton, 2002). Although this may introduce gender bias, it reflects real-world demographics, making the findings relevant to the population most commonly undergoing this surgery.

A more concise version can be detailed as follows: The RHD-HA-9 demonstrated initial reliability and validity as a measure of discharge readiness, consistent with key functional criteria in the orthopedic field for hip and knee treatment (Eastwood et al., 2002; Giaquinto et al., 2010; Holm et al., 2014). These criteria included 1) the ability to independently perform daily activities such as dressing, sitting, and moving in and out of bed, 2) independence in personal care, 3) mobility with an assistive device, particularly crutches, and 4) effective oral pain management during activities (Holm et al., 2014).

The RHD-HA-9 instrument identified two key components. The first component, “physical performance of hip function,” included seven items related to hip joint function after surgery: sitting, standing, balance, walking, transfers between bed, chair, and toilet, adherence to hip precautions, and participation in rehabilitation. The second component, “barriers to physical activity,” was aligned with recommendations from orthopedic experts and literature, highlighting the importance of these assessments in determining readiness for discharge (Holm et al., 2014).

The inter-rater reliability of the RHD-HA-9 scale was tested by having five nurses independently evaluate the same five patients. This approach ensured consistency was assessed by comparing how similarly different nurses rated the same patients under identical conditions, eliminating variability due to patient status changes. This method highlights the scale’s ability to provide consistent and repeatable results, an essential aspect of reliability (Koo & Li, 2016). However, future research could further validate the consistency of the scale by including a larger and more diverse sample across different settings (Hogan, 2003).

In CFA, most variables showed factor loadings above 0.70, indicating strong correlations with their respective factors. However, item 7, related to caregiving, had a lower loading of -0.45. Despite this, the item was retained due to evidence in the literature emphasizing the significant impact caregivers have on patient recovery after hip arthroplasty (Wong et al., 1999). Involving caregivers in the discharge process is crucial, as they support discharge plans and contribute to better patient outcomes (Changsuphan et al., 2018; Fowler et al., 2021; Nurhayati et al., 2019). Preparing older patients for discharge, particularly by ensuring they have assistance at home, significantly enhances their readiness (Baksi et al., 2021).

Predictive validity in clinical settings (DeVon et al., 2007) can be challenging. The study followed up with patients two weeks post-discharge, which aligned with clinical practice requirements. This timeframe was selected to assess immediate recovery and discharge readiness. The ROC curve was used to determine cutoff points for clinical prediction (DeCastro, 2019; Polit & Yang, 2016). For the RHD-HA-9, the ROC analysis identified a cutoff point of 0.9 (score = 9.5), with sensitivity at 90.70%, specificity at 70.60%, accuracy at 89.0%, and an AUC of 0.837, indicating high predictive ability (Ray et al., 2010). Similar ROC curve analyses have been used in studies predicting discharge readiness and outcomes like unplanned readmissions, deaths, and emergency department visits (Kaya et al., 2018), including those assessing readiness in Thai stroke patients (Posri et al., 2022). Although the ROC analysis initially established a cutoff score indicating predictive validity, further validation across a more diverse cohort would enhance its clinical utility (Koo & Li, 2016). By testing the cutoff score on a broader sample, including different healthcare settings, clinical environments, and cultural backgrounds, it is possible to ensure its accuracy and generalizability. This approach will strengthen the clinical acceptance and practical application of the RHD-HA-9 scale (Burns, 2014; Polit & Yang, 2016).

The RHD-HA-9 readiness score should guide nurses in planning interventions based on the patient’s readiness level. For instance, a cutoff score of 9 indicates a lack of readiness for discharge, while a score of 10 or higher suggests readiness. The RHD-HA-9 score may also serve as a prognostic tool to anticipate potential complications after discharge, with positive health outcomes associated with higher readiness scores (Guan & Feng, 2023). This requires further study.

Implications for Nursing Practice

The RHD-HA-9, a tool developed specifically for older patients undergoing hip arthroplasty, assesses readiness for discharge and predicts potential complications post-discharge. Nurses can use this tool to educate patients and evaluate their readiness for a safe discharge. The instrument is available online in Thai and has been tested with approximately five patients in the orthopedic ward. Nurses can use it to calculate and report readiness scores in real time. Feedback from nurses on the instrument and the online version has been positive. However, this study presents evidence of preliminary psychometric properties, and validation in future research is required. Future research should focus on developing interventions to enhance discharge readiness after hip arthroplasty.

Limitations

The limitation of RMSEA value 0.12 is slightly above the conventional cutoff, but other fit indices (CFI, TLI, SRMR) suggest a robust model fit. Future research recommendations with larger sample sizes or model complexity enhanced the RMSEA fit.

Conclusion

The findings support the internal consistency and reliability, construct validity, concurrent validity, and predictive validity of the RHD-HA-9 for evaluating discharge readiness for patients undergoing hip arthroplasty. The RHD-HA-9 score may also help predict patient outcomes two weeks post-discharge. Nurses can use this tool to accurately identify patient needs and deliver effective post-discharge care, improving patient outcomes.

Declaration of Conflicting Interest

The authors declared no potential conflicts of interest with respect to the research, authorship, or publication of this article.

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Authors' Contributions

Supattra Changsuphan contributed to the study's conceptualization, literature review, research design, data collection, data analysis, conclusions, and manuscript writing while verifying the accuracy of the results, ensuring the absence of plagiarism, and maintaining the integrity of the research findings.

Boonjai Srisatidnarakul participated in the conception and planning of the study, critically wrote, reviewed, and revised the manuscript for important intellectual content, assisted in interpreting the results, worked on the manuscript, approved the final version for publication, and was responsible for all communications related to the submission of the manuscript to a journal.

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Data Availability

The data in this study are available from the corresponding author upon a reasonable request.

Declaration of Use of AI in Scientific Writing

There is nothing to declare.

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