International Journal of Nursing Sciences 11 (2024) 286–294

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Contents lists available at ScienceDirect

International Journal of Nursing Sciences

journal homepage: http://www.elsevier.com/journals/international-journal-of-nursing-sciences/2352-0132

Review

Efficacy and safety of continuous nursing in improving functional recovery after total hip or knee arthroplasty in older adults: A systematic review

Jing Sun [a, b], Yirong Xu [a, b], Juan Zhu [a, b], Bei Zhu [a, b], Wei Gao [a, *]

[a] School of Nursing, Jiangsu Vocational College of Medicine, Yancheng, China
[b] Department of Nursing, Faculty of Nursing, Lincoln University College, Kuala Lumpur, Malaysia

ARTICLE INFO

Article history:
Received 28 August 2023
Received in revised form
15 February 2024
Accepted 8 March 2024
Available online 11 March 2024

Keywords:
Aged
Continuity of patient care
Joint replacement
Rehabilitation
Systematic review

ABSTRACT

Objective: This systematic review was conducted to evaluate the efficacy and safety of continuous nursing care for the recovery of joint function in older adults with total hip or knee arthroplasty.
Methods: Randomized controlled trials and cohort studies of continuous nursing in older patients after joint replacement were searched from the database of Cochrane Library, Web of Science, PubMed, and Embase from their establishment to October 25, 2023. After literature screening, two researchers completed data extraction, and the risk of bias was assessed using the Cochrane risk-of-bias tool. The risk analysis included in cohort studies was based on the Newcastle-Ottawa Scale (NOS).
Results: The study included a total of 15 articles, comprising 34,186 knee and hip replacement patients. In this review, the effects of continuous nursing on the recovery of joint function of knee replacement and hip replacement in older adults were classified and discussed. Continuous nursing interventions targeted for total hip replacement could greatly increase the range of joint mobility, enhance muscle strength during hip movements like flexion, extension, and abduction, maintain joint stability, relieve pain, improve daily activities, and lower the risk of complications. For older patients with knee arthroplasty, continuous nursing programs could markedly improve knee motion range, joint flexion, joint stability, daily activities, and pain management. Despite the implementation of interventions, the incidence of complications caused by total knee replacement did not decrease. Out of all the studies reviewed, only one used a theoretical framework for interventions provided to patients during the postoperative period of hip arthroplasty. The overall quality of the included studies was very high.
Conclusion: Continuous nursing can effectively improve the joint function of older patients after joint replacement. However, its effectiveness in terms of clinical outcomes, patient satisfaction, and medical cost of associated continuous nursing needs to be further clarified. In addition, continuous nursing has no significant advantage in the safety of postoperative complications and readmission rates in older adults after knee joint replacement. To enhance the efficacy and safety of continuous nursing effectively, it is crucial to refine the continuous nursing program in the future, thereby elevating the quality of nursing services.

What is known?

- Total hip arthroplasty and total knee arthroplasty are the most effective surgical methods for joint diseases of the hip or knee. As the population ages, the proportion of these surgeries is expected to increase.
- Patients undergoing joint replacement surgery require long-term exercise to promote functional recovery. It is necessary to provide continuous nursing care for older patients after discharge.

* Corresponding author.
E-mail address: 913163039@qq.com (W. Gao).
Peer review under responsibility of Chinese Nursing Association.

https://doi.org/10.1016/j.ijnss.2024.03.013

What is new?

- Continuous nursing can promote recovery of hip and knee joint function, reduce pain, and improve daily living ability in older adults.
- Continuous nursing has no significant advantage in the safety of postoperative complications and readmission rates in older patients after total knee arthroplasty.
- With the development of technology, continuous nursing has become more integrated with information network platforms. However, telephone and door-to-door visits are still practical for older adults, especially in areas with relatively undeveloped information construction.

1. Introduction

Joint replacement surgery is a common procedure used to treat bone and joint diseases such as arthritis. The occurrence of knee and hip replacements tends to increase with advancing age [1,2]. By 2030, 635,000 total hip arthroplasty (THA) and 1.26 million total knee arthroplasty (TKA) surgeries will be performed for the first time in the United States [3]. THA and TKA comprise the majority of lower extremity joint replacements and are used to restore joint function and resolve joint pain by replacing prostheses to improve patient's quality of life [4,5]. However, a successful surgery does not mean the end of treatment. After joint replacement surgery, patients still require long-time exercise at home to promote functional recovery [6]. Therefore, it is necessary to provide continuous nursing care upon discharge for older patients who have undergone joint replacement [7].

The University of Pennsylvania proposed continuous nursing as a part of overall care in 1981 [8], which usually refers to the continuation of care from hospital to family. Continuous nursing is believed to ensure patient safety and to effectively improve patients' quality of life [9,10]. Continuous nursing involves various methods such as telephone follow-up, family visits, specialist clinics, and network platforms for common chronic diseases, enterostomy, joint replacement patients, and high paraplegia. Through practical application, continuous nursing has achieved good results in patients after joint replacement. Cyriac et al. [11,12] established the Total Joint Perioperative Home for joint replacement patients. The program was staffed by a multidisciplinary team composed of anesthesiologists, rehabilitations, and nurses, and continuous nursing services were implemented for patients within three months after discharge. After two years, a retrospective study of 328 patients who received joint replacement treatment via the program found that this continuous nursing could improve joint function and reduce pain and postoperative complications. With the development of technology, Wang's team found that providing continuous nursing to hip or knee replacement patients via a remote mobile communication device resulted in significant improvements in self-efficacy, health-related quality of life, anxiety, and depression after 10 weeks. However, the two groups showed no significant differences regarding physical condition, pain scores, and Visual Analogue Scale [13]. In another study of 621 patients at risk for poor prognosis after knee replacement, follow-up found that patients in the group receiving home rehabilitation had higher Late-Life Function and Disability Instrument scores than those in the traditional care group at 6 months for the primary outcome indicator, but the secondary outcome indicators of knee scores, knee injury, and joint outcome indicators were not statistically significant at 6-month and 12-month follow-ups [14]. These studies suggest that although continuity of care plays a vital role in functional recovery from joint replacement, the results of the current studies are not uniform, and further review of their feasibility and effectiveness is needed. Although previous studies have analyzed the effects of joint replacement, the study population is primarily adults, while joint replacement is often for older adults due to underlying diseases and metabolic factors. Therefore, the content and methods of continuous nursing for older adults after hip and knee joint replacement must be further analyzed [15,16].

In light of the current situation, wherein there is no evidence-based study of the effect of continuous nursing on promoting the functional recovery of older adults after THA or TKA, the purpose of this systematic review was to assess the validity of evidence supporting the practicality of continuous nursing for joint function recovery in this population. By incorporating evidence-based continuous nursing interventions, joint function can be enhanced, reducing complications and improving quality of life.

2. Methods

2.1. Protocol and registration

This systematic analysis was conducted using the PRISMA guidelines. The systematic review protocol was registered on PROSPERO (CRD42023422572).

2.2. Search strategy

We searched the Cochrane Library, Web of Science, PubMed, and Embase database, covering the period from the establishment to October 25, 2023. The search terms were all in English, as shown below. Appendix A shows the search strategy for PubMed

((“Continuity of Patient Care” or “continu* nursing,” or “continu* care,” or “transitional care,” or “continuous nursing care” or “extended care”) and (“alloarthroplasty,” “arthroplasties” or “joint reconstruction” or “joint reconstructive procedure” or “joint reconstructive surgery alloarthroplast*” or “joint reconstruct*” or “joint replacement” or “articular replacement” or “hip replacement” or “total hip prosthesis” or “robotic hip replacement system” or “total hip prosthe*” or “robotic hip replacement system, hip replacement operation” or “total hip replacements” or “robotic knee arthroplasty system” or “total knee replacements” or “knee replacement surgery” or “knee joint arthroplasty” or “knee joint replacement surgery” or “elder*, aged patient, aged people” or “aged person” or “aged subject”) and (“elderly” or “elderly patient” or “elderly people” or “elderly person” or “elderly subject” or “senior citizen” or “senium” or “old people”)).

2.3. Inclusion and exclusion criteria

The inclusion criteria were as follows:

Participants: The study subjects were older patients aged ≥60 years who received hip or knee replacement.

Intervention/exposure: Based on routine care, various methods of continuity of care are used to maintain the continuity of the relationship, information, and management with the patient after discharge, including a detailed post-discharge care plan, rehabilitation guidance after joint replacement, position of the affected limb, and pain management [10]. Continuing care methods include telephone, home, and internet visits.

Comparison: Routine nursing care was provided to the control group, which included health education, medication management, functional exercises during hospitalization, and scheduled outpatient rehabilitation or follow-up visits after discharge.

Outcomes: The primary outcome indicators involved in this systematic review include joint range of motion, joint flexion, joint stability, daily activities, pain, and complication rate [17–19].

Study design: The study type was a randomized controlled trial (RCT), with or without blinding and designated hiding, or a cohort study.

In the selection process, the following exclusion criteria were used. 1) The research involved animal, in vitro, cadaver, or biomechanical experiments. 2) Full-text data could not be obtained by various means. 3) Conference abstracts, reviews, or case studies. 4) Unpublished or republished literature. 5) Non-English literature.

2.4. Literature selection and extraction

According to the above retrieval strategies and inclusion and exclusion criteria, literature screening and data extraction were independently completed by two researchers (J. S. and Y. X.). To extract the data, the researchers screened retrieved literature titles and abstracts and read the full text of the preliminarily included literature. A self-made feature table was used to remove the following basic information from the literature: first author, publication year, country, study design, sample size, surgical method, age, gender, follow-up time, description of intervention and control, outcome measures and tools, and main findings. If there were different opinions on literature screening, a third researcher (B. Z.) was asked to participate in the evaluation.

2.5. Quality evaluation

The quality of the included RCTs was evaluated according to the Cochrane risk of bias tool [20,21]. According to the standards, three grades were adopted for evaluation: “low risk,” “unclear,” and “high risk.” “Grade A” was given for full compliance with the requirements, “Grade B” for partial compliance, and “Grade C” for complete non-compliance. Literature rated as “Grade C” was excluded from this study.

The risk analysis for included cohort studies was based on the Newcastle-Ottawa Scale (NOS) [22]. The full score was nine stars and six or more stars considered a “low risk” of bias.

The two researchers (J. S. and Y. X.) appraised the quality of the included RCTs and cohort studies. The third researcher (B. Z.) was requested to resolve any disagreement about the controversial articles.

3. Results

3.1. Literature search results

A total of 6,454 articles were retrieved, including 2,793 from PubMed, 2613 from Embase, 619 from Cochrane Library, and 429 from the Web of Science. After removing 2,058 duplicate articles, 15 articles that met the inclusion and exclusion criteria were selected. The process is shown in Fig. 1.

3.2. Design of the study

There were seven studies on continuing nursing care for older patients after knee replacement [23–29], including four RCTs [23,25,28,29] and three cohort studies [24,26,27]. There were six studies on the continuing care of older adults after hip replacement [30–35], including five RCTs [31–35] and one cohort study [30]. Among the included literature, there were two studies [36,37], including THA and TKA, both of which are cohort-controlled studies. Totally, the review encompassed 15 studies [23–37], comprising six cohort studies [24,26,27,30,36,37] and nine RCTs [23,25,28,29,31–35], involving 34,186 patients. The essential characteristics of the included literature are shown in Table 1.

3.3. Study time and settings

Only one of the 15 studies was conducted in 2016 [36]; the rest were after 2018 [23–35,37]. There were six studies on postoperative hip replacement [30–35], four from China [32–35], one from Australia [31], and one from the United States [30]. Seven studies on continuing nursing care after knee replacement [23–29], three from the United States [24,26,27], two from South Korea [25,29], one from Thailand [23], and one from Finland [28]. The two studies involving both THA and TKA, are from the United States [36,37].

3.4. Participants and follow-up duration

Most of the sample sizes in RCTs were not more than 200. Among the six studies of continuing nursing in older patients after hip replacement, patient follow-up periods varied: three studies followed up for six months [31,32,35], two studies for three months [30,34], and one study for just one month [33]. In the seven continuing nursing studies on postoperative knee replacement, the longest follow-up time was one year in one study [24], and the shortest was seven weeks in two studies [23,25]. Patients’ outcomes were assessed four times in one study [33], three times in three studies [24,27,35], and twice in five studies [23,28,29,31,32].

3.5. Theoretical framework usage

Only one study in this review applied the Omaha System theory to patients with THA [34]. The Omaha System is a standardized terminology model consisting of three related, effective, and reliable parts: a problem classification plan, an intervention plan, and a result-oriented question scoring table, aiming at fully integrating information [38]. According to the Omaha System, this research implemented continuous nursing intervention and made specific rehabilitation plans based on the needs of clinical nursing practice. By assessing the comprehensive personal situations, patients’ problems were screened, scored, and presented in one table, which provided evidence for nurses to dynamically adjust their nursing plans.

3.6. Types of intervention

In this review, continuous nursing has been used to guide the rehabilitation of older adults with joint replacement, to promote the recovery of patients’ functional level after joint replacement, and to maintain their normal physiological function. Many effective interventions have been taken in the continuous nursing of older adults after THA, which mainly include Tele-Rehabilitation (e.g., WeChat platform, Electronic Patient Rehabilitation Applications) [30–32,35], the clinical nursing pathway, the theory of the Omaha System [34], and continuous nursing combined with calcitonin [33]. Continuous nursing methods after TKA mainly include home visits [23], telehealth rehabilitation [27,29], progressive dynamic balance training (PDBT) with physical therapy in a rehabilitation hospital [25], a home exercise program [24], health services by a registered nurse [26], and unsupervised home exercise by standard protocol [28]. In addition to the above interventions, professional institutions provide home-visiting nurse services for THA and TKA, including visiting nurse (VN) care and physical therapy (PT) [36] or through a skilled nursing facility [37].

3.7. Types of outcome measures

Objective indexes were used to evaluate the recovery of joint function in the included studies. Postoperative rehabilitation

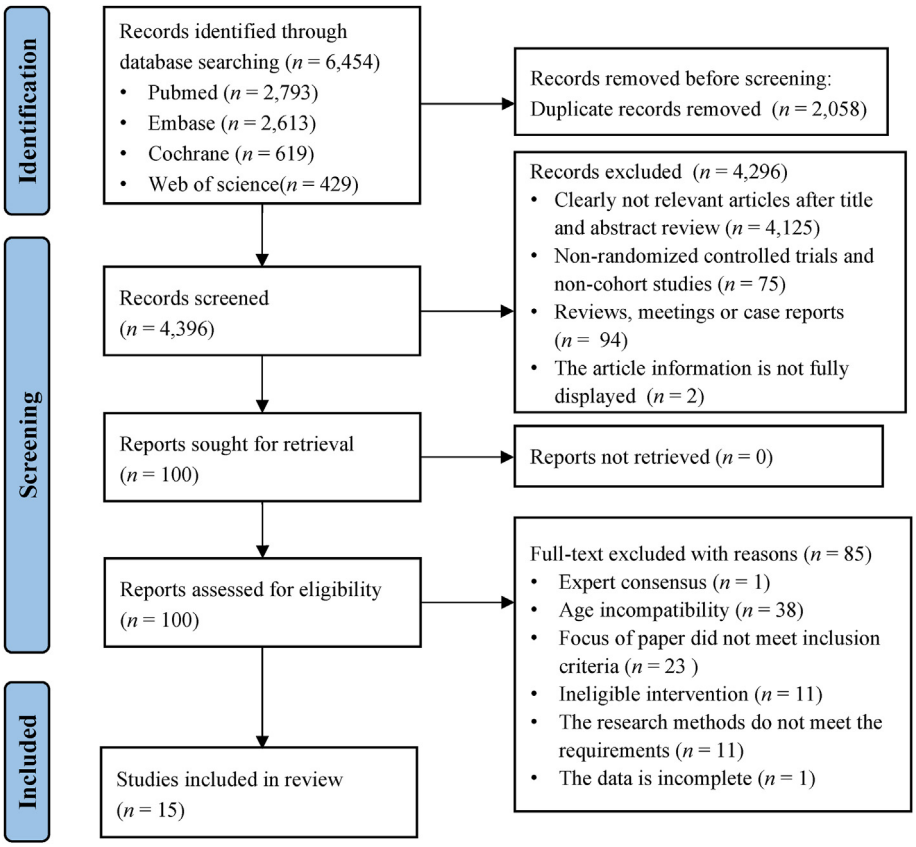

Fig. 1. Flow chart of studies considered for inclusion.

indicators of hip replacement mainly include.

- Hip function score (HHS) [32–35]
- Barthel index (ability of daily living) score after discharge [33,34].
- Hip Disability and Osteoarthritis Outcome Score. (HOOS) [30,31].
- The quality of life (QOL) subscale of the hip disability [31,33].
- Functional independence measure (FIM) [35].
- Postoperative complications (e.g., fracture, prosthesis slippage, deep venous thrombosis, and infection) [32,33,35].
- Readmission rates [32,36,37].

Evaluation indexes of continuing nursing effect after knee replacement mainly include.

- Western Ontario and McMaster University Osteoarthritis Index (WOMAC) [23,25].
- The knee range of movement (ROM) [23,25,28,29].
- Time Up and Go (TUG) test (fast/slow) [25,28].
- Knee Injury and Osteoarthritis Outcome Score (KOOS) [27].
- Pain scores from Visual Analogue Scale (VAS) [23,27–29].
- Oxford Knee Score (OKS) [28].
- Postoperative complications (e.g., deep Venous Thrombosis and infection) [24,26,27].
- Readmission rates [26,36,37].

In the two studies involving THA and TKA, the comprehensive cost of continuous nursing was used as the evaluation index instead of the outcome above indicators [36,37].

3.8. Effects of interventions

After continuous nursing for the older patients after THA, the leading indicators of functional improvement were HHS [32–35], QOL [31,33], Barthel index (ability of daily living) [33,34], and postoperative complications [32,33,35]. However, no statistical significances were observed in HOOS [30,31]. The indices of continuous nursing for TKA demonstrated improvement, including ROM [23,25,28,29], WOMAC [23,25], and KOOS [27]. Objective indicators showed a decrease in knee joint pain during exercise [23,27–29], an increase in the speed of the TUG test [25,28], and a reduction in the time required to complete the TUG test. However, continuous nursing was not found to improve postoperative complications significantly. Moreover, older adults undergoing postoperative THA and TKA who received home health services from professional institutions experienced [36,37].

3.9. Risk of bias of the included studies

Two researchers (J. S. and Y. X.) evaluated and graded the quality of nine RCT studies based on the Cochrane Handbook. Among these, one study was graded as A [34], while eight as B [23,25,28,29,31–33,35]. Due to the influence of experimental methods, some studies have not reported blind or covert grouping situations [23,25,28,29,33,35], which may result in some measurement bias and selection bias. However, the primary outcomes were all based on objective indicators, minimizing the impact of whether the studies were double-blinded. Therefore, the overall quality of the included studies was relatively high, and the research results were reliable (Table 2). Additionally, the bias risk analysis results of the six included cohort studies were more than six stars

Table 1
Characteristics of studies included in systematic review.

First author, year, Country	Study design	Surgical method	Study population (total, age, gender, group)	Follow-up time	Description of intervention/ observation and control	Outcome measures and tools	Main findings
Sindhupakorn et al., 2019 [23] Thailand	RCT	TKA	$n = 48$ Age: not mentioned F/M: 34/14 IG/CG: 24/ 24	6 weeks	Intervention: Home visit Control: Non-home visit	Pain score, ROM, knee functional mobility using WOMAC, knee score, and functional score	The pain score of the IG was lower than that of the CG; the ROM, function scores, knee score, and WOMAC of the IG were higher than those of the CG.
Nelson et al., 2020 [31] Australia	RCT	THA	$n = 70$ Age: not mentioned F/M: 44/26 IG/CG: 35/ 35	6 months	Intervention: Home tele-rehabilitation (technology-based home exercise program) Control: Outpatient physiotherapy and a paper-based home exercise program	QOL, HOOS	The continuous nursing of remote rehabilitation improves the satisfaction of patients, but the rehabilitation effect of limb function in IG is not better than CG.
Lee et al., 2021 [25] Korea	RCT	TKA	$n = 38$ Age: >60 F/M: 38/0 IG/CG: 19/ 19	6 weeks	Intervention: Progressive resistance training at home and PT Control: General PT	WOMAC, PPT, SF-36, ROM, TUG, VAS	PDBT combined with physical therapy has a positive effect on physical function, balance ability, and quality of life of patients after total knee arthroplasty.
Liu et al., 2021 [32] China	RCT	THA	$n = 124$ Age: >65 F/M: 44/80 IG/CG: 62/ 62	6 months	Intervention: Continuous nursing based on WeChat platform Control: Routine nursing and telephone follow-up guidance	HHS, excellent-effective rate of hip joint function, and the incidence of complications	The interventions in IG based on the WeChat platform can improve the hip joint function of patients after THA, reduce the incidence of complications and postoperative readmission, and improve the QOL of patients.
Zhu et al., 2021 [33] China	RCT	THA	$n = 99$ Age: >60 F/M: 47/52 IG/CG: 49/ 50	30 days	Intervention: Continuous nursing combined with salcatonin Control: Routine nursing	VAS, QOL, HHS	Continuous nursing combined with calcitonin has significant effects on early pain relief, long-term joint function improvement, and reducing the incidence of falls and refractures in elderly patients after hip replacement.
Guo et al., 2022 [34] China	RCT	THA	$n = 104$ Age: >60 F/M: 51/53 IG/CG: 53/ 51	3 months	Intervention: Continuous nursing care based on clinical nursing pathway and Omaha System theory Control: Routine nursing	HHS, Barthel index score, and ADL scale	Continuous nursing care has a better effect on promoting the recovery of hip joint function, improving the quality of life, and reducing anxiety and depression in elderly patients with total hip replacement.
Park et al., 2023 [29] Korea	RCT	TKA	$n = 57$ Age: >60 F/M: 51/6 IG/CG: 29/ 28	12 weeks	Intervention: Multidimensional home rehabilitation Control: Traditional rehabilitation	Knee Pain, knee ROM, muscle strength of the knee	Multi-dimensional home rehabilitation program can be used as an effective nursing intervention for physical and mental recovery of TKA patients.
Wu et al., 2023 [35] China	RCT	THA	$n = 85$ Age: >65 F/M: 61/24 IG/CG: 43/ 42	6 months	Intervention: Continuous nursing care based on telehealth rehabilitation Control: Routine nursing	HHS, FIM, SAS, postoperative complications	The Internet-based transitional care model can promote joint rehabilitation and reduce the incidence of complications.
Janhunen et al., 2023 [28] Finland	RCT	TKA	$n = 52$ Age: >60 F/M: 33/19 IG/CG: 25/ 27	16 weeks	Intervention: Unsupervised exergame-based home exercise. Control: Unsupervised home exercise by standard protocol	OKS, TUG, ROM	Improvement in mobility measured by TUG was greater in the IG than CG. There were no differences between the groups in the OKS.
Ponzio et al., 2016 [36] USA	Cohort	THA, TKA	$n = 509$ Age: not mentioned F/M: 281/ 228 OG/CG: 230/279	6 months	Observation: Home-visiting nurse services including VN care and PT Control: Home self-care	Discharge-to-home rate, mean LOS, complication rate, re-operation rate, readmission rate, and charges of associated HVNSs	With dramatically diminished HVNS utilization after primary TJA, there was an associated decrease in length of stay and no increase in complication rate suggesting no compromise of patient care with significant cost savings.
Davidovitch et al., 2018 [30] USA	Cohort	THA	$n = 267$ Age: not mentioned F/M: 156/ 111 OG/CG: 168/99	12 weeks	Observation: Home health services and electronic patient rehabilitation applications Control: Electronic patient rehabilitation applications only	VR-12 mental and physical sub-scores, and HOOS	The integration of electronic rehabilitation tools is gaining acceptance within the orthopedic community. EPRA alone was clinically non-inferior while substantially less costly than EPRA-HHS.
	Cohort	TKA	$n = 520$	one year	Observation: Home exercise program	SF-12, Knee Society Scores, complication rate	Compared with the traditional outpatient rehabilitation exercise program, the self-

Table 1 (*continued*)

First author, year, Country	Study design	Surgical method	Study population (total, age, gender, group)	Follow-up time	Description of intervention/ observation and control	Outcome measures and tools	Main findings
Wang et al., 2019 [24] USA			Age: not mentioned F/M: 313/207 OG/CG: 269/251		Control: Routinely prescribed OPPT		directed home exercise program can achieve the same effect and reduce costs.
Kaidi et al., 2021 [37] USA	Cohort	THA, TKA	$n = 189$ Age: >60 F/M: 142/47 OG/CG: 128/61	90 days	Observation: Receive care in a skilled nursing facility Control: Home self-care	90-day readmission rates, readmission diagnoses, total post-discharge costs	A skilled nursing facility selected after discharge can improve CJR performance by cost reduction and overall outcomes
Burnett et al., 2022 [26] USA	Cohort	TKA	$n = 31,698$ Age: >65 F/M: 19,541/12,157 OG/CG: 15,849/15,849	3 months	Observation: Home health services by a registered nurse Control: Home under self-care	Hospital charges, emergency department charges, and readmission charges	Home health services do not appear to provide value as they are associated with significantly increased costs and do not lower the rates of complications, emergency department visits, or readmissions following TKA.
LeBrun et al., 2022 [27] USA	Cohort	TKA	$n = 326$ Age: not mentioned F/M: 156/170 OG/CG: 82/244	120 days	Observation: Continuous nursing care based on telehealth rehabilitation Control: Traditional rehabilitation	KOOS-JR, VAS, VR-12 mental and physical sub-scores, LEAS	Telehealth rehabilitation can be an equally effective alternative to conventional PT following TKA.

Note: ADL = activities of daily living. CG = control group. CJR = care for joint replacement. EPRA = Electronic Patient Rehabilitation Applications. EPRA-HHS = Electronic Patient Rehabilitation Applications with Home Health Services. FIM = functional independence measure. HHS = Harris Hip Score. HOOS = Hip Disability and Osteoarthritis Outcome Score. HVNS = home-visiting nurse services. KOOS-JR = Knee injury and Osteoarthritis Outcome Score for Joint Replacement. LEAS = Lower-Extremity Activity Scale. LOS = length of stay. IG = intervention group. OG = observation group. OKS = Oxford Knee Score. OPPT = outpatient physical therapy. PDBT = progressive dynamic balance training. PPT = pain pressure threshold. PT = physical therapy. QOL = quality of life. RCT = randomized controlled study. ROM = range of motion. SAS = Self-rating Anxiety Scale. SF-36 = Short-Form Health Survey 36. THA = total hip arthroplasty. TJA = total joint arthroplasty. TKA = total knee arthroplasty. TUG = timed up and go. VAS = Visual Analogue Scale. VN = visiting nurse. VR-12 = Veterans Rand 12-Item Health Survey. WOMAC = Western Ontario and McMaster Universities Osteoarthritis Index.

Table 2
Risk of bias appraisal and quality assessment for the included RCTs studies.

Study	Random sequence generation	Allocation concealment	Blinding of participants and personnel	Blinding of outcome assessment	Incomplete outcome data	Selective reporting	Other bias	Quality assessment
Sindhupakorn et al., 2019 [23]	Low	Unclear	Unclear	Low	Low	Low	Low	B
Nelson et al., 2020 [31]	Low	Unclear	Unclear	Low	Low	Low	Low	B
Lee et al., 2021 [25]	Low	Unclear	Low	Low	Low	Low	Low	B
Liu et al., 2021 [32]	Low	Unclear	Unclear	Low	Low	Low	Low	B
Zhu et al., 2021 [33]	Low	Unclear	Unclear	Low	Low	Low	Low	B
Guo et al., 2022 [34]	Low	Low	Low	Low	Low	Low	Low	A
Park et al., 2023 [29]	Low	Unclear	Unclear	Low	Low	Low	Low	B
Wu et al., 2023 [35]	Low	Unclear	Unclear	Low	Low	Low	Low	B
Janhunen et al., 2023 [28]	Low	Unclear	Unclear	Low	Low	Low	Low	B

according to the NOS scale, indicating that the quality of the included studies was high. Detailed quality assessment results are presented in Table 3.

Table 3
Quality assessment for cohort studies by Newcastle-Ottawa Scale.

Study	Selection	Comparability	Exposure	Scores
Ponzio et al., 2016 [36]	★★★★	★★	★★★	9
Davidovitch et al., 2018 [30]	★★★★	★	★★	7
Wang et al., 2019 [24]	★★★★	★	★★	7
Kaidi et al., 2021 [37]	★★★★	★★	★★★	9
Burnett et al., 2022 [26]	★★★★	★★	★★★	9
LeBrun et al., 2022 [27]	★★★★	★★	★★★	9

4. Discussion

4.1. Effectiveness of continuing nursing care

At present, the evaluation of the effect of continuous nursing is mainly focused on the clinical results and the functional assessment of older people [39–41]. Our results show that continuous nursing not only promoted physical rehabilitation of the hip and knee joints but also played a positive role in daily living ability. While most studies demonstrate improved hip function within 6 months of continuous nursing, some indicate that hip scores plateau after three months of care extension. Similarly, research on continuous care for patients after knee joint replacement reveals significant improvements in range of motion within the initial three months. The consensus of certain experts from the United

States and Canada agree that professionals should provide rehabilitation guidance after THA and TKA, indicating the positive effect of continuous nursing after lower limb joint replacement [42]. The main reason is that patients' joint condition and functional recovery after joint replacement did not ultimately improve. It takes a relatively long time for patients to recover after THA and TKA, and more rehabilitation training is done outside the hospital [41,43]. Continuous nursing ensures continuity of information, relationship, and treatment, promoting joint function rehabilitation and relief of pain. Although the hip and knee rehabilitation guidelines mentioned the duration, frequency, and range of postoperative exercise, they lack specificity regarding joint activity angles and optimal muscle strength recovery levels [42,44]. In the reviewed literature, the rehabilitation plans were made by each hospital that performs the surgery, and the intervention time and scope of activities were different according to different medical levels [32,33,35]. Therefore, this review suggests that the correlation between rehabilitation programs (e.g., the duration and frequency of each exercise program) and functional recovery after joint replacement must be further investigated.

Our results also show continuous nursing could effectively reduce pain, consistent with Tang et al. [45]. In a meta-analysis of 14 studies, Beswick et al. [46] found that pain levels were reduced after lower limb joint replacement compared with preoperative. However, 10%–34% of patients after knee joint replacement still had pain lasting about three months [46,47]. In an RCT of 99 older patients undergoing hip replacement, the study group added calcitonin treatment based on continuous nursing, administered once daily at 50 units per dose for 14 days. The results showed that the pain scores of the study group were lower than those of the control group at 7, 10, 14, and 30 days postoperatively [33]. This outcome was attributed to osteoporosis, which was evident in older patients, as calcitonin can inhibit the pain-relieving activity of osteoclasts and promote the formation of osteoblasts and the absorption of calcium by bones [33]. In addition, Park et al. [29] carried out an RCT of a multi-dimensional family rehabilitation plan for 58 older adults who underwent joint replacement, suggesting that continuous nursing significantly improves early postoperative replacement pain.

Whether continuous nursing care is effective requires a comprehensive evaluation of the medical cost for continuous nursing, clinical outcomes, joint functional level, and patient satisfaction [48,49]. Unfortunately, only three studies have been included to analyze the economic effects, and their results have yet to be unified [26,36,37]. The research on economic indicators mainly comes from the United States, Canada, and other countries [26,36,37]. While the medical insurance system guarantees the continuous nursing of medical institutions in these countries, China's healthcare system has yet to fully implement comprehensive medical coverage for continuous nursing [50]. Therefore, the further sustainable development of nursing requires the support of medical security mechanisms and systematic laws and regulations. In addition, the current effectiveness of joint function is mainly reflected in clinical results and functional levels. Thus, future research should focus on comprehensive data analyses combining the medical cost of continuous nursing, clinical outcomes, joint functional level, and patient satisfaction.

4.2. Safety of continuing nursing care

Postoperative complications and readmission incidence are considered an essential safety index after joint replacement [51,52]. In this study, the literature on complications was included, and results indicated that continuing nursing had no obvious advantage over postoperative complications of the THA, which also meant that continuing nursing did not show significant improvement in safety after TKA. However, Liu et al. conducted an RCT involving 68 patients after THA through the WeChat platform, and they found that continuous nursing via this platform can identify problems in a timely and effective manner [32]. Furthermore, the study demonstrated that implementing the continuous nursing method significantly decreased the total incidence of complications after THA. However, this was a single-center study with a small sample size and was not representative. In the future, high-quality literature is required to support this conclusion. A retrospective survey by Burnett et al. [26] revealed that patients receiving home health services had 0.5% and 0.6% increased rates of emergency department visits within two weeks and three months compared to the control group, respectively. The complications in both groups were similar, at 11.4% and 10.9%, respectively. The authors believed that a slightly lower readmission rate in the control group might not necessarily indicate a decrease in complications, as this difference may be due to their inability to determine whether some complications were due to behavior and not seeking timely medical attention [26]. Some scholars [53,54] suggested that complications can be found more intuitively and conveniently through wearable devices to reduce complications in continuous nursing. In future clinical practice, developing and utilizing visual wearable devices for remote monitoring and objective evaluation of joint function could aid in promptly preventing complications.

4.3. Increasing diversity of nursing intervention methods

Currently, the continuous nursing methods for joint replacement of lower limbs are mainly hospital-based or community-based, where communities and hospitals jointly implement continuous nursing services. The literature included in this study mainly focused on continuing nursing in hospitals and included seven studies [23,25,29,32–35]. In addition, four studies reported a new mode of continuing care: home visit services provided by institutions after joint replacement or private home care institutions [26,30,36,37]. The intervention methods are diverse and random, including telerehabilitation, family visits, outpatient visits, self-made rehabilitation training plans, and continuous nursing combined with clinical pathways. Although there are many forms of continuing care, many studies in this review adopt mobile information technology. With the development of technology, continuous nursing has become more integrated with information network platforms. Compared to traditional telephone visits, this method is unlimited by time and space. WeChat and remote rehabilitation service platforms enhanced communication between patients and healthcare providers, which can more efficiently identify and answer patients' questions to improve the effectiveness and compliance of exercise regimes. For instance, Liu et al. [32] conducted an RCT of 68 patients after hip replacement through the WeChat platform. They found continuous nursing based on information platforms can reduce pain, improve joint motion, and enhance hip joint function. Furthermore, the functions of remote rehabilitation service platforms are constantly being upgraded to meet the needs of patients. Wu et al. [35], in an RCT of 90 hip replacement patients, developed a home rehabilitation system for hip surgery to facilitate continuous nursing, where multi-team collaboration, remote information pushing, data reporting, consultation communication, and other functions could be achieved through patient-specific applications (i.e., APPs) and work portals for clinical doctors. After a six-month follow-up, the study found that the hip joint score and functional independence score of patients with remote platforms of continuous nursing were better than those of the control group. Finally, exercise data could be efficiently collected through the information-based

telerehabilitation platform. However, it is important to realize that telephone and home visits remain effective for delivering continuous nursing care, particularly in regions with limited network infrastructure, information resources, and low digital literacy levels among older adults. Therefore, nurses should provide clear guidance when using the information platform, especially for older adults with a significant digital gap.

4.4. Limitations

The results of this study show that most of the included studies adopted RCT designs (60%), and the rest were cohort studies. Randomized clinical trials are the best way to control selection and confounding bias [55]. Therefore, it is necessary to carry out more high-quality randomized clinical trials in future continuing nursing studies after lower limb joint replacement in older patients. This review found that only one study constructed intervention measures for continuing nursing based on the Omaha System theory. Evidence suggests interventions to change behavior are more likely to be effective if constructed and implemented based on an appropriate theoretical framework [56]. Therefore, it is recommended that future research, guided by theoretical frameworks, expands the content of continuous nursing service programs and diversifies nursing methods to align with patients' actual needs and characteristics of illnesses. Additionally, relevant systems and standards should be formulated to standardize the operation process of its service.

5. Conclusion

According to the existing evidence, continuous nursing can effectively improve the joint function of older adults after the joint replacement of lower limbs. Nonetheless, its effectiveness in terms of quality of life, patient satisfaction, and economics must be further clarified. In addition, continuous nursing has no significant advantage in the safety of postoperative complications and readmission rates in older patients after TKA. There was clinical heterogeneity among different continuous nursing strategies. In order to improve the clinical application of these interventions, future research should clarify the frequency and duration of the implementation scheme.

Funding

Nothing to declare.

Data availability statement

The datasets analyzed during the current study are available from the corresponding author upon reasonable request.

CRediT authorship contribution statement

Jing Sun: Conceptualization, Methodology, Validation, Formal analysis, Investigation, Data curation, Writing – original draft, Writing – review & editing, Project administration. **Yirong Xu:** Conceptualization, Methodology, Validation, Formal analysis, Investigation, Resources, Data curation. **Juan Zhu:** Conceptualization, Methodology, Validation, Formal analysis, Investigation. **Bei Zhu:** Conceptualization, Methodology, Validation, Formal analysis, Investigation. **Wei Gao:** Conceptualization, Methodology, Validation, Formal analysis, Investigation, Resources, Data curation, Writing – review & editing, Supervision, Project administration.

Declaration of competing interest

This manuscript has no potential conflict of interest to disclose. The authors declare that they have no conflict of interest. The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Acknowledgments

Not Applicable.

Appendices. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ijnss.2024.03.013.

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