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Effectiveness of nurse-led transitional care interventions for adult patients discharged from acute care hospitals: a systematic review and meta-analysis

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Abstract

Background With the guidance of healthcare policy and advances in medical technology, the average length of stay in hospitals continues to decrease. In this context, expectations for nurse-led interventions for patients discharged home are increasing. However, few systematic reviews of nurse-led transitional care have focused on patients discharged from acute care hospitals. This systematic review aimed to assess the effects of nurse-led transitional care interventions on readmission rates, unscheduled outpatient-visit rates, and quality of life (QOL) of adult patients discharged from acute care hospitals, compared with usual care.

Methods Four electronic databases were searched for articles published through October 2023. Individual and cluster randomized controlled trials (RCTs) examining the effectiveness of nurse-led transitional care interventions were included. Independent reviewers performed study selection, data extraction, risk of bias assessment, and certainty of evidence using the GRADE approach.

Results Sixteen RCTs were included. In a meta-analysis of RCTs with readmission rates as the outcome, readmission rates were significantly reduced in the intervention group when the data collection period exceeded 12 weeks (RR 0.67; 95% CI, 0.49–0.92; $P=0.01$; $I^2=66\%$; certainty: moderate). The rate of emergency room visits was also significantly reduced in the intervention group (RR 0.63; 95% CI, 0.49–0.81; $P=0.0003$; $I^2=0\%$; certainty: high). QOL measured with the SF-36 was significantly higher after 5 weeks (MD 1.27; 95% CI, 0.52–2.02; $P=0.0009$, $I^2=0\%$; certainty: low) and after 6 weeks (MD 2.46; 95% CI, 1.67–3.25; $P=0.00001$; $I^2=19\%$; certainty: low), both showing a possibility of improvement in the intervention group. However, the number of studies and samples included in the meta-analysis, particularly for readmission rates and QOL, were small, and the results should be interpreted with caution due to differences in subjects, institutions, and types of interventions.

Conclusion Nurse-led transitional care interventions effectively reduced readmission and emergency department visit rates and improved QOL in adult patients discharged from acute care hospitals.

Keywords Meta-analysis, Nurse-led intervention, Quality of life, Transitional care, Readmission

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Background

The rising cost of healthcare has become a global issue, with Japan experiencing one of the highest healthcare costs relative to GDP [1]. To address this, Japan's Fourth National Plan for Optimizing Healthcare Costs emphasized efficient use of medical resources, including hospital bed differentiation and outpatient care improvements [2]. The countries with the highest density of hospital beds worldwide include Korea and Japan. Japan has around 12.6 hospital beds per 1,000 population. On the other hand, the United States reported just 2.8 hospital beds per 1,000 population [3]. Furthermore, Japan also has a long average length of hospital stay, but this is decreasing owing to policy changes and advances in medical technology [4]. As a result, early discharge is increasingly promoted, leading to a higher number of patients discharged with significant medical needs. While early discharge has benefits, it also raises concerns about readmissions, as seen in the U.S. with the implementation of the Hospital Readmissions Reduction Program in 2012 [5–7]. With a shift from "hospital-based health care" to "community-based health care" care, preventing severe illness and disease recurrence in outpatient settings has become more important. Therefore, the role of nursing staff in providing health-care guidance and support to ensure continued home care and improve patients' physical symptoms and quality of life (QOL) is critical [8]. In other countries, established transitional care programs and guidelines facilitate smooth transitions from hospital to home [9–12]. Although systematic reviews on transitional care have demonstrated effects on readmission rates and QOL [13–17], there is a lack of reviews focusing specifically on patients discharged from acute care hospitals.

Hence, this systematic review aims to evaluate the effects of nurse-led transitional care interventions on the outcomes of readmission rates, unscheduled outpatient visits, and QOL in adult patients discharged from acute care hospitals compared with usual care.

Methods

Electronic database searches

This systematic review followed the Cochrane Handbook for systematic reviews of interventions [18] and the PRISMA 2020 guidelines [19]. We searched using the term "nurse-led transitional care" in PubMed, EMBASE, Cochrane Central (CENTRAL), and CINAHL for articles published through October 2023. The search strategy was developed with the advice of the librarian. For consistency of interpretation and feasibility, we limited ourselves to English-language articles only. In addition, gray literature, including conference abstracts, was excluded from this review to ensure quality and stable access to the research. We excluded articles published from low-income countries because we believed that the different levels of health care would make comparisons and analysis difficult. The search ended on March 31, 2024. The protocol was registered in PROSPERO (CRD: 42024507120).

Study selection

We included individual and cluster RCTs that assessed nurse-led transitional care for adult patients discharged from acute care hospitals. Non-randomized trials and studies lacking detailed intervention descriptions were excluded. Acute care hospitals were medical institutions providing acute care, excluding inpatient facilities and nursing homes whose main purpose is recuperation and rehabilitation, and included general hospitals, university hospitals, tertiary or quaternary care institutions. In this review, acute care is defined as medical care provided for the purpose of curing or recovering from the onset of cardiac disease or stroke, or exacerbation of chronic diseases such as respiratory, gastrointestinal, and nephrology. Participants were adults discharged from acute care, excluding pediatrics, psychiatry, obstetrics, and rehabilitation. Selection was performed using Rayyan [20], and two reviewers (CS, EE) independently evaluated titles and abstracts, resolving disagreements through discussion.

Intervention

Nurse-led transitional care interventions for adults discharged home were reviewed. Coleman et al. defined transitional care as "a series of strategic interventions aimed at ensuring seamless coordination and continuity of healthcare services during patients' transitions across various healthcare settings or different levels of care within the same setting" [21]. These interventions aimed to ensure coordination and continuity of care, including education on illness, self-care, follow-up by phone or in person, and collaboration with other professionals. Studies focusing solely on pre-discharge interventions, telemonitoring, or single-disease management were excluded. The control group received usual care, such as discharge teaching or placebo interventions.

Outcomes

The outcomes included readmission rates, unscheduled visits, and QOL, as defined by the authors using quantitative tools.

Data extraction and management

Data on study design, participants, interventions, outcomes, and results were extracted and cross-checked by two reviewers (CS, EE). Any discrepancies were resolved with a third reviewer. Transition care components were categorized using 18 elements from previous studies [13, 22].

Risk of bias assessment

Two reviewers (CS, EO) independently assessed the risk of bias using the RoB 1.0 tool in the Cochrane Handbook [23]. The risk was categorized as low, high, or unclear for random sequence generation, allocation concealment, blinding, incomplete data, selective reporting, and other biases. Disagreements were resolved through discussion.

Data synthesis and statistical analysis

For outcomes with cluster RCTs, we combined hazard ratios (HRs) from both cluster and individual RCTs using the generic inverse variance method with random-effects model. For the two cluster RCTs [34, 38], we used the adjusted HRs and their confidence intervals as reported in the original papers, which had already accounted for clustering effects. For individual RCTs, we converted the reported data to HRs using the methods described by Tierney et al. [24]. The standard errors were derived from the reported confidence intervals using the formula: SE = (ln (upper CI) - ln (lower CI))/3.92.

For outcomes without cluster RCTs, we combined relative risks (RRs) using the Mantel-Haenszel method. We applied random-effects model when heterogeneity was evident based on clinical diversity, methodological diversity, and statistical heterogeneity. Fixed-effects model was used when heterogeneity was minimal. For dichotomous outcomes, we extracted the number of events and total participants from each study. Heterogeneity was measured with the I^2 statistic, using risk ratios for binary data and mean differences with 95% confidence intervals for continuous data.

All effect estimates are reported with their 95% confidence intervals (CIs). All analyses were performed using Review Manager (RevMan) [Version 5.4, The Cochrane Collaboration, 2020].

Sensitivity analysis was performed for studies with high risk of bias or heterogeneity. Subgroup analysis was conducted for readmission rates, dividing patients into two groups according to intervention period (6 weeks or less vs. 7 weeks or more). In addition, subgroup analysis was conducted for the QOL subscale.

Certainty of evidence

The GRADE approach [25] was used to evaluate the certainty of evidence for readmission rates, emergency department visits, and QOL, categorized into high, medium, low, or very low levels.

Results

The database searches yielded 2647 articles. The screening of abstracts and titles identified 19 relevant articles. After excluding one conference abstract, one duplicate, one non-RCT article, and two articles focused entirely on medical management for a specific condition, 16 RCTs remained. The flow and number of studies included in this systematic review are described in the PRISMA flow diagram (Fig. 1).

Characteristics of the included studies

Table 1 provides an overview of the 16 RCTs included [26–41]. The study designs included 11 single-center RCTs [26, 27, 29, 30, 32–34, 36–38, 40], three multicenter RCTs [28, 31, 41], and two step-wedge cluster RCTs [35, 39]. Six RCTs were conducted in China, two each in Hong Kong, the United States, and Canada, and one each in France, Denmark, the Netherlands, and Turkey. In terms of subject admission sites, four were university hospitals, one was teaching hospital, one was tertiary care institution, seven were general hospitals, and one was regional hospital; the two step-wedge cluster RCTs included university hospitals and general hospitals or tertiary or quaternary care hospitals. The total number of subjects was 6005, ranging from 40 to 616 in the individual RCTs and from 705 to 2494 in 10 clusters in both step-wedge cluster RCTs.

The study characteristics with respect to the subject's disease were as follows: Five RCTs included cardiac disease, three RCTs included stroke, two RCTs included other chronic diseases, two RCTs included multiple diseases and four RCTs did not have disease restriction. Because transitional care interventions in the included RCTs included a variety of components, they were categorized by intervention components with reference to the classification of previous studies [13, 22] (Table 2).

The main intervention components included telephone follow-up (15 RCTs), patient education, self-management (11 RCTs each) discharge planning, and home visits (9 RCTs each). The duration of the implementation of the intervention varied, with all trials beginning before discharge, four RCTs after four weeks, two trials after ten days and six weeks, and others at different time periods (ranging from two days to 12 months).

Regarding the type of intervention, most interventions were performed by nurses only, while two RCTs reported interventions by a multidisciplinary team led by a nurse. The control group received usual care at discharge, nursing discharge instructions on medication and other issues, discharge planning, health counseling, prompting for medical visits, routine physical training programs, discretionary guidance from physicians and others, usual home nursing visits, telephone follow-up and other usual care, or placebo calls.

Risk of bias in included studies

The risk of bias was evaluated for the 16 RCTs included in this review (Fig. 2). For random sequence generation, the risk was considered low because computer- or table-based random number generation and random blocks

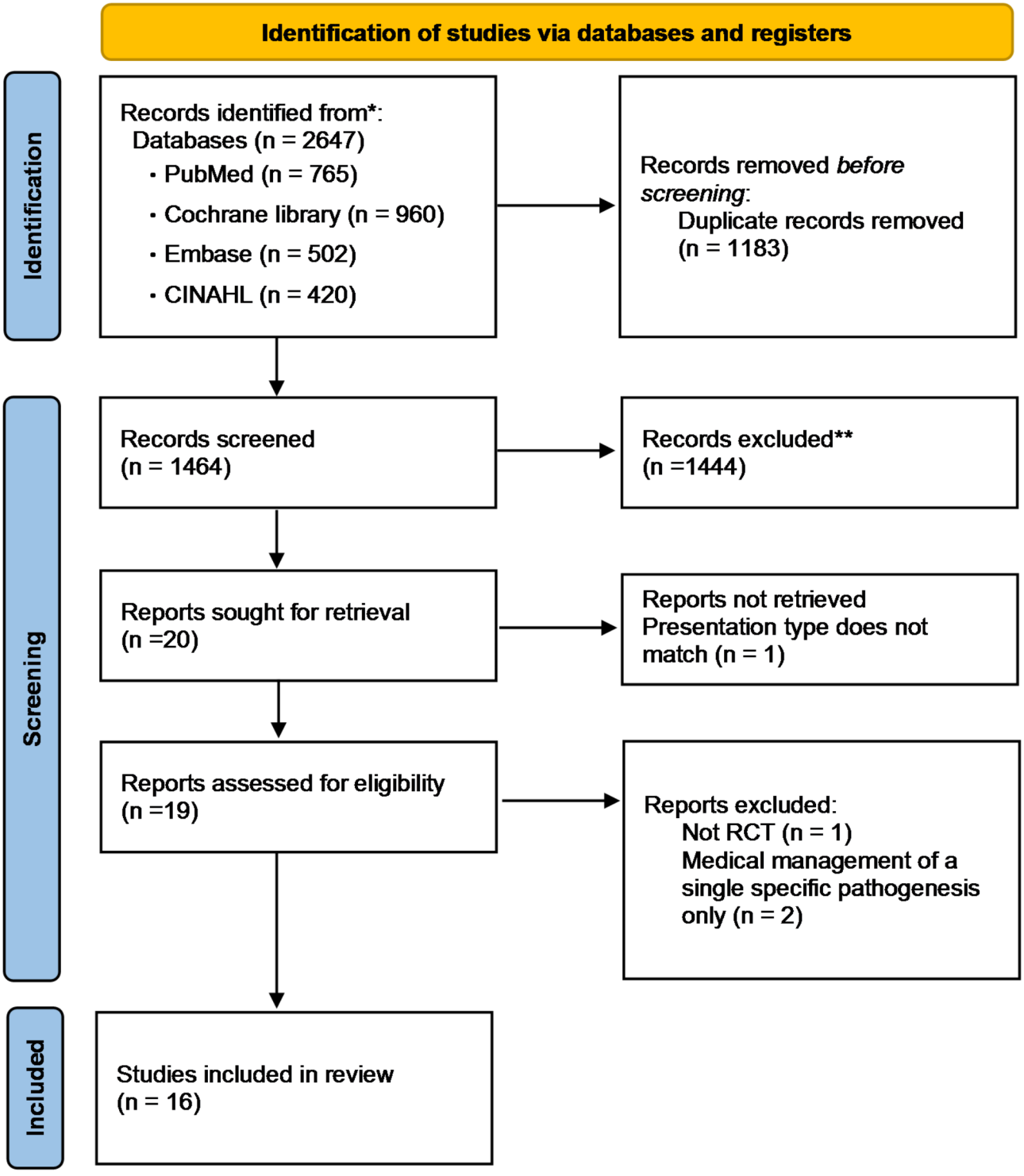

Fig. 1 Flow diagram of studies included in this systematic review

were used, except for three RCTs where the method was not described.

Regarding allocation concealment, papers that did not provide specific descriptions of envelope management methods were considered unclear. Regarding the blinding for participants and personnel, all trials were single-blind or open-label. If the outcome was reported by the patient, RCTs with unclear impact of blinding for outcome assessors were considered unclear. RCTs that were incompletely blinded, but collected information on

Table 1 Characteristics of included trials

Author [Ref. Number]	Design	Facility	Country	Number of subjects	Number of subjects in each group	Subject characteristics	Intervention group	Control group	Timing of Intervention	Number of intervening occupations1)	Number of classified interventions2)	Outcomes3) 4)
Harrison et al. 2002 [26]	Single-center RCT	Two general medical units of a large urban teaching hospital	Canada	157	Intervention: 79 Control: 78	Patients admitted to eligible facilities and diagnosed with congestive heart failure	Transitional Care (use of comprehensive protocols for counseling and education for heart failure self-management; collaboration with planned home care nurses to help patients take responsibility for their own care)	Usual care	On admission, within 24 hours and 2 weeks after discharge	1	7	・Health-related quality of life: Minnesota Living with Heart Failure Questionnaire(MLHFQ) ・QOL: SF-36 ・ The number of all-cause emergency room visits and hospital readmissions.
Latour et al. 2007 [27]	Single-center RCT	The VU University Medical Center in Amsterdam	Netherlands	121	Intervention: 69 Control: 52	Patients 18 years of age or older who have been admitted to the Department of Internal Medicine, Gastroenterology, Respiratory Medicine, or Cardiology at least once in the past 5 years	A nurse-led, home-based case management intervention NHI (care plan development based on assessment of case and complexity of care, post-discharge home visits according to care plan, psychosocial support by telephone, mediation between patient and provider, guidance on medication, exercise, diet, promotion of self-management, etc.)	Usual care	Within 1–3 days after discharge, within 3–10 days, visits every 2 months, regular phone calls, up to 24 weeks after discharge	1	7	・The number of emergency readmissions ・QOL: SF-36 ・Psychological functioning: the Hospital Anxiety and Depression Scale (HADS) Other Multiple Outcomes
Li et al. 2014 [28]	Multicenter RCT	The renal unit of two local regional hospitals	China	135	Intervention: 69 Control: 66	Inpatient in renal ward receiving peritoneal dialysis	Pre-discharge comprehensive discharge planning protocols and standardized nurse-led post-discharge telephone support interventions	Routine discharge care	Before discharge, up to 72 hours after discharge, 6 weeks after discharge	1	4	・QOL: The Kidney Disease Quality of Life Short Form (KDQOL-SF, version 1.3, RAND, Santa Monica, CA, USA) ・The observed complication control of participants ・The existence of complications ・Number of hospitalizations and attended outpatient clinics ・Days between index discharge and readmission
Goldman et al. 2014 [29]	Single-center RCT	San Francisco General Hospital and Trauma Center	United States of America	561	Intervention: 275 Control: 286	Eligible facility inpatients 55 years of age and older	Nurse-led individualized discharge planning and post-discharge telephone follow-up	Usual discharge care	Enrollment date and within 24 hours of discharge, days 1–3 and 6–10 post-discharge	1	6	・ED visits or readmissions ・Non-ED ambulatory care visits
Chow et al. 2014 [30]	Single-center RCT	Medical department of a 1700-bed acute, general regional hospital	Hong Kong	281	Home visit: 87 Call: 96 Control: 98	Patients 65 years of age or older admitted to the internal medicine ward with a diagnosis of chronic respiratory disease, cardiac disease, type 2 diabetes mellitus, or renal disease	Two groups of home visits or telephone intervention with a nurse-led case management program (integrated pre-discharge and post-discharge multicomponent intervention, framed as a self-help program using a motivational and empowerment approach)	Two placebo calls (5 minutes each) within 4 weeks	Pre-discharge, up to 4 weeks after discharge	1	6	・Unplanned hospital readmission rate ・Self-efficacy ・Self-rated health ・QOL: SF-36

Table 1 (continued)

Author [Ref. Number]	Design	Facility	Country	Number of subjects	Number of subjects in each group	Subject characteristics	Intervention group	Control group	Timing of Intervention	Number of intervening occupations1)	Number of classified interventions2)	Outcomes3) 4)
Wong et al. 2015 [31]	Multicenter RCT	Three regional hospitals within the same cluster	Hong Kong	108	Intervention: 54 Control: 54	Stroke patients admitted to eligible facilities and scheduled to be discharged home	Transitional care program (family interviews, home visits, and telephone follow-up by providing holistic care using the Omaha system)	Routine hospital-based physical training programme	Pre-discharge, 1, 2, 3, and 4 weeks post-discharge	1	5	・QOL: SF-36 ・The World Health Organization– Quality of Life– Spirituality, Religion and Personal Beliefs (WHO-QOL-SRPB) ・The patient satisfaction questionnaire (PSQ-HK) ・Functional performance: the Modified Barthel Index (MBI) ・Depressive symptomatology in the general population: the Center for Epidemiological Studies for Depression Scale (CES-D) ・Hospital readmission and unscheduled Emergency Department attendance rates
Chan et al. 2015 [32]	Single-center RCT	San Francisco General Hospital and Trauma Center	United States of America	616	Intervention: 301 Control: 315	Eligible facility inpatients 55 years of age and older	Nurse-led individualized discharge planning and post-discharge telephone follow-up	Usual care	Enrollment date and within 24 hours of discharge, days 1–3 and 6–10 post-discharge	1	10	・Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) Domains of Patient Experience. ・Three-Item Care Transitions Measure (CTM-3)
Zhang et al. 2017 [33]	Single-center RCT	The cardiovascular medical department of a 1,700-bed three-A hospital in the city	China	199	Intervention: 100 Control: 99	Cardiology inpatients diagnosed with angina pectoris or myocardial infarction	Pre- and post-discharge nurse-led transitional care programs (pre-discharge: assessment and patient education; post-discharge: teaching and counseling, treatments and procedures, case management and monitoring)	Routine care Monthly placebo social calls	Approximately 1 week before discharge and 7 months after discharge	1	5	・Hospital readmission rate ・Self-efficacy to implement health-promoting behaviours: the Chinese version of Selfrated abilities for health practices scale (SRAHP) ・Functional status and quality of life: the Chinese version of Seattle Angina Questionnaire (SAQ)
Liu L. 2018 [34]	Single-center RCT	Department of Neurology at a tertiary first-class hospital in Zhengzhou	China	40	Intervention: 20 Control: 20	Patients admitted to an eligible facility with an initial diagnosis of stroke and scheduled for discharge	Nurse-led transitional care interventions (discharge assessment, individualized transitional care plans and health education, exercise programs, home visits and telephone tutoring)	Routine instructions at discharge	Prior to and one month after discharge	3	6	・Functional exercise compliance: The functional exercise compliance questionnaire developed by Zhenxiang Zhang et al. ・Health status: SF-36
Spall et al. 2019 [35]	Step-wedge cluster RCT	11 tertiary or quaternary care urban hospitals across southern Ontario for Inclusion	Canada	2494	Intervention: 1104 Control: 1390	Patients admitted to eligible facilities due to heart failure	Patient-Centered Transitional Care in Heart Failure (PACT-HF) service model (needs assessment, self-care education, discharge summary, arranging visits to family physician, home visits after discharge, etc.)	Transitional care at clinician discretion	Upon discharge from the hospital Once a week for 4 to 6 weeks until the cardiac function clinic visit	1	7	・All-cause readmission, emergency department visit, or death at 3 months and all-cause readmission or emergency department visit at 30 days ・B-PREPARED score for discharge preparedness ・3-Item Care Transitions Measure (CTM-3) score ・Euro QOL-5D -5 level version (EQ-5D-5L) scores ・Quality-adjusted life-years (QALY) ・Post hoc exploratory clinical outcomes: components of the composite clinical outcomes, number of clinical events

Table 1 (continued)

Author [Ref. Number]	Design	Facility	Country	Number of subjects	Number of subjects in each group	Subject characteristics	Intervention group	Control group	Timing of Intervention	Number of intervening occupations1)	Number of classified interventions2)	Outcomes3) 4)
Cui et al. 2019 [36]	Single-center RCT	The Liaocheng People's Hospital cardiology department	China	96	Intervention: 48 Control: 48	Patients with coronary heart disease, 18 years of age or older, admitted to an eligible facility	Structured, nurse-led educational programs (e.g., educational sessions, exercise plans, telephone or face-to-face pre-visit interviews)	Standard medical care by physicians and nurses; recommendation to attend a heart failure clinic after discharge from the hospital	Before discharge, 4 weeks and up to 12 months after discharge	1	6	・All-cause mortality ・Hospital readmission due to cardiac problems, such as shortness of breath, chest pain, arrhythmia, and syncope ・The self-management ability
Lisby et al. 2019 [37]	Single-center RCT	An acute medical unit at a large Danish university hospital	Denmark	200	Intervention: 101 Control: 99	Inpatients 18 years of age or older at high risk of readmission who are admitted to an acute care internal medicine unit and are scheduled to be discharged home	Nurse-led comprehensive discharge intervention (assessment of overall situation and intervention, interview regarding discharge recommendations, discharge letter, post-discharge follow-up phone call)	The usual nursing routines in the acute medical unit	Before and 2 days after discharge	1	5	・The proportion of all-cause readmissions ・The total number of readmissions post-discharge ・Health-related outcomes: (1) number of emergency room visits that did not result in hospitalization, (2) number of visits to general practitioners, (3) number of after-hours visits ・Health-related quality of life: EuroQol-5D (EQ-5D) ・Patient experience: 10 questions selected from the Danish National Patient Experience Survey in the emergency department Other Multiple Outcomes
Liu Z et al. 2020 [38]	Single-center RCT	A large-scale general hospital located in the northwestern part of mainland China	China	88	Intervention: 44 Control: 44	Inpatients with rheumatoid arthritis in the Department of Rheumatology and Immunology	Omaha System Transitional Care Program (individual discharge plans, patient education, post-discharge follow-up calls, timely interventions, rehabilitation plans, etc.)	Routine care	Up to 3 days prior to discharge, within 72 hours and 4 weeks after discharge	1	6	・Self-efficacy: the Chinese version of the Arthritis Self-Efficacy Scale-8 (ASES-8) ・Health status and physical function: The Health Assessment Questionnaire-Disability Index (HAQ-DI) ・Hospital readmission rates
Gilbert et al. 2021 [39]	Step-wedge cluster RCT	10 geriatric acute care units, of which 3 were university hospitals and 7 were general hospitals.	France	705	Intervention: 336 Control: 369	Patients over 75 years old admitted to an acute geriatric ward for more than 48 hours and returned home after admission	Nurse-led bridging program (discharge planning, community service coordination, assistance with needs projections, post-discharge follow-up home visits, phone calls, etc.)	Usual care plan	Pre-discharge, day of discharge, and 1 month post-discharge (48–72 hours and 3 week visit after discharge, 2 and 4 week phone call after discharge)	1	5	・A composite of at least 1 unscheduled hospital readmission or ED visit within 30 days from discharge ・Thirty-day mortality ・Length of stay during index admission ・Patients' quality of life: the French version of EuroQoL-5D questionnaire ・Patients' satisfaction: the Care Transition Measuree15 (CTM-15) questionnaire Other Multiple Outcomes

Table 1 (continued)

Author [Ref. Number]	Design	Facility	Country	Number of subjects	Number of subjects in each group	Subject characteristics	Intervention group	Control group	Timing of Intervention	Number of intervening occupations1)	Number of classified interventions2)	Outcomes3) 4)
Coskun et al. 2022 [40]	Single-center RCT	One cardiovascular surgery clinic of a university hospital located in the Black Sea Region of Turkey	Turkey	64	Intervention: 32 Control: 32	Patients over 60 years of age admitted for the first time for open heart surgery	Nurse-led transitional care model TCM (health status assessment, regular clinic visits, care process coordination, individualized care planning, post-discharge home visits, etc.)	Routine healthcare practices by cardiovascular doctors and nurses in cardiovascular clinic	From the date of admission to 9 weeks after discharge	4	4	・The patients'functional autonomy: The Functional Autonomy Measurement System (SMAF) ・QOL: SF-36 ・Their post-discharge recurrent referral rates to hospital and recurrent hospitalization rates
Lin et al. 2022 [41]	Multicenter RCT	Four stroke wards from the First and the Third Affiliated Hospitals of Army Medical University	China	140	Intervention: 70 Control: 70	Stroke patients 18 years of age or older with a first diagnosis of ischemic or hemorrhagic stroke who will be discharged home and family caregivers 18 years of age or older who are the primary caregivers of the patient	Nurse-led health coaching program (individual coaching sessions prior to discharge, follow-up intervention after discharge: telephone support and in-person coaching in outpatient settings)	Usual transitional discharge plan	Pre-discharge and 12 weeks post-discharge	1	7	・Self-efficacy of stroke survivors: the Stroke Self-efficacy Questionnaire (SSEQ) ・QoL: the short version of the Stroke-Specific Quality of Life Scale (SSQoL-12) ・Stroke-related health knowledge: the Chinese Stroke Prevention Knowledge Questionnaire (SPKQ) ・Caregiver-related burden: the Modified Caregiver Strain Index (CSI) ・The number of adverse events (secondary strokes, falls, pressure ulcers and urinary tract infections), and unplanned hospital readmissions

1) Number of intervening occupations: Nursing students and visiting nurses all count as nurses

2) Number of classified interventions (see Table 2): Counted in accordance with the classification of previous studies [13, 22]

3) Outcomes: Outcomes not included in this review, measures and other details are omitted

4) SF-36: MOS 36-Item Short Form Health Survey

Table 2 Components of each study on transitional care interventions 1)

Author [Ref. Number]	Discharge planning	Case management	Telephone follow-up	Telemonitoring	Patient education	Self-management	Medication intervention	Home Visits	Follow-up scheduled	Patient-centered discharge instructions	Clinician continuity	Timely follow-up	Timely PCP communication	Patient hotline	Rehabilitation intervention	Streamlining	Making requisite	Other
Harrison et al. 2002 [26]			1		1	1		1		1	1					1		
Latour et al. 2007 [27]	1	1	1			1		1				1	1				1	
Li et al. 2014 [28]	1		1		1												1	
Goldman et al. 2014 [29]	1		1		1	1	1			1			1	1				
Chow et al. 2014 [30]			1			1	1	1				1	1					
Wong et al. 2015 [31]			1		1	1		1								1		
Chan et al. 2015 [32]	1	1	1		1	1	1			1			1	1			1	Engage caregivers in education and training
Zhang et al. 2017 [33]		1	1		1	1		1									1	Group activity for CAD patients
Liu L 2018 [34]	1		1		1		1	1							1		1	Nurse-led multidisciplinary team, also targeting primary caregivers

Table 2 (continued)

Author [Ref. Number]	Discharge planning	Case management	Telephone follow-up	Telemonitoring	Patient education	Self-management	Medication intervention	Home Visits	Follow-up scheduled	Patient-centered discharge instructions	Clinician continuity	Timely follow-up	Timely PCP communication	Patient hotline	Rehabilitation intervention	Streamlining	Making requisite	Other
Spall et al. 2019 [35]	1	1	1		1	1		1		1			1			1	1	Heart Failure Self-Care Education for Informal Caregivers
Cui et al. 2019 [36]			1		1	1						1	1		1		1	1 Detailed exercise plan, encourage family participation, contact social support
Lisby et al. 2019 [37]		1	1				1			1							1	
Liu Z et al. 2020 [38]	1		1		1	1									1		1	
Gilbert et al. 2021 [39]	1	1	1					1		1			1			1		

Table 2 (continued)

Author [Ref. Number]	Discharge planning	Case management	Telephone follow-up	Telemonitoring	Patient education	Self-management	Medication intervention	Home Visits	Follow-up scheduled	Patient-centered discharge instructions	Clinician continuity	Timely follow-up	Timely PCP communication	Patient hotline	Rehabilitation intervention	Streamlining	Making requisite	Other
Coskun et al. 2022 [40]	1	1						1	1							1	1	Multidisciplinary team including patients and caregivers
Lin et al. 2022 [41]			1		1	1	1					1				1	1	Interventions for patient and family caregiver pairs

1) Transition care components were categorized using 18 elements from previous studies [13, 22]

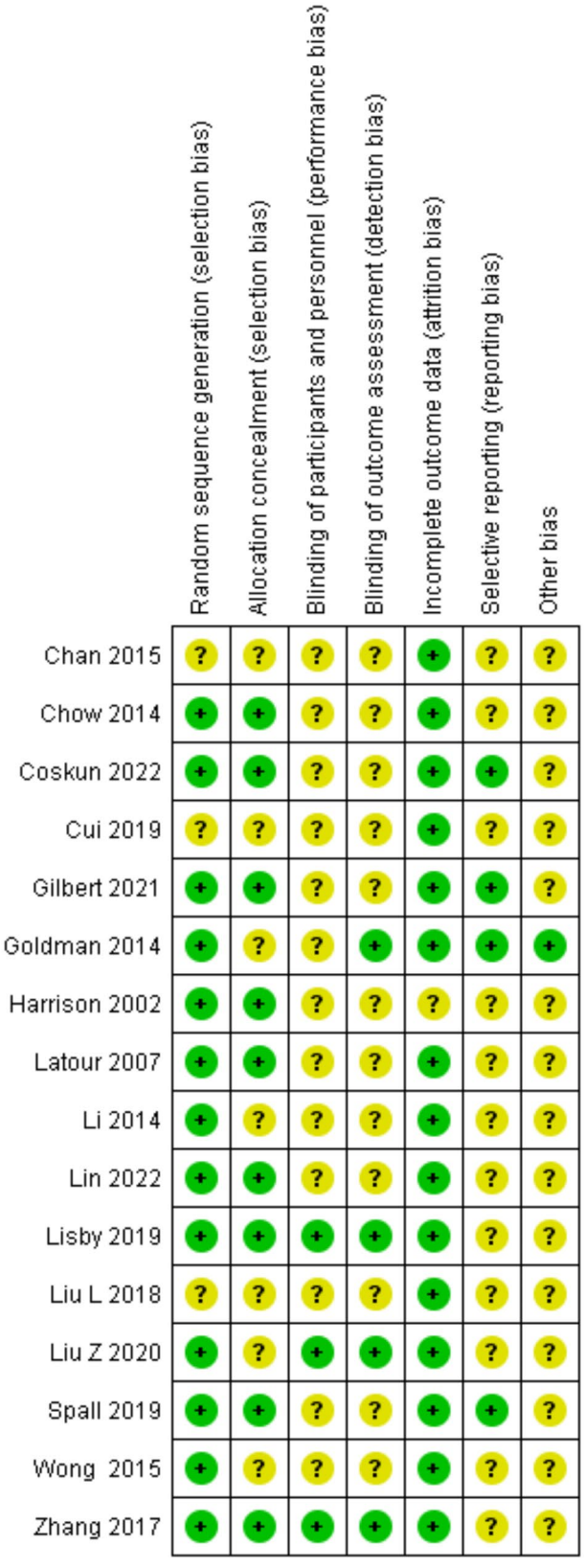

Fig. 2 Risk of bias for each trial

readmission and emergency department visit rates from medical records, were considered low risk. For incomplete outcome data, RCTs with less than 20% missing data or RCTs analyzed intention-to-treat were considered low risk. For selective reporting, studies for which protocols were available and all outcomes were reported were considered low risk; other studies were considered equivocal.

Effects of intervention

A meta-analysis of the effects of nurse-led transitional care interventions for patients discharged from acute care hospitals was conducted in RCTs using readmission rates, emergency department visit rates, and QOL as outcomes.

Readmission rates

A meta-analysis was conducted by pooling data from 13 RCTs with readmission rates as the outcome, using the occurrence of patients readmitted at least once during the data collection period as the binary variable, regardless of the number of readmissions. Three RCTs [28, 30, 35] were analyzed separately for multiple time periods, thus data were analyzed separately for studies with data collection periods of less than 12 weeks after discharge and for RCTs with data collection periods of 12 weeks or longer. Because we conducted a meta-analysis incorporating cluster randomized controlled trials (cRCTs) and individually randomized controlled trials (iRCTs), we employed the generalized inverse variance (GIV) method with HRs log-transformed (logHR) to appropriately account for both cRCTs and iRCTs. A random-effects model was applied due to the high statistical heterogeneity of 66%. As a result, the relative risk ratios for binary variable data on readmission rates were not significantly different for the seven RCTs that were less than 12 weeks after discharge. However, nine RCTs (3739 participants) in 12 weeks or more revealed that the readmission rates in the intervention group were significantly decreased by 33% (RR 0.67; 95% CI, 0.49–0.92; $P = 0.01$; $I^2 = 66\%$; certainty: moderate) compared with usual care (Fig. 3). The 13 RCT interventions included in the meta-analysis were characterized using telephone follow-up (12 trials) and patient education focused on self-management (9 trials).

Subgroup analysis by intervention period on readmission rates

To examine differences in effects according to the intervention period, a subgroup analysis was performed on 13 RCTs, dividing them into two groups: within six weeks after discharge and seven weeks or more. For the three RCTs [27, 29, 34] included within six weeks, data was collected over multiple periods. Therefore, the data from the first time point of these three RCTs were combined

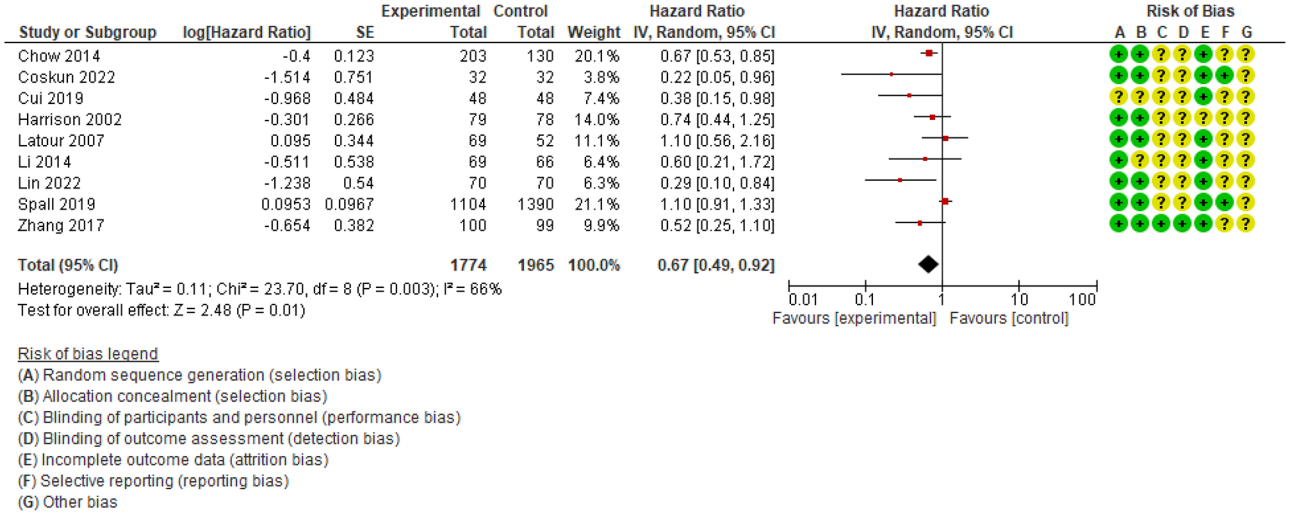

Fig. 3 Forest Plot of the effect of transitional care interventions on readmission rates with duration of data collection of twelve weeks and more

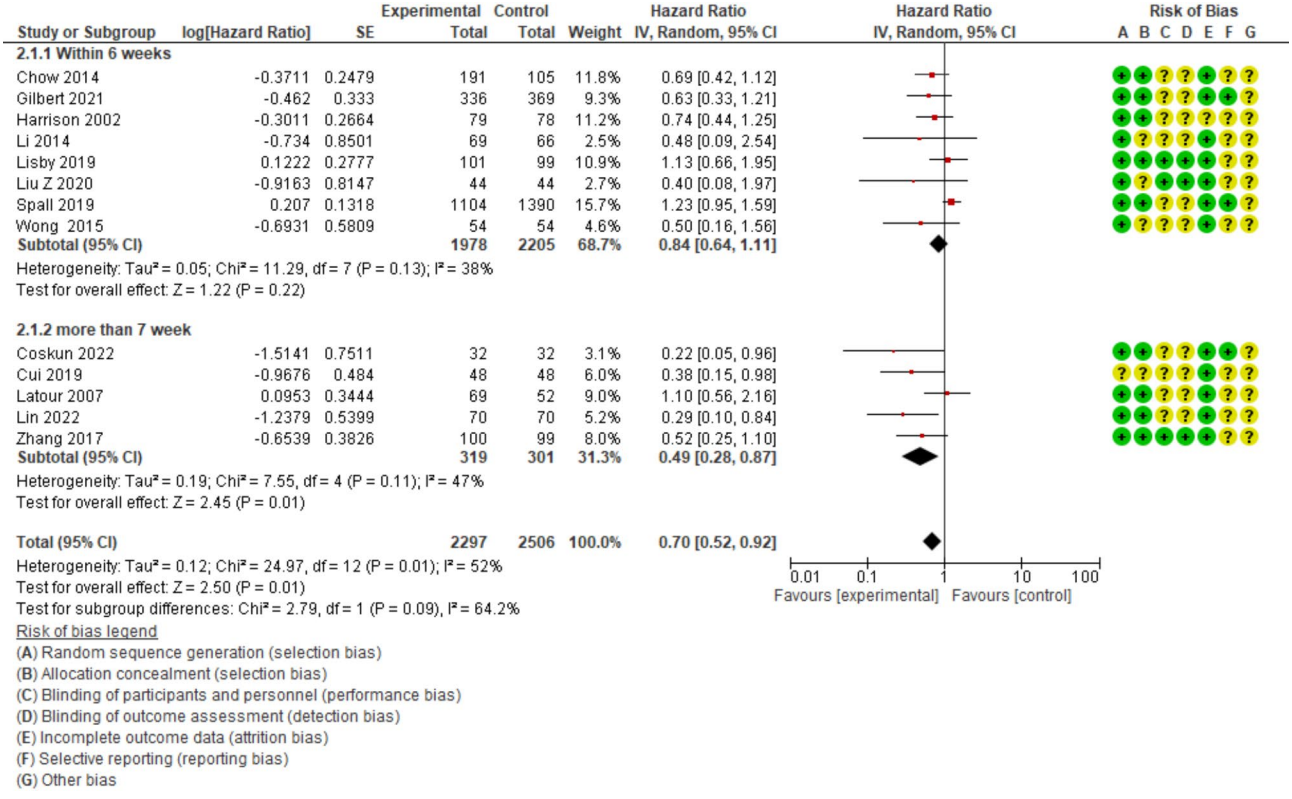

Fig. 4 Forest Plot of the effect of transitional care interventions on readmission rates

with the data from the other ten RCTs and meta-analyses carried out. Because the subgroup analysis included two cRCTs [35, 39], we employed the GIV method with logHR as in the meta-analysis on readmission rates. A random-effects model was applied due to statistical heterogeneity of 52%. No significant differences were found between the subgroups ($I^2 = 64.2\%$, $P = 0.09$), therefore, we focus on the results of merging the two subgroups.

Regardless of the timing of the intervention, the readmission rate in the intervention group was significantly reduced compared to the readmission rate in the control group (RR 0.70; 95% CI, 0.52–0.92; $P = 0.01$; $I^2 = 52\%$; certainty: moderate) (Fig. 4).

Emergency department visit rate

A meta-analysis was conducted by pooling data from four RCTs (3464 participants) [26, 31, 35, 39] that described the occurrence of emergency department visits and unplanned outpatient visits during the study period as binary variables. The RCT did not specify whether the visit was unplanned [28] and the two RCTs that used nonbinary measures [29, 37] were excluded. Among these trials, one [35] provided data for two periods (30 days and 12 weeks post-discharge). Data 30 days after discharge were combined with the other three RCTs for meta-analysis, while data 12 weeks after discharge were combined with another RCT [26] that collected data for the same period for meta-analysis. Because the meta-analysis incorporated cRCTs and iRCTs, GIV method with logHR was employed, as was the readmission rate. Statistical heterogeneity was 0%, and a fixed-effects model was applied. The results showed a significantly reduced risk of emergency department visits in the intervention group compared to the control group (RR 0.63; 95% CI, 0.49–0.81; $P=0.0003$; $I^2=0\%$; certainty: high) (Fig. 5). There was no significant difference between the two RCTs with data collected 12 weeks after discharge. Interventions in the four RCTs that focused on emergency department visit rates included telephone follow-ups, home visits, and streamlining.

Quality of life

In RCTs that used QOL as an outcome, various scales were used, including SF-36, EQ-5D, and several other measures. Among these, a meta-analysis was performed on five RCTs using SF-36. SF-36 is a scale that measures comprehensive health-related QOL and has been proven to have sufficient psychometric properties in terms of reliability, validity, and responsiveness. It consists of 36 items, eight scales, and two summary scales that aggregate the eight scales. Each subscale is scored in a range of 0 to 100, with higher scores indicating better health, after weighting certain response options [42]. Among the RCTs that used SF-36, some investigated eight subscales, while others examined the two components of physical and mental factors [30, 31], and one RCT [26] investigated three components: physical factors, mental factors, and general health. Therefore, a meta-analysis was performed by pooling data on physical and mental factors only for the three RCTs that included each of the two factors as outcomes. Additionally, subgroup analyses were performed for the three RCTs with eight subscales of the SF-36 as outcomes.

Physical and mental components of SF-36: The three RCTs (449 participants) that examined physical and psychological components collected data at two time points, thus meta-analyses were performed for each component up to four weeks and five to twelve weeks after discharge. A random effects model was used for the meta-analysis of the physical component five to twelve weeks after discharge owing to high heterogeneity ($I^2=77\%$, $P=0.01$), while a fixed effect model was used for the remainder of the time-period. The results showed a significantly higher physical component on average up to four weeks after discharge in the intervention group (MD 0.85; 95% CI, 0.41–1.29; $P=0.0001$; $I^2=0\%$; certainty: moderate). For the mental component, the intervention group had a significantly higher mean at both time points (up to four weeks: MD 0.72, 95% CI, 0.34–1.11; $P=0.0002$, $I^2=0\%$; five to twelve weeks: MD 0.60, 95% CI, 0.15–1.04, $P=0.008$, $I^2=37\%$; certainty: moderate).

Subgroup analysis of SF-36: Among the three RCTs that examined the eight subscales of the SF-36, two RCTs [30, 34] collected data at two time points. Therefore, subgroup analyzes were conducted separately for the two RCTs within five weeks after discharge (225 participants) and the three RCTs at six weeks or later (289 participants). In the two RCTs within five weeks post-discharge, $I^2=0\%$ ($P=0.57$), and thus a fixed-effects model was adopted. For the three RCTs at six weeks or

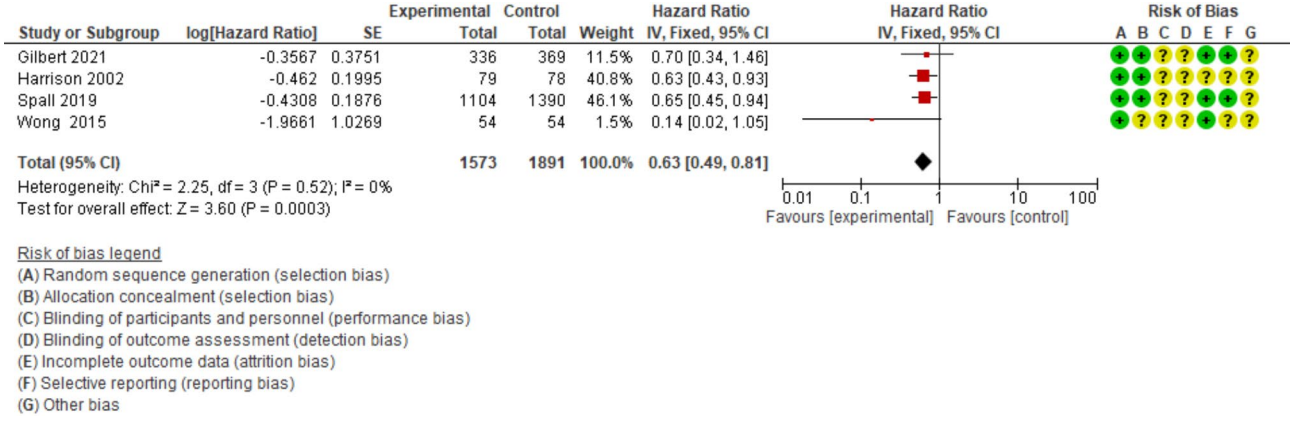

Fig. 5 Forest plot of the effect of transitional care interventions on emergency department visit rates

later, $I^2 = 92\%$ ($P < 0.00001$), necessitating the adoption of a random effects model and the execution of a sensitivity analysis. Specifically, a subgroup analysis was performed again for the three trials at six weeks or later, excluding one RCT [40], which showed a significant difference in the mean of each scale compared with the other two trials (225 participants). As a result, A subgroup analysis of the SF-36 with data collection within 5 weeks of discharge showed a significant score improvement of 1.27 points in the intervention group. (MD 1.27; 95% CI, 0.52–2.02; $P = 0.0009$; $I^2 = 0\%$; certainty: low) (Fig. 6). In the sensitivity analysis for trials up to six weeks post-discharge, $I^2 = 19\%$ ($P = 0.23$), led to the adoption of a fixed effects model. The subgroup analysis of SF-36 at six weeks or later also showed that the mean in the intervention group was significantly higher (MD 2.46; 95% CI, 1.67–3.25; $P = 0.00001$; $I^2 = 19\%$; certainty: low) (Fig. 7). However, because the Test for subgroup differences is $I^2 = 59.2\%$ ($P = 0.02$), focusing on the results for each subgroup, we found a significant score improvement of more than 2 points in all seven groups except "social functioning" (Fig. 7). The two RCTs included in the analysis of the effects of nurse-led transitional care interventions on QOL featured telephone follow-ups, medication intervention and home visits as part of the intervention.

Subgroup (Duration of intervention: within six weeks versus seven to twelve weeks versus thirteen weeks and more) Duration of data collection: less than twelve weeks.

Subgroup analysis of SF-36 subscale: duration of data collection up to five weeks.

Subgroup analysis of SF-36 subscale: sensitivity analysis, duration of data collection: six weeks and more.

The certainty of evidence

The results of the GRADE evaluation of the effects of the nurse-led transition support intervention on readmission rates, emergency department visit rates, and QOL are presented in the GRADE summary table (Table 3). For readmission rates, heterogeneity was 66% ($P = 0.003$) for meta-analyses with a data collection period of at least 12 weeks after discharge and was therefore rated moderate. The subgroup analysis by intervention duration was rated – 2 low due to heterogeneity of 52% (0.01) and small sample size in the group with an intervention duration of more than 7 weeks. The rate of emergency department visits was rated as high. For QOL (SF-36), the outcomes for each component were generally rated as moderate. The reason for the downgrade was that the risk of bias was unclear for more than half of the items. The outcomes with eight to 12 weeks of follow-up for the physical component were rated very low because the 95% CI did not include an effect, and the heterogeneity was 77% ($P = 0.01$). For the outcomes of the SF-36 subgroup analysis with eight subscales, the results were rated low for up to five weeks of follow-up and for more than six weeks of follow-up and its sensitivity analysis. The reasons for the downgrade (-2) were that the risk of bias was unclear for more than half of the items and the small sample size.

Discussion

The purpose of this review was to evaluate the effects of nurse-led transitional care interventions on the outcomes (i.e., readmission rates, unscheduled outpatient visits, and QOL) of adult patients discharged from an acute care hospital. The results indicated that nurse-led transitional care interventions reduced the readmission and emergency department visit rates and improved QOL after discharge.

Readmission rates

Nurse-led transitional care interventions were found to have the potential to reduce readmissions by 330 per 1,000 patients when the data collection period was at least 12 weeks after discharge. Most of the integrated RCTs were characterized by the inclusion of telephone follow-up and the intervention that focused on self-care management. These interventions were intended to promote patient empowerment, suggesting the potential for long-term effects. A meta-analysis of adult surgical patients [17] similarly observed a decrease in readmission rates following a nurse-led discharge services intervention. A systematic review of inpatients with chronic illness and rehabilitation needs [15] also found that nurse-led early discharge planning programs reduced readmission rates compared with usual care. Given the results of these two reviews [15, 17], nurse-led transitional care interventions may be effective in reducing readmission rates in a wide range of subjects. More validation of the effectiveness of population-based patient interventions is needed. Our review found a significant effect on readmission reduction in a meta-analysis of trials with follow-up periods longer than 12 weeks after discharge, indicating that nurse-led transitional care interventions are effective in reducing readmission rates over longer periods. The RCT interventions integrated into the meta-analysis were unique in that seven of the eight RCTs included telephone follow-up and six RCTs included patient education focused on self-care management. Including these interventions may increase their effectiveness in reducing readmission rates. However, the limited number of articles included in the analysis differed in terms of target population, type of health care organization, type and duration of intervention, and study design, and were highly statistically heterogeneous. In determining the effectiveness of nurse-led transitional care interventions, research and reviews are needed to narrow the focus of the subjects and to identify the components and duration of effective interventions.

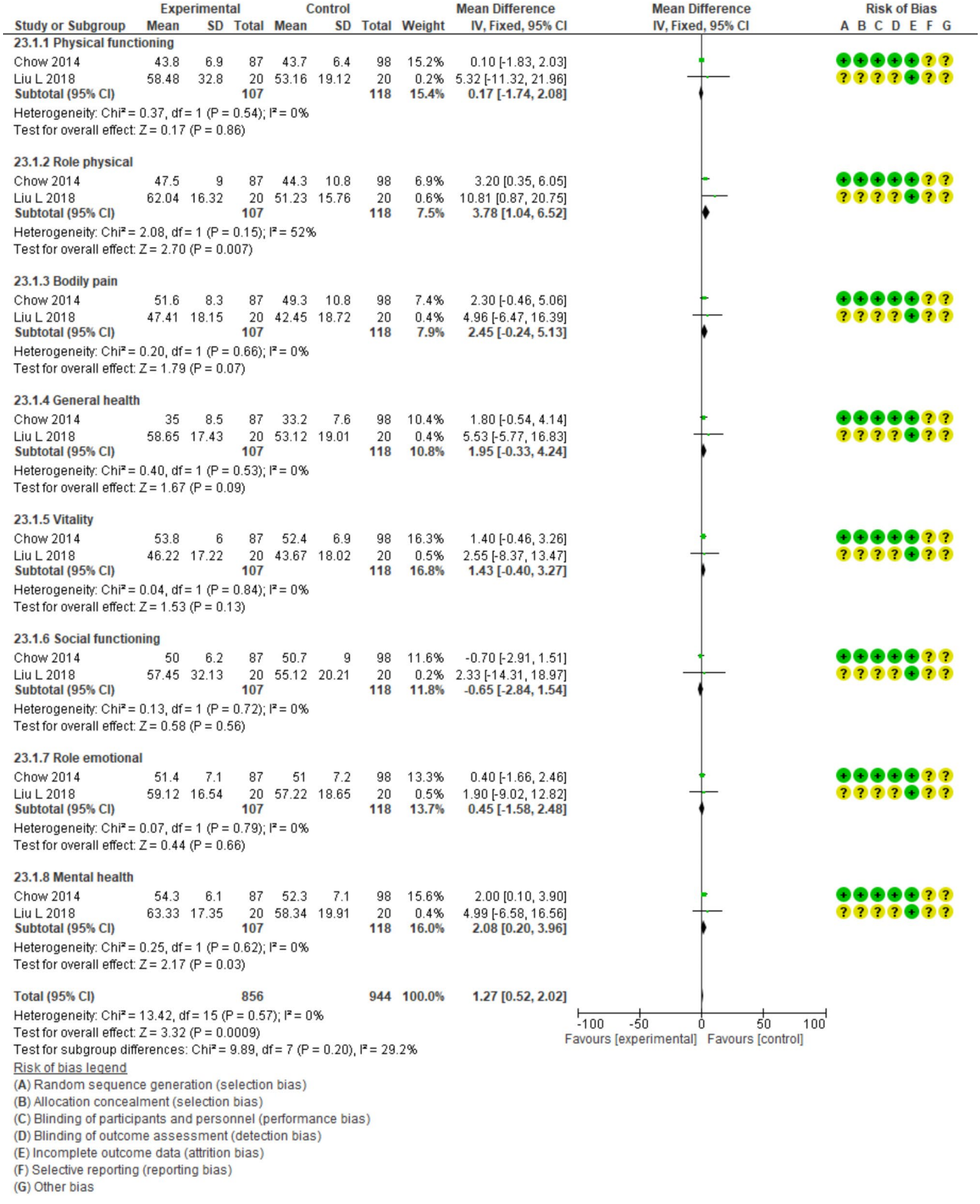

Fig. 6 Forest plot of the effect of transitional care interventions on quality of life

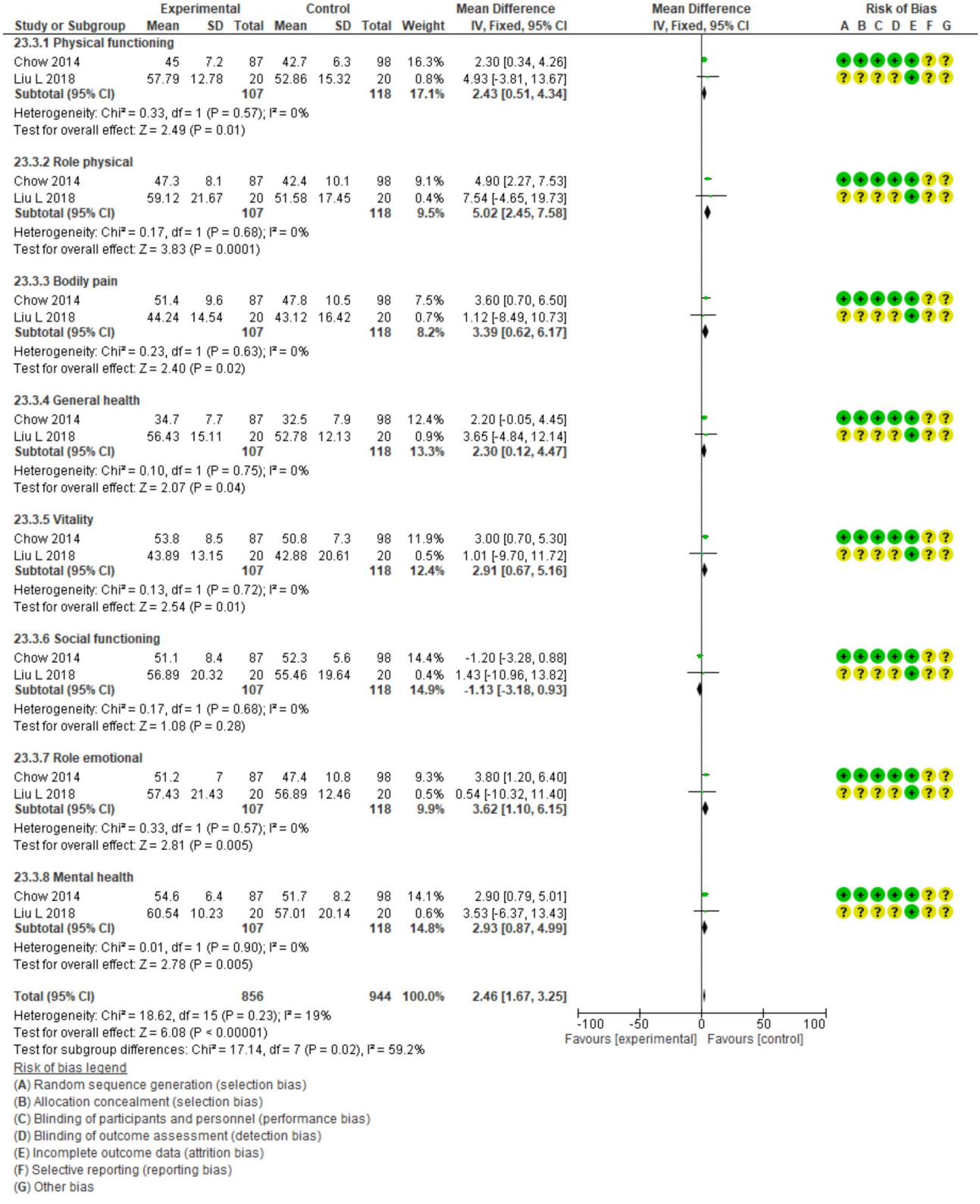

Fig. 7 Forest plot of the effect of transitional care interventions on quality of life

Table 3 Transitional care intervention compared to usual care for readmission, emergency department visit, and quality of life

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	№ of participants (studies)	Certainty of the evidence (GRADE)
	Risk with usual care	Risk with Transitional are intervention (ver. 1)			
Readmission (Duration of data collection: 12 weeks and more)	333 per 1,000	**223 per 1,000** (163 to 307)	**RR 0.67** (0.49 to 0.92)	3739 (9 RCTs)	⨁⨁⨁◯ Moderate[a]
Readmission: Subgroup (Duration of intervention: within six weeks versus seven weeks and more) Data collection duration for 3 RCTs [28, 30, 35]: less than 12 weeks	187 per 1,000	**131 per 1,000** (97 to 172)	**RR 0.70** (0.52 to 0.92)	4803 (13 RCTs)	⨁⨁◯◯ Moderate[b, d]
ED visit	149 per 1,000	**94 per 1,000** (73 to 121)	**RR 0.63** (0.49 to 0.81)	3464 (4 RCTs)	⨁⨁⨁⨁ High
Quolity of life: SF-36 -Mental component 2–4 weeks	The mean quolity of life: SF-36 -Mental component 2–4 weeks was **0**	MD **0.72 higher** (0.34 higher to 1.11 higher)	-	449 (3 RCTs)	⨁⨁⨁◯ Moderate[c]
Quality of life: Subgroup analysis of SF-36 subscale (Up to 5 weeks)	The mean quality of life: SF-36(Up to 5 weeks) was **0**	MD **1.27 higher** (0.52 higher to 2.02 higher)	-	225 (2 RCTs)[1)]	⨁⨁◯◯ Low[b, c]
Quality of life: Subgroup analysis of SF-36 subscale (6weeks and more) Sensitvity analysis	The mean quality of life: SF-36(6weeks and more) Sensitvity analysis was **0**	MD **2.46 higher** (1.67 higher to 3.25 higher)	-	225 (2 RCTs) [1)]	⨁⨁◯◯ Low[b, c]

1) The sample size for the Subgroup analysis of the SF-36 subscale reflects the total number of participants in the two RCTs [30, 34] that analyzed the subscale

***The risk in the intervention group** (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI)

CI: confidence interval; **MD**: mean difference; **RR**: risk ratio **GRADE Working Group grades of evidence**

High certainty: we are very confident that the true effect lies close to that of the estimate of the effect

Moderate certainty: we are moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different

Low certainty: our confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect

Very low certainty: we have very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of effect

Explanations (a) I-square was 66% (-1), (b) Estimate based on small sample size (-1), (c) Most trials were unclear risk of bias (-1), (d) I-square was 52% (-1)

Emergency department visit rates

Emergency department visits were potentially reduced by 370 per 1,000 patients in the nurse-led transitional care intervention group. A review of nurse-led discharge services for adult surgical patients [17] also demonstrated effectiveness in reducing emergency department visit rates. The two RCTs included in the meta-analysis of this review included telephone follow-up and home visits. It is possible that these nurse-led interventions were effective. However, Regarding the impact of interventions on emergency department visit rates, the number of RCTs that could be pooled for analysis was small, and the subject populations and interventions differed. No studies were able to include the rate of unscheduled outpatient visits in the meta-analysis as a binary variable. Further empirical research on the effectiveness of nurse-led transitional care interventions is needed to narrow the target population and intervention methods, and to use emergency department visit rates and unscheduled outpatient visit rates as outcomes.

Quality of life

A meta-analysis of the effects of transitional care interventions for adult patients discharged from acute care hospitals on the two components (physical and mental) of SF-36 found an effect on the mental component regardless of the follow-up period. The subgroup analysis of the eight SF-36 subscales showed significant improvement in scores during the follow-up period up to 5 weeks after discharge, and significant improvement in all subscales except "social functioning" during the follow-up period of 6 weeks or longer. Nurse-led transitional care interventions are effective in mental health and can have short- and long-term effects on overall QOL. Conversely, no significant difference was observed in "social functioning" at any time point, suggesting challenges in improving social functioning with nurse-led intervention, possibly due to the nature of the questions comprising social functioning, which focus on "decrease in socializing" and "decrease in time spent socializing". A previous review of adult surgical patients [17] found that the

intervention group had a higher mean than the control group in a subgroup analysis of the eight scales of SF-36. The results of this review on the effects of nurse-led transitional care interventions on QOL, although with different subjects, support the findings of this review and suggest that nurse-led transitional care interventions for patients discharged from the hospital may have positive outcomes on patient QOL. However, the number of studies and sample sizes in this analysis were small, and the circumstances of the populations covered were different. Sensitivity analysis was necessary because of the high heterogeneity in RCTs with follow-up periods longer than 6 weeks. A trial [40], which was excluded from the analysis owing to sensitivity analysis, differed in that it included surgical patients scheduled for surgery, while all other RCTs included medical conditions, and did not use telephone follow-up, which all other trials included as a component of the intervention, which may have increased heterogeneity. Few studies have used QOL as an outcome of transitional care interventions, and the wide variety of measures makes it difficult to integrate the effects. QOL is an important indicator for patients transitioning from acute care to home care, and further validation of effectiveness using a common outcome is needed.

Limitations

Only 16 RCTs were included in this review. The number of RCTs included in the meta- and subgroup analyses was small, and subject populations, institution types, interventions, and timing varied, as did outcome types and data collection periods; in particular, heterogeneity was high for readmission rate outcomes, and the number of studies in subgroup analyses of QOL (SF-36) subscales and sample sizes were small. In addition, the review was limited to English-language articles only and excluded studies from low-income countries, which should be interpreted in consideration of their impact on the generalizability of the results.

Conclusions

Nurse-led transitional care interventions were potentially effective in reducing readmission and emergency department visit rates and improving QOL in adult patients discharged from acute care hospitals. Long-term effects can be expected for readmission rates, and short- and long-term effects can be expected for quality of life. However, the number of RCTs included in the meta-analysis and subgroup analyses in this review was small. The sample size was also small for QOL outcomes. These limitations require careful interpretation of the trials from this review. A unique feature of the RCTs included in the meta-analysis was that all but one RCT for readmission rates and all RCT interventions for emergency department visit rates and QOL included telephone follow-up, which may have contributed to making the interventions more effective. On this point as well, further evidence on practices that include these elements and their application to clinical practice, implementation studies to evaluate practices, and randomized controlled trials are needed to determine the effectiveness of the interventions and specific elements.

Supplementary Information

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Supplementary Material 1

Supplementary Material 2

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Author contributions

The conception and planning were performed by C.S., E.O., and H.O.; the selection and extraction of data by C.S. and E.E.; and the analysis by C.S., E.O., and H.O. The first draft of the manuscript, figures and tables were written by C.S., and all authors commented on previous versions of the manuscript. All authors (C.S., E.E., E.O., and H.O.) read and approved the final manuscript.

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Data availability

A portion of this systematic review was presented at the 44th Annual Meeting of the Japanese Society of Nursing Science on December 7, 2024, and an abstract was published in the journal. The Japanese abstract of the presentations made at the 44th Annual Meeting of the Japanese Society of Nursing Science can be found on the Society's website (https://confit.atlas.jp/guide/event/jans44/subject/P1-1-24/entries).

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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