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Impact of transitional care interventions on hospital readmissions in older medical patients: a systematic review

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ABSTRACT

Objectives To identify and synthesise available evidence on the impact of transitional care interventions with both predischarge and postdischarge elements on readmission rates in older medical patients.

Design A systematic review.

Method Inclusion criteria were: medical patients ≥65 years or mean age in study population of ≥75 years; interventions were transitional care interventions between hospital and home with both predischarge and postdischarge components; outcome was hospital readmissions. Studies were excluded if they: included other patient groups than medical patients, included patients with only one diagnosis or patients with only psychiatric disorders. PubMed, The Cochrane Library, Embase, Cumulative Index to Nursing and Allied Health Literature (CINAHL) and Web of Science were searched from January 2008 to August 2019. Study selection at title level was undertaken by one author; the remaining selection process, data extraction and methodological quality assessment were undertaken by two authors independently. A narrative synthesis was performed, and effect sizes were estimated.

Result We identified 1951 records and included 11 studies: five randomised trials, four non-randomised controlled trials and two pre–post cohort studies. The 11 studies represent 15 different interventions and 29 outcome results measuring readmission rates within 7–182 days after discharge. Twenty-two of the 29 outcome results showed a drop in readmission rates in the intervention groups compared with the control groups. The most significant impact was seen when interventions were of high intensity, lasted at least 1 month and targeted patients at risk. The methodological quality of the included studies was generally poor.

Conclusion Transitional care interventions reduce readmission rates among older medical patients although the impact varies at different times of outcome assessment. High-quality studies examining the impact of interventions are needed, preferably complimented by a process evaluation to refine and improve future interventions.

PROSPERO registration number CRD42019121795.

Strengths and limitations of this study

- ► Focus on discharge interventions where intervention elements are provided both at the hospital and at home.
- ► High internal validity as Preferred Reporting Items for Systematic Reviews and Meta-Analyses guideline has been applied.
- ► Results may under-represent negative study findings as negative impacts often remain unpublished.
- ► Unplanned readmissions were the only outcome assessed in this review.

INTRODUCTION

Transitional care interventions (TCIs) may be essential in older medical patients' transition from hospital to home as they may prevent adverse events and unplanned hospital readmissions. These events can have detrimental consequences for the individual patient.

The global demography is radically changing. In the European Union, elderly above 65 years are estimated to account for 29.1% of the total population in 2080 compared with 19.2% in 2016. Additionally, the fraction of the population above 80 years is expected to double between 2016 and 2080.[1] We may therefore expect a dramatic increase in healthcare service demands and costs.[2] As these changes will bring substantial challenges to healthcare systems,[3 4] the potential need for TCIs will also increase. Older people needing healthcare are often medical patients with several concurrent diseases, reduced physical or mental functionalities, limited ability to provide self-care and they are often living alone and need care from primary or secondary healthcare services.[5]

Older people with complex comorbid conditions are at high risk of adverse events and safety incidents immediately after their discharge from hospital.[6]

Unplanned readmission seems to be related to insufficient discharge planning, and unintended events during discharge and transition

such as medication errors and inadequate communication between hospital and primary care professionals.[7–10] By contrast, optimised, customised and patient-centred discharge planning and transitions may reduce length of hospital stay, risk of readmission, medication discrepancies and mortality; and may as well improve the patients' activity of daily living and reduce healthcare costs.[11]

One approach to addressing these challenges is to examine the impact of interventions aimed at reducing readmissions.

Previous systematic reviews have mainly evaluated the impact of hospital-based and/or home-based interventions on readmissions[12 13] and included populations with specific conditions or both medical and surgical patients. To our knowledge, no systematic review has been conducted examining the impact of TCIs that take place in both hospital and home on older medical patients' readmission rates based on recent data.

The purpose of this systematic review is to evaluate the impact of TCIs with both predischarge and postdischarge elements on readmission among older medical patients.

METHODS

This review was registered in the PROSPERO database prior to data collection (CRD42019121795).[14] It is presented in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA).[15]

Eligibility criteria

We identified studies that aimed to reduce readmission rates through TCIs among older medical patients. The PICO process for framing the research question was applied[16] and defined as:

1. Population: older medical patients discharged from a general medical ward or emergency department (ED).
2. Intervention: in the transitional phase between hospital and home which examined the impact of the intervention on readmission rates. The interventions had to include both predischarge and postdischarge components.
3. Comparison: usual care defined as standard care and treatment.
4. Outcome: unplanned readmission to hospital.

Selecting tool is displayed in online supplemental 1.

Studies were excluded if:

1. The population was aged under 65 years or the mean age was below 75 years.
2. They included other patient groups than medical patients (eg, surgical patients).
3. They included participants with only one medical diagnosis (International Classification of Disease-10th edition).
4. Studies included participants with psychiatric disorders only.
5. They compared interventions with anything other than usual care.
6. Readmission was not an outcome.
7. Intervention only included either predischarge or postdischarge components; they were reviews, case reports or case studies without comparison groups.

Information sources

To identify eligible studies, we searched the following bibliographic databases: PubMed, The Cochrane Library, Embase, CINAHL and Web of Science from January 2008 to August 2019. An extensive snowball search was performed where the reference lists from relevant studies, systematic reviews and included studies were examined. Additionally, publication lists from prominent researchers within the field were examined. Grey literature was searched in all relevant resources listed by Paez[17] from January 2008 to August 2019. Authors from relevant study protocols and grey literature were contacted in order to examine whether the studies were published or study results were available. The Negative Results Scientific Journal was searched.

Search strategy

The search string (online supplemental 2) was developed in collaboration between the authors and a university research librarian. We used key terms, free text-words, subject headings, index terms and appertaining synonyms, which were identified through relevant theory and research. The searches were limited by only including studies published in English or Scandinavian languages. The bibliographic searches were conducted on 13 and 14 December 2018 and the searches were regularly updated until 31 August 2019.

Study selection

First, titles were screened for their potential relevance according to population and outcome by the first author (LFR). Second, two authors independently screened titles and abstracts for intervention eligibility (LFR and MG). Third, an assessment of the full text was performed by two authors independently (always including LFR). In case of disagreement, a third author, who was chosen a priori, was consulted.

Data extraction

The Cochrane Data Extraction Form was modified to fit the present patient group and intervention type.[18] Data from the included studies were extracted by two researchers independently (always including LFR). Extracted data included study characteristics and results such as author, year of publication, country, study design, setting, participants, study size, outcomes, follow-up time and impact of intervention in numbers and/or per cent. Only data on the outcome 'readmission' were extracted and analysed.

Quality assessment

'The Quality Assessment Tool for Quantitative Studies' (EPHPP) (online supplemental 3) was applied to

assess bias in each study included in the review. The validated tool is recommended by The Cochrane Collaboration[16 19] and provides a standardised means to assess study quality. The Effective Public Healthcare Panacea Project (EPHPP) assesses six methodological dimensions: selection bias, study design, confounders, blinding, data collection as well as withdrawals and dropouts. It distributes the overall methodological rating into a strong, moderate or weak measure of internal validity.[20] Quality assessment will be conducted at study level. All studies meeting the inclusion criteria are included in the synthesis regardless of the results of the quality assessments. Quality assessment across studies will be analysed and the impact hereof will be discussed.

Data synthesis

Inspired by Pigott and Shepperd,[21] the following aspects that can entail heterogeneity will be assessed: (1) context, (2) target population, (3) intervention, (4) methodological features and (5) researcher characteristics and reporting context. This assessment will result in a descriptive synthesis or a meta-analysis of data. Risk estimates (RR) and their 95% CIs are calculated (section 6.4.1 in Ref. 16) when possible and presented in forest plots stratified by subgroups. Only main results will be presented and discussed according to subgroups based on study—and intervention characteristics and review findings. The certainty of the synthesised results will be assessed using Grading of Recommendations Assessment, Development and Evaluation (GRADE) (section 14-2-1 in Ref. 16).

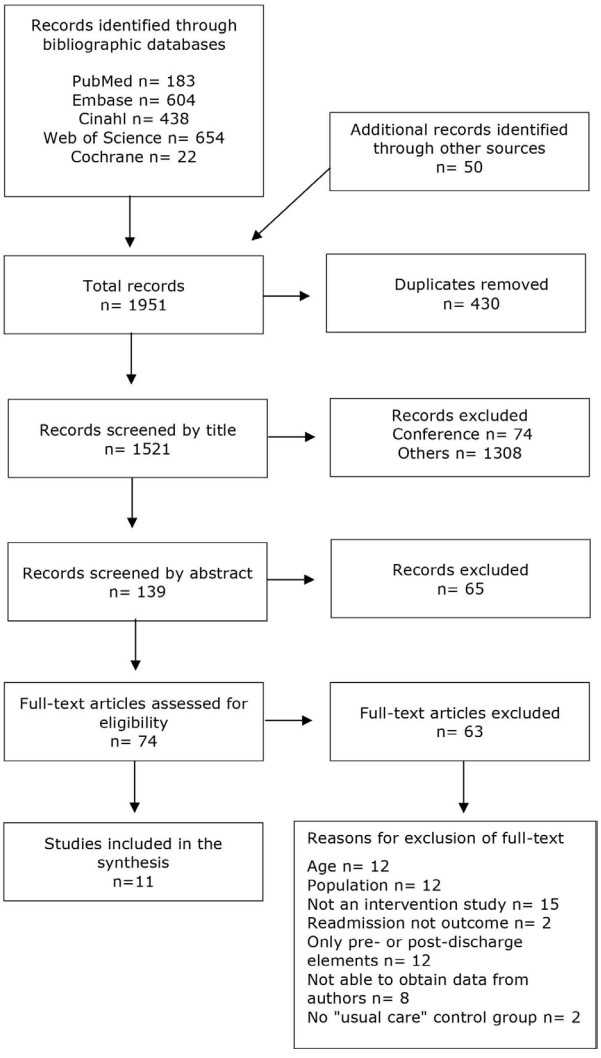

Figure 1 Flow chart of the study selection.

Patient and public involvement

Patients or the public were not involved in this study.

RESULTS

Study selection

In total, 1951 records were identified. Of those, 1901 records were identified through bibliographic databases and 50 records were found through other sources. After removing duplicates, 1521 records were screened by title and abstract. Seventy-four records were considered for full-text review of which 11 met the eligibility criteria (figure 1). The 63 remaining records were excluded due to participants' age, population, study design, readmission not listed as an outcome, only predischarge or postdischarge elements in the intervention, not able to obtain data from authors or no 'usual care' control group (online supplemental 4).

Study characteristics

The 11 included studies represented 15 different interventions and 29 outcome assessments measuring readmission rates at different time points. Two studies were multiarm studies.[22 23] Study characteristics are shown in table 1. Five of the included studies were randomised trials (RCTs),[23–27] four non-randomised controlled trials (NRCTs)[22 28–30] and two pre–post cohort studies.[31 32]

Sample sizes of individual studies ranged from 41 to 19 157. Allocation to intervention or control group was performed on an individual level. The majority of studies reported that readmissions were unplanned or acute.[23–28 32]

Outcome assessments were conducted 7–182 days after discharge. In addition to readmission, the 11 studies assessed outcomes according to physical functioning[24 27]; cognitive functioning[24]; quality of life[22 25 27]; time to either hospital readmission or discharge from nursing homes[24 28]; self-efficacy[22]; self-rated health[22]; visits to EDs, general practitioners or allied health professional[25 26 28 31 32]; length of stay[27 31]; comorbidity[27]; cost-effectiveness[27] and mortality.[24 28]Three studies took place in USA,[26 29 30] two in Australia,[23 25] two in Hong Kong,[22 31] one in the Netherlands,[24] one in the UK,[27] one in Denmark[28] and one in New Zealand.[32] The studies were published between 2009 and 2018.

Table 1 Study characteristic

Author (year)	Country setting	Design	Intervention	Study population	Mean age, years (SD) or median (range)	Female n (%)	Outcomes	OA	Readmission (event/total)	RR (CI)
Buurman *et al*[24] (2016)	Netherland Multicentre study	RCT	Transitional care bridge programme intervention	T: 674 I: 337 C:337 Unselected patients	I: 79.7 (7.3) C: 80.0 (7.8)	I: 195 (57.9) C: 195 (57.9)	▶ Readmission ▶ Katz Index of ADL ▶ Mortality ▶ Cognitive functioning ▶ Time to hospital readmission ▶ Time to discharge from a nursing home	182	I: 106/316 C: 88/303	1.15 (0.91–1.45)
Chow and Wong[22] (2014)	Hong Kong Single-centre study	NRCT	The nurse case management intervention	T: 312 Ia: 96 Ib: 108 C: 108 Unselected patients	Ia: 75.00 (60–92) Ib: 75.50 (60–89) C: 77.00 (60–89)	Ia: 46 (52.9) Ib: 52 (54.2) C: 49 (50.0)	▶ Readmission ▶ Quality of life ▶ Self-efficacy ▶ Self-rated health	28 84	Ia:14/91 Ib: 16/100 C: 24/105 Ia: 32/97 Ib: 30/106 C: 59/130	Ia: 0.67 (0.37–1.22) Ib: 0.70 (0.40–1.24) Ia: 0.73 (0.52–1.03) Ib: 0.62 (0.43–0.89)
Courtney *et al*[25] (2009)	Australia Single-centre study	RCT	Older hospitalised patients' discharge planning and in-home follow-up protocol	T: 128 I: 64 C: 64 Patients at risk	I: 78.1 (6.3) C: 79.4 (7.3)	I: 36 (62.1) C: 40 (62.5)	▶ Readmission ▶ Visits to emergency department ▶ Visits to general practitioner ▶ Visits to allied health professional ▶ Health-related quality of life	28 84 168	I: 2/49 C: 9/58 I: 10/49 C: 16/58 I: 11/49 C: 27/58	0.26 (0.06–1.15) 0.74 (0.37–1.48) 0.48 (0.27–0.87)

Continued

Table 1 Continued

Author (year)	Country setting	Design	Intervention	Study population	Mean age, years (SD) or median (range)	Female n (%)	Outcomes	OA	Readmission (event/total)	RR (CI)
Finlayson *et al*[23] (2018)	Australia Multicentre study	RCT	NR	T: 222 Ic: 57 Id:56 Ie:54 C:55 Patients at risk	Ic: 77.1 (7.64) Id: 77.6 (6.50) Ie: 77.8 (6.23) C: 77.9 (6.20)	Ic: 46 (80.7) Id: 42 (75.0) Ie: 37 (68.5) C: 37 (67.3)	▶ Readmission	28 84 168 	Ic: 4/53 Id: 7/49 Ie: 5/49 C: 13/53 Ic: 11/53 Id: 16/44 Ie: 9/48 C: 19/50 Ic: 18/52 Id: 18/42 Ie: 16/47 C: 23/50 	Ic: 0.31 (0.11–0.89) Id: 0.58 (0.25–1.33) Ie: 0.42 (0.16–1.09) Ic: 0.55 (0.29–1.04) Id: 0.96 (0.57–1.63) Ie: 0.49 (0.25–0.97) Ic: 0.75 (0.46–1.21) Id: 0.93 (0.59–1.47) Ie: 0.74 (0.45–1.22)
Koehler *et al*[26] (2009)	USA Single-centre study	RCT (pilot)	Elderly care bundle	T: 41 I: 20 C:21 Patients at risk	I: 77.2 (5.3) C: 79.8 (5.6)	I: 17 (85) C: 13 (62)	▶ Readmission ▶ Emergency department visits	30 60	I: 2/20 C: 8/21 I: 6/20 C: 9/21	0.26 (0.06–1.08) 0.70 (0.30–1.61)
Lin *et al*[31] (2015)	Hong Kong Multicentre study	Cohort analytic (two groups pre–post study)	Integrated care and discharge support for elderly patients	T: NR I: 1090 C: NR Patients at risk	Total: 80.4±7.6 I: NR C: NR	T: 557 (51.1)	▶ Readmission ▶ AED attendance ▶ LOS	182 pre 182 post	NR Reports a statistically significant reduction on 47% in readmissions	NR

Continued

Table 1 Continued

Author (year)	Country setting	Design	Intervention	Study population	Mean age, years (SD) or median (range)	Female n (%)	Outcomes	OA	Readmission (event/total)	RR (CI)
Nielsen *et al*[28] (2018)	Denmark Single-centre study	NRCT	Elderly activity performance intervention	T: 375 I:144 C: 231 Unselected patients	I: 81 (7.9) C: 78 (8.6)	I: 79 (55) C: 122 (53)	▶ Readmission ▶ All-cause mortality ▶ Number of contacts to general practitioners and emergency departments without admission ▶ Time to first readmission	30 182	I: 25/139 C: 55/231 I: 64/144 C: 99/231	0.76 (0.50–1.16) 1.04 (0.82–1.32)
Robinson *et al*[32] (2015)	New Zealand Multicentre study	Cohort analytic (two groups pre–post study)	Integrated transition of care	T: 19157 I: 5172 C:13985 Patients at risk	I: 78.2 (9.2) C: 77.6 (9.1)	I: 2486 (48.1) C: 6765 (48.4)	▶ Readmission ▶ Emergency attendances	7 28 90	I: 500/5172 C: 1239/13 985 I: 1370/5172 C: 3588/13 985 I: 2281/5172 C: 6079/13 985	1.09 (0.99–1.20) 1.03 (0.98–1.09) 1.01 (0.97–1.05)
Rottman-Sagebiel *et al*[29] (2018)	USA Single-centre study	NRCT	The geriatrics medication education at discharge project	T: 1624 I: 435 C: 1189 Patients at risk	I: 74.9 (7.6) C: 75.2 (8.35)	I: 14 (3.6) C: 26 (2.2)	▶ Readmission	30	NR	NR
Sahota *et al*[27] (2017)	UK Single-centre study	RCT	The community in-reach rehabilitation and care transition	T: 250 I: 125 C: 125 Unselected patients	I: 83.6 (6.6) C: 84.5 (5.9)	I: 82 (66) C: 79 (63)	▶ Readmission ▶ LOS ▶ Day 91-super spell bed days ▶ Functional ability ▶ Comorbidity ▶ Health-related quality of life ▶ Cost-effectiveness analysis	28 91	I: 18/106 C: 14/106 I: 45/106 C: 39/106	1.29 (0.68–2.46) 1.15 (0.82–1.61)

Continued

Table 1 Continued

Author (year)	Country setting	Design	Intervention	Study population	Mean age, years (SD) or median (range)	Female n (%)	Outcomes	OA	Readmission (event/total)	RR (CI)
Voss *et al*[30] (2011)	USA Multicentre study	NRCT	Care transitions intervention	T: 1888 I: 1042 C: 846 Unselected patients	I: NR C: NR	I: NR C: NR	▲ Readmission	30	NR	NR

ADL, activity of daily living; AED, accident and emergency departments; C, control; CGA, comprehensive geriatric assessment; I, intervention; Ia, 'Home visit'; Ib, 'Call'; Ic, EN-HaT (exercise and nurse home visit and telephone follow-up); Id, exercise; Ie, N-HaT (nurse home visit and telephone follow-up); LOS, length of hospital stay ; NR, not reported or author could not access the raw data; NRCT, non-randomised controlled trial; OA, readmission outcome assessment in days after hospital discharge; RCT, randomised trial; RR, relative risk; T, total.

Study population

In total, approximately 24 500 patients were evaluated in our review; 8800 in the intervention groups and 15 700 in the control groups. The mean age of the participants in the intervention groups was approximately 78 years (range 74.9–83.6), while the mean age among the control groups was approximately 79 years (range 75.2–84.5). Approximately 59% (range 3.6–85) of the participants in the intervention groups were women and 52% (range 2.2–67) of the participants in the control group were women.

TCIs

All studies included predischarge and postdischarge components and some included bridging components. The most pronounced difference between the interventions was in the predischarge phase, whereas elements in the bridging and postdischarge phase were somewhat similar. Table 2 outlines the intervention components, and online supplemental 5 contains detailed descriptions of the interventions.

Predischarge components

Across studies, predischarge components consisted of health record or plan, discharge planning, involvement of caregivers, concerns or barriers, patient education, physical exercise (physical exercise (muscle strength, stretch, balance and walking), medication reconciliation, counselling, nutritional screening, predischarge home visit or patient assessments (comprehensive geriatric assessment, problem classification scheme, assessment of patients' performance of daily activities and assessment of motor and process skills).

Bridging components

Bridging components consisted of written handover between hospital and primary sector, telephone handover or in-person handover.

Postdischarge components

Postdischarge components comprised of home visits, telephone follow-up, referral to additional healthcare services (rehabilitation, early specialist follow-up, general practitioner or other community services), nurse availability from hospital discharge until 7 days after discharge or rapid and intensive community support.

Synthesis of results

All five aspects that may introduce heterogeneity were analysed and a pronounced diversity between the included studies was found. Additionally, some studies had incomplete reporting of study effects. Therefore, because of the heterogeneity, a meta-analysis could not be conducted.

Considering the impact on outcome level, 22 of the 29 outcome results (76%) showed a positive impact on readmission in the intervention groups compared with the control groups. Three studies did not report readmission rates but reported a positive impact on readmission rates,

Table 2 Intervention components

Study	Predischarge components													Bridging components					Postdischarge components						
	Patient assessment	Personal health record and/or plan	Education	Medication reconciliation	Physical exercise	Address concerns and/or barriers	Counselling	Discharge planning	Nutrition screening	Caregiver involvement	Home visit to assess future needs	Multidisciplinary care	In- person hand -over	Written hand -over	Telephone hand -over	Community -based nurse visits hospital	Communications path unknown	Number of home visits	Number of telephone follow-up	Nurse availability	Referral to additional services	Intensive community support	Intervention intensity
Buurman *et al*[24]	+	+										+	+			+		5*					9
Chow *et al*[22]†	+	+				+												2*	2				6
Chow *et al*[22]‡	+	+				+													4				6
Courtney *et al*[25]	+	+			+	+		+				+		+				1*§'	9				12
Finlayson *et al*[23]¶	+	+			+					+		+						6**					10
Finlayson *et al*[23]††	+	+						+		+		+						1*§	10	+			12
Finlayson *et al*[23]‡‡	+	+			+			+		+		+						1*§ 6**	10	+			12
Koehler *et al*[26]		+	+	+		+	+	+		+		+		+				2§§					7
Lin *et al*[31]¶¶	+							+				+						?***	?				6
Lin *et al*[31]†††	+							+				+									+‡‡‡	+	5
Nielsen *et al*[28]	+	+‡‡‡			+												+	1*					4
Robinson *et al*[32]	+		+§§§	+§§§					+			+		+	+‡‡‡				2¶¶¶				7
Rottman-Sagebiel *et al*[29]			+§§§	+§§§						+		+		+	+‡‡‡				1		+‡‡‡		6
Sahota *et al*[27]	+	+								+	+	+						1§***			+‡‡‡		3
Voss *et al*[30]		+													+			1*	3				7

?, number not reported.
*First visit within 3 days after discharge.
†Postdischarge home visit group.
‡Postdischarge call group.
§Additional home visits available if needed.
¶Exercise intervention.
**By physiotherapist.
††N-Hat (nurse home visit and telephone follow-up) intervention.
‡‡Ex-Hat (exercise and nurse home visit and telephone follow-up) intervention.
§§One call by nurse and one call by pharmacist.
¶¶ICM case management group.
***Time for first home visit unknown.
†††HST service group.
‡‡‡If deemed necessary.
§§§By pharmacist.
¶¶¶To participants who return to independent living.

and it was not possible to obtain these numbers from the authors.[29–31] It was not possible to calculate RRs and their 95% CIs for those studies, and they are therefore not presented in the forest plots.

The impact size (RR) from individual studies was calculated using the reported readmission rates from eight studies. RRs ranged from 0.26 to 1.29. Nineteen outcome results were <1 of which one was close to 1 (RR=0.96). Seven estimates were >1 of which three were close to 1 (RR=1.01, 1.03, 1.04). Of the 29 outcome results, five were statistically significant.[22 23 25 26 31]

Considering the impact on study level, seven of the 11 studies showed an entirely positive impact on readmissions,[22 23 25 26 29–31] while one study presented both a positive impact and no impact,[28] and three studies showed no impact at all.[24 27]

Subgroup analysis

Study population

Online supplemental 6 exhibits impact according to the included study population. There is a clear difference in impacts between the groups. In total, 14 of 17 (82%) interventions including 'patients at risk' reported positive impacts on readmission rates. In contrast, only five out of nine (56%) interventions including 'unselected patients' reported positive impacts. In addition, the positive impacts were larger among interventions including patients at risk than among interventions with unselected patients. Three of the four statistically significant results are found among the patients at risk group. However, the 95% CIs are wider among patients at risk compared with the unselected patients indicating less precise effect estimates.

Intervention intensity

Calculation of intervention intensity was inspired by Verhaegh *et al*.[33] Ten interventions were categorised as low intensity[22 26–32] and five were categorised as high intensity.[23–25]

Online supplemental 7 illustrates a clear difference. The vast majority of interventions with a high intensity reported a positive impact on readmission rates whereas only half of the interventions with a low intensity showed a positive impact. The impacts were larger and statistically significant among high-intensive interventions.

Length of support

The interventions lasted from enrolment until 1 day to 6 months after hospital discharge. Four studies lasted between 1 and 7 days,[28 29 32] two studies lasted 28 and 30 days,[30] one study 84 days,[31] two 168 days,[24] one 182 days[25] and one study did not report the duration of the intervention.[27] Online supplemental 8 displays the impact on readmission rates according to the duration of the interventions. A short length of support is associated with less or no impact on readmission rates. A length of support of 1 month or more is associated with positive, larger and statistically significant impacts.

Country of origin

Studies conducted outside the European countries seemed to have a greater impact on readmissions than studies conducted within the European Union and all statistically significant results are found in studies conducted in non-European countries (online supplemental 9).

Outcome assessment

The impact on readmissions was largest within 30 days after hospital discharge. The impact decreased hereafter and was similar between 1 month and 6 months after discharge. Most statistically significant results are found when outcomes are assessed between 1 and 3 months (online supplemental 10).

Quality assessment within studies

Of the 11 studies, two studies were assessed to have a strong methodological quality,[22 25] three had a moderate[24 27 32] and six had a weak methodological quality.[23 26 28–31] Of the RCTs, one had a strong,[25] two had a moderate[24 27] and two had a weak quality.[23 26] Of the NRCTs, one study had a strong[22] and three had a weak quality.[28–30] One of the pre–post cohort studies had a moderate[32] and one had a weak quality[31] (table 3).

Quality assessment across studies

The majority of the studies did not meet the criteria in the components *selection bias* and *blinding* and were thus rated moderate or weak. The vast majority of studies met the criteria of *study design*, *confounders* and *data collection* and were therefore rated strong (figure 2).

DISCUSSION

We found that the majority of interventions in the transitional phase between hospital and home appears to reduce readmission rates among older patients discharged from a medical ward.

However, some studies reported both a positive impact and no impact on the readmission rate following similar care interventions. These divergent results may have several plausible explanations as discussed below.

Explanations related to study characteristics

Country of origin

Studies conducted in European countries have less impact than studies conducted in non-European countries. The impact of complex interventions is, among others, altered by the context of the implementation,[34 35] and differences in impact between countries may therefore be explained by diversity in the social, political, economic, clinical and geographical setting. The accessibility, type, character, quality and overall comprehensiveness of healthcare services provided may also play a role.[36] The USA and Australia have a long history of discharge planning and transitional care, and these countries therefore have a high quantity of research as well as refined strategies and guidelines.[37–39]

Table 3 Quality assessment

Author	Selection bias	Study design	Confounders	Blinding	Data collection methods	Withdrawals and drop-outs	Global rating
Buurman *et al*[24]	Moderate	Strong	Strong	Strong	Strong	Weak	Moderate
Chow *et al*[22]	Moderate	Strong	Strong	Moderate	Strong	Strong	Strong
Courtney *et al*[25]	Moderate	Strong	Strong	Moderate	Strong	Moderate	Strong
Finlayson *et al*[23]	Weak	Strong	Strong	Weak	Weak	Moderate	Weak
Koehler *et al*[26]	Weak	Strong	Strong	Weak	Strong	Weak	Weak
Lin *et al*[31]	Strong	Moderate	Weak	Weak	Weak	Strong	Weak
Nielsen *et al*[28]	Strong	Strong	Strong	Weak	Strong	Weak	Weak
Robinson *et al*[32]	Strong	Moderate	Strong	Weak	Strong	Strong	Moderate
Rottman-Sagebiel *et al*[29]	Weak	Strong	Strong	Weak	Weak	Weak	Weak
Sahota *et al*[27]	Strong	Strong	Strong	Weak	Strong	Moderate	Moderate
Voss *et al*[30]	Weak	Strong	Strong	Weak	Strong	Weak	Weak

Study population

The impact on readmissions is greater among patients at risk than among 'unselected older patients'. This is to be expected as readmission rates are higher among patients at risk than among unselected patients. Furthermore, patients at risk are more frail and may have a higher degree of morbidity, which could have affected the risk of readmission.[40]

Readmission rates prior to the study

Preintervention readmission rates may mirror differences in impact between studies. It may be assumed that hospitals with low preintervention readmission rates may experience no reduction of postintervention readmission rates as the remaining readmissions may not be preventable. In contrast, it may also be assumed that hospitals with high preintervention readmission rates will achieve a reduction in postintervention readmission rates.

Sample size

Several studies had small sample sizes. As seen in table 1, studies with small sample sizes reported a stronger impact than studies with larger sample sizes. This is in line with Dechartres *et al* who also reported larger effect sizes in small-to-moderate-sized trials than in larger trials.[41] One reason may be that small studies are more prone to publication bias than larger studies.[42]

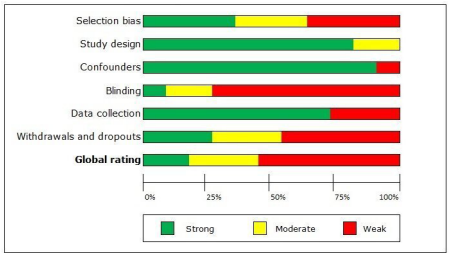

Figure 2 Quality assessment across studies. The green colour indicates strong methodological quality, yellow indicates moderate quality and red indicates weak quality across studies.

Explanations related to review findings

Interventions

Our findings suggest that the intensity of interventions influences the impact on readmission rates as high-intensity interventions generally have a stronger impact than low-intensity interventions. This is in line with previous findings presented by Verhaegh *et al*.[33] The higher quantity of elements means that more aspects in a complex patient cohort and complex settings can be addressed.

Intervention components that at first glance appear to be similar across studies may comprise different features. The diverging impact on readmissions may be affected by differences in intervention contents across studies. It is not possible to make an intervention component analysis across studies that evaluates which components positively affect readmissions. However, some trends are seen in table 2. Interventions with a positive impact on readmission comprise the following components: patient assessment, personal health record or plan, concerns and barriers, discharge planning, caregiver involvement, home visits and telephone follow-up.

Intervention fidelity

The impact on readmission rates may be affected by the fidelity of the interventions.[43] However, several studies do not describe intervention fidelity, which may be due to inconsistency in monitoring of the implementation or lack of transparency in reporting the study. These shortcomings thus hinder assessment of whether lack of positive impact is caused by poor implementation of the intervention or if the intervention did not work.

Outcome assessment

The timing of the outcome assessment has an important bearing on the possible preventive readmission rate.[44]

The findings of this review suggest that interventions have the largest impact within the first 30 days after discharge. A potential impact is likely to have obliterated if outcome is assessed later than 30 days after discharge.

Residual confounding

Several of the included studies did not adjust for potential confounders such as length of stay, fall within the past 12 months, living conditions, prior admissions, poor overall health condition and functional disability.[45–47] This could have affected the internal validity and the impact on readmission rates. The lack of analysis adjusting for potential confounders is highlighted in previous studies,[48] underlining the problematic trend in this research area.

Risk of bias

Differences in the quality assessment and thus risk of bias may explain the variation in the impact of the included studies.[16] Online supplemental 11 shows that studies assessed to have weak and strong methodological quality have a positive impact on readmission rates whereas studies with moderate quality have no impact.

Statistical analysis

Several authors fail to report whether the statistical analysis is performed based on the first readmission. One patient may therefore represent several readmissions within a specific follow-up period. If this is the case, results from those studies may report a higher readmission rate and thus greater impact than studies using unique observations in their statistical analysis.

Quality assessment

The methodological quality of the majority of the included studies was low, thus indicating a high risk of bias. Low global rating can reflect both the methodological quality and insufficient reporting of the methodology. The latter makes it difficult to accurately assess the true quality and thus the risk of bias. If the low rating is caused by insufficient methodological reporting, it may have no effect on the impact. However, if the low rating reflects methodological problems, it probably underestimates the true impact of the interventions.

The component 'blinding' represents the weakest rating. Blinding of participants was not always possible due to the nature of the interventions. Blinding is crucial in pharmaceutical trials and in other clinical studies. However, little is known about the benefits or disadvantages of blinding participants in complex interventions and how bias due to blinding may affect the results. Blinding outcome assessors may not be crucial when outcome is collected through digital records.

COMPARISON WITH PREVIOUS RESEARCH

Prior systematic reviews included other study populations such as surgical patients or patients with only one medical condition. The present review includes a broader population, namely older medical patients. Direct comparison of the present findings with previous findings is therefore difficult. The present review suggests that TCIs reduce the risk of readmission among older medical patients.

These findings are in line with findings in similar reviews that found positive effects of TCIs on hospital readmission.[49–51] These reviews also found that the included studies had a very-low-to-moderate methodological quality.

LIMITATION OF INCLUDED EVIDENCE BASE

Transparency across studies is lacking even if the Consolidated Standards of Reporting Trials statement recommends reporting a sufficient description of interventions.[52] A call for more transparency in clinical trials and adherence to appropriate guidelines is also reported elsewhere.[53] If the template for the intervention description and replication is followed, the replicability may improve, thus making it possible to build on prior research findings.[54]

Evaluating TCIs provides insight into whether interventions reduce readmissions among intervention groups compared with control groups. However, we gain no knowledge about causality between exposure and outcome. In complex interventions, such as TCIs, it is difficult to evaluate which mechanisms or components result in change.[55] A process evaluation may have captured the fidelity of the interventions and may thus have provided insight into which mechanisms and components actually work.[56] Process evaluation has previously been requested,[57] stressing the unmet need to identify essential components in TCIs. We have requested missing intervention details and other relevant data from authors; some requests were met while others were not. Lastly, all GRADE domains except one (indirectness of evidence) were assessed and found to downgrade the evidence and hence, lower the certainty of the evidence of this review.

Strengths and limitations of this review

The study has several strengths. This review adhered to PRISMA[15] and synthesis without meta-analysis[58] which ensures that all important methodological considerations were made. By reducing the risk of bias in this review, systematic errors were minimised during all stages of the process.

Despite these strengths, we note some limitations. The eligibility criteria were somewhat narrow, which limited the number of included studies. This, however, was deemed necessary to meet the need for evidence focusing on clinical settings where a large number of hospital wards are general medical wards.

Only studies published in English, Danish, Norwegian or Swedish were eligible for inclusion in this review. Therefore, studies published in other languages were omitted, potentially excluding useful evidence.

This review only focuses on hospital readmission as an outcome although the included studies evaluated the intervention impact on multiple outcomes. It is therefore

possible that some studies report a positive impact in terms of other outcomes than readmission.

Positive findings are more likely to be published in English language journals, whereas negative findings are more often published in local-language journals.[59] Publication bias is therefore likely present. During this review process, we have contacted several researchers who had registered TCIs on ClinicalTrials.gov. All researchers who found no or negative impact either struggled to publish or decided not to publish. The above-mentioned issues may result in an underrepresentation of negative results in the evidence base and thus in this present review.

Implications and future research

Future research projects may benefit from the knowledge gained from the present review when designing and developing new studies. Knowing that interventions with a minimum duration of 1 month that have a high intensity and target high-risk patients may result in more effective interventions.

This review highlights an unmet need for studies of high methodological quality that evaluate the impact of TCIs among older medical patients. Therefore, future research can benefit from a higher level of adherence to relevant guidelines and more detailed descriptions of (1) interventions and comparison groups, (2) the implementation process and (3) actions taken to minimise bias and confounding. Further research should be undertaken to investigate the process evaluations of complex interventions to identify how and why interventions either work or do not work. To develop a broader picture of TCIs, additional studies need to focus on psychological outcomes. The societal cost of such interventions versus individual and societal benefits needs to be further evaluated. High-risk patients such as physically disabled, chronically ill patients may benefit from these kinds of interventions regardless of age and comorbidity.[60]

CONCLUSION

The majority of TCIs have a positive impact on readmission rates among older medical patients, although the most significant impact was seen within 30 days after hospital discharge. Therefore, we believe that the current evidence supports recommending transitional care that includes both predischarge and postdischarge components. However, no evidence for recommending a specific intervention exists. The key finding shows an apparent pronounced positive impact among patients categorised as patients at risk in 'high-intensity' interventions and in interventions with duration of 1 month or more. This, however, should be seen in the light of the fact that only 11 studies met the inclusion criteria and a low certainty of evidence according to the GRADE approach.

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