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Continuity of care interventions for preventing hospital readmission of older people with chronic diseases: A meta-analysis

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ABSTRACT

Background: Hospital readmission after discharge is a frequent, burdensome and costly event, particularly frequent in older people with multiple chronic conditions. Few literature reviews have analysed studies of continuity of care interventions to reduce readmissions of older inpatients discharged home over the short and long term.
Objective: To evaluate the effectiveness of continuity of care interventions in older people with chronic diseases in reducing short and long term hospital readmission after hospital discharge.
Design: Meta-analysis of randomized controlled trials.
Data sources: A comprehensive literature search on the databases PubMed, Medline, CINAHL and EMBASE was performed on 27 January 2019 with no language and time limits.
Review methods: RCTs on continuity of care interventions on older people discharged from hospital having hospital readmission as outcome, were included. Two reviewers independently screened the studies and assessed methodological quality using the Cochrane Risk of Bias tool. Selected outcome data were combined and pooled using a Mantel-Haenszel random-effects model.
Results: Thirty RCTs, representing 8920 patients were included. Results were stratified by time of readmissions. At 1 month from discharge, the continuity interventions were associated with lower readmission rates in 207/1595 patients in the experimental group (12.9%), versus 264/1645 patients in the control group (16%) (Relative Risk [RR], 0.84 [95% CI, 0.71-0.99]). From 1 to 3 months, readmission rates were lower in 325/1480 patients in the experimental group (21.9%), versus 455/1523 patients in the control group (29.8%) (RR 0.74 [95% CI, 0.65-0.84]). A subgroup analysis showed that this positive effect was stronger when the interventions addressed all of the continuity dimensions. After 3 months this impact became inconclusive with moderate/high statistical heterogeneity.
Conclusions: Continuity of care interventions prevent short term hospital readmission in older people with chronic diseases. However, there is inconclusive evidence about the effectiveness of continuity interventions aiming to reduce long term readmission, and it is suggested that stronger focus on it is needed.

What is already known about the topic?

- Older people with chronic conditions are associated with the highest rates of hospital readmission.
- The most-studied timeframe measuring hospital readmission is 30-day, probably due to the financial penalties introduced in Europe and US. Therefore, late hospital readmissions are understudied.
- A recent systematic review classifying interventions to reduce 30-day readmissions in older people could not identify effective any one intervention or bundle of interventions.

What this paper adds

- Continuity of care interventions prevent short term hospital readmission in older people with chronic diseases, and those

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interventions that cover all continuity dimensions are more effective.
- It is paramount that healthcare systems should be designed to support long term care of chronicity, moving beyond the 30-day standard risk readmission rate.

1. Introduction

Chronic diseases are characterized by long duration and slow progression (World Health Organization, 2014) and are often related to multimorbidity status (Lalkhen and Mash, 2015; Pengpid and Peltzer, 2017). Older people living with a chronic disease have continuing complex care needs (Coleman, 2003) that require multiple care settings. Their life-pattern is characterized by frequent transitions in health (Naylor, 2012), high rates of hospital readmission (Berry et al., 2018) and involvement of patients, families and several healthcare providers in their care over a long period of time (Naylor, 2012). Chronic diseases can decrease quality of life and productivity and, if they are not effectively managed, result in acute and long-term complications requiring expensive hospitalizations and readmissions (Dye et al., 2018).

Effective management of chronicity includes continuity of care interventions with the goal of connecting and coordinating care between patients and providers across time and settings (Russell et al., 2011; van Servellen et al., 2006; Yang et al., 2017). Continuity of care occurs when healthcare events are experienced by patients as coherent, connected and consistent with their complex care needs (Haggerty et al., 2003). It is composed of three dimensions of continuity: *relational* (a patient-provider relationship over time), *informational* (the effective transfer and use of patients' past and current personal information) and *management* (consistent and timely coordination of care and services) (Haggerty et al., 2003). These elements are closely interrelated and should be all integrated by effective healthcare organizations (Guthrie et al., 2008). Moreover, two "core elements" distinguish continuity of care from other attributes of care: a focus on the patients' experience and the timeframe.

Most of the efforts spent on ensuring continuity of care aim at the reduction of hospital readmissions (Pacho et al., 2017), which are a common burden to healthcare systems (Gerhardt et al., 2013; Unruh et al., 2017), and undesirable events for patients (Kripalani et al., 2014). Older people perceived readmission to hospital as a challenge and a negative experience; they also felt that their existential, emotional and psychological wellbeing was not addressed by healthcare professionals (Blakey et al., 2017).

In literature, the most-studied timeframe measuring hospital readmission is 30-day, (Kristensen et al., 2015) probably due to the financial penalties introduced in Europe and US that forced hospitals to reduce early readmissions (Gupta and Fonarow, 2018) through pre and post-discharge continuity interventions. A number of publications exist on continuity of care interventions to reduce hospital readmission in adult patients but few reviews were conducted of studies on older people with chronic diseases. A systematic review aimed at classifying interventions to reduce 30-day readmissions in older people could not identify an intervention or bundle of interventions that reliably reduced readmissions (Hansen et al., 2011). Indeed, the effectiveness of continuity of care interventions in reducing hospital readmission in older people, in particular in the long-term, is still understudied. To date, the only metanalysis on the effectiveness of continuity of care intervention in the short and long term was conducted on adult patients with Chronic Obstructive Pulmonary Disease discharged home, with conflicting results (Yang et al., 2017). Therefore, the evidence on continuity of care interventions that effectively reduce both early and long term hospital readmission in older people with chronic diseases is sparse.

This systematic review of randomized controlled trials (RCTs) aims to evaluate the effectiveness of continuity of care interventions in older people with chronic diseases in reducing short and long term hospital readmission after hospital discharge.

2. Method

This review was reported in accordance with PRISMA statement guidance (Liberati et al., 2009). The protocol was previously registered on PROSPERO, registration number CRD42016050755. Preliminary searches of main databases could not find any existing or ongoing systematic reviews with this aim.

2.1. Eligibility criteria and search strategy

This review included only RCT with following inclusion criteria:

Types of participants: older patients ($\geq$ 65 years) diagnosed with one or more chronic diseases (World Health Organization, 2014), who were discharged home from hospital. Studies on cancer or psychiatric patients were excluded due to the particular illness trajectories characterizing those patients.

Types of intervention: continuity of care interventions provided by any healthcare professional during and after hospital discharge. Continuity of care interventions are defined as those focusing on the connection and coordination between patients and providers across time and settings and classified in informational, management, and relational continuity interventions (Reid et al., 2002). To be included, the interventions had to address at least one type of continuity (informational, management or relational) (Further details in Table 1).

Table 1
Characteristics of continuity of care dimensions.

Continuity of care dimensions (Reid et al., 2002)
Relational continuity Relational continuity refers to an established relationship between patient and provider that extends across illnesses over time. An ongoing patient-provider relationship helps bridge discontinuous events and provides patients and caregivers with a sense of predictability and coherence. Relational continuity interventions usually refer to the strength of interpersonal relationships including the level of communication, comfort, trust and belief.
Informational continuity Informational continuity is the transfer and use of information from previous events and conditions to plan appropriate interventions. The availability and use of data from prior events are a prerequisite for coordination of care, and accumulated knowledge is important for bridging separate care events and ensuring that services are responsive to patients' needs. Informational continuity interventions are related to the availability of documentation and to the comprehensiveness of information transfer between providers and settings.
Management continuity Management continuity is achieved when interventions are delivered in a complementary and timely manner. When care is long term, the ability to provide consistent, predictable care is pivotal and care needs to be flexible enough to respond to changing patient health status and needs. Outreach and on-going monitoring are important to adapt the care strategy to the changing needs of the patients with a focus on individualized care plans and to increase patients'/caregivers' self-care.

Specifically, if the care was provided longitudinally with an ongoing therapeutic relationship with one or more providers who connect care over time, the interventions were considered as relational continuity. For example, the presence of a transitional care nurse who follows patients from hospital into their homes and guarantees the liaison with healthcare providers and the primary care hub.

If the information about patient's health was available and transferred from one provider to another throughout the follow-up period, the interventions were considered as informational continuity. For example, the use of interventions to record information such as electronic record charts, referral forms, and written discharge plans. As well as strategies to empower patients in their care through informational booklets or medication reconciliation.

When the care was provided with tailored and shared interventions to ensure consistency during treatment, the interventions were considered as management continuity. For example, the presence of a case manager who plays a vital role in patients/caregivers training and coaching with the aim to enhance their self-confidence in monitoring and managing the symptoms.

Since continuity of care is a result of the interconnection of all three dimensions, the more the interventions address different dimensions of continuity, the greater is the likelihood of the patients' experiencing continuity of care (Reid et al., 2002).

Types of outcome: all-cause hospital readmissions measured as the number of patients readmitted in both experimental and control groups during the follow up of 1 month, 1< months ≤3; 3< month ≤6, and 6< month ≤12 from discharge.

To enhance homogeneity, only studies in which the duration of intervention was as long as the readmission timeframe considered were included. For example, the studies included in the results of "readmission at 1 month" evaluated readmission at 1 month and interventions carried out in the course of 1 month; the studies included in the results of "readmission 1< months ≤3" evaluated readmission from 1 up to 3 months and interventions carried out in the course of up to three months, and so on.

A comprehensive literature search on the databases PubMed, Medline, CINAHL and EMBASE was performed on 27 January 2019 with no language and time limits. Medical subject headings and free-terms were searched for the following keywords: chronic disease, aged, continuity of patient care, hospital readmission (Appendix 1). Search strategies were checked by three reviewers (GF, DD, MP).

2.2. Study selection and data collection

Study screening was conducted independently by two reviewers (GF, DD). First, titles and abstracts and then full-texts selected from the first round were reviewed based on the inclusion criteria. To maximize search sensitivity a snowball method was used and the reference lists of the full-texts included were screened. Conflicts regarding study inclusion were resolved by mutual agreement between reviewers. The data from the full-texts selected were extracted independently by two authors (DA, AO) and checked by a third author (GF). Extracted data included first author, publication year, country, sample size, patient disease, interventions, follow-up time, type of continuity dimension, and principal healthcare provider involved in the intervention.

2.3. Quality assessment

Two reviewers independently evaluated the methodological quality and reliability of the findings through the risk of bias tool (Higgins et al., 2011). Study quality was assessed with the following criteria: selection, performance, detection, attrition, reporting and other biases. Each criterion was evaluated assigning zero for low risk, one point for unclear, and two points for high risk of bias. The potential total score ranged 0–14, in which a low score indicated higher quality level, and a high score indicated lower quality (Massimi et al., 2017). Based on this score, the studies were classified in three levels: low (> 3), moderate (2–3) and high (0–1) quality. Only moderate and high quality studies were included in review, to limit heterogeneity and improve the reliability of the study.

2.4. Definition of outcome

The primary outcome was the effectiveness of continuity of care interventions in reducing hospital readmissions of older patients with chronic diseases in the time sections of 1 month; 1< months ≤3; 3< months ≤6, and 6< months ≤12 months from discharge.

2.5. Data synthesis and analysis

Double data entry was performed by two reviewers (GF, DD). The number of patients readmitted in each group were reported and combined for the analysis. A meta-analysis was conducted using Review Manager software version 5.3 to pool data at different outcomes. For each study, we computed the relative risk (RR) of readmission at different outcomes. Pooled risk ratios and 95% of confidence intervals (CI) were computed by means of a Mantel-Haenszel random-effects modeltest (Mantel and Haenszel, 1959). Statistical heterogeneity was assessed using the standard chi-square (Cochran, 1954) and I-square with a value of greater than 50% indicating substantial heterogeneity (Higgins et al., 2003). Egger's test was used to detect funnel plot asymmetry (Higgins, 2011) and to assess potential publication bias. Subgroup analyses were planned on the time of follow-up (short and long term). Subgroup analyses were conducted to explore whether readmission risk at different time sections varied according to the number of continuity dimensions (three versus any) addressed by the interventions.

A post-hoc sensitivity analysis was conducted excluding those studies in which the randomization process was not clearly reported, multi-component continuity interventions were not employed, and the readmission rate was considered as a secondary outcome.

3. Results

The selection process is illustrated in Fig. 1. The search strategy yielded 854 articles. After duplicate removal and titles, abstracts and full-texts review, 36 studies were evaluated for methodological quality, 30 of which resulted eligible for the review and metanalysis.

3.1. Study and patient characteristics

A total of 8920 older patients discharged from hospital to home were included. All the studies were published in English in peer-reviewed journals from 1993 to 2018, and were mostly conducted in the USA (n = 10), China (n = 5), and Australia (n = 3). Patients were affected by chronic heart failure in 16 studies (53%), chronic obstructive pulmonary disease in 3 studies (10%), chronic obstructive pulmonary disease plus chronic heart failure in 2 studies (7%) and chronic lung disease in 1 study (3%). The remaining 8 studies (27%) coded patients' diseases under the broader classification of multi chronic disease (Table 2).

3.2. Intervention characteristics

The number of interventions carried out per each study ranged from 1 to 6. Eighteen different types of interventions were identified among which home visits (N = 17), telephone follow-up

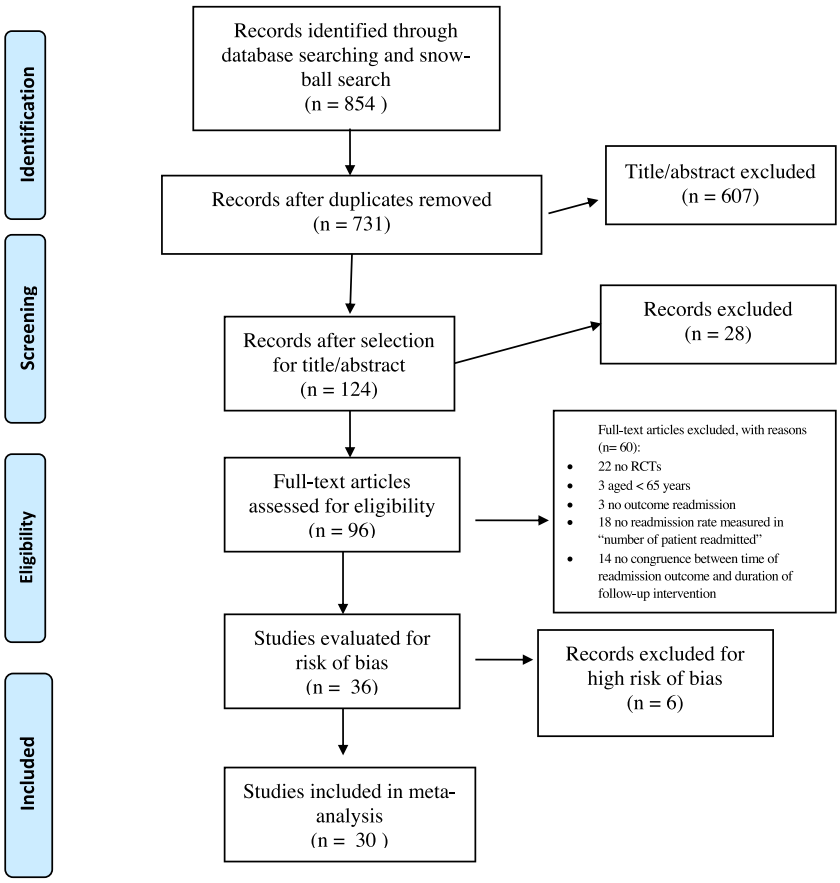

Fig. 1. Flow chart of search strategy.

(N = 16), self-management (N = 15), and transitional care models (N = 7) were prevalent (Table 2).

Most interventions were carried out by nurses with advanced competences (specialist nurse, case manager, health visitor, transition nurse, cardiac nurse, community nurse) in collaboration with other providers (n = 23 studies; 77%).

Eleven (37%) studies considered all three continuity dimensions. In particular, interventions of informational, management, and relational continuity were reported in 19 (63%), 29 (97%), and 18 (60%) studies, respectively.

3.3. Quality assessment

Of the 36 studies meeting our inclusion criteria, 6 had low quality and were excluded from the meta-analysis. Methodological quality was high in 10 (33%) and moderate in 20 (67%) studies. The double-blind procedure was not sufficiently detailed in 14 studies (47%) or absent in 6 studies (20%), where it might have been infeasible due to the nature of the intervention.

3.4. Readmission rates

The studies included presented readmission rates as primary (26, 87%), or secondary (4, 13%) outcomes. Fig. 2 shows our results in terms of all-cause readmissions, over a follow-up period from 1 to 12 months from discharge. The results were stratified by time sections (1 month; 1< months ≤3; 3< month ≤6, and 6< month ≤12). In addition, a subgroup analyses were performed to analyse the risk of hospital readmission stratified by number of continuity of care dimensions (Table 3).

3.5. Short term readmission

In this group eleven different and concurrent types of interventions were identified. Of these the most frequent were: telephone follow-up (82%), home visit (82%), self-management (72%), and patient education (27%).

3.5.1. Readmissions at 1 month

Data for readmission rates within 1 month were reported in 10 studies. The control and experimental groups included 3240 patients diagnosed with multi chronic diseases (n = 7; 70%), chronic obstructive pulmonary disease (n = 1; 10%), chronic heart failure (n = 1; 10%), and chronic obstructive pulmonary disease plus chronic heart failure (n = 1; 10%).

Individual study RRs ranged from 0.20 (95% CI, 0.04-0.88) (Benzo et al., 2016) to 1.2 (95% CI, 0.38–3.77) (Marusic et al., 2013). The continuity of care interventions were associated with a lower readmission rate in 207 of 1595 patients in the experimental group (12.9%), versus 264 of 1645 patients in the control group (16%) (RR, 0.84 [95% CI, 0.71-0.99] p = 0.04; Cochran Q χ^2, 9.32, p = 0.41; I^2, 3%). No publication bias was detected.

Meta-analyses of subgroup showed a statistically significant effect if the interventions addressed the three continuity dimensions (relational, management and relational) (RR, 0.77 [95% CI, 0.63-0.93] p = 0.006; I^2, 19.4%, p = 0.28) (Table 3).

3.5.2. < Months ≤3 readmission

Data for readmission rates at 1–3 months were reported in eleven studies, 1 of which evaluated readmission rates at 2 months, while the others considered 3-month readmission rates.

Table 2
Characteristics of included studies.

Author/year	Country	Disease	Sample size (N)	COC dimension			Intervention	Provider
				Informational	Relational	Management	Type	
Barker et al., 2012	Australia	CHF	114	X	X	X	Medication reconciliation Home visits	Pharmacist
Benzo et al., 2016	USA	COPD	215	X	X	X	Written Emergency Plan Self-management Daily exercises Home visit Telephone follow up Patient hotline	Nurse Physiotherapist
Blue et al., 2001	UK	CHF	165	X		X	Home visits Liaison with healthcare provider Self-management Telephone follow up Informational booklet	Specialist nurse
Braun et al., 2009	Israel	MCD	209	X	X	X	Discharge planning Telephone follow up	Missing
Chow and Wong, 2014	China	MCD	185	X	X	X	Comprehensive patient assessment Home visit Self-management Telephone follow up	Nurse
Cleland et al., 2005	Germany, UK, Netherlands	CHF	255	X		X	Liaison with healthcare provider Home tele-monitoring Patient hotline	Nurse
Coleman et al., 2006	USA	MCD	750	X	X	X	Transitional care model Self-management	Nurse
Collinsworth et al., 2018	USA	COPD	308	X	X		Patient education Self-management Telephone follow up Liaison with healthcare provider	Respiratory therapist
Courtney et al., 2009	Australia	MCD	122		X	X	Transitional care model (with liaison with social service) Self-management Exercise intervention	Nurse Physiotherapist Social worker
DeBusk et al., 2004	USA	CHF	462			X	Informational booklet Telephone follow up Self management Coordination of care services	Nurse
Doughty et al., 2002	New Zealand	CHF	197	X		X	Clinic visit Discharge planning Liaison with healthcare provider Educational booklet Home visit	Cardiologist General practitioner Nurse
Dunn et al., 1994	UK	MCD	204			X	Home visit	Chiropody General practitioner Nurse
Ekman et al., 1998	Sweden	CHF	158	X	X	X	Patient hotline Liaison with healthcare provider Self-management Clinic visit, Home visit	Nurse
González-Guerrero et al., 2014	Spain	CHF	117		X	X	Patient education Telephone follow up, Social services	Nurse Geriatrician Social worker
Harrison et al., 2002	Canada	CHF	192	X	X	X	Transitional Care Model	Nurse
Hermiz et al., 2002	Australia	COPD	147	X		X	Home visit Self-management Patient education Liaison with healthcare provider Telephone follow up	Nurse
Hughes et al., 2000	USA	CHF, COPD	1966		X	X	Home visit Management of patients across organizational boundaries (social services)	Nurse Social worker Physician
Jaarsma et al., 1999	USA	CHF	179	X	X	X	Patient education Home visit Telephone follow up Self-management	Nurse
Krumholz et al., 2002	USA	CHF	88			X	Informational booklet Home visit Telephone follow up Telemonitoring	Nurse
Kwok et al., 2004	China	CLD	149	X		X	Comprehensive patient assessment Patient hotline Home visit Liaison with healthcare provider	Nurse
Kwok et al., 2008	China	CHF	105	X		X	Comprehensive patient assessment Home visit Patient hotline Liaison with healthcare provider	Nurse
Leventhal et al., 2011	Switzerland	CHF	42		X	X	Informational booklet Home visit Self-management Telephone follow up	Nurse
Lopez Cabezas et al., 2006	Spain	CHF	134	X		X	Patient education Telephone follow up Home visit	Pharmacists Cardiologists
Marusic et al., 2013	Croatia	MCD	160			X	Medication reconciliation and management Home visit	Pharmacist
Rainville, 1999	USA	CHF	34			X	Informational booklet Telephone follow up	Pharmacist Nurse
Rich et al., 1995	USA	CHF	282		X	X	Home visit Telephone follow up	Nurse Dietician Cardiologist
Ritchie et al., 2016	USA	CHF, COPD	478		X	X	Transitional Care Model Self-management	Nurse
Wong et al., 2014	China	MCD	406	X	X	X	Transitional Care Model Home visit Telephone follow up Self-management	Nurse
Wong et al., 2008	China	MCD	354	X	X	X	Transitional Care Model Home visit Telephone follow up Self-management	Nurse
Yu et al., 2015	Japan	CHF	178	X	X	X	Transitional Care Model Self-management	Nurse

Key: COC = Continuity Of Care; CHF = chronic heart failure; MCD = multi-chronic disease; COPD = chronic obstructive pulmonary disease; CLD = chronic lung disease.

The control and experimental groups included 3003 patients diagnosed with multi chronic diseases (n = 5; 45.4%), chronic obstructive pulmonary disease (n = 2; 18.1%), and chronic heart failure (n = 4; 36.3%).

Individual study RRs ranged from 0.46 (95% CI, 0.21–1.00) (Benzo et al., 2016) to 1.36 (95% CI, 0.72–2.59) (Hermiz et al., 2002). The continuity of care interventions were associated with a lower readmission rate in 325 of 1480 patients in the experimental group

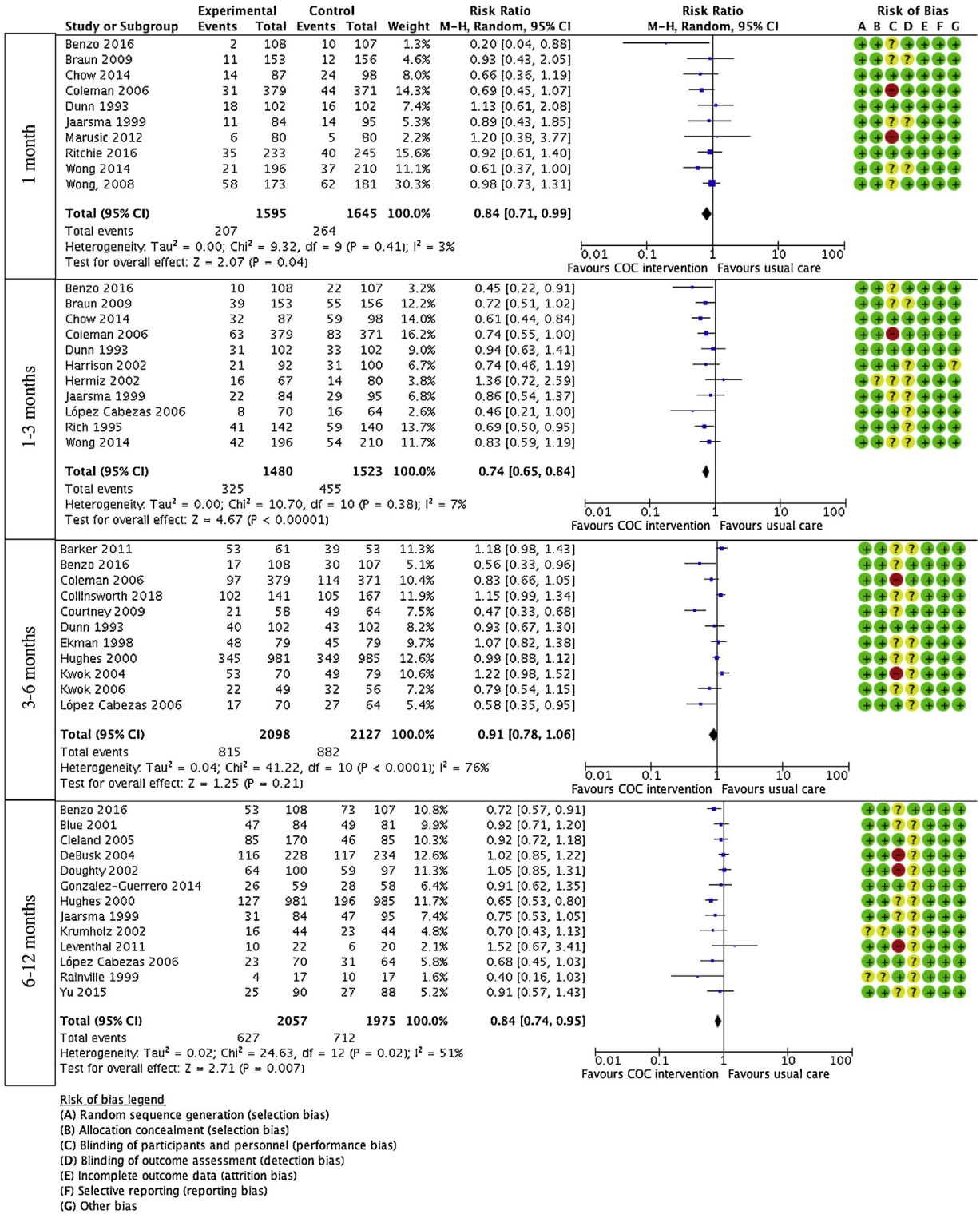

Fig. 2. Forest plot: effect of continuity of care interventions on readmission rate at 1 month, from 1 to 3 months, from 3 to 6 months, and from 6 to 12 months after hospital discharge.

(21.9%), versus 455 of 1523 patients in the control group (29.8%) (RR, 0.74 [95% CI, 0.65-0.84] $p < 0.001$; Cochran Q χ^2, 10.7, $p = 0.38$; I^2, 7%). No publication bias was detected.

A positive association for studies that addressed the three continuity dimensions (RR, 0.72 [95% CI, 0.62–0.83] $p = 0.000$; I^2 0.0%, $p = 0.67$) was found (Table 3).

3.6. Long term readmission

In this group 17 different and concurrent types of interventions were identified. Of these the most frequent interventions were: home visit (65%), self-management (45%), informational booklet (30%), patient hotline (25%), and liaison with healthcare provider (25%).

Table 3
Meta-analysis of the risk of hospital readmission stratified by continuity of care dimensions.

SUBGROUPS	*Readmission*	*Studies (N)*	*RR (95% CI)*	*I^2(%)*	*p**
ALL CONTINUITY OF CARE DIMENSIONS	1 month	7	0.77 (0.63-0.93)	19.40	0.28
	1< months ≤3	7	0.72 (0.62-0.83)	0.00	0.67
	3< month ≤6	4	0.91(0.79-1.04)	76.5	0.00
	6< month ≤12	3	0.76 (0.64-0.91)	0.00	0.67
ANY CONTINUITY OF CARE DIMENSIONS	1 month	3	1.00 (0.72-1.39)	0.00	0.82
	1< months ≤3	4	0.79 (0.63-0.99)	51.2	0.10
	3< month ≤6	6	0.93 (0.85-1.02)	79.5	0.00
	6< month ≤12	10	0.84 (0.76-0.92)	58.7	0.01

Key: * *p* value for heterogeneity.

3.6.1. < Month ≤6 readmission

Eleven studies evaluated 6-month readmission rates. The control and experimental groups included 4225 patients diagnosed with multi chronic diseases (n = 3; 27%), chronic obstructive pulmonary disease (n = 2; 18%), chronic heart failure (n = 4; 36%), chronic obstructive pulmonary disease plus chronic heart failure (n = 1; 9%) and chronic lung disease (n = 1; 9%).

Individual study RRs ranged from 0.47 (95% CI, 0.33-0.68) (Courtney et al., 2009) to 1.22 (95% CI, 0.98–1.52) (Kwok et al., 2004). There appeared to be a reduction in hospital readmission with continuity interventions (RR, 0.91 [95% CI, 0.78–1.06]; p = 0.21). However, both approaches for heterogeneity indicated considerable heterogeneity ($Q\chi^2$ 41.22, p < 0.001; I^2 = 76%) for this outcome, with the presence of publication bias on the test for asymmetry of the funnel plot, and a borderline small size effect (p = 0.075).

Null association with high heterogeneity was noted for studies that addressed either three continuity dimensions (RR, 0.91 [95% CI, 0.79–1.04] p = 0.1; I^2 76.5%, p = 0.005) or any continuity dimension (RR, 0.93 [95% CI, 0.85–1.02] p = 0.12; I^2 79.5%, p = 0.000) (Table 3).

3.6.2. < Month ≤12 months readmission

A total of 13 studies are included in this timeframe, 1 of which considered 8 months, 3 studies considered 9 months, while the others considered 12 months readmission rate.

The control and experimental groups included 4032 patients diagnosed with chronic obstructive pulmonary disease (n = 1; 7.69%), chronic heart failure (n = 11; 84.6%), and chronic obstructive pulmonary disease plus chronic heart failure (n = 1; 7.69%).

Individual study RRs ranged from 0.40 (95% CI, 0.16–1.03) (Rainville, 1999) to 1.52 (95% CI, 0.67–3.41) (Leventhal et al., 2011). Although the pooled data on hospital readmission are in favour of intervention (RR, 0.84 [95% CI, 0.74-0.95]), the Cochran Q χ^2 of 24.63 (p = 0.02), and the I^2 of 51% suggested the presence of a moderate study variability. Moreover, publication bias was detected among studies (p = 0.49).

We observed a positive association for studies that addressed three continuity dimensions (RR, 0.76 [95% CI, 0.64–0.91] p = 0.003; I^2 0.0%, p = 0.67) (Table 3), but an important heterogeneity between studies (RR, 0.84 [95% CI, 0.76–0.92] p = 0.000; I^2 58.7%, p = 0.01) that addressed any continuity dimensions precludes any conclusion on the effectiveness of such interventions.

3.7. Sensitivity analysis

The recalculation of the pooled estimates RR did not significantly alter the effect of the continuity interventions on all-cause readmission.

4. Discussion

To our knowledge, this is the first systematic review and metanalysis specifically evaluating the effectiveness of continuity of care interventions in older people with chronic diseases in reducing hospital readmission in the short and long term after hospital discharge.

Continuity of care interventions in the short term are associated with lower readmission rates. In the long term from discharge the impact on readmission rates becomes inconclusive, with high/moderate statistical heterogeneity (I^2 = 76%, 51%). This means that as the follow-up time becomes longer, the effect of continuity of care interventions becomes unclear.

Although a recent Cochrane review did not focus specifically on continuity interventions in chronically ill older people, but on discharge planning elements in a broader population, their results showing a lower readmission rate at three months from discharge are consistent with our findings (Goncalves-Bradley et al., 2016).

A meta-analysis of 42 RCTs targeting 30-day readmissions (Leppin et al., 2014), found a pooled risk ratio of 0.82 (95% CI, 0.73-0.91) that is very similar to our results at the same time frame (RR, 0.84 [95% CI, 0.71-0.99]). However, while Leppin et al. (2014) failed to find an interaction between their results and the age of participants, our analysis shows the consistent and beneficial effect of continuity of care intervention in reducing 30-day readmissions in older people. This finding is important for clinical practice because historically about a quarter of older people are readmitted to hospital within the first three months of discharge (Nuckols et al., 2017).

No clear evidence of continuity of care interventions on hospital readmissions in the long term was shown, mainly due to heterogeneity of the studies that biased the analyses. This is consistent with a study on the effectiveness of strategies to promote safe transition of older people that showed how multi-competent continuity interventions were effective in reducing readmissions within 3 months, but found no evidence for their benefit in the longer term (Mansah et al., 2009).

Older people with chronic diseases usually require frequent hospitalization to manage the exacerbations of their chronic disorders. When they enter the hospital setting the focus of care shifts from chronic to acute management to stabilize it (Vashi et al., 2013). As a consequence, early readmissions are attributed to the hospital's insufficient recognition of care needs, closely connected with the underlying diseases that have determined the admission, and to a poor discharge process (Zuckerman et al., 2016). Conversely, readmissions after a longer time are more likely to be due to events related to patient self-management, outpatient care, socio-economic issues, and community resources, rather than to the underlying disease (Kripalani et al., 2014).

Our results outline the effectiveness of continuity interventions in reducing only short-term readmission and urge hospitals to focus their efforts on the management of chronicity, looking for longitudinal strategies (Dharmarajan et al., 2013; Sheingold et al., 2016) to reduce also long-term readmissions.

In addition, the subgroup analyses showed that the continuity dimensions addressed by the interventions did interact with measure effectiveness. In particular, this effect is clearer when the interventions addressed all three continuity dimensions (informational, management and relational). Our findings confirm previous evidence in which the number of dimensions of continuity interventions were significantly related to their effectiveness (Bradley et al., 2013; Burke et al., 2014, Kripalani et al., 2014), and confirm the necessity to plan multimodal interventions that include as many continuity of care dimensions as possible (van Walraven et al., 2010v). It should be noted that management continuity is present in almost all of the RCTs analysed. This confirms the study by van Servellen et al. (2006), where management continuity is viewed as an integral part of any form of continuity without which neither informational nor relational continuity would be possible.

Finally, our review identified that the most used interventions were telephone follow-up and home visits in the short and long term group respectively. Literature confirms that telephone follow-up is the most frequently used 30-day post-discharge intervention, but also highlights inconclusive evidence about its effect (Mistiaen and Poot, 2006). As regards home visiting in the long term, it demonstrated a small relative effect that may not be clinically important (Mayo-Wilson et al., 2014).

Our review provides much needed evidence that continuity of care reduces short term hospital readmission, and may thus provide added value in the care of older people with chronic conditions. Clear recommendations have emerged from this review for primary care to improve continuity of care. Our research supports the importance of the *synchronization* of the three continuity dimensions during healthcare delivery. In fact, despite previous constant efforts to find the most effective interventions to reduce readmission, the key challenge is to provide different interventions addressing all of the continuity dimensions synchronously. Undoubtedly, any effective intervention will need to be implemented using a robust infrastructure of community services to provide ongoing assistance over time.

Moreover, the inconsistent effectiveness of continuity interventions in reducing long term readmission suggests that healthcare systems should be designed to support long term care of chronicity. With this aim it would also be necessary to plan wider and longer term interventions with reinforcement contacts able to modify patient behaviours (Cakir et al., 2017; Gupta and Fonarow, 2018). Besides, health policies should monitor long term readmissions by introducing strategies that force hospitals to pay attention to this outcome also, similar to the penalties for 30 day readmissions.

Finally, policymakers should recognize the need to reduce undesirable readmissions due to discontinuity of care and to promote continuity while improving the quality of care, thus increasing the value of the healthcare system by reducing cost without worsening quality.

Our study has several limitations. First, although we implemented comprehensive search strategies, we may not have identified all RCTs. Second, to enhance study homogeneity, we considered only studies measuring readmission rates as number of patients readmitted and with congruence between intervention and follow-up time.

The studies included comprised some multicomponent interventions differing substantially in their approach, thus it was nearly impossible to analyse which components of these made a difference to any of the outcomes assessed. Moreover, when labelling the types of continuity, some dimensions could not be clearly described or were difficult to extract, leading to an underestimation of the continuity accounted for. Finally, this review focused only on the hospital readmission outcome, and did not address other relevant health- or cost-related outcomes. Further research is needed to address the latter issues.

5. Conclusions

Continuity of care interventions prevent hospital readmissions in the short term in older people with chronic diseases. The evidence about the effectiveness of continuity interventions aiming to reduce long term readmissions, is inconclusive, suggesting the need to focus on it more strongly.

In particular, since long term readmissions are related to both clinical and socioeconomic factors, they could be prevented by closer cooperation and integration across different contextual boundaries (social, clinical, cultural), formal partnerships between acute-care hospitals and community-based organizations (Linertova et al., 2011).

Larger, well-conducted studies should continue to collect data on the effectiveness of continuity of care interventions in the long term.

Declaration of Competing Interest

The authors have no conflicts in the cover letter as well as in the manuscript, as noted above.

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Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.ijnurstu.2019.103396.

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