

Interventions to reduce hospital readmissions in the elderly: in-hospital or home care. A systematic review

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Abstract

Rationale, aims and objectives Unplanned hospital readmissions of elderly people represent an increasing burden on health care systems. This burden could theoretically be reduced by adequate preventive interventions, although there is uncertainty about the effectiveness of different types of interventions. The objective of this systematic review was to identify interventions that effectively reduce the risk of hospital readmissions in patients of 75 years and older, and to assess the role of home follow-up.

Methods We searched studies in MEDLINE, CINAHL, CENTRAL and seven other electronic databases up to October 2007, and we updated the MEDLINE search in October 2009. Clinical trials (randomized or controlled) evaluating the effectiveness of an intervention aimed at reducing readmissions in elderly patients were selected. Quality was assessed using the SIGN tool and the information extracted is presented in text and tables.

Results Thirty-two clinical trials were included and they were divided into two groups: in-hospital interventions (17 studies) and interventions with home follow-up (15 studies). A positive effect of the intervention evaluated on the readmission outcome was found in three studies from the first group and in seven from the second group.

Conclusions Most of the interventions evaluated did not have any effect on the readmission of elderly patients. However, those interventions that included home care components seem to be more likely to reduce readmissions in the elderly.

Introduction

Hospital readmissions have a significant dimension in elderly people, because of the rising number of elderly people requiring hospital care, the pressure on the availability of beds and the problems surrounding hospital discharge [1]. Early hospital readmission following a previous discharge may be viewed as an adverse outcome of care. Consequently, the early hospital readmission rate represents a potentially useful indicator to monitor the quality of medical care [2–4]. Broadly, a readmission could be associated with health care factors (e.g. suboptimal health and social care offered either by the hospital or the primary/social care structures), patient factors (e.g. poor treatment adherence), disease factors (e.g. natural disease progression), or a combination of all

the above. Readmissions related to health care and patient factors could be assumed to be potentially avoidable [5].

In this context, the index hospital admission is defined as the first stay of the patient, regardless of its length and whether it is planned or unplanned. Readmission is the next subsequent admission, urgent or unplanned, of a patient to any hospital within the same area and within a defined reference period [6]. The length of the period between the index admission and readmission has not been internationally unified. In fact, the period of time between the index admission and readmission used in studies ranges from 1 week through to 1 year. Also the term 'elderly people' appears to be similarly ill-defined in the international literature. However, most of the studies use patients aged 75 years and over [7]. In Spain, this group represents about 8% of the population, but it

corresponds to 20% of the hospital admissions and 30% of hospital stays [8].

The medical, social and psychiatric challenges presented by elderly patients admitted to hospital are complex, and there is certain controversy regarding which forms of care offer most clinical benefits and are most cost-effective. Indeed, different types of interventions have been proposed to reduce the risk of readmission, with or without some form of home follow-up after discharge. The objective of this review was to identify interventions that effectively reduce the risk of hospital readmission for elderly people (at least 75 years old) and to assess the role of home follow-up. For the results to be accessible to a wider scientific community, we present the update of a systematic review published in Spanish [9].

Methods

We searched the following electronic databases: MEDLINE, EMBASE, MEDLINE in process, CINAHL, CENTRAL (Cochrane Central Register of Controlled Trials), CRD (Centre for Reviews and Dissemination), Science Citation Index, Social Science Citation Index, Google Scholar, Índice Médico Español and LILACS up to October 2007; the search in MEDLINE was then further extended until October 2009. The Medical Subject Headings (MeSH) and text terms used included 'readmission', 'rehospitalisation', 'aged', 'old\$', 'nursing', 'geriatrics', 'discharge planning' and 'home care'. We also reviewed the references lists in the studies included. The search strategy and the review protocol can be provided by the authors on request.

The selection criteria included the following: controlled trials published in English or Spanish, both randomized as well as non-randomized, which assessed an intervention carried out during admission and/or the follow-up in order to reduce readmissions of elderly patients admitted to hospital for any medical problem (studies focusing on a specific disease were excluded). One of the outcome measures (not necessarily the primary one) had to be unplanned hospital readmission (absolute differences, risk ratio, odds ratio). Studies were excluded if more than half of participants were younger than 75 years or if the average age of all participants was less than 75 years.

Two reviewers independently selected the studies and the relevant data from the studies included were extracted by one reviewer and supervised by a second. The data were gathered in spreadsheets designed ad hoc to obtain a standard format for each study. The methodological quality of the selected studies was independently assessed by two reviewers by means of the SIGN (Scottish Intercollegiate Guideline Network) tool for clinical trials [10], and disagreements were discussed. When a consensus was not reached, a third reviewer was consulted. The data collected were synthesized through narrative procedures with detailed tables of the results.

Results

The flow diagram of the references included and excluded is presented in Fig. 1, highlighting the 25 clinical trials that fulfilled the inclusion criteria. The review of the reference lists and the manual review yielded an additional four studies and the update identified three more. Finally, 32 clinical trials were included in the study (25

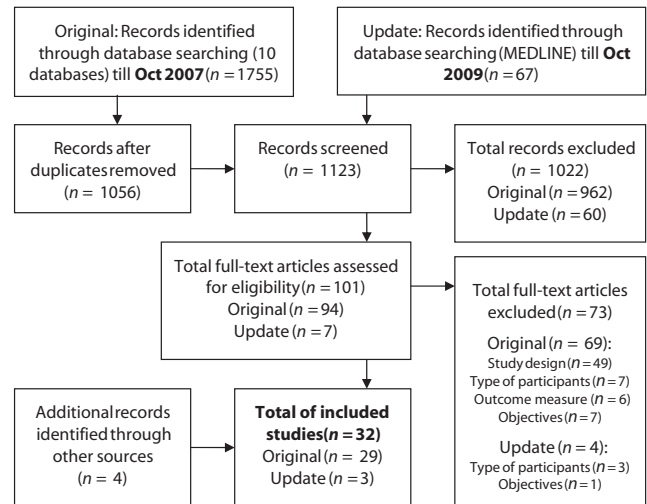


Figure 1 Flow diagram.

randomized and 7 non-randomized) and the evaluated interventions were divided into two categories depending on whether they included some kind of home care or not:

- In-hospital geriatric evaluation and discharge management (17 studies).
- Geriatric assessment with home follow-up (15 studies).

In-hospital geriatric evaluation and discharge management

There were 17 clinical trials that included this type of intervention, the characteristics, results and quality appraisal of which can be seen in Table 1. All the interventions used a geriatric assessment during the hospital stay and comprehensive discharge planning, and they were compared with the usual care. Moreover, 10 interventions also included a care plan elaborated by a geriatric team following discharge [11,12,14–16,22,24,26,27] and three included a pharmaceutical care review [16,17,23]. In 11 interventions, some kind of follow-up was carried out, either through collaboration with the patient's general practitioner or the intermediate care services [12,15,18,19,22–24,26], or through follow-up phone calls or outpatient geriatric consultations [12,15,16,18,22,26]. In only three studies did an intervention produce statistically significant differences to the control group in terms of reduced readmissions [14,16,25], and in one of them, this difference was only partial and it depended on the time period measured [16]. A negative effect was observed in one study [15] and the remainder did not show any effect of the interventions evaluated on the risk of hospital readmission.

The details of the studies in which the interventions were proposed to be effective were evaluated. In a study that evaluated intermediate care at a community hospital as an alternative to prolonged general hospital care [14], the intervention produced important differences in the number of patients readmitted in the 6 months after discharge. However, the outcome variable was the number of readmissions for the same disease, which makes it difficult to compare these data with other studies. The

Table 1 Characteristics and results of included studies: in-hospital geriatric evaluation and discharge management

Study: 1st author, year, country, design, follow-up	Interventions	Participants: <i>n</i> , mean age, % of women (GI/GC)	Results of readmission outcomes (GI vs. GC)	Quality assessment*
Asplund 2000 [11] Sweden RCT Follow-up: 3 months	<ul style="list-style-type: none"> GI: geriatric-based wards – early rehabilitation, discharge planning GC: general medical wards 	190/223 80.9/81 years 58%/63%	Patients readmitted [<i>n</i> (%)]: <ul style="list-style-type: none"> In 3 months after discharge: 61 (34) vs. 61 (28); <i>n.s.</i>; RR = 1.01 (0.81–1.26) 	+
Brand 2004 [12] Australia Quasi-experimental Follow-up: 6 months	<ul style="list-style-type: none"> GI: transitional care service – chronic disease management model GC: usual care 	83/83 77.5/79.6 years 48%/68%	Patients readmitted [<i>n</i> (%)]: <ul style="list-style-type: none"> In 3 months after discharge: 30 (36.1) vs. 30 (36.1); <i>n.s.</i> In 6 months: 26 (31.3) vs. 21 (25.3); <i>n.s.</i> 	+
Cunliffe 2004 [13] UK RCT Follow-up: 12 months	<ul style="list-style-type: none"> GI: early discharge and rehabilitation service GC: usual care 	185/185 80/79 years 71%/62%	Patients readmitted [<i>n</i> (%)]: <ul style="list-style-type: none"> In 3 months after discharge: 49 (26) vs. 40 (22); RR = 1.21 (0.93–1.38) In 12 months: 102 (55) vs. 90 (49); RR = 1.13 (0.93–1.38) 	++
Garasen 2007 [14] Norway RCT Follow-up: 26 weeks	<ul style="list-style-type: none"> GI: intermediate care at a community hospital GC: usual care 	72/70 80.9/81.3 years 78.1%/72.2%	Patients readmitted for the same disease [<i>n</i> (%)]: <ul style="list-style-type: none"> In 6 months after discharge: 14 (19.4) vs. 25 (35.7); <i>P</i> < 0.05[†] 	+
Kircher 2007 [15] Germany RCT Follow-up: 12 months	<ul style="list-style-type: none"> GI: geriatric evaluation and management consultation services GC: usual geriatric care External comparison group: usual care without consultation services 	122/107/81 79/78.4/76.9 years 81%/73%/75%	Patients with at least one readmission (%): <ul style="list-style-type: none"> In 12 months after discharge 56 vs. 50.4 vs. 37 <i>n.s.</i> (GI vs. GC) <i>P</i> < 0.05 (GI vs. external comparison group) 	++
Koehler 2009 [16] USA RCT Follow-up: 2 months	<ul style="list-style-type: none"> GI: in-hospital daily visits by care coordinators and pharmacists, post-discharge phone call GC: usual care 	20/21 77.2/79.8 years 85%/62%	Patients readmitted (%): <ul style="list-style-type: none"> In 1 month after discharge: 10 vs. 38.1; <i>P</i> < 0.05[†] In 2 months after discharge: 30 vs. 42.9; <i>n.s.</i> 	+
Landefeld 1995 [17] USA RCT Follow-up: 3 months	<ul style="list-style-type: none"> GI: special medical unit designed to help older persons maintain independence in self-care activities GC: usual care 	327/324 80.2/80.1 years 68%/65%	Patients readmitted for the same disease [<i>n</i> (%)]: <ul style="list-style-type: none"> In 3 months after discharge: 104 (34) vs. 109 (36); <i>n.s.</i> 	++
Lim 2003 [18] Australia RCT Follow-up: 12 months	<ul style="list-style-type: none"> GI: post-acute care – assessment, discharge plan, short-term case management GC: usual care with hospital discharge planning 	340/314 76.5/76.8 years 60%/57%	Patients readmitted [<i>n</i> (%)]: <ul style="list-style-type: none"> In 6 months after discharge: 75 (25) vs. 79 (28); <i>n.s.</i> In 12 months: 80 (26) vs. 74 (26); <i>n.s.</i> 	++
McInnes 1999 [19] Australia RCT Follow-up: 6 months	<ul style="list-style-type: none"> GI: GP input into discharge planning – GP's pre-discharge visit GC: usual care 	205/159 81/81 years 57%/54%	Patients with at least one readmission (%): <ul style="list-style-type: none"> In 6 months after discharge: 30 vs. 25; OR = 1.34 (0.83–2.17); <i>n.s.</i> 	++

Table 1 *Continued*

Study: 1st author, year, country, design, follow-up	Interventions	Participants: <i>n</i> , mean age, % of women (GI/GC)	Results of readmission outcomes (GI vs. GC)	Quality assessment*
Mudge 2006 [20] Australia Quasi-experimental Follow-up: 6 months	<ul style="list-style-type: none"> GI: multidisciplinary care teams – assessment, communication, discharge planning GC: usual care 	792/746 74/74 years (median) 52%/54%	Patients readmitted [<i>n</i> (%): <ul style="list-style-type: none"> In 6 months after discharge: 220 (27.8) vs. 225 (30.2); n.s. 	++
Mudge 2008 [21] Australia Quasi-experimental Follow-up: 1 month	<ul style="list-style-type: none"> GI: in-hospital structured, multi-component, early rehabilitation programme GC: usual care 	62/62 81.7/82.4 years 57%/60%	Patients readmitted (%): <ul style="list-style-type: none"> In 1 month after discharge: 17.7 vs. 19.4; n.s. 	+
Reuben 1995 [22] USA RCT Follow-up: 3 months	<ul style="list-style-type: none"> GI: comprehensive geriatric assessment GC: usual care 	1337/1016 77.6/76.7 years 56%/48%	Patients readmitted (<i>n</i>): <ul style="list-style-type: none"> In 3 months after discharge: 341 vs. 278; RR = 1.00 (0.71–1.43) 	++
Spinewine 2007 [23] Belgium RCT Follow-up: 12 months	<ul style="list-style-type: none"> GI: geriatric evaluation and management with pharmaceutical care GC: geriatric evaluation and management 	103/100 81.9/82.4 years 72%/67%	Patients readmitted (%): <ul style="list-style-type: none"> In 12 months after discharge: 32.6 vs. 33.7; n.s. 	++
Steeman 2006 [24] Belgium Quasi-experimental Follow-up: 3 months	<ul style="list-style-type: none"> GI: discharge management by social workers or nurses, case management GC: usual care with discharge planning 	355/469 82/81.7 years 66%/65%	Patients readmitted [<i>n</i> (%): <ul style="list-style-type: none"> In 15 days after discharge: 10 (2.8) vs. 24 (5.1); n.s. In 3 months: 47 (13.2) vs. 76 (16.2); n.s. 	–
Thomas 1993 [25] USA RCT Follow-up: 6 months	<ul style="list-style-type: none"> GI: inpatient community-based geriatric assessment GC: usual care 	68/64 76/77 years 59%/65%	Readmissions per patient [mean (SD)]: <ul style="list-style-type: none"> In 6 months after discharge: 0.3 (0.6) vs. 0.6 (1.0); <i>P</i> < 0.05† 	+
Trappes-Lomax 2006 [26] UK RCT Follow-up: 12 months	<ul style="list-style-type: none"> GI: joint health/social care rehabilitation unit GC: usual care 	94/112 83.1/80.7 years ?%/?%	Patients readmitted [<i>n</i> (%): <ul style="list-style-type: none"> In 12 months after discharge: 36 (38.0) vs. 48 (42.9); n.s. 	–
Winograd 1993 [27] USA RCT Follow-up: 6 months	<ul style="list-style-type: none"> GI: inpatient interdisciplinary geriatric consultation GC: usual care 	99/98 75.7/76.6 years 0%/0%	Readmissions per patient [mean (SD)]: <ul style="list-style-type: none"> In 6 months after discharge: 1.0 (1.3) vs. 1.2 (1.7); n.s. 	++

*SIGN criteria (overall assessment): ++ All or most of the criteria have been fulfilled. + Some of the criteria have been fulfilled. – Few or no criteria fulfilled.

†Effectiveness in reducing hospital readmissions.

GI, group of intervention; GC, group of controls; RCT, randomized controlled trial; *n*, number; n.s., difference statistically not significant; SD, standard deviation; GP, general practitioner; OR, odds ratio; RR, relative risk.

effectiveness of an inpatient community-based geriatric consultation team was also demonstrated in the 6 months after discharge [25]. Finally, the effects of a targeted care package for high risk elderly were also studied [16], which included daily in-hospital visits by care coordinators and post-discharge phone calls by clinical pharmacists. The intervention reduced readmission rate at 30 days when compared with the control group, but not at 60 days. All the interventions described in these studies involved communication with primary health care services.

It should be mentioned that one study [15], which compared a geriatric evaluation and management consultation service with a control group from the same hospital and with an external control group from four different centres without geriatric units, found no differences between the intervention and control group; however, there was a significant difference against the intervention compared with the external group. The authors suggested various explanations for this effect, indicating that perhaps the usual care was already similar to the geriatric programmes or that the consultation team might have been ineffective.

Geriatric assessment with home follow-up

Home follow-up is an alternative way of promoting health and delivering preventive care to older people, thereby avoiding hospital readmission. There were 15 studies that assessed interventions involving some type of post-discharge home care and that compared them with the usual care (see Table 2 for the characteristics, results and quality assessment). Beside home visits, some of the interventions also implemented a care plan after discharge [29,30,33,36,37,40,41], home rehabilitation [32,34,36,39,41,42], cooperation with patients' general practitioners [28,29,32,33,35,37–39], phone calls [30,31,37], coordination of post-discharge care services [29,33,36,40,41] or patient education (about self-care, correct utilization of medication, home service possibilities, etc.) [28,30,35,37–39].

The effectiveness of the intervention was demonstrated in seven clinical trials [28–31,36,37,41], two of them only partially depending on the follow-up period [30,41], while in one study a negative effect on readmission rate was described [35]. The rest of the studies were unable to prove any effect on readmission outcomes.

Among the studies reporting positive effects, a comprehensive geriatric assessment followed by home care provided by a hospital-based multidisciplinary outreach team was evaluated [29]. This study showed that patients in the intervention group had a lower rate of hospital readmissions during the first 30 days, together with a lower rate of emergency admissions and a longer time to the first emergency admission. Another study that evaluated a similar intervention, observed fewer readmissions of patients and fewer hospital days per patient for the intervention group 6 months after admission [37]. An intervention that involved an in-hospital assessment, a nurse-conducted home visit and telephone follow-up for 6 months after discharge was also effective [31]. Similarly, results were reported in a study on the effectiveness of a home treatment intervention team at 6 and 12 weeks [36], although the initial differences between the groups limited these findings. When an inpatient pharmaceutical counselling intervention was backed up with simple medicine reminder cards [28], and it was followed up with pharmacist visits up to 3 months post discharge, the intervention contributed to better drug knowledge

and treatment compliance, together with reduced unplanned visits to the doctor and readmissions. However, the quality of this study is limited by its quasi-experimental design.

Partial effects were described in two studies, one of which evaluated a care transitions intervention with home visits and phone follow-up during 28 days [30]. This intervention was effective in reducing readmission rate at 1 and 3 months, but not at 6 months after discharge. By contrast, when a community-based hospital discharge scheme was evaluated [41], the intervention was effective at 18 but not at 3 months after discharge.

In this group of interventions, we also found a study that described a negative effect on readmission rate [35]. This large randomized trial involved more than 850 patients and evaluated a home-based medication review, involving two home visits by a pharmacist 2 and 8 weeks after discharge. The authors observed that the intervention was associated with a significantly higher rate of hospital readmissions. They analysed the possible reasons for this fact in detail [43] and offered three possible explanations: first, a better understanding of their conditions helped the patients recognize warning signs earlier; second, better adherence may have precipitated an iatrogenic illness that had been previously avoided; and third, home visits may have added to the complexity of the care, which increased anxiety and confusion or dependence on health services. The pharmacists' characteristics did not have any influence on the results.

Discussion

The results of this report indicate that reducing the risk of hospital readmissions in the elderly is not easy to achieve and they also reflect the heterogeneity of our current understanding of this issue. Because of the complexity and variability of the interventions reviewed in this work, and of their methodologies, it was not possible to make direct comparisons between studies. Strong variability was also observed in the indicators used to measure readmissions, which can be expressed in terms of the number (or percentage) of events or the number of patients readmitted during a given period. While some studies measured the number of days from the admission to the first readmission, others counted patients according to their number of readmissions. Other differences were caused by the distinct lengths of the follow-up period and of the measurement times, which ranged from 15 days to 1 year post discharge. There were also differences in the treatment provided to the control groups, although the majority of the studies compared the intervention with 'usual care' (almost never described in detail). Hence, this care may vary according to the health care system of each country and it may include some components of geriatric management. Indeed, some authors chose to compare the intervention with geriatric care established in the hospital [15,19,23,24]. All these factors hinder the comparison of the effectiveness between the interventions.

Most of the studies included in this review did not find any influence of the intervention evaluated on readmissions (18 of 29 articles) and two of them even described a negative effect, speculating on possible reasons [15,35]. On the other hand, 10 clinical trials showed that the intervention assessed had a positive effect [14,16,25,28–31,36,37,41], although some were only partial and they depended on the length of the follow-up [16,30,41]. It is

Table 2 Characteristics and results of included studies: geriatric assessment with home follow-up

Study: 1st author, year, country, design, follow-up	Interventions	Participants: <i>n</i> , mean age, % of women (GI/GC)	Results of readmission outcomes (GI vs. GC)	Quality assessment*
Al Rashed 2002 [28] UK Quasi-experimental Follow-up: 3 months	<ul style="list-style-type: none"> GI: pharmaceutical counselling and medication discharge summaries with home visits of a pharmacist GC: usual care 	43/40 81/80.2 years ?%/?%	Patients readmitted (<i>n</i>): <ul style="list-style-type: none"> In 3 months after discharge: 3 vs. 15; $P < 0.05^{\dagger}$ 	–
Caplan 2004 [29] Australia RCT Follow-up: 1 month	<ul style="list-style-type: none"> GI: comprehensive geriatric assessment and multidisciplinary intervention (DEED II Study) GC: usual care 	370/369 82.1/82.4 years ?%/?%	Patients readmitted [<i>n</i> (%)]: <ul style="list-style-type: none"> In 1 month after discharge: 61 (16.5) vs. 82 (22.2); $P < 0.05^{\dagger}$ 	++
Coleman 2006 [30] USA RCT Follow-up: 6 months	<ul style="list-style-type: none"> GI: care transitions intervention with in-hospital visits, home visits and telephone follow-up by a transition coach GC: usual care 	379/371 76/76.4 years 48.3%/52.3%	Patients readmitted (%): <ul style="list-style-type: none"> In 1 month after discharge: 8.3 vs. 11.9; $P < 0.05^{\dagger}$ In 3 months: 16.7 vs. 22.5; $P < 0.05^{\dagger}$ In 6 months: 25.6 vs. 30.7; n.s. 	++
Courtney 2009 [31] Australia RCT Follow-up: 6 months	<ul style="list-style-type: none"> GI: nursing and physiotherapy assessment, exercise, nurse-conducted home visit, telephone follow-up GC: usual care 	58/64 78.1/79.4 years 62%/63%	Patients readmitted (%): <ul style="list-style-type: none"> In 6 months after discharge: 22 vs. 46.7; $P < 0.01^{\dagger}$ 	++
Fleming 2004 [32] UK RCT Follow-up: 12 months	<ul style="list-style-type: none"> GI: rehabilitation service provided by rehabilitation assistants GC: usual care 	80/84 83/80 years 68%/69%	Patients readmitted [<i>n</i> (%)]: <ul style="list-style-type: none"> In 3 month after discharge: 22 (28) vs. 32 (38); n.s. In 12 months: 41 (51) vs. 46 (55); n.s. 	+
Hansen 1992 [33] Denmark RCT Follow-up: 12 months	<ul style="list-style-type: none"> GI: geriatric follow-up by home visits by district nurse one day after discharge and by patient's GP 2 weeks after discharge GC: usual care 	199/205 >75 years (mean of all patients) 35%/30%	Patients with <i>x</i> readmissions in 12 months after discharge (%): <ul style="list-style-type: none"> 0 readmissions: 54 vs. 54 1 readmission: 29 vs. 26 2 readmissions: 8 vs. 14 3 readmissions: 4 vs. 4 ≥4 readmissions: 5 vs. 2 n.s. 	+
Harris 2005 [34] New Zealand RCT Follow-up: 3 months	<ul style="list-style-type: none"> GI: hospital-at-home service provided by nursing-led multidisciplinary team GC: hospital care 	143/142 80 years (mean of all patients) ?%/?%	Patients readmitted [<i>n</i> (%)]: <ul style="list-style-type: none"> 1st readmission in 1–10th day: 18 (12.6) vs. 9 (6.3); n.s. 1st readmission in 11–30th day: 12 (8.4) vs. 9 (6.3); n.s. 1st readmission in 31–90th day: 14 (9.8) vs. 15 (10.6); n.s. 	+

Holland 2005 [35] UK RCT Follow-up: 6 months	<ul style="list-style-type: none"> • GI: home-based medication review – education of patients and carers, collaboration with GPs and local pharmacists • GC: usual care 	429/426 85.4/85.5 years 61.1%/63.8%	Readmissions (<i>n</i>): <ul style="list-style-type: none"> • In 6 months after discharge: 234 vs. 178; RR = 1.30 (1.07–1.58); <i>P</i> < 0.01 (against the intervention) 	+
Martin 1994 [36] UK RCT Follow-up: 3 months	<ul style="list-style-type: none"> • GI: home treatment team – care plan prepared by nurse manager and home visits by health care assistants • GC: conventional community services 	29/25 80.4/82.9 years 83%/80%	Patients readmitted [<i>n</i> (%)]: <ul style="list-style-type: none"> • In 6 weeks: 4 (14) vs. 9 (38); <i>P</i> < 0.01[†] • In 12 weeks: 9 (31) vs. 14 (40); <i>P</i> < 0.05[†] 	++
Naylor 1999 [37] USA RCT Follow-up: 6 months	<ul style="list-style-type: none"> • GI: comprehensive discharge planning and home follow-up • GC: standard discharge planning and home care 	177/186 75.5/75.3 years 46%/54%	Readmissions (<i>n</i>): <ul style="list-style-type: none"> • In 6 months after discharge: 49 vs. 107; <i>P</i> < 0.001[†] 	++
Nazareth 2001 [38] UK RCT Follow-up: 6 months	<ul style="list-style-type: none"> • GI: pharmacy discharge plan with home visits by a community pharmacist • GC: usual medication information 	181/181 84/84 years 62%/66%	Patients readmitted [<i>n</i> (%)]: <ul style="list-style-type: none"> • In 3 months after discharge: 64 (39.0) vs. 69 (39.2); n.s. • In 6 months: 38 (27.9) vs. 43 (28.4); n.s. 	+
Nikolaus 1999 [39] Germany RCT Follow-up: 12 months	<ul style="list-style-type: none"> • GI 1: comprehensive geriatric assessment and home follow-up • GI 2: comprehensive geriatric assessment and recommendations, usual care at home • GC: usual care in hospital and at home 	181/179/185 81.4 years (mean of all patients) 73% (all patients)	Patients readmitted [<i>n</i> (%)]: <ul style="list-style-type: none"> • In 12 months after discharge: 43 (30.7) vs. 43 (30.9) vs. 45 (31.9); n.s. 	+
Runciman 1996 [40] UK RCT Follow-up: 1 month	<ul style="list-style-type: none"> • GI: health visitor follow-up within 24 hours post discharge • GC: usual care 	232/192 81 years (mean of all patients) 7%/7%	Patients readmitted [<i>n</i> (%)]: <ul style="list-style-type: none"> • In 4 weeks after discharge: 27 (11.6) vs. 18 (9.3); n.s. 	+
Townsend 1988 [41] UK RCT Follow-up: 18 months	<ul style="list-style-type: none"> • GI: community-based hospital discharge scheme – support from care attendants for practical care, help with rehabilitation and organizing social help • GC: usual care 	464/439 82/81.8 years 63%/66%	Patients readmitted [<i>n</i> (%)]: <ul style="list-style-type: none"> • In 3 months after discharge: 105 (23) vs. 102 (23); n.s. • In 18 months: 176 (52) vs. 173 (56); <i>P</i> < 0.05[†] 	–
Young 2005 [42] UK Quasi-experimental Follow-up: 12 months	<ul style="list-style-type: none"> • GI: intermediate care services – coordination of support and rehabilitation from sector-based intermediate care teams • GC: usual care 	848/800 85/83 years 67.2%/69.9%	Readmissions per patient [media (SD)]: <ul style="list-style-type: none"> • In 3 months: 0.26 (0.56) vs. 0.28 (0.66); n.s. • In 6 months: 0.44 (0.85) vs. 0.41 (0.79); n.s. • In 12 months: 0.98 (1.45) vs. 0.81 (1.12); n.s. 	–

*SIGN criteria (overall assessment): ++ All or most of the criteria have been fulfilled. + Some of the criteria have been fulfilled. – Few or no criteria fulfilled.

[†]Effectiveness in reducing hospital readmissions.

GI, group of intervention; GC, group of controls; RCT, randomized controlled trial; *n*, number; n. s., difference statistically not significant; SD, standard deviation; GP, general practitioner; OR, odds ratio; RR, relative risk.

noteworthy that seven of these 10 studies included some type of home care during the follow-up period.

This evidence suggests that interventions that incorporate geriatric management supported with home care post discharge are more likely to reduce or prevent hospital readmissions in elderly patients. These complex services require a high degree of collaboration and communication between patients, caregivers, geriatricians, general practitioners, social community services and other agents. The specific features of these interventions are patient education on specific issues, close follow-up, home monitoring, adjustment of medication and regular communication with clinical experts [44]. Therapeutic success in many instances rests more on effective patient targeting than on setting, intensity or duration of the interventions [45].

Despite the large number of studies evaluating the effectiveness of interventions to reduce hospital readmissions in the elderly, new studies of higher methodological quality using comparable approaches are necessary. Small-scale local studies may not be adequate to evaluate the outcomes of complex interventions when clinical factors and other aspects of the health care system are likely to influence the effects of the intervention. Funding bodies should be encouraged to support multicentre investigation of health service interventions using rigorous research methods [12]. It would be convenient if future research standardized the readmission outcome measure to make it possible to directly compare between studies and to perform meta-analyses. Researchers should clearly distinguish between urgent and planned readmissions, and single and multiple readmissions, as well as establishing measurement periods that would permit time-related issues to be compared.

Although we did our best to identify as many interventions as we could, there are limitations related to the methodology of systematic reviews, such as publication or language bias. It should also be noted that in this review, we focused exclusively on readmission outcomes as a measure of intervention effectiveness, although the clinical trials included in this review also evaluated other outcomes like mortality, functional outcomes, nursing home placement, institutionalization, use of community services or overall well-being. Therefore, some interventions evaluated might prove to be effective in terms of other outcomes apart from readmission.

In conclusion, although the heterogeneity of interventions, measures and methodologies impede combining the results of the different studies identified here, it appears that interventions that comprise some kind of home care follow-up are more likely to be successful in reducing readmissions. Undoubtedly, an intervention as complex as multidisciplinary geriatric management with home care follow-up is not easy to introduce into clinical practice. Nevertheless, the possible implementation of an effective intervention to reduce the risk of readmission would have important implications for health care systems, as it could considerably reduce the use of resources and consequently, health care costs.

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