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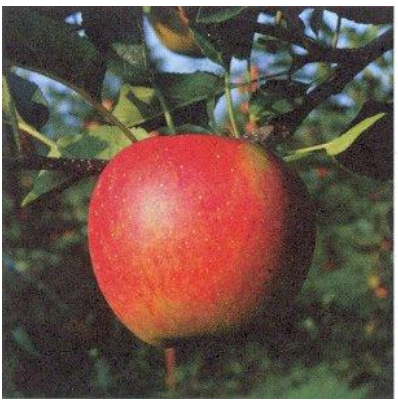
Systematic Literature Review

'Readmission to Hospital' Project

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Systematic Literature Review

'Readmissions into Hospital' Project

February 2010

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Acknowledgements

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The Commissioning Brief of this Review

East Kent Hospitals University NHS Foundation Trust commissioned a literature review on current evidence on avoiding early readmission after discharge from hospital. The review was conducted in preparation for developing an intervention or intervention programme which could be piloted in East Kent to reduce readmission rates across the three hospital sites. The review is being used in the preparation and development of a proposal for an externally funded research project to evaluate the intervention systematically and independently.

1.Introduction: Methods of the Review

1.1 Scoping the review

The review was conducted using rapid review methodology. Rapid review methodology involves an initial scoping stage to identify particular areas the review should focus upon. The initial scoping review of potential literature identifies the range and types of interventions studies and the range and types of methodologies applied. The initial scoping review identified a large number of good quality Randomised Controlled Trials available in the area and a decision was made to focus upon RCT designed studies.

1.2 Search strategy

The aim of the search strategy is to provide a comprehensive retrieval of all published research addressing the research question. As a rapid review was conducted retrieval did not involve searches of grey literature, unpublished material or scanning of reference lists.

Generic electronic search strategies were developed and tested that focused upon the research question. Details of the search strategy are provided in appendix I. The following databases were searched; Medline Ovid, Embase, CINAHL and ASSIA. A specific filter was applied to identify controlled studies.

1.3 Criteria for including studies in the review

1. Randomised controlled trials
2. Patient population 65 years or older
3. Patients discharged from inpatient facilities
4. Patients not discharged from ambulatory care, day hospitals or nursing homes
5. Interventions aimed at modification to discharge procedure
6. Interventions not surgical or pharmaceutical

1.4 Assessment of studies for inclusion

Each selected study was further assessed for methodological quality using the checklist in appendix II. Studies were excluded if they involved pseudo-randomisation or inappropriate controls or if loss to follow-up exceeded 40%.

1.5 Data extraction

The primary data extracted included population type, setting, intervention type and readmission rate at follow-up. Where possible readmission rates were standardized for comparison. A random effects model was utilized in the analysis to address for the observed heterogeneity. Sub-group analysis and sensitivity analysis was beyond the scope of a rapid

review. Review manager version 5 (Cochrane 2009) was used for the synthesis and meta-analysis.

1.6 Typology of interventions

The scoping review identified a typology of intervention types that are not mutually exclusive but provide a categorical framework for conceptualizing intervention types.

1. Discharge planning are primarily interventions that utilize comprehensive discharge planning protocols.
2. Discharge support involves the development of new and utilization of existing schemes targeted specifically at newly discharged patients.
3. Comprehensive geriatric assessment involved complex assessment of inpatients and patients recently discharged from hospitals.
4. Educational interventions involves a wide array of interventions with an educational component particularly orientated towards self-management and symptom management.

These interventions are all dealt with individually in the following sections.

2. Discharge Planning

2.1 Introduction

The review was undertaken as detailed in the introduction in section 1. Overall 267 initial studies were classified as involving discharge planning and after assessment 13 were identified as good quality randomized controlled trials as defined by the assessment criteria detailed in appendix II.

The studies retrieved all address discharge planning prior to discharge from secondary care. The studies involve a variety of populations all aged 65 years or older (table 2.1). The sample sizes of the studies ranged from relatively small to quite large (table 2.3) and this has been taken into account in the analysis. Naylor et al (1990) and Coleman et al (2004) were both described as pilot studies. The meta-analysis involves the synthesis of weighted odds ratios for all studies where the primary outcome was available. The primary outcome is the number of readmissions in a specified period. Naylor et al (1999) and Palfrey (1999) used a survival analysis to calculate time to first readmission as a primary outcome and Somers et al (2000) used a readmission rate over an 18-month period. These studies are described but not included in the meta-analysis. In order to adjust for heterogeneity between study populations, settings and interventions a random effects model has been applied to the data synthesis.

The interventions detailed in the selected studies contain a number of common elements (Table 2.2). Interventions were delivered by a single specialist, usually a specialist nurse, but in one case a specialist social worker (Evans et al 1993). The role of the specialist was to assess, co-ordinate and provide post-discharge support. They also provided educational support relating o the individual's condition and reinforced any clinical education already provided. All of the studies included post-discharge support usually in the form of a contact within the first 24-hours of discharge. Laramee et al (2003) extended telephone support contact over a 12-week period and McInnes et al (1999) co-coordinated a home visit by the patients general practitioner within 24-hours of discharge. Many of the studies involved co-ordination between secondary care and community resources. McInnes et al (1999) also explored the communication interface between primary and secondary care.

Translation of these models to the NHS would likely involve the development of either specialist discharge staff or the up skilling of existing nursing staff to assess, co-ordinate and educate patients at discharge and follow them up over a period of time after discharge.

2.2 Results

Table 2.4 contains the readmission rates for the studies included in the meta-analysis. The primary outcome measure was the number of re-admissions in a given time period for each of the intervention or treatment as usual groups. The statistic derived is the odds ratio, i.e. the odds of being re-admitted in the intervention group versus the odds of being re-admitted in the treatment as usual group. RevMan (v.5.0) was used for the meta-analysis. The overall odds ratio is derived using a random effects model with the study sample size used as a weighting variable.

Only 10 studies reported the primary outcome in a way that was accessible to synthesis or in a way that could be standardized for synthesis. Two studies reported survival curves indicating time to first re-admission and one study calculated re-admission rates over an 18 month period, far in excess of the period reported for other studies.

Figure 2.1 is a funnel plot of the studies included in the review. The funnel plot graphs the standard error of the natural logarithm of the odds ratio for each study versus the odds ratio for each study. The funnel plot is used to explore for any potential in bias in either identification or publication of studies. We conclude from this plot that the studies included are representative and generalisable to the overall population.

The meta-analysis was conducted using a random effects model to adjust for observed heterogeneity between the study populations and settings. Figure 2.2 is the individual and synthesized results of the 10 studies included in the review. Two studies (Laramee 2003 and Naylor 1994) indicate a non-significant negative effect of discharge planning (1.16; 0.71 – 1.89 and 1.11; 0.54 – 2.27). Three studies indicate a non-significant positive effect of discharge planning (Balaban 2008, Kennedy 1997 and McInnes 1999). Five studies indicate a significant positive effect of discharge planning (Coleman 2004, Coleman 2006, Evans 1993, Lim 2003 and Naylor 1994).

The overall pooled odds ratio favouring discharge planning is 0.68 (95% CI 0.58-0.79) and this is significant at the 0.01 level.

The results of this review based upon 10 high quality randomized controlled trials of discharge planning versus treatment of usual indicate that discharge planning has the potential to reduce readmission rates by approximately 20% in the older population being discharged from secondary care.

Discharge planning is loosely defined as having a named individual who takes responsibility for assessing the needs of an individual patient prior to discharge, co-coordinating community and primary sources of post-discharge services, providing and reinforcing educational information relating to patient self-management and providing short term telephone follow-up to address any ongoing concerns for the patient after discharge.

Table 2.1: Characteristics of studies included in the review

Study	Setting	Inclusions	Exclusions
Kennedy 1987	Acute teaching hospital	>75 years, Non-ITU, English speaking, admitted from home	No telephone
Naylor 1990	Urban hospital	Alert and orientated, English speaking, admitted from home	No telephone; Cognitive impairment
Naylor 1994	University hospital	CHF, angina, MI, CABG, > 70 years, admitted from home	No telephone; Cognitive impairment
Evans 1993	Veterans affairs medical centre	At risk of readmission or discharge to nursing homes	Critical illness
Naylor 1999	Hospital	>=65 years, MI, CABG, bowel surgery, orthopedic, angina, CHF, admitted from home, poor discharge outcome	Language, not alert and orientated, telephone, geographical residence

Palfrey 1999	Hospital	No specific inclusion	Cognitive impairment, short stay, receiving chemotherapy, obstetric, aged > 85 years
McInnes 1999	Hospital	Dependence in self-care, multiple service user, frequent readmissions	No specific exclusion
Somers 2000	Hospital	Aged >=65 years, two chronic conditions, one risk factor for readmission	Cognitive impairment
Laramee 2003	Hospital	Aged >= 65 years, primary or secondary heart failure, comorbid conditions	No specific exclusions
Lim 2003	University hospital	Aged >= 65 years, requiring community support after discharge	No specific exclusions
Coleman 2004	Integrated health service	Community dwelling, aged >=65 years	No specific exclusions
Coleman 2006	Integrated health service	Community dwelling, aged >=65 years	No specific exclusions
Balaban 2008	University Hospital	Emergency admission, community resident	Elective admission

Table 2.2: Description of study interventions

Study	Intervention model of care
Kennedy 1987	Comprehensive discharge protocol implemented by a nurse specialist compared with treatment as usual
Naylor 1990	Comprehensive discharge protocol implemented by specialist nurse compared with treatment as usual
Naylor 1994	Comprehensive discharge protocol implemented by specialist nurse compared with treatment as usual
Evans 1993	Selection of suitable patients for early discharge planning
Naylor 1999	Comprehensive discharge protocol implemented by specialist nurse with post-discharge follow-up compared with treatment as usual
Palfrey 1999	Discharge questionnaires to identify early identification of need
McInnes 1999	General practitioner pre-discharge visits versus treatment as usual
Somers 2000	Assessment of healthcare needs, identification of community support, 6 week telephone follow-up versus treatment as usual
Laramee 2003	Discharge planning with patient and carers, needs assessment and telephone follow-up for 12 weeks versus treatment as usual
Lim 2003	Specialist nurse needs assessment and post-discharge care co-ordination versus treatment as usual
Coleman 2004	Nurse led education and information on community versus treatment as usual
Coleman 2006	Nurse led education and information on community versus treatment as usual
Balaban 2008	Nurse led education and communication planning between secondary and primary care services versus treatment as usual

Table 2.3: Study sample sizes

Study	Intervention	Control
Kennedy 1987	39	41
Naylor 1990	20	20
Naylor 1994	140	136
Evans 1993	177	186
Naylor 1999	417	418
Palfrey 1999	841	758
McInnes 1999	205	159
Somers 2000	280	263
Laramee 2003	141	146
Lim 2003	311	287
Coleman 2004	158	1235
Coleman 2006	379	371
Balaban 2008	47	49

Table 2.4: Readmission rates

Study	Measured	Intervention	Control
Kennedy 1987	60 days	29	35
Naylor 1990	90 days	3	12
Naylor 1994	90 days	18	16
Evans 1993	90 days	100	146
Naylor 1999	NA		
Palfrey 1999	NA		
McInnes 1999	180 days	61	51
Somers 2000	NA		
Laramee 2003	90 days	49	46
Lim 2003	180 days	124	143
Coleman 2004	180 days	36	395
Coleman 2006	90 days	63	83
Balaban 2008	30 days	4	4

Figure 2.1: Funnel plot for discharge planning synthesis

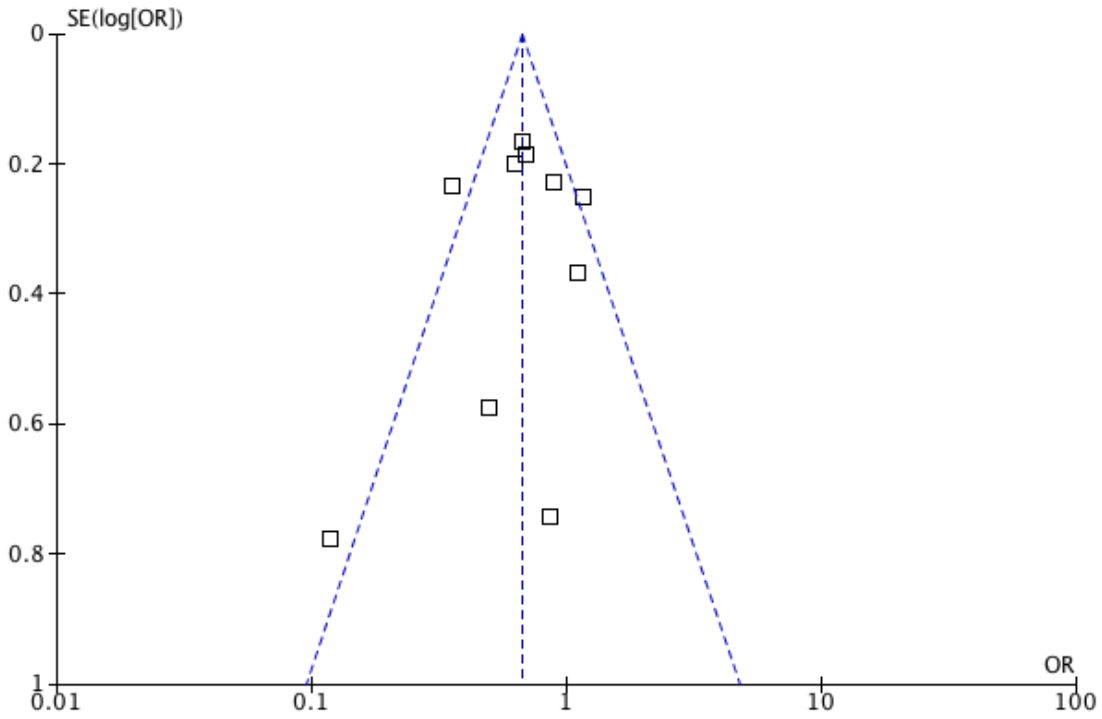
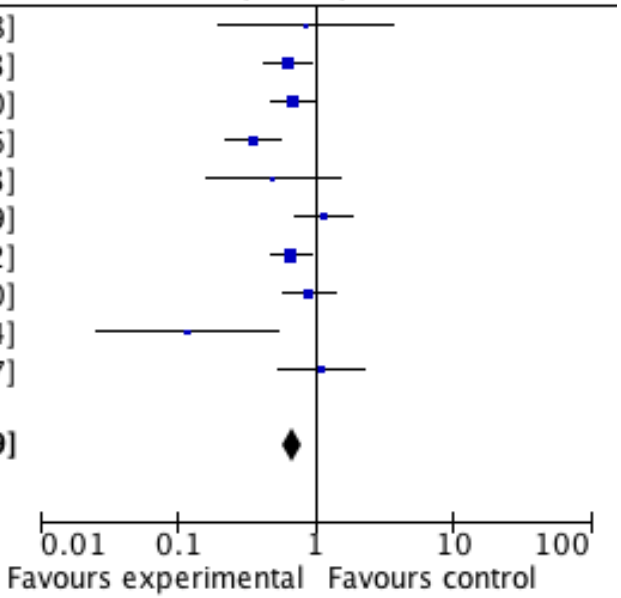


Figure 2.2: Meta-analysis and forest plot for the 10 studies included comparing discharge planning versus treatment as usual

Study or Subgroup	Intervention Events	Intervention Total	Control Events	Control Total	Weight	Odds Ratio M-H, Fixed, 95% CI
Balaban 2008	4	47	4	41	1.0%	0.86 [0.20, 3.68]
Coleman 2004	36	158	395	1235	17.4%	0.63 [0.42, 0.93]
Coleman 2006	63	379	83	371	17.6%	0.69 [0.48, 1.00]
Evans 1993	100	177	146	186	15.6%	0.36 [0.22, 0.56]
Kennedy 1997	29	39	35	41	2.2%	0.50 [0.16, 1.53]
Laramee 2003	49	141	46	146	7.4%	1.16 [0.71, 1.89]
Lim 2003	124	311	143	287	22.5%	0.67 [0.48, 0.92]
McInnes 1999	61	205	51	159	10.2%	0.90 [0.57, 1.40]
Naylor 1990	3	20	12	20	2.6%	0.12 [0.03, 0.54]
Naylor 1994	18	140	16	136	3.6%	1.11 [0.54, 2.27]
Total (95% CI)		**1617**		**2622**	**100.0%**	**0.68 [0.58, 0.79]**
Total events	487		931			

Heterogeneity: $Chi^2 = 21.09$, df = 9 (P = 0.01); $I^2 = 57\%$

Test for overall effect: Z = 4.98 (P < 0.00001)



3. Multi-disciplinary Comprehensive Geriatric Assessment

3.1 Introduction

The review was undertaken as detailed in the introduction. Overall 134 studies or potential studies were identified and after assessment 17 were considered of suitable quality to be included in the meta-analysis.

All of the studies address the use of comprehensive geriatric assessment (CGA) (table 3.1). CGA is distinctive in that it is delivered by a multi-disciplinary team with the exception of Siu (1996) where the intervention was provided by a single practitioner, a geriatric nurse specialist, with support from a wider multi-disciplinary team. The majority of studies were conducted overseas particularly in the US. The majority of studies involve patients aged 70 years or more in general or psychiatric inpatient services. The synthesis of data includes outcomes for 12 of the 17 studies where readmission rates were reported. The time period of outcome measurement ranges from 30 days to 12 months. To adjust for heterogeneity in the synthesized studies a random effects model has been applied.

The majority of comprehensive geriatric assessment interventions occurred as inpatients and used specialist multi-disciplinary staff including consultants, doctors, specialist nurses, physiotherapists, occupational therapists, dieticians and social workers (table 3.2). It is worth bearing in mind that the intervention involves not only comprehensive clinical and social needs assessment and co-ordination of care but also involves an assessment of suitability for discharge and as such potential issues of generalisability arise. Study sample sizes are detailed in Table 3.3.

The lack of UK based studies makes generalising the findings of these interventions to an NHS setting problematic, and they may be overly resource intensive for NHS settings in that they depend upon complex multi-disciplinary teams. Further an emphasis of the studies is

upon suitability for discharge rather than managing the discharge process and the interface between secondary care, primary care and social services.

3.2 Results

Table 3.4 contains the re-admission rates for studies included in the analysis. The primary outcome measure was number of re-admissions in a given time-period and this ranged from 30 days to 12 months. The derived statistic is the odds ratio, the odds of being re-admitted in the intervention group versus the odds of being re-admitted in the treatment as usual group. Revman 5.0 was used for the meta-analysis and a random effects model fitted to adjust for observed heterogeneity in terms of populations, environment and interventions.

Figure 3.1 is a funnel plot if the reported studies and indicates no concerns regarding potential sources of publication or extraction bias. Figure 3.2 reports the results of the individual studies including the weighting factor imposed and the overall results of the meta-analysis. Five of the 12 studies synthesized indicated an overall positive effect of comprehensive geriatric assessment (Crotty 2008, Garasen 2007, Hansen 1995, Slaets 1997 & Thomas 1993). None of the studies indicated an overall negative effect and the remainder of the studies indicated equivocal effects between comprehensive geriatric assessment and treatment as usual. The overall effect significantly favours comprehensive geriatric assessment with an odds ratio of 0.75 (95% CI 0.64 – 0.89). The results based upon 12 randomised controlled trials indicate that comprehensive geriatric assessment has the potential to reduce the re-admission rate by something of the order of 10%.

Table 3.1: Characteristics of studies included in the review

Study	Setting	Inclusions	Exclusions
Rubenstein 1984	Hospital geriatric assessment unit	Acute admission, aged >=65 years, LOS > 7 days	Cognitive impairment, terminal illness, no support network
Hogan 1987	Hospital geriatric consultation team	Impaired mobility or fall or confusion or admitted from nursing home or previous admission in last 3 months	ITU, acute cerebrovascular
Saltz 1988	Inpatient geriatric consultation team	Aged >= 75 years	ITU, Est LOS < 48hrs
Fretwell 1990	Hospital geriatric assessment unit	Aged >=75 years	ITU, CCU
Harris 1991	Hospital geriatric assessment unit	Non-elective, Age >=70 years	Readmission, Nursing home resident
Rubin 1992	Hospital home assessment unit	Aged >=70 years	Terminally ill, cognitive impairment
Winograd 1993	Inpatient geriatric consultation team	Aged >=65 years, Est. LOS > 96 hrs	Terminally ill, cognitive impairment
Thomas 1993	Inpatient geriatric consultation team	Aged >=70 years	ITU, CCU, terminally ill
White 1994	Nurse led geriatric assessment service	Aged >=65 years	Terminally ill
Fishman 1994	Hospital based transition assessment service	Target conditions	None stated
Naughton 1994	Hospital geriatric assessment unit	Aged >= 70 years	Surgical transfer
Hansen 1995	Community based geriatric assessment team	None stated	None stated

Landefeld 1995	Hospital nurse-led geriatric assessment team	Aged >= 70 years	ITU, CCU, Oncology
Siu (1996)	Hospital and community geriatric assessment team	Reversible geriatric medical problems	LOS < 48 hrs, nursing home
Slaets 1997	Hospital joint psychiatric geriatric assessment team	Aged >= 70 years	None stated
Garasen 2007	Community geriatric assessment team	Acute admission, aged >= 60 years	None stated
Crotty 2008	Community geriatric assessment team	Aged >= 65 years	ITU, CCU

Table 3.2: Description of study interventions

Study	Intervention model of care
Rubenstein 1984	Inpatient and outpatient team intervention involving physicians, nurses and social workers
Hogan 1987	Inpatient team intervention; Dr, nurse, physiotherapist and discharge planning
Saltz 1988	Inpatient and phone based team intervention; Dr, nurse and social worker
Fretwell 1990	Inpatient team intervention; Dr, physiotherapist, pharmacist and dietician
Harris 1991	Inpatient team intervention; Dr, nurse, physiotherapist, occupational therapist and social worker
Rubin 1992	Outpatient based team intervention; Dr, nurse and social worker
Winograd 1993	Inpatient based team intervention; Dr, nurse, social worker and others as required
Thomas 1993	Team based intervention; Dr, nurse, physiotherapist, social worker, pharmacist and dietician
White 1994	Inpatient team intervention
Fishman 1994	Inpatient team intervention; nurse and social worker
Naughton 1994	Inpatient team; nurse and social worker
Hansen 1995	Home based team intervention; Dr, nurse and social worker
Landefeld 1995	Inpatient team intervention; Dr, nurse, physiotherapist, occupational therapist, social worker and dietician
Siu (1996)	Individual nurse intervention based within supporting team. Inpatient and home based
Slaets 1997	Inpatient team intervention; Dr, nurse and physiotherapist
Garasen 2007	Community based team intervention; Dr, nurse and social worker

Crotty 2008	Community hospital based intervention; nurse and physiotherapist

Table 3.3: Study sample sizes

Study	Intervention	Control
Rubenstein 1984	63	60
Hogan 1987	57	56
Saltz 1988	93	92
Fretwell 1990	221	215
Harris 1991	97	170
Rubin 1992	100	100
Winograd 1993	99	98
Thomas 1993	62	58
White 1994	20	20
Fishman 1994	98	147
Naughton 1994	51	43
Hansen 1995	96	97
Landefeld 1995	327	324
Siu (1996)	178	176
Slaets 1997	140	97
Garasen 2007	72	70
Crotty 2008	173	181

Table 3.4: Readmission rates

Study	Measured	Intervention	Control
Rubenstein 1984	12 months	22	30
Hogan 1987	12 months	9	6
Saltz 1988	6 months	36	26
Fretwell 1990	NA		
Harris 1991	NA		
Rubin 1992	NA		
Winograd 1993	12 months	33	31
Thomas 1993	6 months	21	35
White 1994	30 days	4	6
Fishman 1994	NA		
Naughton 1994	NA		
Hansen 1995	6 months	42	62
Landefeld 1995	90 days	104	109
Siu (1996)	60 days	43	37
Slaets 1997	6 months	24	29
Garasen 2007	6 months	14	29
Crotty 2008	3 months	24	40

Figure 3.1: Funnel plot for comprehensive geriatric assessment synthesis

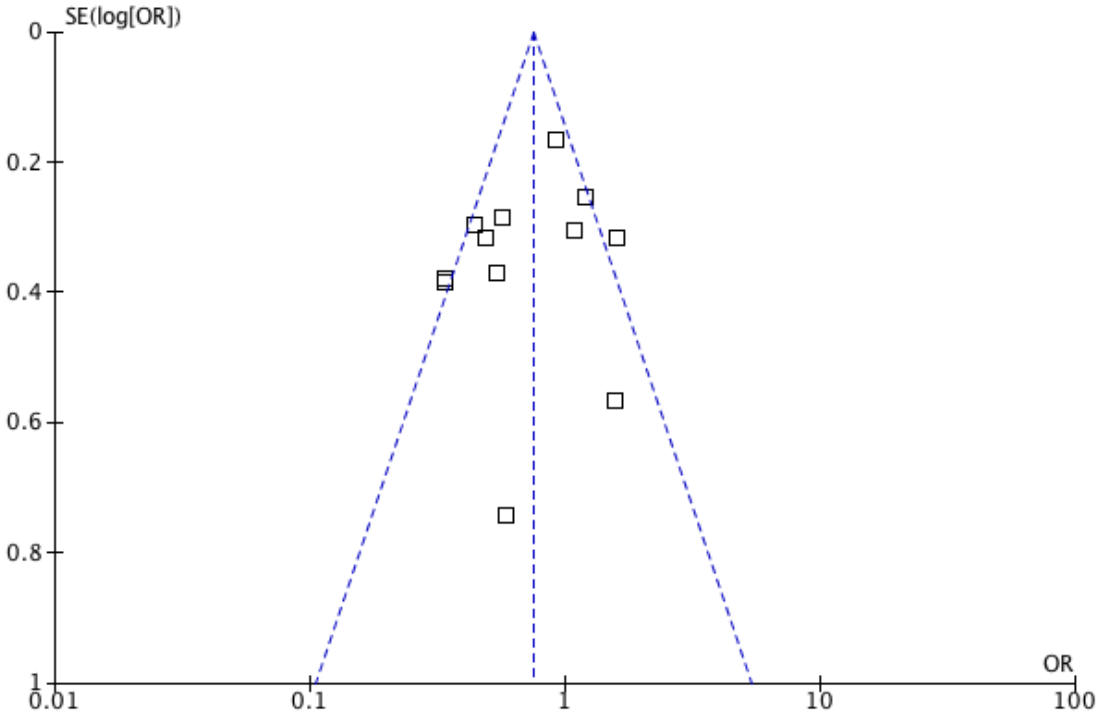
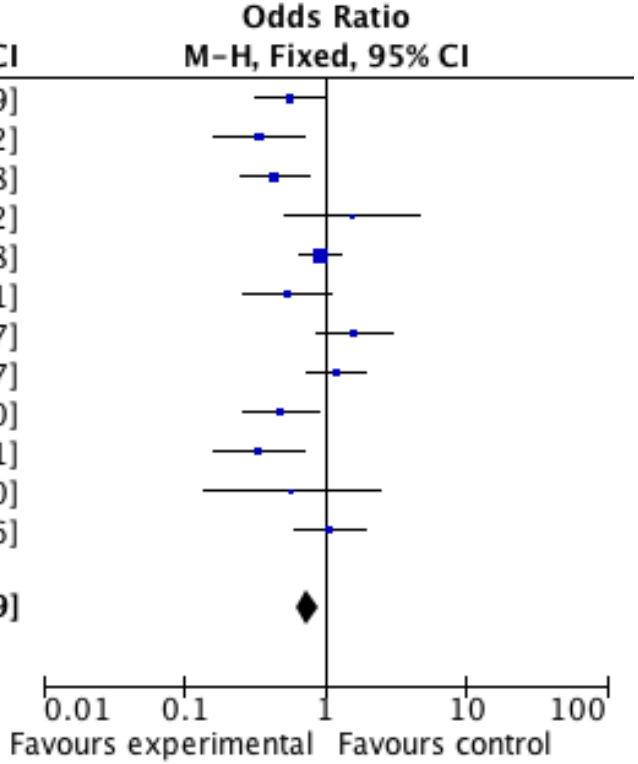


Figure 3.2: Meta-analysis and forest plot for the 12 studies comparing CGA with treatment as usual

Study or Subgroup	Intervention Events	Intervention Total	Control Events	Control Total	Weight	Odds Ratio M-H, Fixed, 95% CI
Crotty 2008	24	173	40	181	10.7%	0.57 [0.33, 0.99]
Garasen 2007	14	72	29	70	7.5%	0.34 [0.16, 0.72]
Hansen 1995	42	96	62	97	11.1%	0.44 [0.25, 0.78]
Hogan 1987	9	57	6	56	1.6%	1.56 [0.52, 4.72]
Landefield 1995	104	327	109	324	23.8%	0.92 [0.66, 1.28]
Rubenstein 1984	22	63	30	60	6.4%	0.54 [0.26, 1.11]
Saltz 1988	36	93	26	92	5.1%	1.60 [0.87, 2.97]
Siu 1996	43	178	37	176	9.0%	1.20 [0.73, 1.97]
Slaets 1997	24	140	29	97	9.0%	0.49 [0.26, 0.90]
Thomas 1993	21	62	35	58	7.6%	0.34 [0.16, 0.71]
White 1994	4	20	6	20	1.5%	0.58 [0.14, 2.50]
Winograd 1993	33	99	31	98	6.6%	1.08 [0.60, 1.96]
Total (95% CI)		**1380**		**1329**	**100.0%**	**0.75 [0.64, 0.89]**
Total events	376		440			

Heterogeneity: $Chi^2 = 29.58$, df = 11 (P = 0.002); $I^2 = 63\%$

Test for overall effect: Z = 3.31 (P = 0.0009)



4. Discharge Support Arrangements

4.1 Introduction

Discharge support arrangements include interventions designed to support older people after discharge from hospital. Discharge support arrangements encompass a broad range of interventions from a simple telephone call post-discharge to multi-disciplinary interventions including elements of rehabilitation. The initial scoping review identified 277 studies of which 15 have been extracted and included within the synthesis.

The studies all involve discharge of older people, aged 65 or more years, and the sample sizes vary from quite small to very large. A full description of interventions and study inclusion and exclusion criteria is detailed in tables 4.1 and 4.2 and study sample sizes are detailed in table 4.3. Because of the variety of setting, populations and interventions a random effects model has been applied to the resulting meta-analysis.

Discharge support arrangements encompass a broad array of intervention types and intensities. They include elements of rehabilitative support in the patients home provided by secondary and primary care staff, supervision and co-ordination of secondary care discharge by primary care staff who take responsibility for post-discharge clinical management and a variety of forms of surveillance including visits from health professionals, visits from other professionals such as social services and telephone contact. The intervention is usually provided by a nurse or assistant. Disease specific rehabilitation programmes, for stroke or cardiac problems, are only included in the review if the intervention is generalisable over and above the specialist nature of the condition.

4.2 Results

Table 4.4 contains re-admission rates for the 10 studies included in the meta-analysis. The primary outcome measure was the number of re-admissions over a specified period and this

ranged from 30 days to 12 months. The derived statistic is the odds ratio, with study sample size used as a weighting variable. A random effect model has been applied.

Figure 4.1 is a funnel plot of the synthesized studies and indicates no evidence of potential bias in publication or retrieval. Figure 4.2 is the individual and overall meta-analysis for the 10 included studies. Only one study (Beckie 1989) indicated a significant positive effect of the intervention and this study was one of the smallest sample sizes. One study (Weinberger 1996) indicated an significant negative effect favouring the treatment as usual condition. The remaining 8 studies were equivocal. The overall meta-analysis indicated an equivocal effect with an odds ratio of 1.07 (95% CI 0.92 – 1.23).

This result would tend to suggest that discharge support arrangements as conceptualised within this review are not effective in reducing re-admission rates in this population. It is worth noting that home-based rehabilitation, one of the core elements of discharge support arrangements, are effective within certain disease specific areas most notable cardiac and stroke. The application of these interventions to a more general population probably dilutes the observed effectiveness.

Table 4.1: Characteristics of studies included in the review

Study	Setting	Inclusions	Exclusions
Beckie 1989	Teaching hospital	Uncomplicated admission	No telephone, language
Townsend 1988	Hospital and community	Aged >=75 years, discharged home	None stated
Smith 1988	Hospital and home	Discharge home	Discharge institution
Mor 1983	Rehabilitation and home	Unclear	None stated
Wong 1990	Hospital orthopaedics	Uncomplicated admission	Cognitive impairment, severe comorbidity
Weinberger 1996	Hospital	General medical patients	Cognitive impairment, language, nursing home resident

Donald 1995	Hospital	Discharged home, carers	None stated
Melin 1995	Hospital and community	Clinically ready for discharge	Cognitive impairment, nursing home resident
Martin 1994	Hospital	At risk of readmission	Require intensive assistance
Fitzgerald 1994	Hospital and primary care	Age >= 65 years, telephone	< 60 days to live
Gladman 1993	Hospital	WHO criteria	Discharged to nursing home. Admission < 7 days
Williams 1992	Community	Aged > 75 years, discharged home	None stated
Dunn 1994	Hospital and home	All discharges	None stated
Richards 1998	Hospital	Available carer	Discharged to nursing home, admission > 1 day and < 28 days
Braun 2009	Hospital	Routine discharge	Dementia, discharge to nursing home

Table 4.2: Description of study interventions

Study	Intervention model of care
Beckie 1989	Individual phone post-discharge follow-up
Townsend 1988	Individual home post-discharge follow-up
Smith 1988	Individual phone post-discharge follow-up
Mor 1983	Individual home post-discharge follow-up
Wong 1990	Individual inpatient pre-discharge and home post-discharge follow-up
Weinberger 1996	Team phone and outpatient post-discharge follow-up
Donald 1995	Team home post-discharge follow-up
Melin 1995	Team home post-discharge follow-up
Martin 1994	Individual home post-discharge follow-up
Fitzgerald 1994	Individual phone and outpatient post-discharge follow-up
Gladman 1993	Team home post-discharge follow-up
Williams 1992	Individual home post-discharge follow-up
Dunn 1994	Individual home post-discharge follow-up
Richards 1998	Team home post-discharge follow-up
Braun 2009	Individual phone post-discharge follow-up

Table 4.3: Study sample sizes

Study	Intervention	Control
Beckie 1989	37	37
Townsend 1988	464	439
Smith 1988	499	502
Mor 1983	102	40
Wong 1990	98	96
Weinberger 1996	695	701
Donald 1995	30	30
Melin 1995	150	99
Martin 1994	29	25
Fitzgerald 1994	333	335
Gladman 1993	165	162
Williams 1992	231	239
Dunn 1994	102	102
Richards 1998	160	81
Braun 2009	200	200

Table 4.4: Readmission rates

Study	Measured	Intervention	Control
Beckie 1989	45 days	2	9
Townsend 1988	90 days	102	102
Smith 1988	12 months	58	58
Mor 1983	NA		
Wong 1990	NA		
Weinberger 1996	6 months	343	310
Donald 1995	6 months	9	6
Melin 1995	6 months	51	32
Martin 1994	45 days	4	9
Fitzgerald 1994	12 months	31	32
Gladman 1993	NA		
Williams 1992	NA		
Dunn 1994	6 months	49	51
Richards 1998	NA		
Braun 2009	30 days	12	11

Figure 4.1: Funnel plot of studies included in the discharge support meta-analysis

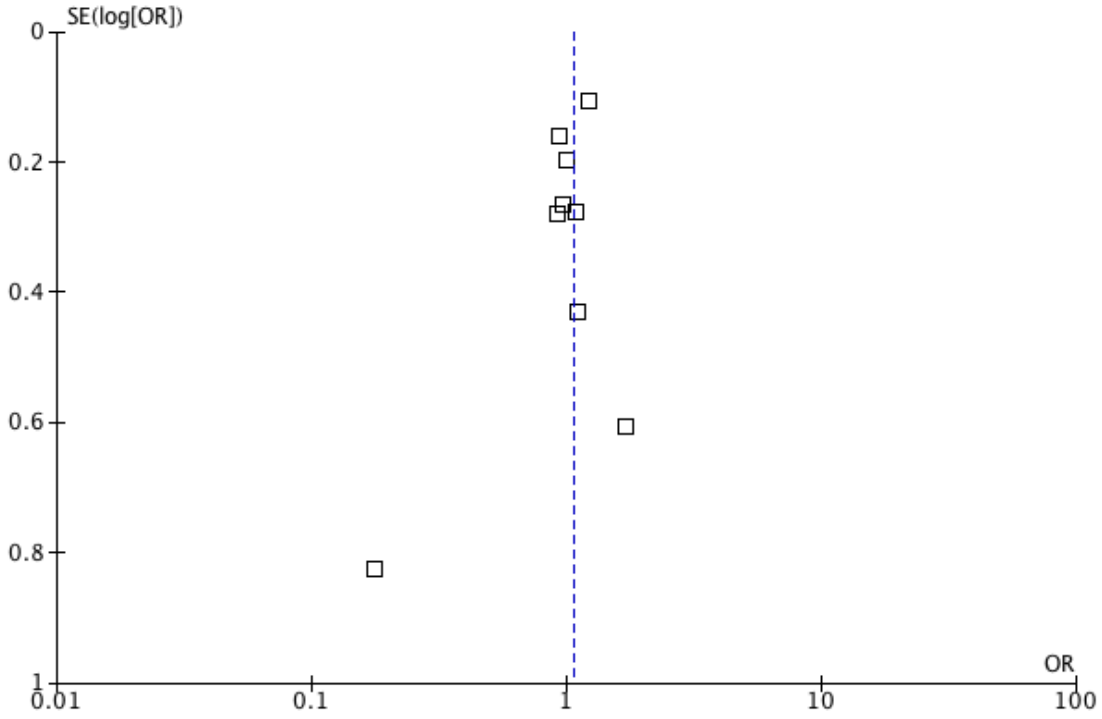
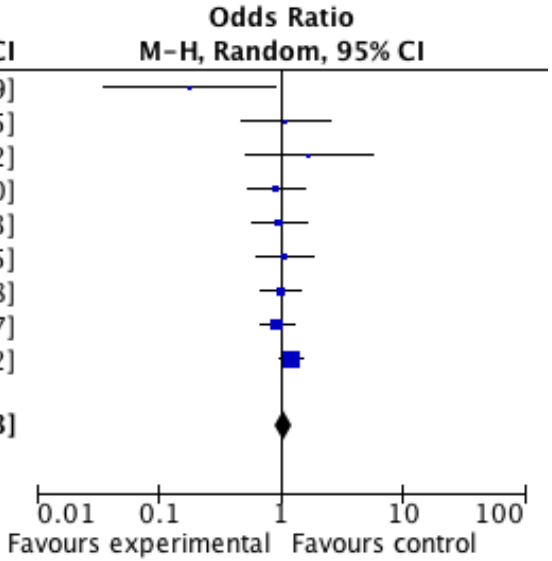


Figure 4.2 Individual and meta-analysis of the 10 studies included in the DPA review

Study or Subgroup	Intervention Events	Intervention Total	Control Events	Control Total	Weight	Odds Ratio M-H, Random, 95% CI
Beckie 1989	2	37	9	37	0.8%	0.18 [0.04, 0.89]
Braun 2009	12	200	11	200	2.9%	1.10 [0.47, 2.55]
Donald 1995	9	30	6	30	1.5%	1.71 [0.52, 5.62]
Dunn 1994	49	102	51	102	6.8%	0.92 [0.53, 1.60]
Fitzgerald 1994	31	333	32	335	7.6%	0.97 [0.58, 1.63]
Melin 1995	51	150	32	99	7.0%	1.08 [0.63, 1.85]
Smith 1988	58	499	58	502	13.3%	1.01 [0.68, 1.48]
Townsend 1988	102	464	102	439	19.9%	0.93 [0.68, 1.27]
Weinberger 1996	343	695	310	701	40.2%	1.23 [1.00, 1.52]
Total (95% CI)		**2510**		**2445**	**100.0%**	**1.07 [0.92, 1.23]**
Total events	657		611			

Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 8.31$, df = 8 (P = 0.40); $I^2 = 4\%$

Test for overall effect: Z = 0.87 (P = 0.39)



5. Educational Interventions

5.1 Introduction

The review was undertaken as detailed in the introduction. Overall 198 potential studies were identified in the scoping review. After methodological assessment 19 studies were considered for inclusion in the synthesis.

The studies all address educational interventions to reduce readmission rates in people aged 65 years or more discharged from secondary care. Educational interventions are broadly defined as interventions that are orientated towards empowering patients to self-manage aspects of their own clinical care post-discharge. These interventions include proactive methods of providing education through the provision of information, either written or verbal, or through providing information regarding appropriate sources of help and information in the community after discharge from secondary care. A particular focus in this review includes the extended role of pharmacists in providing guidance, support and medication review and the potential effectiveness of this approach in reducing re-admissions.

Table 5.1 and table 5.2 contain description of the populations and interventions of studies included in the review. A total of 19 studies were considered of appropriate scientific value to be included in the review. Of these, 12 included re-admission rates in a form suitable for synthesis. Five studies focused particularly upon pharmacist delivered interventions and these are analysed within the main review and as a sub-group of the main review. Study sample sizes are detailed in table 5.3.

5.2 Results

Table 5.4 highlights re-admission rates of the 12 studies included in the review. The primary outcome measure was re-admissions within a specified time period and this varied between studies from 45 days to 12 months. The statistic derived is the odds ratio, the odds of re-admission in the intervention group compared with the odds of re-admission in the treatment as usual group. Meta-analysis was undertaken using Revman v5.0 and a random

effects model fitted to adjust for the heterogeneity observed in populations, settings and interventions. Figure 5.1 is a funnel plot of the studies and indicates no reason to be concerned regarding publication or retrieval bias. Figures 5.2 and 5.3 provide individual and meta-analytical results and forest plots for the overall review and the pharmacist sub-group review.

In the initial analysis 12 studies were synthesized. Of these, four reported a significant positive effect of intervention over control (Beckie 1989, Koelling 2005, Sinclair 2005 & Stewart 1998). One study reported a significant negative effect of the intervention (Holland 2005). The remaining studies were equivocal in terms of effect. The overall meta-analysis provided an estimate of the odds ratio of 0.73 (95% CI 0.54 – 0.99) significantly favouring the intervention.

A sub-group analysis of five studies explored educational intervention delivered in the main by pharmacists, both community and secondary care pharmacists, and including medication review as one aspect of the intervention. One study indicated a significant positive effect of the intervention (Stewart 1998) and one study indicated a significant negative effect of the intervention (Holland 2005). Three further studies were equivocal regarding effects. The overall meta-analysis provided no evidence that the intervention is any better or any worse than treatment as usual with an odds ratio of 0.88 (95% CI 0.54 – 0.99).

Table 5.1: Characteristics of studies included in the review

Study	Setting	Inclusions	Exclusions
Beckie 1989	Teaching hospital	Uncomplicated admission	Language, cognitive impairment, no telephone
Wong 1990	General hospital	Uncomplicated admission	Cognitive impairment, severe comorbidity
Pereles 1996	Geriatric inpatient unit	MMSE score > 19, discharge home	None stated
Williford 1995	Hospital	Discharged home	Dementia

Rich 1995	Teaching hospital	Aged >= 70 years, risk of readmission	Dementia, psychiatric comorbidity, discharge to nursing home
Lowes 1995	Hospital	Consecutive admissions, responsibility for medications	Discharge to nursing home, terminal illness
Gillis 1993	Hospital	Speak English, access to telephone	Severe comorbidity
Rich 1993	Teaching hospital	Aged >= 70 years	Low risk of readmission
Lipton 1994	Community hospital	Aged >= 65 years, access to telephone	Discharge to nursing home
Stewart 1998	Hospital	Discharged home, taking medication for a chronic condition	Terminal illness
Cline 1998	Teaching hospital	Target conditions	Alcohol or drug abuse, psychiatric comorbidity
McCorkle 2000	Hospital	Aged >= 60 years, chronic admission	Language, severe comorbidity
Coleman 2006	Community	Aged >= 65 years	Cognitive impairment, severe comorbidity
Blue 2001	Teaching hospital	Aged >= 60 years, acute admission	None stated
Jaarsma 1999	University hospital	Acute admission	Terminal illness
Koelling 2005	Hospital	Aged >= 60 years, acute admission	None stated
Sinclair 2005	Hospital	Aged >= 65 years, discharged to home	None stated
Holland 2005	Community pharmacy	Aged > 79 years, emergency admission, discharged home with 2 or more medications	Dialysis treatment
Gillespie 2009	Hospital pharmacy	Aged >= 79 years, acute admission	None stated

Table 5.2: Description of study interventions

Study	Intervention model of care
Beckie 1989	Post-discharge educational telephone support
Wong 1990	Inpatient education with written materials and community nurse support post-discharge versus treatment as usual
Pereles 1996	Self-medication educational support versus treatment as usual
Williford 1995	Pharmacist counselling versus no counselling
Rich 1995	Multidisciplinary educational programme including medication reviews versus treatment as usual
Lowes 1995	Self-medication education versus usual care
Gillis 1993	Inpatient psycho education and post-discharge telephone support versus usual care
Rich 1993	Nurse led inpatient education and medication review, post-discharge follow-up versus usual care
Lipton 1994	Pharmacy led medication review as inpatient followed telephone medication consultation 1w, 4w, 1m and 3m post-discharge versus usual care
Stewart 1998	Home based intervention by nurse including pharmacist led medication review versus usual care
Cline 1998	Inpatient nurse led education and written materials versus usual care
McCorkle 2000	Home based counselling and education versus usual care
Coleman 2006	Education and patient empowerment versus usual care
Blue 2001	Home based post-discharge educational support versus usual care
Jaarsma 1999	Home based educational self-management versus usual care
Koelling 2005	Inpatient educational session with specialist nurse versus treatment as usual

Sinclair 2005	Home based education, compliance advice by trained nurse versus treatment as usual
Holland 2005	Home based medication review versus treatment as usual
Gillespie 2009	Inpatient and pre-discharge medication review by hospital pharmacist versus treatment as usual

Table 5.3: Study sample sizes

Study	Intervention	Control
Beckie 1989	37	37
Wong 1990	50	48
Pereles 1996	51	56
Williford 1995	36	35
Rich 1995	142	140
Lowes 1995	45	46
Gillis 1993	75	81
Rich 1993	63	35
Lipton 1994	350	356
Stewart 1998	381	381
Cline 1998	80	110
McCorkle 2000	190	185
Coleman 2006	379	371
Blue 2001	84	81
Jaarsma 1999	84	95
Koelling 2005	107	116
Sinclair 2005	163	161
Holland 2005	437	436

Gillespie 2009	199	201

Table 5.4: Readmission rates

Study	Measured	Intervention	Control
Beckie 1989	45 days	2	9
Wong 1990	NA	NA	NA
Pereles 1996	NA	NA	NA
Williford 1995	NA	NA	NA
Rich 1995	90 days	18	28
Lowes 1995	NA	NA	NA
Gillis 1993	NA	NA	NA
Rich 1993	90 days	20	14
Lipton 1994	NA	NA	NA
Stewart 1998	90 days	154	197
Cline 1998	12 months	22	43
McCorkle 2000	6 months	28	18
Coleman 2006	6 months	26	31
Blue 2001	12 months	125	180
Jaarsma 1999	9 months	31	47
Koelling 2005	6 months	16	32
Sinclair 2005	100 days	35	51
Holland 2005	6 months	234	178
Gillespie 2009	12 months	227	213

Figure 5.1 Funnel plot for studies involved in the educational interventions review

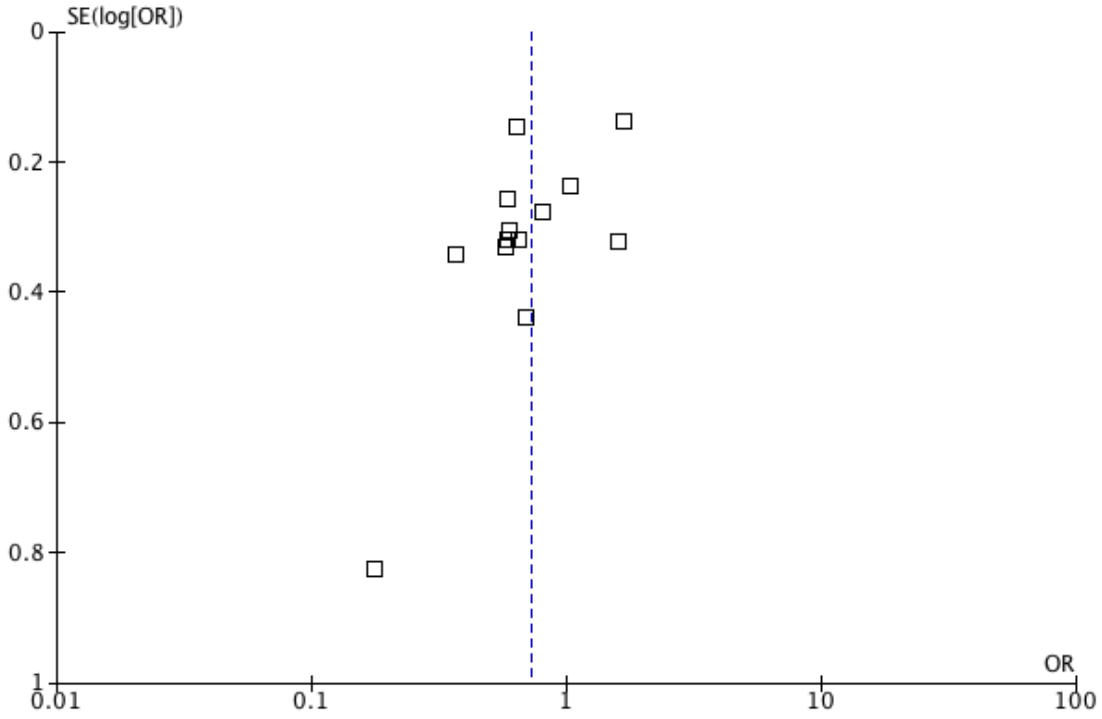


Figure 5.2: Forest plot of individual and overall meta-analysis of studies included in the educational interventions review

Study or Subgroup	Intervention Events	Intervention Total	Control Events	Control Total	Weight	Odds Ratio M-H, Random, 95% CI
Beckie 1989	2	37	9	37	2.7%	0.18 [0.04, 0.89]
Blue 2001	45	81	56	85	7.6%	0.65 [0.35, 1.21]
Cline 1998	22	80	43	110	7.6%	0.59 [0.32, 1.10]
Coleman 2006	26	379	31	371	8.3%	0.81 [0.47, 1.39]
Gillespie 2009	47	199	46	201	8.9%	1.04 [0.66, 1.66]
Holland 2005	234	437	178	436	10.3%	1.67 [1.28, 2.18]
Jaarsma 1999	31	84	47	95	7.8%	0.60 [0.33, 1.09]
Koelling 2005	16	117	32	106	7.2%	0.37 [0.19, 0.72]
McCorkle 2000	28	190	18	185	7.5%	1.60 [0.85, 3.01]
Rich 1993	20	63	14	35	5.9%	0.70 [0.30, 1.65]
Rich 1995	18	142	28	140	7.4%	0.58 [0.30, 1.11]
Sinclair 2005	35	163	51	161	8.6%	0.59 [0.36, 0.97]
Stewart 1998	154	381	197	381	10.2%	0.63 [0.48, 0.84]
Total (95% CI)		**2353**		**2343**	**100.0%**	**0.73 [0.54, 0.99]**
Total events	678		750			

Heterogeneity: $Tau^2 = 0.21$; $Chi^2 = 49.75$, df = 12 ($P < 0.00001$); $I^2 = 76\%$

Test for overall effect: Z = 2.02 (P = 0.04)

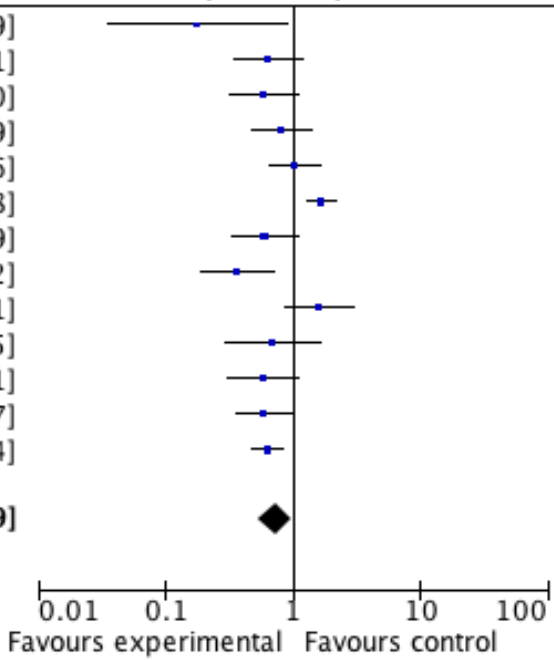
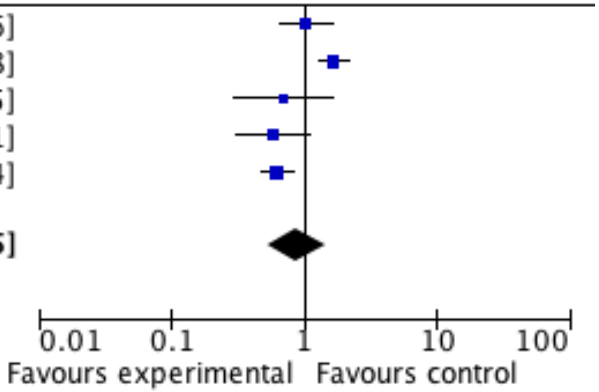


Figure 5.3: Forest plot of individual and overall meta-analysis of studies included in the pharmacist sub-group review

Study or Subgroup	Experimental Events	Experimental Total	Control Events	Control Total	Weight	Odds Ratio M-H, Random, 95% CI
Gillespie 2009	47	199	46	201	20.8%	1.04 [0.66, 1.66]
Holland 2005	234	437	178	436	23.6%	1.67 [1.28, 2.18]
Rich 1993	20	63	14	35	14.4%	0.70 [0.30, 1.65]
Rich 1995	18	142	28	140	17.8%	0.58 [0.30, 1.11]
Stewart 1998	154	381	197	381	23.4%	0.63 [0.48, 0.84]
Total (95% CI)		**1222**		**1193**	**100.0%**	**0.88 [0.54, 1.45]**
Total events	473		463			

Heterogeneity: $Tau^2 = 0.26$; $Chi^2 = 27.25$, df = 4 ($P < 0.0001$); $I^2 = 85\%$

Test for overall effect: Z = 0.49 (P = 0.62)



6. Recommendations for Potential Research

For this review 860 studies were extracted (mainly from the US with a limited number available from the UK). These studies were evaluated according to effect size, quality of design and whether it was a Randomised Controlled Trial. A scoping review grouped interventions identified within these studies into four fields as described in this report: Discharge planning, multi-disciplinary geriatric assessment, discharge support management and educational interventions. A limited number of the studies extracted were then suitable to be combined for the meta-analysis outlined in this systematic review.

The findings of the systematic review of these four fields suggests that a recommended strategy for development of an intervention for potential research on reducing readmission rates in East Kent Hospitals University NHS Foundation Trust would be to develop a factorial intervention. This would involve:

1. Educational components, including consideration of involving Pharmacists and liaison with community Pharmacists

2. Individual case management, involving a named person at discharge

3. Any intervention developed is likely to require skills and capacity within the Trust to deliver the intervention.

7. Bibliography

1. Balaban RB, Weissman JS, Samuel PA, Woolhandler S: **Redefining and redesigning hospital discharge to enhance patient care: a randomized controlled study**. *J Gen Intern Med* 2008, **23**(8):1228-1233.

2. Beckie T: **A supportive-educative telephone program: impact on knowledge and anxiety after coronary artery bypass graft surgery**. *Heart Lung* 1989, **18**(1):46-55.

3. Blue L, Lang E, McMurray JJ, Davie AP, McDonagh TA, Murdoch DR, Petrie MC, Connolly E, Norrie J, Round CE *et al*: **Randomised controlled trial of specialist nurse intervention in heart failure**. *BMJ* 2001, **323**(7315):715-718.

4. Braun E, Baidusi A, Alroy G, Azzam ZS: **Telephone follow-up improves patients satisfaction following hospital discharge**. *Eur J Intern Med* 2009, **20**(2):221-225.

5. Cline CM, Israelsson BY, Willenheimer RB, Broms K, Erhardt LR: **Cost effective management programme for heart failure reduces hospitalisation**. *Heart* 1998, **80**(5):442-446.

6. Coleman EA, Parry C, Chalmers S, Min SJ: **The care transitions intervention: results of a randomized controlled trial**. *Arch Intern Med* 2006, **166**(17):1822-1828.

7. Coleman EA, Smith JD, Frank JC, Min SJ, Parry C, Kramer AM: **Preparing patients and caregivers to participate in care delivered across settings: the Care Transitions Intervention**. *J Am Geriatr Soc* 2004, **52**(11):1817-1825.

8. Coleman WB: **Cancer bioinformatics: addressing the challenges of integrated postgenomic cancer research**. *Cancer Invest* 2004, **22**(1):161-163.

9. Crotty M, Giles LC, Halbert J, Harding J, Miller M: **Home versus day rehabilitation: a randomised controlled trial**. *Age Ageing* 2008, **37**(6):628-633.

10. Donald IP, Baldwin RN, Bannerjee M: **Gloucester hospital-at-home: a randomized controlled trial**. *Age Ageing* 1995, **24**(5):434-439.

11. Dunn RB, Lewis PA, Vetter NJ, Guy PM, Hardman CS, Jones RW: **Health visitor intervention to reduce days of unplanned hospital re-admission in patients recently discharged from geriatric wards: the results of a randomised controlled study**. *Arch Gerontol Geriatr* 1994, **18**(1):15-23.

12. Evans RL, Hendricks RD: **Evaluating hospital discharge planning: a randomized clinical trial**. *Med Care* 1993, **31**(4):358-370.

13. Fishman LE, M. : **Active use of serial functional assessment improves outcome and shortens acute geriatric hospitalization**. *Top Geriatr Rehabili* 1994, **9**(3):16-29.

14. Fitzgerald JF, Smith DM, Martin DK, Freedman JA, Katz BP: **A case manager intervention to reduce readmissions**. *Arch Intern Med* 1994, **154**(15):1721-1729.

15. Fretwell MD, Raymond PM, McGarvey ST, Owens N, Traines M, Silliman RA, Mor V: **The Senior Care Study. A controlled trial of a consultative/unit-based geriatric assessment program in acute care**. *J Am Geriatr Soc* 1990, **38**(10):1073-1081.

16. Garasen H, Windspoll R, Johnsen R: **Intermediate care at a community hospital as an alternative to prolonged general hospital care for elderly patients: a randomised controlled trial**. *BMC Public Health* 2007, **7**:68.

17. Gillespie U, Alassaad A, Henrohn D, Garmo H, Hammarlund-Udenaes M, Toss H, Kettis-Lindblad A, Melhus H, Morlin C: **A comprehensive pharmacist intervention to reduce morbidity in patients 80 years or older: a randomized controlled trial**. *Arch Intern Med* 2009, **169**(9):894-900.

18. Gilliss CL, Gortner SR, Hauck WW, Shinn JA, Sparacino PA, Tompkins C: **A randomized clinical trial of nursing care for recovery from cardiac surgery**. *Heart Lung* 1993, **22**(2):125-133.

19. Gladman JR, Lincoln NB, Barer DH: **A randomised controlled trial of domiciliary and hospital-based rehabilitation for stroke patients after discharge from hospital**. *J Neurol Neurosurg Psychiatry* 1993, **56**(9):960-966.

20. Hansen FR, Poulsen H, Sorensen KH: **A model of regular geriatric follow-up by home visits to selected patients discharged from a geriatric ward: a randomized controlled trial**. *Aging (Milano)* 1995, **7**(3):202-206.

21. Harris RD, Henschke PJ, Popplewell PY, Radford AJ, Bond MJ, Turnbull RJ, Hobbin ER, Chalmers JP, Tonkin A, Stewart AM *et al*: **A randomised study of outcomes in a defined group of acutely ill elderly patients managed in a geriatric assessment unit or a general medical unit**. *Aust N Z J Med* 1991, **21**(2):230-234.

22. Hogan DB, Fox RA, Badley BW, Mann OE: **Effect of a geriatric consultation service on management of patients in an acute care hospital**. *CMAJ* 1987, **136**(7):713-717.

23. Holland R, Lenaghan E, Harvey I, Smith R, Shepstone L, Lipp A, Christou M, Evans D, Hand C: **Does home based medication review keep older people out of hospital? The HOMER randomised controlled trial**. *BMJ* 2005, **330**(7486):293.

24. Jaarsma T, Halfens R, Huijer Abu-Saad H, Dracup K, Gorgels T, van Ree J, Stappers J: **Effects of education and support on self-care and resource utilization in patients with heart failure**. *Eur Heart J* 1999, **20**(9):673-682.

25. Kennedy L, Neidlinger S, Scroggins K: **Effective comprehensive discharge planning for hospitalized elderly**. *Gerontologist* 1987, **27**(5):577-580.

26. Koelling TM, Johnson ML, Cody RJ, Aaronson KD: **Discharge education improves clinical outcomes in patients with chronic heart failure**. *Circulation* 2005, **111**(2):179-185.

27. Landefeld CS, Palmer RM, Kresevic DM, Fortinsky RH, Kowal J: **A randomized trial of care in a hospital medical unit especially designed to improve the functional outcomes of acutely ill older patients**. *N Engl J Med* 1995, **332**(20):1338-1344.

28. Laramee AS, Levinsky SK, Sargent J, Ross R, Callas P: **Case management in a heterogeneous congestive heart failure population: a randomized controlled trial**. *Arch Intern Med* 2003, **163**(7):809-817.

29. Lim WK, Lambert SF, Gray LC: **Effectiveness of case management and post-acute services in older people after hospital discharge**. *Med J Aust* 2003, **178**(6):262-266.

30. Lipton HL, Bird JA: **The impact of clinical pharmacists' consultations on geriatric patients' compliance and medical care use: a randomized controlled trial**. *Gerontologist* 1994, **34**(3):307-315.

31. Lowe CJ, Raynor DK, Courtney EA, Purvis J, Teale C: **Effects of self medication programme on knowledge of drugs and compliance with treatment in elderly patients**. *BMJ* 1995, **310**(6989):1229-1231.

32. McCorkle R, Strumpf NE, Nuamah IF, Adler DC, Cooley ME, Jepson C, Lusk EJ, Torosian M: **A specialized home care intervention improves survival among older post-surgical cancer patients**. *J Am Geriatr Soc* 2000, **48**(12):1707-1713.

33. McInnes E, Mira M, Atkin N, Kennedy P, Cullen J: **Can GP input into discharge planning result in better outcomes for the frail aged: results from a randomized controlled trial**. *Fam Pract* 1999, **16**(3):289-293.

34. Melin AL: **A randomized trial of multidisciplinary in-home care for frail elderly patients awaiting hospital discharge**. *Aging (Milano)* 1995, **7**(3):247-250.

35. Mor V, Granger CV, Sherwood CC: **Discharged rehabilitation patients: impact of follow-up surveillance by a friendly visitor**. *Arch Phys Med Rehabil* 1983, **64**(8):346-353.

36. Naughton BJ, Moran MB, Feinglass J, Falconer J, Williams ME: **Reducing hospital costs for the geriatric patient admitted from the emergency department: a randomized trial**. *J Am Geriatr Soc* 1994, **42**(10):1045-1049.

37. Naylor M, Brooten D, Jones R, Lavizzo-Mourey R, Mezey M, Pauly M: **Comprehensive discharge planning for the hospitalized elderly. A randomized clinical trial**. *Ann Intern Med* 1994, **120**(12):999-1006.

38. Naylor MD: **Comprehensive discharge planning for the elderly**. *Res Nurs Health* 1990, **13**(5):327-347.

39. Naylor MD, Brooten D, Campbell R, Jacobsen BS, Mezey MD, Pauly MV, Schwartz JS: **Comprehensive discharge planning and home follow-up of hospitalized elders: a randomized clinical trial**. *JAMA* 1999, **281**(7):613-620.

40. Parfrey P, Gardner,E. Vavasour, H., Harnelt,J., McManoman, C. McDonald, J.: **The feasibility and efficacy of early discharge planning initiated by the admitting department in two acute care hospitals.** *Clin Invest Med* 1999, **17**(2):88-96.

41. Pereles L, Romonko L, Murzyn T, Hogan D, Silvius J, Stokes E, Long S, Fung T: **Evaluation of a self-medication program**. *J Am Geriatr Soc* 1996, **44**(2):161-165.

42. Rich MW, Beckham V, Wittenberg C, Leven CL, Freedland KE, Carney RM: **A multidisciplinary intervention to prevent the readmission of elderly patients with congestive heart failure**. *N Engl J Med* 1995, **333**(18):1190-1195.

43. Rich MW, Vinson JM, Sperry JC, Shah AS, Spinner LR, Chung MK, Davila-Roman V: **Prevention of readmission in elderly patients with congestive heart failure: results of a prospective, randomized pilot study**. *J Gen Intern Med* 1993, **8**(11):585-590.

44. Richards SH, Coast J, Gunnell DJ, Peters TJ, Pounsford J, Darlow MA: **Randomised controlled trial comparing effectiveness and acceptability of an early discharge, hospital at home scheme with acute hospital care**. *BMJ* 1998, **316**(7147):1796-1801.

45. Rubenstein LZ, Josephson KR, Wieland GD, English PA, Sayre JA, Kane RL: **Effectiveness of a geriatric evaluation unit. A randomized clinical trial**. *N Engl J Med* 1984, **311**(26):1664-1670.

46. Rubin CD, Sizemore MT, Loftis PA, Adams-Huet B, Anderson RJ: **The effect of geriatric evaluation and management on Medicare reimbursement in a large public hospital: a randomized clinical trial**. *J Am Geriatr Soc* 1992, **40**(10):989-995.

47. Saltz CC, McVey LJ, Becker PM, Feussner JR, Cohen HJ: **Impact of a geriatric consultation team on discharge placement and repeat hospitalization**. *Gerontologist* 1988, **28**(3):344-350.

48. Sinclair AJ, Conroy SP, Davies M, Bayer AJ: **Post-discharge home-based support for older cardiac patients: a randomised controlled trial**. *Age Ageing* 2005, **34**(4):338-343.

49. Siu AL, Kravitz RL, Keeler E, Hemmerling K, Kington R, Davis JW, Mitchell A, Burton TM, Morgenstern H, Beers MH *et al*: **Postdischarge geriatric assessment of hospitalized frail elderly patients**. *Arch Intern Med* 1996, **156**(1):76-81.

50. Slaets JP, Kauffmann RH, Duivenvoorden HJ, Pelemans W, Schudel WJ: **A randomized trial of geriatric liaison intervention in elderly medical inpatients**. *Psychosom Med* 1997, **59**(6):585-591.

51. Smith DM, Weinberger M, Katz BP, Moore PS: **Postdischarge care and readmissions**. *Med Care* 1988, **26**(7):699-708.

52. Somers SA, Hurley R, Oehlmann ML: **Staying the course: pursuing value in the Medicaid managed care era and beyond**. *J Urban Health* 2000, **77**(4):519-535.

53. Stewart S, Pearson S, Luke CG, Horowitz JD: **Effects of home-based intervention on unplanned readmissions and out-of-hospital deaths**. *J Am Geriatr Soc* 1998, **46**(2):174-180.

54. Thomas DR, Brahan R, Haywood BP: **Inpatient community-based geriatric assessment reduces subsequent mortality**. *J Am Geriatr Soc* 1993, **41**(2):101-104.

55. Townsend J, Piper M, Frank AO, Dyer S, North WR, Meade TW: **Reduction in hospital readmission stay of elderly patients by a community based hospital discharge scheme: a randomised controlled trial**. *BMJ* 1988, **297**(6647):544-547.

56. Weinberger M, Oddone EZ, Henderson WG: **Does increased access to primary care reduce hospital readmissions? Veterans Affairs Cooperative Study Group on Primary Care and Hospital Readmission**. *N Engl J Med* 1996, **334**(22):1441-1447.

57. White SJ, Powers JS, Knight JR, Harrell D, Varnell L, Vaughn C, Brawner D, Burger MC: **Effectiveness of an inpatient geriatric service in a university hospital**. *J Tenn Med Assoc* 1994, **87**(10):425-428.

58. Williams EI, Greenwell J, Groom LM: **The care of people over 75 years old after discharge from hospital: an evaluation of timetabled visiting by Health Visitor Assistants**. *J Public Health Med* 1992, **14**(2):138-144.

59. Williford SL, Johnson DF: **Impact of pharmacist counseling on medication knowledge and compliance**. *Mil Med* 1995, **160**(11):561-564.

60. Winograd CH, Gerety MB, Lai NA: **A negative trial of inpatient geriatric consultation. Lessons learned and recommendations for future research**. *Arch Intern Med* 1993, **153**(17):2017-2023.

61. Wong J, Wong S, Nolde T, Yabsley RH: **Effects of an experimental program on post-hospital adjustment of early discharged patients**. *Int J Nurs Stud* 1990, **27**(1):7-20.

Appendix I: Medline OVID Search Strategy

1. exp aged
2. geriatrics
3. homes for the aged
4. Health services for the aged
5. geriatric assessment
6. geriatric nursing
7. geriatric psychiatry
8. geriat$.tw
9. gerontol$.tw
10. oldest.old$.tw
11. old.old.tw
12. old age$.tw
13. elder$.tw
14. old$adult$.tw
15. old$people$.tw
16. old$person$.tw
17. or/ 1-16
18.patient discharge
19. aftercare
20. continuity of patient care
21. patient transfer
22. post dischargs$.tw
23. postdischarg$.tw
24. post hospital$.tw
25. posthospital$.tw
26. predischag$.tw
27. pre dischargs$.tw
28. Patient dischargs$.tw
29. dischargs$.ti
30. ((readmission$ or early or premature or care or medication or destination or decision or decid$ or support$ or prepar$ or process$ or plan$ or system$) adj6 dischargs$.tw
31. or/ 18-31
32. 17 and 31
33. clinical trial.pt
34. exp clinical trial
35. random allocation
36. double-blind method
37. cli$ adj24 trial$(.tw
38. random$.tw
39. or /33 – 38
40. (animal not human).sh
41. 39 not 40
42.32 and 41

Appendix II: Study Methodology Evaluation Sheet

Clinical trial checklist:

Conduct

- How was the randomisation carried out?
- Did untoward events occur during the study?

Analysis

- Were the treatment groups comparable at baseline?
- Were deviations from planned treatment reported?
- Were the results analysed by intention to treat?
- Was the statistical significance assessed?
- Were the basic data adequately described?
- Do the numbers add up?
- Were side effects reported?