Discharging older patients from the emergency department effectively: a systematic review and meta-analysis

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Abstract

Background: a decline in health state and re-attendance are common in people aged ≥65 years following emergency department (ED) discharge. Diverse care models have been implemented to support safe community transition. This review examined ED community transition strategies (ED-CTS) and evaluated their effectiveness.

Methods: a systematic review and meta-analysis using multiple databases up to December 2013 was conducted. We assessed eligibility, methodological quality, risk of bias and extracted published data and then conducted random effects meta-analyses. Outcomes were unplanned ED representation or hospitalisation, functional decline, nursing-care home admission and mortality.

Results: five experimental and four observational studies were identified for qualitative synthesis. ED-CTS included geriatric assessment with referral for post-discharge community-based assistance, with differences apparent in components and delivery methods. Four studies were included in meta-analysis. Compared with usual care, the evidence indicates no appreciable benefit for ED-CTS for unplanned ED re-attendance up to 30 days (odds ratio (OR) 1.32, 95% confidence interval (CI) 0.99–1.76; n = 1,389), unplanned hospital admission up to 30 days (OR 0.90, 95% CI 0.70–1.16; n = 1,389) or mortality up to 18 months (OR 1.04, 95% CI 0.83–1.29; n = 1,794). Variability between studies precluded analysis of the impact of ED-CTS on functional decline and nursing-care home admission.

Conclusions: there is limited high-quality data to guide confident recommendations about optimal ED community transition strategies, highlighting a need to encourage better integration of researchers and clinicians in the design and evaluation process, and increased reporting, including appropriate robust evaluation of efficacy and effectiveness of these innovative models of care.

Keywords: emergency, discharge, meta-analysis, older people

Demographic change poses a distinct challenge for Emergency Departments (EDs), with attendances by older people aged ≥65 years accelerating at a rate beyond that due to population ageing [1, 2]. This age group constitutes ~18% of attendances across Australia, UK, USA and Canada [3]. Older people presenting to ED often have complex medical and psychosocial issues that lead to longer lengths of stay, increased likelihood of admission [2] and require more resources to fully understand presenting complaints [3]. The ‘hazards’ of hospitalisation [4] add to pressures faced by clinicians in the context of time-based targets, ED flow, resource allocation and requisite need to uphold quality and safety of care.

An ED attendance is described as a sentinel event for an older person [5, 6], with associated functional decline and other adverse outcomes including subsequent increased risk of re-presentation well documented [7–9]. With 45% of older patients discharged directly home from ED [10], diverse models of care have been employed across Canada [11], USA [12, 13], UK [14–16], Europe [17, 18] and Australia [19] to support safe transition. Comprehensive guidelines have been published in the UK [20] and USA [21]; however, these focus on the ED stay. There is no consensus within similar systems of care, as to what constitutes evidence-based best practice for patients discharged home from ED.

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Previous reviews have examined effects of different types of ED-based care models [22–24]; however, their impact on outcomes has not been quantified. We therefore conducted a systematic review with meta-analysis to (i) profile effective care transition models and (ii) provide robust estimates of effect of these care models on risk of ED re-presentation or hospitalisation, functional decline in activities of daily living (ADL), nursing-care home admission and mortality in older people discharged home from ED. This study is part of the Safe Elderly Emergency Discharge (SEED) project [25] aimed to develop a best practice model of care for older patients discharged from ED.

Methods

A systematic review and meta-analysis was conducted and reported in accordance with the PRISMA Statement [26]. Study design was informed by the Cochrane Effective Practice and Organisation of Care approach for appraising clinical trials [27], specifically elements pertaining to identification and screening of sources, quality assessment and data extraction. The protocol is available on our project website (www.seed.monash.org.au).

Data sources and search strategy

An electronic search was conducted on OVID Medline (1946 to December 2013) and Cochrane Library (2005 to December 2013) databases. A library scientist guided development of the search strategy. Medical subject heading search terms and text or keywords associated with concepts of geriatric or older adults; emergency; evaluation, assessment or intervention; discharge or follow-up were used as detailed in Supplementary data, Appendix S1, available in Age and Ageing online. No language or publication time lines were applied. The search strategy was translated for the CINAHL database (1937 to December 2013). Bibliographies of included articles were examined for additional references.

Study selection

Two reviewers (R.M., J.C.) independently assessed eligibility of retrieved articles by screening titles and abstracts. Queries were resolved through discussion with J.L.

Inclusion criteria

Articles that described effectiveness of discharge and care transition strategies formulated in the ED, for patients aged ≥65 years who were discharged home, were included. We considered randomised and quasi-randomised trials, controlled before/after trials and controlled interrupted time series. We took a pragmatic approach and also considered observational studies including comparative controlled cohort, case control and before/after studies, because health services research is necessarily restricted by practical and ethical barriers when introducing new practice to improve quality of care [28], including that conducted in EDs. Studies were included if there was comparison of the intervention with a historical or contemporaneous control group, with data reported on post-discharge outcomes typically used as a measure of effectiveness of ED care transition. These included unplanned ED re-presentation, emergency hospitalisation, functional decline in ADL including nursing home admission and death.

Exclusion criteria

Studies that included patients admitted to hospital, described single disease management models (e.g. fracture, falls, delirium) or failed to report adequate information about post-discharge outcomes were excluded.

Data extraction and quality assessment

Data extraction was conducted independently (J.L., R.M.) and cross-checked for accuracy using a tool based on the National Health and Medical Research Council guidelines [29] used previously [30]. Study setting and design, selection and measurement bias, baseline and follow-up outcome measurements, risk of bias, intervention characteristics, summary measures including odds and risk ratios and percentage mean differences, intention-to-treat analysis, study power and issues pertaining to generalisability were extracted.

Risk of bias for RCTs was rated independently (J.L., R.M.) according to the Cochrane Collaboration’s tool [31] and a high/moderate/low score was generated [32]. Observational study quality was evaluated using the Newcastle-Ottawa Scale (NOS) [33]; however, the inherent high level of bias and potential over-estimation of intervention effectiveness in such designs were taken into consideration. The maximum possible score was 8 points, with study quality categorised as high (6–8), moderate (4 or 5) or low (0–3) [32].

Data synthesis and analysis

Data regarding characteristics and effectiveness of ED community transition strategy (ED-CTS) in comparison with usual care were extracted. Sample size estimations were reported, based on predetermined primary outcomes of an expected 5–10% reduction in unplanned ED re-presentation or hospital admission. If studies were under-powered for a given outcome, results are presented when they met requirements for clinical and statistical heterogeneity. All data were synthesised and analysed to describe the impact of ED-CTS on different outcomes.

Our primary meta-analyses were of RCTs with low risk of bias. We then added the high-quality observational studies as secondary analyses, in an attempt to see whether they altered the estimate of the intervention effect [34, 56]. Meta-analyses were performed using RevMan V5.2 software (Cochrane Collaboration, Oxford, UK) employing random effects models that provide more conservative estimates of treatment effect in the presence of heterogeneity [35]. Heterogeneity was quantified using the I² statistic, the percentage of variation across
studies due to between-study heterogeneity rather than chance. We deemed it not appropriate to report on pooled results with moderate to large heterogeneity across studies ($I^2 > 50\%$) [36]. Given the small number of studies included in the meta-analysis, meta-regression was not possible.

Results

Selected studies

Search results are summarised in Figure 1. Eleven papers describing nine studies met our selection criteria for inclusion in qualitative synthesis. These studies, published between 1996 and 2013, included four randomised controlled trials (RCTs), one quasi-RCT, three uncontrolled before/after studies and one comparative controlled study. Studies were conducted from 1991/92 to 2009/10 in Australia [37, 38], Canada [39–42], USA [43, 44], Scotland [45], Hong Kong [46] and Singapore [47].

Table 1 outlines key characteristics and summary outcome results. There were differences in recruited patient populations with some criteria being age-related [37, 40, 43, 45, 47] and others based on high risk of poor outcomes [38, 41, 44, 46]. All patients or their primary care givers in these studies provided informed consent, enabling inclusion of patients without capacity. There were also differences in the components and delivery methods of care models as summarised in Supplementary data, Appendix Table S3, available in Age and Ageing online. All CTS included geriatric assessment but with differing delivery by nurses, allied health professionals or trained health visitors. Post-discharge interventions focussed on community-based referral, with some providing telephone follow-up, GP liaison [45] and/or direct linkage and/or short-term outreach assistance until community-based services became available [37, 43–45]. Follow-up periods were variable, ranging from 14 days to 18 months. Finally, there was heterogeneity in reported outcomes, with unplanned ED re-presentation or emergency hospital admission measured in all studies and institutionalisation in three studies [37, 43, 46]. All studies measured a combination of healthcare and patient clinical outcomes, with six studies measuring functional decline [37, 42, 45, 46] or mortality [37, 43, 47].

Methodological quality and risk of bias

Methodological domains used to generate risk of bias grading of RCTs and the quasi-RCT [31] (sequence generation and/or loss to follow-up) and quality rating of observational studies [33] (total number of Newcastle-Ottawa Scale is described in Supplementary data, Appendix Table S2, available in Age and Ageing online). Two RCTs were evaluated as having low risk of bias [37, 43]. Both RCTs predetermined their sample size on defined primary outcome measures. Observational study quality varied, with two judged to be of high quality (Guttman before/after trial [40] and Arendts case–control study [38]).

ED-CTS effectiveness

Four studies had sufficient clinical and methodological homogeneity (cohorts, follow-up periods, strategies and outcome measurement) to allow comparison for inclusion in meta-analysis [37, 38, 40, 43].

Outcomes

Meta-analysis was conducted for outcomes of unplanned ED re-attendance, emergency hospitalisation and mortality at specific follow-up points as summarised in Figure 2.

Unplanned ED re-presentation

Pooled data showed no effectiveness at reducing our primary outcome of unplanned ED re-attendance up to 1 month in the RCTs (odds ratio (OR) 1.32, 95% confidence interval (CI) 0.99–1.76; $n = 1,389$) (Figure 2i). Moderately high heterogeneity ($I^2 = 69\%$) was apparent when the observational studies were included in meta-analysis (Figure 2i).

While individual RCTs demonstrated no significant differences in outcomes, the Arendts observational study noted an increase in re-presentation rate at 28 days by patients determined to be at ‘high risk’ (17.9 versus 14.8%, $P = 0.05$); while Guttman reported significant reduction in early ED return at 14 days (relative risk (RR) = 0.79, 95% CI 0.5–0.96) (Table 1).

Emergency hospital admission

Meta-analysis showed no influence on hospitalisation at 1 month after initial attendance (OR 0.89, 95% CI 0.65–1.21; $n = 1,389$), with similar results when the before/after trial was included (OR 0.90, 95% CI 0.70–1.16; $n = 3,113$) (Figure 2ii).

Functional decline in ADL

Functional decline in ADL was only measured in the Caplan and Mion RCTs, at different time points (6 and 12 months [37]; 1 and 4 months [43], respectively). Caplan compared changes in functional status as a secondary outcome, reporting a greater degree of independence in ADL at 6 months and no decline in cognitive function at 12 months in the ED-CTS group. However at 18 months, deterioration in ADL and cognitive status was reported for both groups. Mion reported no impact on physical or mental function with the intervention at either time point. Results could not be pooled because of the diversity of measures and methods of outcome reporting.

Nursing-care home admission

Nursing-care home admission, a marker of functional decline, was a primary outcome in the Mion trial, with ED-CTS patients significantly less likely to be institutionalised at 30 days (OR 0.21, 95% CI 0.05–0.99). The proportion of intervention
patients transferred to permanent care remained lower at 4 months; however, this was not statistically significant. Subgroup analysis of high-risk patients revealed a significant reduction in institutionalisation at 30 days and 4 months, albeit with wide confidence intervals (2 versus 7%: OR 0.2, 95% CI 0.04–0.96; and 3 versus 10%: OR 0.3, 95% CI 0.07–0.94, respectively).

Caplan reported no difference in care home admission at 18 months. Pooling these results indicated moderately high heterogeneity ($I^2 = 67\%$).

No significant effect on mortality was detected as a secondary outcome at any time point measured when the Caplan, Mion and Arendts results were pooled (Figure 2iii). Death
Table 1. Summary of included studies investigating effectiveness of ED community care transition strategies for older patients aged ≥65 years

<table>
<thead>
<tr>
<th>Study</th>
<th>Setting population</th>
<th>Study design, length and year</th>
<th>n</th>
<th>Intervention elements</th>
<th>Outcomes</th>
<th>Results: % difference or odds ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caplan et al. [37]</td>
<td>Australian ED ≥75 years</td>
<td>RCT 18 months 1996/97</td>
<td>739</td>
<td>Comprehensive geriatric nurse assessment + home visit within 24 h + formulation of discharge care plan + referrals + GP liaison + 4-week home-based intervention + weekly interdisciplinary team meetings + seamless transfer of care to community-based services</td>
<td>Primary 30-day hospital admissions (any)</td>
<td>−5.7% (−11.4 to 0.0%)*</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Secondary 30-day emergency hospital admission</td>
<td></td>
<td>−2.5% (−7.4 to 2.4%)</td>
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<td></td>
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<td>30-day ED re-presentation hospital admission</td>
<td></td>
<td>2.4% (−2.7 to 7.5%)</td>
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<td>18-month emergency hospital admission</td>
<td></td>
<td>−9.9% (−17.1 to −2.7%)</td>
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<td>18-month nursing home admission</td>
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<td>1.0% (−2.9 to 4.9%)</td>
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<td>18-month death</td>
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<td>0.5% (−4.6 to 5.5%)</td>
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<td></td>
<td>Other 6-month physical functional decline (Barthel, IADL)</td>
<td></td>
<td>Reduced*</td>
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<td></td>
<td></td>
<td>12-month cognitive functional decline (MSQ)</td>
<td></td>
<td>Reduced*</td>
</tr>
<tr>
<td>Runciman et al. [45]</td>
<td>Scottish ED ≥75 years</td>
<td>RCT 4 weeks 1991/92</td>
<td>424</td>
<td>Health visitor home visit and assessment within 24 h of ED discharge with development of community services package + discussion with patient and GP + service provision arrangement</td>
<td>4-week re-admission</td>
<td>2.3%</td>
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<td></td>
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<td>4-week dependency and functional ADL (Katz)</td>
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<td>−5%</td>
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<td></td>
<td></td>
<td>4-week dependency and functional IADL (Fillenbaum)</td>
<td></td>
<td>−14%*</td>
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<tr>
<td>Mion et al. [45]</td>
<td>≥65 years</td>
<td>RCT 4 months 1999/00</td>
<td>650</td>
<td>Comprehensive geriatric nurse assessment + formulation of discharge care plan + referrals + GP liaison + telephone follow-up until community-based services transfer</td>
<td>Primary 30-day ED re-presentation</td>
<td>OR 1.42 (0.95–2.14)</td>
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<td>30-day hospitalisation</td>
<td></td>
<td>OR 0.99 (0.64–1.54)</td>
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<td>30-day nursing home admission</td>
<td></td>
<td>OR 0.21 (0.05–0.99)*</td>
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<tr>
<td>McCusker et al. [39, 41, 42]</td>
<td>Canadian EDs ≥65 years</td>
<td>4 months 1998/99</td>
<td>345</td>
<td>ISAR screening to identify high-risk patients + brief standardised geriatric nursing assessment + team discharge care planning + community services referrals</td>
<td>Primary 30-day death</td>
<td>OR 2.00 (0.36–11.00)</td>
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<td>120-day ED re-presentation</td>
<td></td>
<td>OR 0.9 (0.66–1.24)</td>
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<td>120-day hospitalisation</td>
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<td>OR 1.05 (0.75–1.49)</td>
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<td></td>
<td>120-day nursing home admission</td>
<td></td>
<td>OR 0.4 (0.14–1.15)</td>
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<td></td>
<td>High-risk patients</td>
<td></td>
<td></td>
<td>120-day death</td>
<td></td>
<td>OR 0.89 (0.36–2.72)</td>
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<td></td>
<td>Primary 4-month functional decline or death</td>
<td></td>
<td>OR 0.53 (0.31–0.91)*</td>
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<td></td>
<td>Secondary 1-month ED re-presentation</td>
<td></td>
<td>OR 1.6 (1.0–2.6)*</td>
</tr>
<tr>
<td>Yim et al. [46]</td>
<td>≥65 years</td>
<td>RCT 6 months 2008/09</td>
<td>1,279</td>
<td>Identification of high-risk patients using HK-ISAR screening tool + standardised assessment of functional (Barthel), cognitive (MMSE) and depression (GDS) status + community-based services referrals</td>
<td>Composite (of all outcomes stated below)</td>
<td>Positive (P = 0.299)</td>
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<tr>
<td></td>
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<td>6-month early return/ frequent ED visits</td>
<td></td>
<td>−0.8%</td>
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<td>6-month admission to hospital</td>
<td></td>
<td>−4.0%</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>6-month functional decline (HK-ISAR)</td>
<td></td>
<td>−0.04 points</td>
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<td></td>
<td>2008/09</td>
<td></td>
<td></td>
<td>6-month institutionalisation or death</td>
<td></td>
<td>0.2% or 0.0%</td>
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</tbody>
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Continued
rates increased over time: 0.2% at 14 days [40], 1.3% at 1 and 4 months [38, 43], 10% at 12 months [38] and 15% at 18 months [37], regardless of initial patient risk profile or whether ED-CTS were provided.

**Discussion**

A variety of models for care transition have been employed internationally since the mid-1990s to diminish risk of adverse outcomes following an ED episode. However, this systematic review highlights a lack of high-level evidence about effectiveness of these models due to a very low literature base overall, with few studies using a robust research evaluation design. The nine studies identified were of variable methodological quality, with only two RCTs evaluated as having low risk of bias and two observational studies having a high-quality rating. All studies comprised numerous components of a comprehensive geriatric-focused ED community transition. Such care models have face validity; however, we have shown limited evidence for effectiveness in reducing unplanned ED re-attendance, hospital admission or mortality. This is disappointing as it indicates no advancement in our understanding of the issues since a similar review was conducted 10 years ago [22], despite addition of more studies and judicious use of meta-analysis.

A recent meta-analysis by Ellis *et al.* [48] identified that provision of inpatient comprehensive geriatric assessment (CGA) increased the likelihood of ‘living at home’ (OR 1.16, 95% CI 1.05–1.28, 18 RCTs; *n* = 7,062) up to 12 months following discharge and decreased death or functional deterioration up to 12 months (OR 0.76, 95% CI 0.64–0.90, 5 RCTs; *n* = 2,622). Components of ED-CTS and CGA are similar in terms of holistic evaluation with referral and linkage to community services. Therefore, one would assume that ED-CTS would facilitate improved patient outcomes.

**Methodological issues**

Our review and meta-analyses were systematic and rigorous; however, certain methodological issues preclude us from identifying evidence for ED-CTS effectiveness. The small number of RCTs identified is most likely attributed to numerous challenges faced by researchers and clinicians when designing studies to test multi-faceted interventions in an uncontrolled ‘real-world’ environment. While RCTs are regarded as ‘gold standard’, they are not without limitations in testing complex health service interventions.
In addition, included studies had subtle differences. For example, populations were all older ‘vulnerable’ patients; however, they varied in age from ≥65 to ≥75 years; and the focus in some studies was on patients determined by a screening tool to be at high risk of adverse outcomes (Table 1).

Figure 2. Effect of ED community care transition strategy among RCTs (primary analysis) and RCTs and observational study (secondary analysis). Weight is the relative contribution of each study to the overall estimate of the treatment effect using a random effects model.
Outcomes of interest

The foremost primary outcome was early return to ED or hospital admission, as effectiveness of hospital-community transition has historically been determined from a health system view of care delivery, rather than patient health outcomes such as functional status.

In addition, follow-up periods ranged from 14 days to 18 months, adding another layer of complexity to evaluation of intervention effects in an older population that continues to age over time, with multi-faceted health and social care issues. Conflicting effects were reported by two studies, with one indicating significant reduction in early ED re-presentation at 14 days [40], while the other showed a significant increase up to 30 days [38]. ED re-presentation and hospitalisation following implementation of ED-CTS may reflect improved surveillance of a cohort considered to be at increased risk. Alternatively, for patients not at risk, it may suggest other factors including satisfaction with the care level provided during and after the visit [40, 43], or confidence with the timeliness, quality and safety of the specialised care provided by EDs compared with that currently available in the community [49]. In addition, convenience of a 24-h acute care system cannot be ignored [50, 51].

Future research might consider more patient- and family/carer-centred outcomes such as independence in ADL, unplanned nursing home transfer or unexpected death; as well as prevention of adverse events such as delirium, infections, pressure ulcers and falls; alongside quality of life, patient experience and carer burden/strain. While physical [37, 41, 43, 47] and cognitive [37, 43] functional outcomes were measured in some studies, they were difficult to interpret due to the variety of tools used and poor reporting. Functional assessment instruments most commonly used in research are not always responsive to clinically important changes in older community-dwelling adults [52]. This highlights the imperative for consensus in future research regarding outcomes that should be measured, how they should be measured and at what time frames, to help us truly understand the true effects of future interventions. Such consensus could be achieved through development of international collaborations.

ED community care transition strategies

Most importantly, ED-CTS are complex health service interventions, comprising multiple components (Supplementary data, Appendix Table S3, available in Age and Aging online). All interventions comprised holistic geriatric assessment with targeted referral to community services. Such interventions are necessarily tailored to individual needs, so components and implementation methods will no doubt vary within and between individual trials [53]. Inclusion of telephone follow-up was the differentiating feature of ED-CTS employed by trials that individually reported significant reduction in early ED re-attendance [40] and need for nursing home admission [43]; however, the precise nature of implementation is uncertain. Strategies including telephone follow-up to confirm ED discharge instructions have been effective in other studies [16, 54].

We also have no information about effectiveness of implementation of any of these complex interventions, which is a function of age of these studies. Future research should consider use of hybrid designs that simultaneously assess effectiveness of interventions alongside implementation strategy [55]. Such evaluations generally include quantitative and qualitative methods to understand barriers and enablers to implementing the intervention and include process, impact and outcome assessments. This would enhance understanding of study outcomes [56]. Performing RCTs within settings whose primary goal is service provision is an ongoing challenge. While clearly this research design is ideal, tensions remain between traditional methods of service improvement that are continuous, iterative and incremental, and academic imperatives to ensure interventions are ‘a priori’ designed and implemented in a more static controlled manner, with a stronger focus on intervention and process fidelity. There will need to be increasing engagement of both academics and service providers in study governance, as well as in intervention design and methods of implementation and evaluation, if these tensions are to be effectively managed.

Strengths and limitations

The strength of this study is use of a systematic search strategy, with only methodologically rigorous evidence considered. A limitation is exclusion of studies not meeting strict eligibility criteria, which may potentially help hypothesis generation. Although studies of single system illness (e.g. rehabilitation for fracture) may have some relevance, we focussed on global multifactorial strategies, because older ED patients typically have complex underlying biopsychosocial issues requiring a holistic assessment/management plan. Comparability of study findings was limited by study heterogeneity. We included observational studies evaluated to be of high quality; however, our meta-analyses and interpretation reflected issues of potential bias and over-estimation of effect.

Current evidence for ED community care transition strategies is limited. Improved study design to assess efficacy and effectiveness will be necessary given the imperative of an ageing population and an environment where there is an increasing focus on appropriate hospital admissions and a focus on helping older people age in settings that meet their needs and preferences.

Key points

- Care models to support safe discharge from the ED are complex health service interventions.
- Meta-analysis identified no evidence for effectiveness of current care models.
- There are limited published data of high quality on which to base definitive conclusions.
- Hybrid mixed-method designs to simultaneously assess intervention efficacy and effectiveness should be considered.
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Conflicts of interest

None declared.

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Supplementary data

Supplementary data mentioned in the text are available to subscribers in Age and Ageing online.

References

(The very long list of references supporting this review has meant that only the most important are listed here and are represented by bold type throughout the text. The full list of references is given in Supplementary data, available in Age and Ageing online).

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