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# Reducing unplanned admissions:

## Using community based interventions

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## Introduction

NHS Future Fit has requested a review of the literature of primary and community care interventions that reduce unplanned admissions. The summary builds on our previous work exploring interventions to reduce unplanned admissions (Aldridge and Turner, 2013) and provides an update of the literature published since 2013. In the interests of time, this review has focused on secondary research only, in the form of syntheses of evidence and systematic reviews. This helps to ensure a focus on research-based findings which have been tested and validated; however, learning from practice may offer valuable lessons, particularly on new and emerging approaches, if highly contextual. If further work to collate and summarise practice-based evidence is required, the Evidence Analysis team can explore in greater detail. The full list of studies reviewed is included in Appendix 1. The methodology used is described in Appendix 2.

The following points should be noted:

- interventions which have a weak or uncertain evidence base are not necessarily ineffective - the evidence is too limited to draw firm conclusions. This highlights the need for robust evaluation of local implementations to strengthen the evidence base;
- whilst some interventions found evidence to support their use in relation to unplanned admissions they may only be applicable to target populations;
- there is considerable variation in definitions and composition of services; what is described in one study as discharge planning, for example, may be significantly different to that described in another study;
- admission, readmission, length of stay are not always measured in studies evaluating interventions;
- it can be difficult to synthesise evidence of interventions across different patient groups; where the research has focused on a specific patient group or population, this is indicated in our summary and review;
- it can be difficult to generalise and apply conclusions from research where populations have been very specific/interventions have been specifically targeted.

## What primary and community interventions are effective at reducing unplanned care?

Key findings include:

- **Case management:** Overall, the evidence for case management has not demonstrated impact on reducing unplanned admissions, however a 2012 Cochrane review (Takeda et al., 2012) supports case management type interventions led by a heart failure specialist nurse for reducing readmissions to hospital.
- **Risk prediction:** No secondary evidence on effectiveness of risk prediction models was found. Kingston et al. (2016) have published a protocol for a systematic review examining the effectiveness of risk prediction models. Evidence from primary research has found that multi-morbidity is important in explaining variations in costs across individuals, and multimorbidity type might provide opportunities for targeted intervention.
- **Education and self-management:** There is some evidence supporting self-management for reducing unplanned admissions for asthma and COPD, with some evidence for cardiac disorders.



- **Exercise and rehabilitation:** There is evidence to support exercise-based cardiac rehabilitation in low-risk people with heart failure and after myocardial infarction (MI) or percutaneous coronary intervention (PCI) as effective in terms of reducing the risk of hospital admission (Anderson and Taylor, 2014). Based on a relatively small sample of studies, pulmonary rehabilitation has been shown as a highly effective and safe intervention to reduce hospital admissions for patients who have recently suffered an exacerbation of COPD. Pulmonary rehabilitation for patients with mild COPD may benefit from PR; however, insufficient evidence is still available.
- **Technology enabled care services:** The strongest evidence to support telemonitoring is for heart failure. A recent Cochrane review (Inglis et al., 2015) found evidence to support structured telephone support and non-invasive home telemonitoring to reduce heart failure-related hospitalisations but no evidence to demonstrated effectiveness in reducing the risk of all-cause hospitalisations. No evidence was found support reduced length of stay.
- **Discharge planning:** A recent Cochrane review (Gonçalves-Bradley et al., 2016) found a small reduction in hospital length of stay and a reduction in the risk of readmission to hospital at three months follow-up for older people with a medical condition. There is some evidence to support discharge planning for patients with chronic conditions.
- **Hospital at home:** The evidence is inconclusive for the use of hospital at home interventions.
- **Community interventions:** The evidence supporting intermediate care as a means to reduce admissions remains uncertain. Recent systematic reviews exploring complex interventions or packages or care have demonstrated multidisciplinary teams are effective at reducing admissions (Ariss et al., 2015, Philp et al., 2013, Leppin et al., 2014, Feltner et al., 2014).
- **Medication review:** There is relatively weak evidence to support the role of pharmacist-led medication reviews in reducing admissions.
- **Features of primary care:** Recent systematic reviews shows that better continuity of care reduces unscheduled secondary care (Huntley et al., 2014, van Loenen et al., 2014), and better access was generally associated with reduced unplanned admissions (van Loenen et al., 2014, Huntley et al., 2014, Gibson et al., 2013). Evidence relating to quality of care was limited and mixed (Huntley et al., 2014, Busby et al., 2015).

Table 1 overleaf show a summary of the various interventions reviewed and indicates where the evidence base is supportive or uncertain. It should be noted that effectiveness is in relation to the impact on reducing unplanned care only; this does not take into account other outcomes such as health, mortality, patient satisfaction.

## Upcoming research

Bobrovitz et al. (2015) have published a protocol for an overview to find, assess and summarise all published peer-reviewed systematic reviews of randomised controlled trials that examine the effect of an intervention on unplanned admissions among adults. The authors propose using a novel methodology to hierarchically rank interventions to reduce unscheduled admissions is an aim to help define which strategies effectively reduce admissions and are supported by a strong evidence-base.



**Table 1. What interventions are effective in reducing unplanned care?**

	Evidence supportive	Evidence weak or uncertain
<b>Case management</b>	<ul style="list-style-type: none"> <li>Heart failure</li> </ul>	<ul style="list-style-type: none"> <li>Post discharge (Transition)</li> <li>Adults with long term conditions</li> <li>Elderly</li> <li>Mental Health</li> <li>Frequent Flyers</li> </ul>
<b>Risk prediction</b>	<i>No evidence</i>	<i>No evidence</i>
<b>Education and self-management</b>	<ul style="list-style-type: none"> <li>Asthma</li> <li>COPD</li> <li>Heart Failure (some evidence)</li> </ul>	<ul style="list-style-type: none"> <li>Asthma (children)</li> <li>COPD (post discharge)</li> </ul>
<b>Exercise and rehabilitation</b>	<ul style="list-style-type: none"> <li>Low-risk people with heart failure and after myocardial infarction (MI) or percutaneous coronary intervention (PCI)</li> <li>Recently suffered an exacerbation of COPD</li> </ul>	<ul style="list-style-type: none"> <li>Patients with mild COPD</li> </ul>
<b>Technology enabled care services</b>	<ul style="list-style-type: none"> <li>Heart failure</li> </ul>	<ul style="list-style-type: none"> <li>COPD</li> <li>Adults and children with asthma</li> <li>Patients with physical disabilities</li> <li>Patients with diabetes</li> <li>Telephone follow-up for patients discharged after a minimum of a 24-hr hospital stay</li> </ul>
<b>Discharge planning</b>	<ul style="list-style-type: none"> <li>Stroke patients (Early Supportive Discharge)</li> <li>Elderly</li> <li>Chronic conditions</li> </ul>	<ul style="list-style-type: none"> <li>Mental health patients</li> <li>Postnatal mothers and babies</li> </ul>
<b>Hospital at home</b>		<ul style="list-style-type: none"> <li>Patients with COPD</li> <li>Elderly patients</li> <li>Children with newly diagnosed Type 1 diabetes</li> <li>Children with acute and chronic illnesses</li> <li>Older people with mental health problems</li> <li>Patients with heart failure</li> </ul>
<b>Community interventions</b>	<ul style="list-style-type: none"> <li>Multidisciplinary teams</li> </ul>	<ul style="list-style-type: none"> <li>Intermediate care</li> </ul>
<b>Medication review</b>	<ul style="list-style-type: none"> <li></li> </ul>	<ul style="list-style-type: none"> <li>Primary care</li> <li>Older people</li> </ul>
<b>Features of primary care</b>	<ul style="list-style-type: none"> <li>Continuity of care</li> <li>Improved access</li> </ul>	<ul style="list-style-type: none"> <li>Quality of care</li> </ul>



## Case management

### Definition

Case management is a broad term, with no single definition. The Case Management Society of America (CMSA) define case management as ‘a collaborative process of assessment, planning, facilitation, care coordination, evaluation, and advocacy for options and services to meet an individual’s and family’s comprehensive health needs through communication and available resources to promote quality cost-effective outcomes’ ([CMSA website](#)). A King’s Fund briefing highlights that definitions such as the CMSA’s suggests that rather than case management being a single intervention, case management refers to a package of care which covers a range of activities that can vary widely between programmes (Ross et al., 2011).

### Evidence on effectiveness

Our earlier review found mixed evidence on the use of case management; some evidence demonstrated reductions in unplanned admissions and length of stay however large variations in practice were reported and thus systematic reviews limited. A Cochrane review published in 2012 (Takeda et al., 2012) found case management type interventions led by a heart failure specialist nurse reduces cardiac heart failure related readmissions after 12 months follow up, all cause readmissions and all cause mortality.

Updated searches found two new published systematic reviews (Stokes et al., 2015, Huntley et al., 2013). A systematic review and meta-analysis of case management for adults with long term conditions in primary care including 36 studies (Stokes et al., 2015) found that case management had a small significant effect on patient satisfaction, in both the short term and long term but did not reduce use of primary or secondary care or costs of care. Subgroup analysis showed that case management delivered by a multidisciplinary team, including social workers, had a small non-significant effect on reducing use of secondary care in the short term, which may merit further investigation. The authors conclude that the current results do not support case management as an effective model, especially concerning reduction of secondary care use or total costs. Huntley et al. (2013) explored the effectiveness of case management for reducing unplanned admissions for older people. The review found no evidence to support the use of case management to reduce unplanned admissions for elderly patients. This finding is consistent we reviews cited in the earlier review (Oeseburg et al., 2009, Lupari et al., 2011).

Table 2 found in [appendix 1](#) shows the evidence from our earlier review (black text) and the evidence from the updated searches (blue bold text).

## Risk prediction models

### Definition

Risk prediction models use mathematical formulae to interpret patient-level data (e.g. age, previous health service use and diagnosed chronic conditions) to identify those at risk of emergency admission (Kingston et al., 2016).



## Evidence on effectiveness

Our earlier review did not find any evidence on the effectiveness of risk prediction models. Updated searches identified a protocol (Kingston et al., 2016) for a systematic review examining the effectiveness of risk prediction models. The authors believe this will be the first effectiveness review. Given the lack of secondary evidence, we have highlighted below two recent papers which offer interesting perspectives (Kadam et al., 2013, Kasteridis et al., 2014).

A clinical-linkage database study (Kadam et al., 2013) using chronic disease registers linked to accident and emergency (A&E) and hospital admissions for a 3-year time period (2007–2009), and associated costs measured by Healthcare Resource Groups explores the associations between multimorbid groups and direct healthcare costs were compared with their respective single disease groups using linear regression methods, adjusting for age, gender and deprivation. Analysis found that specific multimorbid pairs are associated with different levels of healthcare transitions and costs relating to accident and emergency and hospital admissions; patients with hypertension and diabetes mellitus had the fewest transitions in the 3-year time period (37% A&E episode and 51% hospital admission), but those with congestive heart failure and chronic kidney disease had the most transitions (67% A&E episode and 79% hospital admission). The authors conclude that the identification of multimorbidity type and linkage of information across healthcare interfaces provides opportunities for targeted intervention and delivery of cost-effective integrated care.

Similarly, research by the Centre for Health Economics examining patterns of health and social care utilisation and costs for the local population of Somerset to identify which groups of people would most benefit from better integrated care (Kasteridis et al., 2014) found that while costs are positively associated with age, multi-morbidity is much more important in explaining variations in costs across individuals. Regression analysis showed that if age is considered by itself, it is able to explain only 3.36% of the variation in cost among the population, however in contrast, the number of conditions (whether chronic or not) has greater explanatory power - considering this characteristic alone explains 19.80% of the variation in costs. The majority of people with multiple conditions however are likely to be over 65. The research also found that the marginal increase in average costs initially rises the more conditions are recorded. This is primarily driven by acute inpatient costs. In addition the research found that some conditions stand out as having large proportions of costs incurred in other settings; patients with dementia, epilepsy and burns account for relatively large proportions of social care costs, and patients with dementia, alcohol dependence, poisonings and effects of drugs, burns, environmental trauma and eating disorders account for a substantial proportion of mental health care costs.

The National Institute for Health Research are also currently waiting to publish primary research on predictive risk stratification and the impact on care for people with or at risk of chronic conditions (<http://www.nets.nihr.ac.uk/projects/hsdr/0918011054>).

## Education and self-management

### Definition

The Department of Health (2005) defines self-management as “the actions individuals and carers take for themselves, their children, their families and others to stay fit and maintain good physical





and mental health; meet social and psychological needs; prevent illness or accidents; care for minor ailments and long term conditions; and maintain health and wellbeing after an acute illness or discharge from hospital". Interventions to support self-management can be viewed in two ways: as a portfolio of techniques and tools to help patients choose healthy behaviours; and as a fundamental transformation of the patient-caregiver relationship into a collaborative partnership (De Silva, 2011).

## Evidence on effectiveness

Our earlier review found that self-management can be effective at reducing unplanned admissions for adults with asthma but the evidence base for children with asthma is weak. Benefits were also reported for COPD patients. There was weak evidence for the role of education in reducing unplanned admissions in heart failure patients.

Updated searches found two reviews published by the National Institute of Health Research exploring the effectiveness of self-management for people with long-term conditions (Taylor et al., 2014, Panagioti et al., 2014), and an updated Cochrane review on self-management for patients with chronic obstructive pulmonary disease (Zwerink et al., 2014). A further review was identified on supported self-management for patients with COPD who have recently been discharged from hospital. The additional evidence further supports the use of self-management for the reduction in health service use in the context of respiratory long term conditions. There was some evidence of the benefits of self-management for cardiac disorders; however variation across trials was high.

Table 3 found in [appendix 1](#) shows the evidence from our earlier review (black text) and the evidence from the updated searches (blue bold text).

## Exercise and Rehabilitation

### Definition

A working definition adopted by NHS England and developed in partnership with a range of clinical experts defines rehabilitation as, "the restoration, to the maximum degree possible, of an individual's function and/or role, both mentally and physically, within their family and social networks and within the workplace where appropriate" (NHS Improving Quality, 2014).

NHS England (2016) has recently published commissioning guidance for rehabilitation defining rehabilitation services in more detail including the range and scope of rehabilitation.

### Evidence on effectiveness

Our earlier review found evidence from a relatively small sample of studies to support pulmonary rehabilitation as a highly effective and safe intervention to reduce hospital admissions for patients who have recently suffered an exacerbation of COPD. Exercise-based cardiac rehabilitation was also shown to be effective in reducing hospital admissions in shorter term studies.

Updated searches found an overview of Cochrane systematic reviews for cardiac rehabilitation (Anderson and Taylor, 2014), an updated Cochrane review for exercise-based cardiac rehabilitation (CR) (Anderson et al., 2016), and a systematic review exploring pulmonary rehabilitation (PR) for mild COPD (Jácome and Marques, 2014). Further evidence supports exercise-based cardiac



rehabilitation in low-risk people with heart failure and after myocardial infarction (MI) or percutaneous coronary intervention (PCI) is effective in terms of reductions in the risk of hospital admission. Pulmonary rehabilitation for patients with mild COPD may benefit from PR; however, insufficient evidence is still available.

Table 4 in found [appendix 1](#) shows the evidence from our earlier review (black text) and the evidence from the updated searches (blue bold text).

## Technology enabled care services

### Definition

NHS England (2015) defines technology enabled care services (TECS) as “technologies such as telecare, telehealth, telemedicine/ teleconsultation and self-care apps that help people to manage and control chronic illness and sustain independence. They enable the remote exchange of information, primarily between a patient or citizen and a health or care professional, to assist in diagnosing or monitoring health status or promoting good health”.

### Evidence on effectiveness

Our earlier review found that there is some evidence to suggest that telehealthcare may be effective in certain settings or with selected patient groups, for example, patients with heart failure.

Updated searches found a Cochrane review exploring the effects of interactive telemedicine (used with any clinical condition) on professional practice and health care outcomes (Flodgren et al., 2015). Admissions to hospital (11 studies; N = 4529) ranged from a decrease of 64% to an increase of 60% at median eight months follow-up (moderate certainty of evidence). Sixteen studies reported heart failure and/or cardiovascular-related re-admission data, three of these studies reported a reduction in admission and 13 reported no differences between groups. Other updates include three systematic reviews exploring home telemonitoring or structured telephone support programmes for patients with heart failure (Inglis et al., 2015, Pandor et al., 2013a, Pandor et al., 2013b), and a literature review of post-discharge telephone calls (Bahr et al., 2014).

Table 5 found in [appendix 1](#) shows the evidence from our earlier review (black text) and the evidence from the updated searches (blue bold text).

## Discharge planning

### Definition

Discharge planning is the development of an individualised discharge plan for a patient prior to them leaving hospital for home. The discharge plan can be a stand-alone intervention or may be embedded within another intervention (Gonçalves-Bradley et al., 2016).

### Evidence on effectiveness

Our earlier review concluded that the evidence base is supportive of the impact of discharge planning on admissions (Shepperd et al., 2013) . Discharge planning works most effectively as part of a package of care and when discharge planning and discharge support are combined (Mistiaen et al.,



2007, Scott, 2010). A number of reviews focused on specific patient populations were also found which are summarised in Table 6 found in [appendix 1](#).

Updated searches found an updated Cochrane review (Gonçalves-Bradley et al., 2016); a discharge plan tailored to the individual patient probably brings about a small reduction in hospital length of stay and reduces the risk of readmission to hospital at three months follow-up for older people with a medical condition, however it is uncertain whether there is any difference in the cost of care when discharge planning is implemented with patients who have a medical condition (very low certainty evidence, five trials). A review of discharge planning in chronic conditions (McMartin, 2013) found that compared with usual care, there was moderate quality evidence that individualized discharge planning is more effective at reducing readmissions or hospital length of stay but not mortality. There was low quality evidence that the discharge planning plus post-discharge support is more effective at reducing readmissions but not more effective at reducing hospital length of stay or mortality.

We also found a rapid evidence assessment (Miani et al., 2014) exploring organisational interventions to reduce length of stay in hospital. Discharge interventions were categorised interventions as those relating to (1) discharge planning; (2) (early) supported discharge; and (3) post-discharge support. Pooled analysis showed a relatively small but significant reduction in readmission rates with discharge planning, although this was not supported by more recent primary studies. There was consistent evidence across systematic reviews that (early) supported discharge was associated with a reduction in length of stay. In the case of discharge planning with post-discharge follow-up, this was modest, at around 8 hours, but with ESD, meta-analyses showed a reduction of between 7 and 10 days. Three studies were identified on post-discharge programmes relating to patients with heart failure; these did not find an effect of the intervention on length of index hospital admission.

A systematic review (Verhaegh et al., 2014) including 26 RCTs of inpatients with chronic conditions reported that interventions initiated during hospital admission and continued after discharge (through home visits or telephone follow-up) for a minimum of one month were effective in reducing readmissions at 180 days (pooled odds ratio 0.77 (0.62 to 0.96)) and 365 days (0.58 (0.46 to 0.75)).

## Hospital at home

### Definition

'Hospital at home' includes admission avoidance and supported discharge interventions. Admission avoidance hospital at home may admit patients directly from the community thereby avoiding physical contact with the hospital, or may admit from the emergency room (Shepperd et al., 2008). Early discharge hospital at home is defined as "a service that provides active treatment by health care professionals in the patient's home for a condition that otherwise would require acute hospital in-patient care. If hospital at home were not available then the patient would remain in an acute hospital ward" (Shepperd et al., 2009).



## Evidence on effectiveness

Our earlier review found that admission avoidance hospital at home initiatives may provide an effective alternative to inpatient care for a selected group of elderly patients requiring hospital admission, at a similar or lower cost (Shepperd et al., 2008); whilst early discharge hospital at home is associated with increased readmissions for older people with a mixture of conditions (Shepperd et al., 2009). We identified a number of reviews focused on specific patient populations where hospital avoidance and supported discharge interventions were typically both included; in general the evidence was inconclusive.

Updated searches found a Cochrane review on home-based nursing services for children with acute and chronic illnesses (Parab et al., 2013), a Cochrane review on hospital at home for acute exacerbations of chronic obstructive pulmonary disease (Jeppesen et al., 2012), and a systematic review exploring the efficacy of Hospital at Home in Patients with Heart Failure (Qaddoura et al., 2015). The evidence remains inconclusive.

Table 7 found in [appendix 1](#) shows the evidence from our earlier review (black text) and the evidence from the updated searches (blue bold text).

## Community interventions

### Definition

Community interventions include any interventions that did not fit into our other topic areas, and typically assessed packages of care in the community or intermediate care. The Department of Health (2009) defines intermediate care as “a range of integrated services to promote faster recovery from illness, prevent unnecessary acute hospital admission and premature admission to long-term residential care, support timely discharge from hospital and maximise independent living”. Intermediate care can therefore take many forms: “Hospital at home schemes, post-acute care, step-up and step-down services are all types of intermediate care” (Ariss et al., 2015). This section explores such interventions when they are part of a package of care.

### Evidence on effectiveness

Our previous evidence review did not include a section on community services and identified very few syntheses for intermediate care (where outcomes included reduced admissions), and therefore concluded the evidence to support a reduction in admissions or length of stay through intermediate care remains uncertain. A 2007 Cochrane review (Griffiths et al., 2007) exploring the effectiveness of intermediate care in nursing-led in-patient units concluded their review gave some basis on which the nurse led units can be supported. A realist review by (Pearson et al., 2013) concluded that the effect of intermediate care especially in the frail elderly is not known.

Updated searches on complex interventions or packages of care found evidence exploring multidisciplinary teams and multi component interventions. There was evidence to support multidisciplinary teams (Ariss et al., 2015, Philp et al., 2013, Leppin et al., 2014, Feltner et al., 2014). Multi-component interventions including education and skills training are more likely to reduce health care utilisation (Blakemore et al., 2015, Dickens et al., 2014). Table 8 found in [appendix 1](#) shows the updated evidence.



The National Institute for Health Research has published a mixed methods study ‘establishing and implementing best practice to reduce unplanned admissions in those aged 85 years and over through system change’ (Wilson et al., 2015). Whilst primary research and therefore out of scope of the inclusion criteria for this review we thought the study contained useful and highly relevant findings. The mixed methods approach used routine data, interviews and focus groups at 6 case study sites – 3 of which showed a rapid increase in unplanned admissions (“deteriorating”) and 3 which showed a decline (“improving”). Quantitative analysis found that the key differences between deteriorating and improving sites were: the volume of zero-day admissions, readmissions and rates of admission for acute ambulatory care sensitive conditions. There was also a suggestion by the authors that access to GP services could also be a factor. The qualitative analysis suggests a number of critical success factors associated with effective management of unplanned admissions:

- a system-wide strategy, characterised by a shared vision/values across all services with specific policies for this age group and a range of specific community-based interventions across agencies (e.g. rapid access teams; intermediate care; voluntary services; out of hours services);
- strong leadership based on collaboration, commitment to quality and continuity;
- a focus on prevention (e.g. in deteriorating sites, there seems to be a focus on managing delayed discharges rather than preventing admissions);
- a long-term view supported by shared responsibility for resourcing improvement projects (e.g. matched funding) and time to embed changes;
- investment in primary care;
- an integrated approach to planning and delivery, through joined up governance and ways of working;
- a patient-centred approach addressing the whole pathway of care, rather than a focus on particular aspects such as discharge;
- capacity of community-based teams;
- close alignment between services, specifically with out of hours services (e.g. information sharing);
- collaboration with the voluntary sector;
- integration of community care through a single provider enabled greater integration with other agencies and implementation of innovation and improvement.

## Medication review

### Definition

Medication review has been defined as a: “structured, critical examination of a patient's medicines with the objective of reaching an agreement with the patient about treatment, optimising the impact of medicines, minimising the number of medication-related problems and reducing waste” (Task Force on Medicines Partnership, 2002).

For the purposes on this review we have focused on pharmacist led medication review in primary and community care only, and we have excluded medication review during discharge planning of hospitalised patients.



## Evidence on effectiveness

Our previous evidence review found that relatively weak evidence exists to support the role of pharmacist-led medication reviews in reducing admissions. A systematic review on pharmacist-led medication reviews in primary care (Royal et al., 2006) reported reductions in hospital admissions; however when this was restricted to randomised controlled trials only, the result was not statistically significant.

Updated searches found one new systematic review exploring pharmacist-led interventions to reduce unplanned admissions for older people (Thomas et al., 2014). Interventions led by hospital pharmacists (seven trials) or community pharmacists (nine trials) did not reduce unplanned admissions in the older population.

Table 9 found in [appendix 1](#) shows the evidence from our earlier review (black text) and the evidence from the updated searches (blue bold text).

## Features of primary care

### Definition

For primary care feature we explored: continuity of care; access and use of primary healthcare; and quality of care.

### Evidence on effectiveness

Our previous evidence review found mixed evidence on continuity of care for the reduction of unplanned hospital admissions, and highlighted wide variation in the definition for "continuity of care" across studies. Limited reviews were found to have been published.

Updated searches found several new reviews (van Loenen et al., 2014, Huntley et al., 2014, Gibson et al., 2013, Busby et al., 2015). The evidence shows that better continuity of care reduced unscheduled secondary care (Huntley et al., 2014, van Loenen et al., 2014), and better access was generally associated with reduced unplanned admissions (van Loenen et al., 2014, Huntley et al., 2014, Gibson et al., 2013). Evidence relating to quality of care was limited and mixed (Huntley et al., 2014, Busby et al., 2015). Table 10 found in [appendix 1](#) shows the updated evidence.

# Appendix 1 – Evidence tables

## Case management

Table 2. Summary of studies reviewing case management services for specific patient groups/populations

Reference	Patient group	Findings	Evidence suggests may be effective in reducing admissions	Evidence uncertain or of weak quality
<b>Chiu and Newcomer (2007)</b>	Post discharge (Transition)	(Post discharge for elderly patients) The reviewers found just over half of the studies (8 out of 15) reviewed reported a significantly reduction in unplanned readmission in the intervention groups, 7 out of 9 studies reporting on hospital days concluded that the intervention was associated with a statistically significant reduction in the number of hospital re-admissions days / length of stay	✓ (admissions, LOS)	
<b>Latour et al. (2007)</b>		(Post discharge for ambulatory conditions) No firm conclusions could be drawn for readmissions, hospital days, quality of life. Results with regard to the effectiveness of case management were conflicting.		✓ (admissions)
<b>*Takeda et al. (2012)</b>	Heart Failure	CHF related readmissions reduced at six month and 12 months, all cause hospital admissions reduced at 12 months but not 6 months.	✓ (admissions)	
<b>Purdy et al. (2012)</b>		Found case management overall was not effective, however did find three positive heart failure studies in which the interventions involved specialist care from a cardiologist.	✓ (admissions)	
<b>Stokes et al. (2015)</b>	Adults with long term conditions	Case management had a small significant effect on patient satisfaction, in both the short term and long term but did not reduce use of primary or secondary care or costs of care. The authors conclude that the current results do not support case management as an effective model, especially concerning reduction		✓ (admissions)

Reference	Patient group	Findings	Evidence suggests may be effective in reducing admissions	Evidence uncertain or of weak quality
		<b>of secondary care use or total costs.</b>		
<b>Oeseburg et al. (2009)</b>	Elderly	4 out of 6 studies reported no statistically significant difference in hospital admissions, 4 out of 5 studies reported no statistically significant difference in hospital length of stay.		✓ (admissions and LOS)
<b>Lupari et al. (2011)</b>		Quantitative analysis revealed no significant impact on emergency admissions, bed days or costs.		✓ (admissions and LOS)
<b>Huntley et al. (2013)</b>		<b>Eleven trials of case management in the older population were included. Five trials were of community-initiated case management. None showed a reduction in unplanned admissions.</b>		✓ (admissions)
<b>Pimouguet et al. (2010)</b>	Mental Health	(Dementia) No evidence found for savings in health care expenditure or hospitalization recourse.		✓ (admissions)
<b>Smith and Newton (2007)</b>		(Psychiatric case management) No consistent outcomes for hospital admissions or total days admitted to hospital.		✓ (admissions and LOS)
<b>Burns et al. (2007)</b>		(Severe mental illness) The introduction of intensive case management teams would not lead to substantial reductions in hospital use where average hospital use is already low. The authors also conclude the more a case management team is organised like an assertive outreach team, the better it is at reducing time spent in hospital.		✓ (admissions)
<b>Kumar and Klein (2013)</b>	Frequent flyers	Some evidence that case management targeting frequent flyers can reduce emergency department use but not hospital admission.		✓ (admissions)



## Risk prediction models

Currently no evidence identified. A protocol (Kingston et al., 2016) for a systematic review examining the effectiveness of risk prediction models was identified. The authors believe this will be the first effectiveness review.

## Education and self-management

Table 3. Summary of studies reviewing education and self-management services for specific patient groups/populations

Reference	Patient group	Findings	Evidence suggests may be effective in reducing admissions	Evidence uncertain or of weak quality
<b>*Tapp et al. (2007)</b>	Asthma	Asthma education significantly reduced the risk of subsequent hospital admission (RR 0.50; 95% CI 0.27 to 0.91); five studies, N = 572.	✓ (admissions)	
<b>Taylor et al. (2014)</b>		<b>There was well-established evidence that self-management support reduces hospital admissions and ED visits and increases quality of life in people with asthma.</b>	✓ (admissions)	
<b>Panagioti et al. (2014)</b>		<b>In analyses including all studies, self-management support interventions for patients with respiratory problems were associated with small but significant reductions in hospital use. Variation across trials was moderate.</b>	✓ (admissions)	
<b>*Boyd et al. (2009)</b>	Asthma (children)	Some evidence that hospital admissions could be reduced, however when adjusting for the high variation in models (high statistical heterogeneity) the results were not significant.		✓ (admissions)
<b>Coffman et al. (2008)</b>		Asthma education caused a reduction in mean number of hospitalizations (5 studies; SMD: 0.35; 95% confidence limits: 0.63, 0.08), however the review lacked quality assessment.		✓ (admissions)
<b>*Effing et al. (2007)</b>	COPD	There was a significant reduction in the probability of at least one hospital admission among patients receiving self-management education compared to those receiving usual care (OR 0.64; 95%CI 0.47, 0.89).	✓ (admissions)	

Reference	Patient group	Findings	Evidence suggests may be effective in reducing admissions	Evidence uncertain or of weak quality
		There was limited meta-analysis performed due to heterogeneity among studies.		
<b>*Zwerink et al. (2014)</b>		Over one year of follow-up, eight (95% CI 5 to 14) participants with a high baseline risk of respiratory-related hospital admission needed to be treated to prevent one participant with at least one hospital admission, and 20 (95% CI 15 to 35) participants with a low baseline risk of hospitalisation needed to be treated to prevent one participant with at least one respiratory-related hospital admission.	✓ (admissions)	
<b>Taylor et al. (2014)</b>		Self-management education support/disease-specific education interventions were associated with a reduction in COPD-related hospital admissions.	✓ (admissions)	
<b>Panagioti et al. (2014)</b>		In analyses including all studies, self-management support interventions for patients with respiratory problems were associated with small but significant reductions in hospital use. Variation across trials was moderate.	✓ (admissions)	
<b>Majothi et al. (2015)</b>	COPD (post-discharge)	There was no clear evidence of effect on all-cause hospital admissions was observed (hazard ratio 0.88 [0.61, 1.27] I2=66.0%). The authors conclude that there is insufficient evidence to support self-management interventions post-discharge.		✓ (admissions)
<b>Ditewig et al. (2010)</b>	Heart Failure	Due to heterogeneity a narrative synthesis was performed. 2 out of 4 trials showed significant benefit on CHF hospitalizations, 2 out of 8 trials showed significant benefit on all cause hospitalizations. Methodological shortcomings that impaired validation of the effectiveness of self-management interventions on mortality, all-cause hospital readmissions, chronic heart failure hospitalisations and quality of life in patients with chronic heart failure.		✓ (admissions)
<b>Jovicic et al. (2006)</b>		Self-management was associated with significant		✓ (admissions)

Reference	Patient group	Findings	Evidence suggests may be effective in reducing admissions	Evidence uncertain or of weak quality
		decrease in all cause readmissions during the one year follow-up period (OR 0.59; 95% CI 0.44 to 0.80, 5 studies). 3 studies reported self-management strategies decreased the risk of readmission due to heart failure (OR 0.44; 95% CI 0.27 to 0.71). The review however contained limited reporting of study details and the validity assessment.		
<a href="#">Panagioti et al. (2014)</a>		<b>In analyses including all studies, self-management support interventions for patients with cardiovascular problems were associated with small but significant reductions in hospital use. Variation across trials was high.</b>	✓ (admissions)	

## Exercise and Rehabilitation

Table 4. Summary of studies reviewing exercise and rehabilitation services for specific patient groups/populations

Reference	Patient group	Findings	Evidence suggests may be effective in reducing admissions	Evidence uncertain or of weak quality
<b>*Puhan et al. (2011)</b>	COPD (after exacerbation)	Pulmonary rehabilitation (PR) was found to have a significant reduction in hospital readmission in COPD patients who have recently suffered an exacerbation of COPD (5 studies, 250 patients).	✓ (admissions)	
<a href="#">Jácome and Marques (2014)</a>	COPD (mild)	<b>Most of the PR programs had significant positive effects on exercise capacity and HRQOL in patients with mild COPD; however, their effects on health-care resource use and lung function were inconclusive. The authors conclude that patients with mild COPD may benefit from PR; however, insufficient evidence is still available.</b>		✓ (admissions)
<b>*Heran et al. (2011)</b>	Coronary heart disease	Exercise-based cardiac rehabilitation (CR) for coronary	✓ (admissions)	

Reference	Patient group	Findings	Evidence suggests may be effective in reducing admissions	Evidence uncertain or of weak quality
		heart disease found reductions in hospital admissions in the shorter term where follow-up was less than 12 months (4 studies), and no significant differences in studies with a follow up greater than 12 months (7 studies).		
*Anderson and Taylor (2014)		<p>Overview of six Cochrane systematic reviews judged to be of high methodological quality, and including 148 randomised controlled trials (RCTs) in 98,093 participants concluded that exercise-based CR in low-risk people with HF and after MI or PCI, is safe, with no increase in short-term mortality, and effective in terms of reductions in the risk of hospital admission and improvements in patient HRQoL, compared with control.</p> <p>While there was considerable evidence of heterogeneity across included primary studies in both the characteristics of the evaluated CR programmes and also across the included participants, the outcome benefits of CR in terms of HRQoL and reduced hospitalisation appeared to be independent of these programme and participant characteristics</p>	✓ (admissions)	
*Anderson et al. (2016)		<p>The findings of this update are consistent with the previous version of this Cochrane review (Heran et al., 2011). The overall risk of hospital admissions was reduced with CR (15 trials; RR 0.82, 95% CI 0.70 to 0.96) but there was no significant impact on the risk of MI (36 trials; RR 0.90, 95% CI 0.79 to 1.04), CABG (29 trials; RR 0.96, 95% CI 0.80 to 1.16) or PCI (18 trials; RR 0.85, 95% CI 0.70 to 1.04).</p> <p>There was little evidence of statistical heterogeneity</p>	✓ (admissions)	

Reference	Patient group	Findings	Evidence suggests may be effective in reducing admissions	Evidence uncertain or of weak quality
<b>across trials for all event outcomes.</b>				
<b>Peiris et al. (2011)</b>	Patients after an acute event or for a chronic condition	Additional physical therapy compared to standard physical therapy for patients after an acute event or for a chronic condition reported a significantly reduced length of stay.	✓ (LOS)	
<b>Stolee et al. (2012)</b>	Musculoskeletal disorders	Found some evidence that rehabilitation at home produces a similar result to inpatient rehabilitation for patients with musculoskeletal disorders. Length of stay in hospital was reduced in home-based patients in four studies (three RCTs) and rehabilitation periods were found to be longer in two studies (one RCT).		✓ (LOS)

## Technology enabled care services

Table 5. Summary of studies reviewing technology enabled care services for specific patient groups/populations

Reference	Patient group	Findings	Evidence suggests may be effective in reducing admissions	Evidence uncertain or of weak quality
<b>Polisena et al. (2010)</b>	Patients with COPD	Reports association with lower hospitalisations and visits but the evidence base is limited and heterogeneous		✓ (admissions)
<b>*McLean et al. (2012)</b>		Reports a reduction in emergency department visits and hospital admissions with no increase in morbidity or of increased costs.	✓ (admissions)	
<b>Cruz et al. (2014)</b>		<b>Significant differences were found for hospitalisation rates (RR = 0.72; 95% CI = 0.53-0.98; p = 0.034); however, no differences in the other healthcare utilisation outcomes were observed. The authors</b>		✓ (admissions)

Reference	Patient group	Findings	Evidence suggests may be effective in reducing admissions	Evidence uncertain or of weak quality
		concluded the evidence of its benefits is still limited and further research is needed to assess the effectiveness of home telemonitoring in COPD management, as there are still few studies in this area.		
<b>Martinez et al. (2006)</b>	Heart failure patients	23 of 42 studies reported an association between home monitoring and reduced readmissions	✓ (admissions)	
<b>Clark et al. (2007)</b>		“Remote monitoring programmes reduced the rates of admission to hospital for chronic heart failure by 21% (95% confidence interval 11% to 31%”. Noted that may be of benefits to patients with limited transport or infirmity.	✓ (admissions)	
<b>*Inglis et al. (2010)</b>		Telephone support and telemonitoring associated with a reduction in hospitalisation for chronic heart failure. Limited evidence on the impact on length of stay, with only 1 trial reporting a statistically significant result.	✓ (admissions)	✓ (length of stay)
<b>*Inglis et al. (2015)</b>		<p>For people with heart failure, structured telephone support and non-invasive home telemonitoring reduce the risk of all-cause mortality and heart failure-related hospitalisations. Neither structured telephone support nor telemonitoring demonstrated effectiveness in reducing the risk of all-cause hospitalisations.</p> <p>Seven structured telephone support studies reported length of stay, with one reporting a significant reduction in length of stay in hospital. Nine telemonitoring studies reported length of stay outcome, with one study reporting a significant reduction in the length of stay with the intervention.</p>	✓ (admissions)	✓ (length of stay)

Reference	Patient group	Findings	Evidence suggests may be effective in reducing admissions	Evidence uncertain or of weak quality
<b>Pandor et al. (2013a), (Pandor et al., 2013b)</b>		<b>Reductions were observed in all-cause hospitalisations for home telemonitoring (TM) interventions but not for structured telephone support (STS) interventions.</b>	✓ (admissions)	
<b>Clarke et al. (2011)</b>		Reports a reduction in CHF hospital admission (P ¼ 0.0004) but no significant difference in length of stay in hospital, medication adherence or cost. The authors note the significance of the stage and severity of the condition and that remote interventions may have limited effect in later stages, when hospitalisation is more likely.	✓ (admissions)	✓ (length of stay)
<b>Klersy et al. (2011)</b>		"Remote patient monitoring was associated with a significantly lower number of hospitalizations for HF [incidence rate ratio (IRR): 0.77, 95% CI 0.65–0.91, P , 0.001] and for any cause (IRR: 0.87, 95% CI: 0.79–0.96, P ¼ 0.003), while length of stay was not different."	✓ (admissions)	✓ (length of stay)
<b>Kairy et al. (2009)</b>	Patients with physical disabilities	Positive health outcomes but impact on service use is unclear (conflicting findings)		✓ (admissions)
<b>*McLean et al. (2011)</b>	Adults and children with asthma	Found a non-significant increase in the odds of emergency department visits over a 12-month period: OR 1.16 (95% CI 0.52 to 2.58) but a significant reduction in hospitalisations over a 12-month period: OR 0.21 (95% CI 0.07 to 0.61), particularly in those with more severe asthma managed predominantly in secondary care settings.	✓ (admissions)	
<b>Polisena et al. (2009)</b>	Patients with diabetes	Found mixed results in the trials reviewed with some reporting decreased service usage and some reporting increased use (hospitalisations, emergency visits, primary care visits, outpatient visits).		✓ (admissions)

Reference	Patient group	Findings	Evidence suggests may be effective in reducing admissions	Evidence uncertain or of weak quality
Bahr et al. (2014)	Patients discharged after a minimum of a 24-hr hospital stay	Evidence is inconclusive for use of phone calls to decrease readmission, emergency department use, patient satisfaction, scheduled and unscheduled follow-up, and physical and emotional well-being.		✓ (admissions)

## Discharge planning

Table 6. Summary of studies reviewing discharge planning services for specific patient groups/populations

Reference	Patient group	Findings	Evidence suggests may be effective in reducing admissions	Evidence uncertain or of weak quality
Langhorne et al. (2005)	Stroke patients	Reports an 8 day reduction ( $p < 0.0001$ ) in the length of hospital stay for patients receiving early supported discharge services. Concludes: "For stroke patients in hospital, input from an ESD [early supported discharge] service (that provides early assessment in hospital, co-ordinated discharge home, and post-discharge support) can accelerate their discharge home and increase their chance of being independent in the longer term."	✓ (length of stay)	
Rousseaux et al. (2009)		Reports a reduction in length of stay by about 8 days and no effect on readmissions. The overall cost of care (available in four of the 11 trials) was 9 to 20% lower in the ESD groups. Most of the included patients had suffered from mild or moderate strokes.	✓ (length of stay)	
Fisher et al. (2011)		This is a consensus agreement drawing on available evidence which supports early supported discharge for patients with mild or moderate stroke.	✓ (length of stay)	
Larsen et al. (2006)		The average length of stay was reduced by 10 days (95% CI: 2.6 to 18) to an average of 22 days. Concludes: "Early home-supported discharge (EHSD) reduces both inpatient days and poor outcomes [...] The calculated savings on nursing homes	✓ (length of stay)	



Reference	Patient group	Findings	Evidence suggests may be effective in reducing admissions	Evidence uncertain or of weak quality
		and hospital beds more than outbalance the costs, making EHSD a dominant intervention."		
<b>Prvu Bettger et al. (2012)</b>		Reports moderate evidence to suggest hospital-initiated support for stroke patients may reduce length of stay but found insufficient evidence to support other transitional care interventions (patient and family education; community-based support; chronic disease management) for patients suffering stroke or myocardial infarction.	✓ (length of stay)	
<b>Conroy et al. (2011)</b>	Elderly patients	Reports no significant difference for readmissions for patients receiving comprehensive geriatric assessment to those receiving usual care [risk ratio 0.95 (95% CI 0.83–1.08)]; the authors note the heterogeneity across the trials reviewed. The authors note a difference in the risk ratio for readmissions between nurse-led [1.01 (95% CI 0.89–1.15)] and geriatrician-led [0.81 (95% CI 0.59–1.12)] interventions.		✓ (admissions)
<b>Preyde et al. (2009)</b>		Reports mixed findings from different studies, with 8 reporting significantly shorter length of stay, 2 reporting longer and 9 reporting no difference. For the majority of studies, no difference was observed for readmissions; 4 studies reported significant impact on readmissions.		✓ (admissions, LOS)
<b>(Gonçalves-Bradley et al., 2016)</b>		<b>A discharge plan tailored to the individual patient probably brings about a small reduction in hospital length of stay and reduces the risk of readmission to hospital at three months follow-up for older people with a medical condition</b>	✓ (admissions, LOS)	
<b>Lambrinou et al. (2012)</b>	Patients with heart failure	The authors state: "Compared to controls, heart failure management programmes with a nurse-led pre-discharge component statistically significantly reduced heart failure related re-admissions (RR 0.68, 95% CI 0.53 to 0.86; 13 RCTs; substantial statistical heterogeneity $I^2=64%$ ) and all-cause re-admissions (RR 0.85, 95% CI 0.76 to 0.94; 17 RCTs; moderate statistical heterogeneity $I^2=50%$ )."	✓ (admissions)	
<b>Chetty et al. (2006)</b>	Patients with chronic obstructive pulmonary	Reports no significant differences for readmissions. For length of stay, the intervention group (early supported discharge)	✓ (length of stay)	✓ (admissions)

Reference	Patient group	Findings	Evidence suggests may be effective in reducing admissions	Evidence uncertain or of weak quality
	disease (COPD)	averaged 1.7 days whereas the usual care group averages 4.2 days ( $p < 0.001$ ).		
<b>Steffen et al. (2009)</b>	Mental health patients	Discharge planning had significantly lower readmission rates (RR 0.66, 95% CI 0.51 to 0.84; NNT=15); however, a Centre for Reviews and Dissemination summary of the review advises caution as the methodology of combining trial results is unclear.		✓ (admissions)
<b>Bravo et al. (2011)</b>	Postnatal mothers and babies	Concludes: " The evidence available is not enough to either reject or support the practice of early postnatal discharge; different studies have reported different outcomes for women and newborns"		✓ (length of stay)
<b>(McMartin, 2013)</b>	<b>Chronic conditions</b>	<b>Compared with usual care, there was moderate quality evidence that individualized discharge planning is more effective at reducing readmissions or hospital length of stay but not mortality.</b>	✓ (admissions)	
<b>(Verhaegh et al., 2014)</b>		<b>Interventions initiated during hospital admission and continued after discharge (through home visits or telephone follow-up) for a minimum of one month were effective in reducing readmissions at 180 days (pooled odds ratio 0.77 (0.62 to 0.96)) and 365 days (0.58 (0.46 to 0.75)).</b>	✓ (admissions)	

## Hospital at home

Table 7. Summary of studies reviewing hospital at home services for specific patient groups/populations

Reference	Patient group	Findings	Evidence suggests may be effective in reducing admissions	Evidence uncertain or of weak quality
<b>*Wong et al. (2011)</b>	Patients with COPD	Reports no significant change in the number of hospitalisations with the intervention (Peto OR 1.01; 95% CI 0.71 to 1.44) but authors note significant statistical heterogeneity was observed ( $I^2 = 65\%$ ).		✓ (admissions)

Reference	Patient group	Findings	Evidence suggests may be effective in reducing admissions	Evidence uncertain or of weak quality
<b>McCurdy (2012)</b>		Found that 21-37% of patients with COPD exacerbations would be eligible for hospital at home. Reports that hospital at home was associated with a non-significant reduction in readmissions compared to inpatient care; however, some evidence suggests that readmission may be delayed (mean additional days before readmission comparing hospital-at-home to inpatient hospital care ranged from 4 to 38 days).		✓ (admissions, LOS)
<b>British Thoracic Society (2007)</b>		This guidance, based on a review of the evidence base, states "There were no significant differences in forced expiratory volume in 1 second (FEV1), readmission rates, mortality or number of days in care between HaH [hospital at home] and hospital care. [...] One study found that reducing inpatient stay from 6.1 to 3.2 days by using supported discharge was not associated with any increase in readmission rate or mortality. There was no convincing evidence that HaH was either more or less expensive than conventional care"		✓ (admissions, LOS)
<b>*Jeppesen et al. (2012)</b>		<b>Eight trials with 870 patients were included in the review and showed a significant reduction in readmission rates for hospital at home compared with hospital inpatient care of acute exacerbations of COPD (risk ratio (RR)0.76; 95% confidence interval (CI) from 0.59 to 0.99; P=0.04). The authors conclude that the results are only applicable to a subgroup of patients who could be treated at home, but for a majority of the patients with acute COPD exacerbations, "hospital at home" schemes are probably not a suitable option.</b>		✓(admissions)
<b>Linertova et al. (2011)</b>	Elderly patients	Reports mixed findings on the impact of In-hospital geriatric evaluation and discharge management on admissions. Reports mainly positive findings to support the use of geriatric assessment with home follow-up to reduce readmissions but some trials report no effect and one reports an increase.		✓ (admissions)
<b>*Clar et al. (2007)</b>	Children with newly diagnosed Type 1 diabetes	Concludes: "On the whole, the data seem to suggest that where adequate out-patient/home management of type 1		✓ (admissions)

Reference	Patient group	Findings	Evidence suggests may be effective in reducing admissions	Evidence uncertain or of weak quality
		diabetes in children at diagnosis can be provided, this does not lead to any disadvantages in terms of metabolic control, acute diabetic complications and hospitalisations, psychosocial variables and behaviour, or total costs"		
<b>*Parab et al. (2013)</b>	<b>Children with acute and chronic illnesses</b>	<b>No significant differences were reported in health outcomes; two studies reported a reduction in the hospital stay with no difference in the hospital readmission rates.</b>		✓ (admissions, LOS)
<b>Toot et al. (2011)</b>	<b>Older people with mental health problems</b>	The authors were not able to draw firm conclusions due to limitations of the evidence base: "There is very little robust evidence (Level C) indicating that crisis resolution/home treatment services for older people with mental health problems reduce the number of admissions to hospital. For all other outcomes, including maintenance of community residence and length of hospital stay, the evidence is very weak".		✓ (admissions, LOS)
<b>Qaddoura et al. (2015)</b>	<b>Patients with heart failure</b>	<b>In RCTs, HaH demonstrated a trend to decreased readmissions (risk ratio (RR) 0.68 [0.42 to 1.09]). HaH decreased costs of index hospitalization in all RCTs. HaH reduced readmissions and emergency department visits per patient in all 3 observational studies.</b>  <b>The review included a limited number of modest-quality studies.</b>		✓ (admissions)

## Community interventions

Table 8. Summary of studies reviewing community services

Reference	Intervention	Findings	Evidence suggests may be effective in reducing admissions	Evidence uncertain or of weak quality
Ariss et al. (2015)	Increased skill mix / integrated care facilitators'	Highlighted a study by Dixon et al., 2010 that found IC services in England identified increased skill mix (increasing the number of different disciplines in the team by one) in IC teams was associated with a 17% reduction in service costs. Highlighted another study by Bird et al., 2010 that found the use of 'integrated care facilitators' to improve co-ordination of care reduced emergency readmission presentations by 10% (COPD) and 39% (CHF), admissions by 25% (COPD) and 36% (CHF) and length of stay by 18% (COPD) and 36% (CHF). Mortality at 365 days was 18% (COPD and CHF combined) compared with 36% in the control arm.	✓ (admissions)	
Philp et al. (2013)	Integrated community teams with care coordination / Multidisciplinary teams	Found evidence for the effectiveness of care coordination in the prevention of admission to hospital.	✓ (admissions)	
Leppin et al. (2014)	Peri-discharge interventions	A systematic review and meta-analysis of 42 RCTs found that interventions to reduce the risk of 30 day readmission in medical and surgical inpatients were successful overall (pooled relative risk 0.82 (0.73 to 0.91)). Successful interventions usually had five or more components targeting patient factors (including multimorbidity, functional capacity, socioeconomic factors, and self care) as well as caregiver capabilities. Typically these complex interventions were coordinated after inpatients were discharged by at least two healthcare providers who made regular contact with the patient, including home visits.	✓ (admissions)	
Feltner et al. (2014)	Transitional care interventions (heart)	Home-visiting programs and Multidisciplinary-HF clinic interventions reduced all-cause readmission and	✓ (admissions)	

Reference	Intervention	Findings	Evidence suggests may be effective in reducing admissions	Evidence uncertain or of weak quality
	failure patients)	mortality; Structured telephone support reduced HF-specific readmission and mortality but not all-cause readmission. The authors concluded that in general, categories of interventions that reduced all-cause readmissions or mortality were more likely to be of higher intensity, to be delivered face to face, and to be provided by MDS teams.		
Dickens et al. (2014)	Complex interventions for COPD patients (involved multiple components and/or multiple professionals)	Complex interventions were associated with a reduction in urgent healthcare use. Subgroup analyses found that complex interventions that included education, exercise and relaxation therapy were associated with a reduction in healthcare use.		✓ (admissions)
Blakemore et al. (2015)	complex interventions for adult asthma patients (involved multiple components and/or multiple professionals)	Pooled effects indicated that interventions were associated with a reduction in urgent healthcare use. Subgroup analyses found that complex interventions that included general education, skills training, and relapse prevention were associated with a reduction in healthcare use, however in multivariate meta-regression analysis, only skills training remained significant.		✓ (admissions)

## Medication Review

Table 9. Summary of studies reviewing medication review services for specific patient groups/populations

Reference	Patient group	Findings	Evidence suggests may be effective in reducing admissions	Evidence uncertain or of weak quality
Royal et al. (2006)	Various	There is relatively weak evidence to indicate that pharmacist-led medication reviews are effective in reducing hospital admissions.		✓ (admissions)
Thomas et al. (2014)	Elderly	Interventions led by hospital pharmacists (seven trials) or		✓

Reference	Patient group	Findings	Evidence suggests may be effective in reducing admissions	Evidence uncertain or of weak quality
		community pharmacists (nine trials) did not reduce unplanned admissions in the older population.		(admissions)

## Features of primary care

Table 10. Summary of studies reviewing feature of primary care

Reference	Intervention	Findings	Evidence suggests may be effective in reducing admissions	Evidence uncertain or of weak quality
Huntley et al., 2014	Continuity of care	Being able to see the same healthcare professional reduced unscheduled secondary care.	✓ (admissions)	
van Loenen et al., 2014		There is compelling evidence, based on nine observational studies, that higher levels of provider continuity decrease the risk of avoidable hospitalization for ACSC and chronic diseases, regardless of country and age groups (45–53)	✓ (admissions)	
Huntley et al., 2014	Access	Generally, better access was associated with reduced unscheduled care in the USA.	✓ (admissions)	
Gibson et al., 2013		Better access to quality primary care resulted in fewer diabetes-related ACSC hospitalisations: <ul style="list-style-type: none"> <li>• Four of six studies found that less patients per doctor was significantly associated with a decrease in ambulatory care sensitive hospitalisations, one study found the opposite and one study did not find a significant association between the two.</li> <li>• One study found that PHC service availability (based on opening hours), identified that a more resourced service (e.g. PHC service available 24-hour/7-days per week compared to a service available 3 days/week) resulted in less hospitalisation for chronic conditions</li> <li>• One study found that as PHC practice size</li> </ul>	✓ (admissions)	

Reference	Intervention	Findings	Evidence suggests may be effective in reducing admissions	Evidence uncertain or of weak quality
		<p>increased (measured by mean partnership size) the hospitalisation rate decreased. Consistent with this was, as the proportion of sole practitioner PHC services within the health authority area increased hospitalisations increased.</p> <p>The authors conclude that excluding the results of studies (n=3) that did not adjust for health status, the conclusion remains that better access to primary health care resulted in fewer ACSC hospitalisations.</p>		
van Loenen et al., 2014		Adequate physician supply (accessibility) reduced avoidable hospitalisations. Except for 3 studies, the majority (n=9) of studies confirmed a negative association between the number of primary care physicians per population and hospitalisation rates. One study one study found the inverse relationship between supply and avoidable hospitalization rates was only present for supply-rates up to 5.2/10000, while a further increase in supply did not affect hospitalisation rates. One study found a positive relation, indicating that the more primary care physicians, the higher the rates of ACSC hospitalisation.	✓ (admissions)	
Busby et al., 2015		One study looking at the effect of the number of GPs within the population [Barnett and Malcolm, 2010) on admission rates found no consistent effect.		✓ (admissions)
Gibson et al., 2013	Use of primary care services	More visits were associated with higher rates of hospitalization: Three studies found the probability of a diabetes-related hospitalisation increased as the number of PHC visits by the patient increased. One study found that more self-reported visits to the GP in the 12 months previous to a diabetes-related hospitalisation resulted in		✓ (admissions)





Reference	Intervention	Findings	Evidence suggests may be effective in reducing admissions	Evidence uncertain or of weak quality
		less subsequent hospitalisation for the same reason.		
Huntley et al., 2014	Primary care quality	Evidence relating to quality of care was limited and mixed.		✓ (admissions)
Busby et al., 2015		One study looking at the effect of primary care quality, measured using GP quality scores (Downing et al., 2007) on admission rates found no consistent effect.		✓ (admissions)
Gibson et al., 2015	Financial incentives	One study found that financial incentives to improve the quality of diabetes care were associated with less ACSC hospitalisations.		✓ (admissions)

## Appendix 2 - Methodology

This review is a summary of secondary evidence and includes only evidence which meets the following criteria:

- must be secondary research (syntheses of studies); for reasons of expediency, we have not searched for primary literature (individual studies);
- must assess at least one intervention aimed at reducing unplanned admissions, readmissions, or length of stay;
- must provide quantitative analysis of the impact on admissions, readmissions, length of stay;
- has been published since our earlier publication of "Reducing Unplanned Admissions A review of the literature" (Aldridge and Turner, 2013);
- must be in English language.

The following sources were searched (March 2016):

Cochrane Library

Medline

HMIC

NIHR

Kings Fund

Health Foundation

Nuffield Trust

The search strategy used in Medline is included at the end of this appendix; the search strategy included interventions from our previous report on unplanned admissions, adapted to primary and community care interventions.

### Search strategy (Medline)

1. Medline; EMERGENCY MEDICAL SERVICES/ OR EMERGENCY MEDICINE/ OR EMERGENCY SERVICE, HOSPITAL/ OR EMERGENCY TREATMENT/
2. Medline; EMERGENCIES/
3. Medline; HOSPITALIZATION/ OR LENGTH OF STAY/ OR PATIENT ADMISSION/ OR PATIENT READMISSION/
4. Medline; 1 OR 2 OR 3
5. Medline; "emergency hospital admission\*".ti,ab
6. Medline; "emergency admission\*".ti,ab
7. Medline; ("emergency care" adj3 admission).ti,ab
8. Medline; ("emergency care" adj3 readmission).ti,ab
9. Medline; "unplanned hospitalisation".ti,ab
10. Medline; "unplanned hospitalization".ti,ab
11. Medline; "emergency hospitalisation".ti,ab
12. Medline; "emergency hospitalization".ti,ab
13. Medline; ("ambulatory care" adj5 admission\*).ti,ab
14. Medline; (unplanned adj3 admission\*).ti,ab
15. Medline; (unplanned adj3 readmission\*).ti,ab
16. Medline; (unplanned adj3 care).ti,ab
17. Medline; (unscheduled adj3 admission\*).ti,ab
18. Medline; (unscheduled adj3 readmission\*).ti,ab
19. Medline; (unscheduled adj3 care).ti,ab
20. Medline; 5 OR 6 OR 7 OR 8 OR 9 OR 10 OR 11 OR 12 OR 13 OR 14 OR 15 OR 16 OR 17 OR 18 OR 19
21. Medline; 4 OR 20
22. Medline; PATIENT DISCHARGE/
23. Medline; PRIMARY HEALTH CARE/



24. Medline; CASE MANAGEMENT/
25. Medline; HOME CARE SERVICES/
26. Medline; COMMUNITY HEALTH NURSING/
27. Medline; CONTINUITY OF PATIENT CARE/
28. Medline; AFTERCARE/
29. Medline; MANAGED CARE PROGRAMS/
30. Medline; INTERMEDIATE CARE FACILITIES/
31. Medline; COMMUNITY HEALTH SERVICES/
32. Medline; \*PATIENT EDUCATION AS TOPIC/
33. Medline; \*SELF CARE/
34. Medline; TELEMEDICINE/
35. Medline; \*DRUG UTILIZATION REVIEW/
36. Medline; 22 OR 23 OR 24 OR 25 OR 26 OR 27 OR 28 OR 29 OR 30 OR 31 OR 32 OR 33 OR 34 OR 35
37. Medline; "discharge plan\*".ti,ab
38. Medline; "primary care".ti,ab
39. Medline; "virtual wards".ti,ab
40. Medline; "case manag\*".ti,ab
41. Medline; "Risk stratification".ti,ab
42. Medline; "home hospital\*".ti,ab
43. Medline; "hospital at home".ti,ab
44. Medline; "Continuity of care".ti,ab
45. Medline; "community matron\*".ti,ab
46. Medline; "walk in centre\*".ti,ab
47. Medline; "home visit\*".ti,ab
48. Medline; "self management".ti,ab
49. Medline; telemonitoring.ti,ab
50. Medline; "telephone follow-up".ti,ab
51. Medline; "home telehealth".ti,ab
52. Medline; tele-homecare.ti,ab
53. Medline; telehomecare.ti,ab
54. Medline; "home telecare".ti,ab
55. Medline; "home telemedicine".ti,ab
56. Medline; "on-line health".ti,ab
57. Medline; e-health.ti,ab
58. Medline; ehealth.ti,ab
59. Medline; "medication review".ti,ab
60. Medline; ((reduction OR reduce\* OR lessen OR decrease OR diminish OR "drop off")).ti,ab
61. Medline; 37 OR 38 OR 39 OR 40 OR 41 OR 42 OR 43 OR 44 OR 45 OR 46 OR 47 OR 48 OR 49 OR 50 OR 51 OR 52 OR 53 OR 54 OR 55 OR 56 OR 57 OR 58 OR 59.
62. Medline; 60 OR 61.
63. Medline; 36 OR 62
64. Medline; 21 AND 63
65. Medline; REVIEW/
66. Medline; meta-analysis.ti,ab
67. Medline; META-ANALYSIS/
68. Medline; "systematic review".ti,ab
69. Medline; 65 OR 66 OR 67 OR 68
70. Medline; 64 AND 69
71. Medline; 70 [Limit to: Publication Year 2013-2016 and (Language English)]



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