

Author
Sarah Purdy

December 2010

Avoiding hospital admissions

What does the research evidence say?



Executive summary

Emergency admissions – that is, admissions that are not predicted and happen at short notice because of perceived clinical need (NHS Connecting for Health 2010) – represent around 65 per cent of hospital bed days in England (34 million bed days and 4.75 million emergency admissions in 2007/8) (Hospital Episode Statistics 2007/8).

Avoiding emergency hospital admissions is a major concern for the National Health Service (NHS), not only because of the high and rising unit costs of emergency admission compared with other forms of care, but also because of the disruption it causes to elective health care – most notably inpatient waiting lists – and to the individuals admitted (Audit Commission 2009).

Despite considerable efforts to reduce emergency admissions, only a minority of primary care trusts (PCTs) succeeded in doing so between 2007/8 and 2008/9 (Gillam 2010). The average increase in admissions during this time was 5 per cent across all PCTs, ranging from a 12.7 per cent decrease to a 27.3 per cent increase. In order to successfully reduce avoidable emergency admissions, we need to fully understand which interventions are the most effective.

This paper considers the research evidence for a range of interventions to avoid emergency or unplanned hospital admissions.

In this paper, we aim to address the following questions:

- What interventions work in reducing avoidable admissions?
- Who is at risk, and how do we identify them?
- Which admissions are potentially avoidable?
- Which interventions work in:
 - primary care
 - social care
 - emergency care
 - discharge from hospital.

Evidence from the research literature suggests the following.

- People from lower socio-economic groups are at higher risk of avoidable emergency admissions.
- There are several tools available to help identify people at high risk of future emergency admission, including computer database models and simple questionnaires. There is no clear advantage of using one tool over another.
- It is important to be clear which admissions are potentially avoidable and which interventions are likely to be effective. Clarity of disease coding is essential.
- In primary care, higher continuity of care with a GP is associated with lower risk of admission.
- Integrating health and social care may be effective in reducing admissions.
- Integrating primary and secondary care can be effective in reducing admissions.
- Telemedicine seems to be effective for patients with heart failure, but there is little evidence that it is effective for other conditions.
- Hospital at home produces similar outcomes to inpatient care, at a similar cost.
- Case management in the community and in hospital is not effective in reducing generic admissions. There is limited evidence to suggest that it may be effective for patients with heart failure. Assertive case management is beneficial for patients with mental health problems.
- Patient self-management seems to be beneficial.
- Acute assessment units may reduce avoidable admissions, but the overall impact on number of admissions should be considered.
- Early review by a senior clinician in the emergency department is effective. GPs working in the emergency department are probably effective in reducing admissions, but may not be cost-effective.
- There is a lack of evidence on the effectiveness of combinations of interventions.

Re-admissions

- Developing a personalised health care programme for people seen in medical outpatients and frequently admitted can reduce re-admissions.
- Structured discharge planning is effective in reducing future re-admissions.

Introduction

There has been a longstanding ambition within the NHS to ‘manage demand’ and reduce unplanned as well as elective hospital admissions. However, this ambition has yet to be realised, despite considerable effort to deliver interventions across the service. The problem is complex and there are many causes, with issues around population, hospital and community care contributing to the variance in unplanned admissions (Blunt *et al* 2010).

There is also limited evidence on the effectiveness of interventions aimed at reducing unplanned admissions. Interventions may be focused at different stages along the patient journey, from preventive management of people at high risk of admission, through to services that manage acute illness (or exacerbations of chronic illness) without resorting to hospital admission. Other interventions focus on individual patients, from developing skills in self-care to wider interventions such as care pathways and co-ordinated responses to acute medical problems for a given population.

This paper is an overview based on knowledge of the research evidence rather than on a systematic review of the literature. Only peer-reviewed literature was included, except in the case of systematic reviews that met criteria consistent with peer-reviewed literature. Wherever possible, we refer to evidence from systematic reviews rather than individual studies. We have not included interventions focused on the clinical management of diseases – for example, pharmacological agents. While the paper covers a wide range of interventions, it is not exhaustive.

Findings

Who is at risk of emergency admission?

A number of factors are associated with increased rates of admission, and are therefore important to consider when targeting interventions to reduce avoidable admissions.

Age

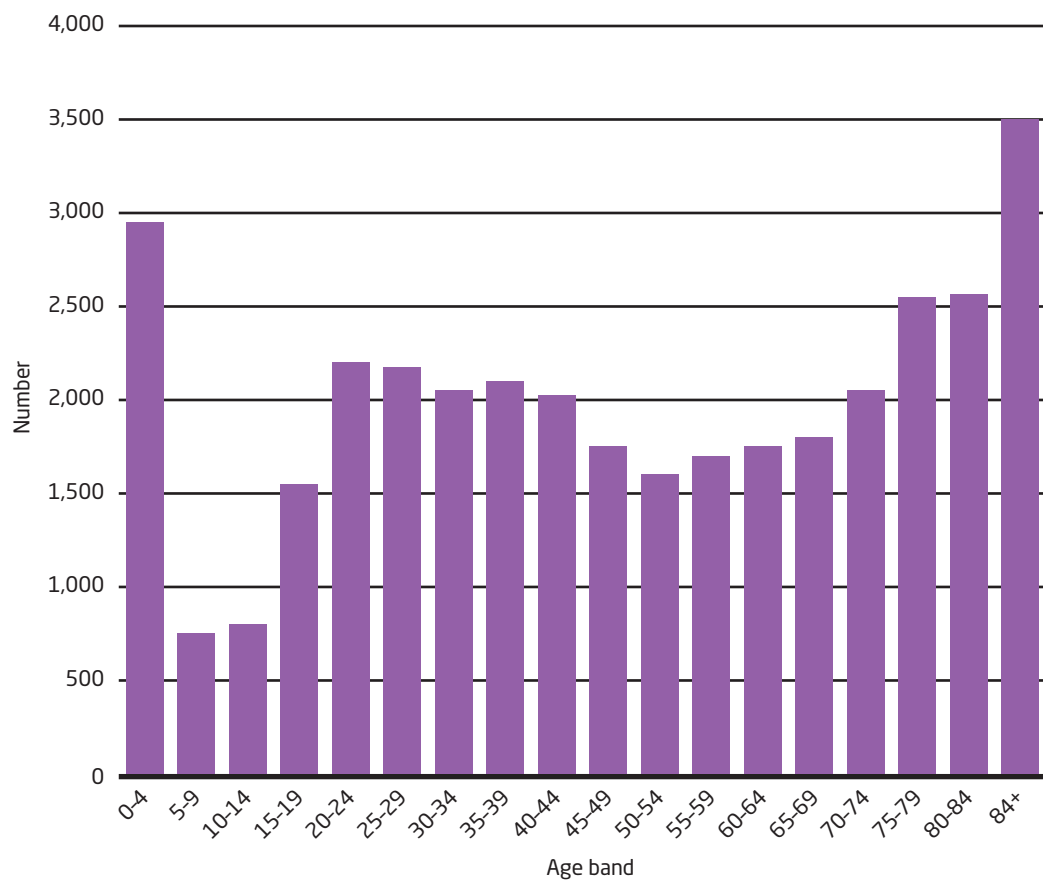
Age is a risk factor for emergency hospital admission, with babies or very young children and older people being at higher risk. However, it is important to recognise that only those aged 5 to 14 years have low risk. Figure 1 overleaf shows emergency admissions for one PCT in England, and illustrates the large number of admissions occurring in those under 65 years of age.

Social deprivation

There is evidence from the UK, North America and Europe that people who live in areas of socio-economic deprivation have higher rates of emergency admissions, after adjusting for other risk factors. In the UK, admission rates are significantly correlated with measures of social deprivation (Majeed *et al* 2000). Socio-demographic variables explain around 45 per cent of the variation in emergency admissions between GP practices, with deprivation more strongly linked to emergency than to elective admission (Reid *et al* 1999; Duffy *et al* 2002). Practices serving the most deprived populations have emergency admission rates that are around 60–90 per cent higher than those serving the least deprived populations (Blatchford *et al* 1999; Purdy *et al* 2010a).

Deprivation is also a risk factor for admission in Europe. Socio-economic risk factors for cardiovascular admission were evaluated in two large Scandinavian studies; both show that increasing socio-economic status – whether measured by employment status, census variables, education, housing tenure or social capital – is associated with decreased emergency admission rates for coronary heart disease (Sundquist *et al* 2007; Tüchsen and Endahl 1999).

Figure 1: Number of emergency admission 2006/7 by age: PCT residents



Morbidity levels

Higher levels of morbidity in a population are associated with higher levels of emergency admission. Admission rates are also correlated with chronic illness (Majeed *et al* 2000). Higher levels of recorded morbidity and chronic disease in patients registered with GP practices have also been shown to be associated with higher rates of emergency admission from those practices (Bottle *et al* 2008; Donald and Ambery 2000).

Area of residence

Those who live in urban areas have higher rates of emergency hospital admission than those in rural areas; for example, we found a 16 per cent higher rate of asthma admissions for urban patients compared with rural patients (Purdy *et al* 2010a). What is uncertain is whether these rates are lower due to better management in the community or because patients who live further from secondary care have more difficulty accessing services (O'Donnell 2000). We also found that those who live closer to A&E departments have higher rates of admission (for instance, a 12 per cent higher rate of admission for asthma), even after taking into account other risk factors, including living in an urban area (Purdy *et al* 2010a).

Ethnicity

Data on the impact of ethnicity on risk of emergency admission are fairly limited. Being from a minority ethnic group is associated with a higher risk of emergency admission (Bottle *et al* 2006). For example, in the UK, asthma admission rates for South Asian patients have been double those of white patients, and are also high for black patients (Gilthorpe *et al* 1998). Different ways of coping with asthma exacerbations and accessing care may partly explain the increased risk of hospital admission among South Asian patients (Griffiths *et al* 2001).

Environmental factors

The evidence for environmental risk factors is variable across diseases. For example, air pollution and meteorological factors in the UK are probably less important in relation to cardiovascular admissions than they are in respiratory conditions such as COPD, where cold weather is associated with increased rates of admission (Maheswaran *et al* 2005; Moran *et al* 2000; Marno 2006).

Recommendation:

- **Policy-makers should consider the impact of socio-economic deprivation and other socio-demographic factors when designing policy around admission rates.**

How do we identify those at risk?

There are a number of ways to identify patients who may be at high risk of future emergency admission. They include the following.

- *Clinical knowledge*, which is the default position in the NHS. There is little research evidence in this area. Although clinicians may be able to identify those currently at high risk, they are less able to identify those who may be at risk in the future (The King's Fund 2005).
- *Threshold modelling*, which is rules based, and identifies those at high risk who meet a set of criteria. Case finding has usually been based on threshold modelling such as identifying patients with repeated emergency admissions as a marker of high risk of future admissions. But the utility of this approach has been questioned as, over four to five years, admission rates and bed use among high-risk patients (those over 65 with at least two emergency admissions in one year) fall to the mean rate for older people (38 per cent of admissions in index year, 10 per cent the following year, and 3 per cent at five years)(Roland *et al* 2005).

Alternative threshold modelling techniques such as identifying patients at high risk through a questionnaire administered by a GP practice have also been tried. The Emergency Admission Risk Likelihood Index (EARLI) is an example of this (Lyon *et al* 2007). It comprises a six-item questionnaire used to identify patients over 75 who are at high risk of admission. The tool correctly identified more than 50 per cent of those at high or very high risk of emergency admission, and more than 79 per cent of those who were not at risk. However, this method does not take account of changes in health status, unless repeated regularly.

- *Predictive modelling*, in which data are entered into a statistical model in order to calculate the risk of future admission. Predictive modelling is thought to be the best available technique (The King's Fund 2005).

Several predictive models calculate the risk of future emergency admission for patients with one or more previous admissions; using information about the patient's age, gender and socio-demographic characteristics. These include the Patients at Risk of Re-Hospitalisation (PARR) and Scottish Patients at Risk of Readmission and Admission (SPARRA) models (*see* Appendix 1) (Billings *et al* 2006; NHS Scotland Information Services Division 2006). Other models, including The King's Fund's Combined Predictive Model, the Predicting Emergency Admissions Over the Next Year (PEONY) model, and the Reduce Emergency Admissions Risk model (Prism), use further data from primary care records such as prescribing or diagnosis and medical test results (The King's Fund 2006; Donnan *et al* 2008; Welsh Assembly Government Department for Health and Social Services 2007). Different models have focused on different population groups – for example, those with a prior history of emergency hospital admission (PARR) and those aged over 65 (SPARRA) – whereas the Combined, PEONY and Prism models include all patients registered with a

GP or PCT. Testing the various models results in varying degrees of accuracy in predicting future admission (see Appendix 1). Those models that include data from primary care records perform around 10 per cent better than those that rely on secondary care data alone.

In order to improve the performance of predictive models, detailed data on individual patients need to be available.

Which admissions are avoidable?

Ambulatory or primary care sensitive conditions (ACSCs) are those for which hospital admission could be prevented by interventions in primary care (Bindman *et al* 1995; Purdy *et al* 2010c). At present, different sets of ACSCs are used in different situations. The most common ACSCs in England are based on a set of conditions initially derived to measure access to primary care in the United States; these were then refined for use in Australia (Agency for Healthcare Research and Quality 2001; NHS Institute for Innovation and Improvement 2007).

Some admissions (eg, those for dementia) may not be perceived to be avoidable, as the disease course is not significantly modifiable. However, the availability of more suitable alternatives to an acute hospital admission – for example, respite care or home care – can result in admission avoidance in the acute situation. This concept of an ACSC, which is dependent on availability and referral to an alternative service, is very different to the original American concept of the ACSC as a marker of availability of traditional clinical ambulatory or primary care.

Commissioners and other stakeholders will inevitably prioritise the conditions that are of interest to them according to different criteria, which will vary depending on the viewpoint of the stakeholder. These priorities will also vary across health care systems, depending on the prevalence of the ACSCs and the economic and policy drivers in the local health care economy.

Recommendation:

- **Commissioners need to be clear about which admissions they consider to be avoidable, what proportion of these admissions are avoidable, and how these admissions should be coded and measured.**

Interventions to reduce avoidable admissions

Self-management

There is evidence from systematic reviews that self-management seems to be effective in reducing unplanned admissions for patients with COPD and asthma. Self-management means the patient developing an understanding of how their condition affects their lives and how to cope with their symptoms. Overall, people report that it helps them live better lives, and puts them in control of their condition (Corben and Rosen 2005). Self-management education for patients with COPD reduces the risk of at least one hospital admission by about 36 per cent compared with usual care (Effing *et al* 2007). This translates into a one-year number needed to treat (NNT) of 10 for patients with more severe disease (51 per cent risk of exacerbation), and 24 for those with milder disease (13 per cent risk of exacerbation). Self-management education was associated with a reduction in shortness of breath and an improved quality of life.

Education for adult patients with asthma attending A&E with an acute exacerbation significantly reduced admission to hospital by 50 per cent, but did not significantly reduce the risk of re-presentation at A&E during follow-up (Tapp *et al* 2007). A previous study also showed that a brief self-management programme during hospital admission reduced

post-discharge morbidity and re-admission for adult asthma patients. The benefit of the programme may have been greater for patients admitted for the first time. It had a small but significant effect on medical management at discharge (use of medications in line with current guidelines) that may explain the benefits of this approach (Osman *et al* 2002).

There is also evidence that asthma education aimed at children and carers who present at A&E with acute exacerbations can result in lower risk of A&E attendance and admission (Boyd *et al* 2009). Following an educational intervention delivered to children, their parents, or both, there was a significantly reduced risk (21 per cent) of subsequent hospital admissions. However, there is a suggestion that the benefits of psycho-educational interventions may not be as evident in those patients with severe and difficult asthma (Smith *et al* 2005).

Not all studies of self-management demonstrate reduced hospital or A&E department use, and there is some debate over which 'active ingredient' in self-management is the most effective. One review of 15 studies measuring the impact of adult asthma self-management education on health care utilisation and costs found that eight studies demonstrated reduced hospital or emergency department use, while seven failed to demonstrate a reduction (Bodenheimer *et al* 2002). Six of the eight studies that did demonstrate a reduction included a self-management action plan, compared with three of the seven that did not, suggesting that a self-management action plan is a useful component.

Recommendation:

- **Policy-makers, commissioners and providers should aim to increase self-management among people with long-term conditions where there is evidence of benefit.**

Interventions in primary care

Practice characteristics

Larger practice size has been suggested as a mechanism for reducing avoidable admissions, as these practices can potentially offer a wider range of services such as chronic disease clinics. However, larger practices are not necessarily associated with lower levels of emergency admissions. Some studies have found that rates of asthma admission may be higher in smaller and single-handed practices (Saxena *et al* 2006; Griffiths *et al* 1997; Yeung *et al* 2005). However, the same relationship has not been demonstrated for other conditions, for instance COPD and cardiovascular admissions (Purdy *et al* 2010a; Saxena *et al* 2006; Purdy *et al* 2010b).

High continuity of care with a family doctor may be associated with lower risk of admission for all age groups. In Canada, high continuity of care with a family physician was associated with reduced odds of an ACSC hospitalisation (but not all hospitalisations) after controlling for demographic and health status measures in older adults (aged 67 and over) (Menec *et al* 2006). Lower continuity of primary care has been associated with higher risk of hospitalisation among children (Dimitri *et al* 2001), and among children and adults enrolled in a Medicaid programme (Gill and Mainous 1998).

Out-of-hours care

In the UK, unplanned admissions have risen steadily over the past 10 years. There is some evidence that this rise may be partly attributable to changes in out-of-hours provision that occurred in 2004 with the new GP contract. These changes included a shift of responsibility for providing out-of-hours care from GPs to PCTs, and the development of new services such as walk-in centres and telephone advice (NHS Direct). Paediatric short-

stay admissions among children under 10, for example, rose by 22 per cent from 1997 to 2006 (Saxena *et al* 2009). The number of short-stay admissions of less than 48 hours rose by 41 per cent over the same time period, with a fall of 12 per cent for stays lasting more than 48 hours. This suggests that short-stay admissions for minor illness episodes in children have increased substantially. Most of these unplanned admissions occur out of hours, and most are via A&E. The authors suggest that these findings may be evidence of both a lack of access to primary care and a failure of primary care services to manage minor illness in children in a timely and appropriate way.

However, although the number of out-of-hours referrals may be rising overall, there is evidence that the proportion of patients with complex problems who are admitted by out-of-hours services did not change with the implementation of the new GP contract (Richards *et al* 2008).

A fivefold variation in out-of-hours admission rates has been observed between GPs working for the same out-of-hours service and caring for the same patient population, suggesting that clinician factors play an important part in determining admission rates (Rossdale *et al* 2007). Qualitative research in the same group of GPs suggests this may be due to lack of confidence, feelings of isolation, aversion to risk and lack of awareness of alternatives to admission (Calnan *et al* 2007) – all of which are modifiable factors.

Involvement of pharmacists

Medication-related adverse events in primary care are a common cause of morbidity. A systematic review of studies that looked at interventions aimed at reducing medication-related adverse events that result in hospital admission found relatively weak evidence that pharmacist-led medication reviews are effective in reducing admissions (Royal *et al* 2006). Moreover, a randomised controlled trial of pharmacist home-based medication review at two and eight weeks after discharge, for patients over 80, showed that this active intervention was associated with a significantly higher rate of hospital admission, and did not significantly improve quality of life or reduce deaths (Holland *et al* 2005).

Quality of primary care

The evidence for an association between higher quality of primary care (as measured by routine data) and reduced rates of admission is mixed. Lower rates of admission for asthma were found in practices whose prescribing patterns suggest better preventive care (Giuffrida *et al* 1999). However, the evidence is not conclusive. More recent research did not find any association between Quality and Outcomes Framework (QOF) scores and hospital admission for patients with asthma, COPD or coronary heart disease (Downing *et al* 2007; Bottle *et al* 2008).

Provision of diabetes clinics in primary care was significantly associated with reduced admission rates for diabetes, but the provision of asthma clinics was not associated with a similar reduction in admissions (Saxena *et al* 2006). Conversely, a systematic review showed that high standards of diabetes care in primary care do not necessarily lead to reduced hospital admissions (Griffin and Kinmonth 2006).

Recommendations:

- **Primary care providers should aim to increase continuity of care with a GP.**
- **Commissioners and primary care providers should consider the impact of local out-of-hours primary care arrangements on avoidable admissions.**

Telemedicine

Telemedicine includes both telecare (using equipment to support the patient in their own home, such as regular contact by telephone) and telehealth (which tends to complement usual care, for example, by providing equipment for monitoring vital signs such as heart rate, and sending the data to a clinician to interpret).

The majority of the evidence around telemedicine concerns patients with heart failure or diabetes. Much of the evidence for its effectiveness comes from large, integrated health care systems such as the Veterans Health Administration (VHA) in the United States, where it has been shown to both reduce hospital admissions and lower costs (Darkins *et al* 2008). Evidence from the UK is less compelling, but two systematic reviews point to cost benefits relating to hospital admissions for certain conditions (Barlow *et al* 2007; Department of Health, Care Services Improvement Partnership (CSIP) 2008).

Based on the evidence reviewed, the most effective telecare interventions appear to be automated vital signs monitoring (for reducing health service use) and telephone follow-up by nurses (for improving clinical indicators and reducing health service use) (Barlow *et al* 2007). The cost-effectiveness of these interventions was less certain. One review found that telemedicine as a component of a multidisciplinary programme for congestive heart failure resulted in reductions in hospital admissions (Deshpande *et al* 2008). Another review focusing on home telemonitoring found evidence that positive effects on health service utilisation, including admissions, are more consistent in patients with pulmonary and cardiac conditions than in those with diabetes and hypertension (Paré *et al* 2007). An older Cochrane Review found five trials concerned with the provision of home care or patient self-monitoring of chronic disease. None of the studies showed unequivocal benefits, and none included formal economic analysis (Currell *et al* 2000).

More recent research suggests that the uptake of e-health, including telecare, may be slower than anticipated because health care professionals lack confidence that it is a safe way to provide health care, and it is not perceived as improving efficiency (Mair *et al* 2008). There are a number of pilot sites throughout the NHS that are implementing integrated care and telecare and telehealth innovations for people with long-term conditions. These are part of the Whole System Demonstrator project and are currently being evaluated as part of a randomised controlled trial that will inform future recommendations on implementation.

Case management

Case management can take a number of forms and tends to be implemented in different ways in different health systems. The Case Management Society of America (2010) defines case management as:

... a collaborative process of assessment, planning, facilitation and advocacy for options and services to meet an individual's health needs through communication and available resources to promote quality cost-effective outcomes.

Case management involves the identification of at-risk individuals, and is therefore dependent on the use of suitable techniques for risk stratification. Case management in the NHS has included less intensive approaches than the traditional US model – for example, the use of health visitors to support older people at home. A meta-analysis of health visitor home support for older people showed no significant reduction in hospital admissions in the six studies that included this outcome, although there was a reduction in mortality and admissions to long-term care (Elkan *et al* 2001).

A systematic review of case management found weak evidence that it reduces admissions (Hutt *et al* 2004). Of the 18 studies it included, two randomised controlled trials showed a reduction in admissions of around 25–40 per cent. A large, controlled (non-randomised)

study of case management in nursing home residents reported a reduction in hospital admissions of almost 50 per cent in the intervention group. However, this was almost exactly mirrored by an increase in the intensity of nurse support (known as ‘intensive service days’) in the nursing home where the patient was resident. Findings from the other 15 studies were equivocal.

A systematic review of nurse-assisted case management to improve hospital discharge transition outcomes for the elderly concluded that, of the 15 trials that included hospital re-admissions as an outcome, seven studies reported no statistically significant difference in unplanned re-admissions between treatment groups, and eight studies reported that the intervention was associated with a significant reduction compared to the control group (Chiu and Newcomer 2007). Of nine studies that reported hospital days as an outcome, seven concluded that the intervention was associated with a statistically significant reduction in the number of hospital re-admissions or length of stay. There are some concerns about the methodology used in this review, but the findings are consistent with other reviews on this topic. A more recent review to determine the effectiveness of post-discharge nurse-led case management of patients with multiple health needs concluded that there was conflicting evidence on whether it had a positive effect on re-admission rates (Latour *et al* 2007). The relative risk in nine of the studies that were included ranged from much lower to significantly higher rates of re-admission and length of stay in the intervention group.

Randomised controlled trials of care management versus usual care in 18,309 Medicare fee-for-service beneficiaries (primarily with congestive heart failure, coronary artery disease and diabetes) across 15 care co-ordination programmes showed no significant difference in hospitalisations in 13 of the 15 (Peikes *et al* 2009). One subsequent ‘before and after’ study conducted in the NHS examined the impact of the Evercare approach to case management of frail elderly people (Gravelle *et al* 2006). The intervention had no significant benefit on rates of emergency admission (an increase of 16.5 per cent) or emergency bed days (a decrease of 4.9 per cent). The authors concluded that:

Case management of frail elderly people introduced an additional range of services into primary care without an associated reduction in hospital admissions. This may have been because of identification of additional cases.

A systematic review of patient advocacy case management in frail elderly patients suggests that this type of case management was effective in decreasing service use and costs in two out of eight studies (Oeseburg *et al* 2009). Service use was not increased in any of the studies.

Disease-specific case management

A systematic review of disease management interventions for patients with chronic heart failure (CHF) found 16 trials involving interventions that the authors put into three models: multidisciplinary interventions (a holistic approach bridging the gap between hospital admission and discharge, delivered by a team); case management interventions (intense monitoring of patients following discharge, often involving telephone follow-up and home visits); and clinic interventions (follow-up in a CHF clinic) (Taylor *et al* 2005a). There was weak evidence that case management interventions are associated with a reduction in admissions for heart failure, but the authors conclude that it is difficult to identify the effective components of the case management interventions. One randomised controlled trial of a multidisciplinary intervention showed reduced heart failure-related re-admissions in the short term.

A recent systematic review explored the effects of intensive case management on hospital use for people with severe mental illness (Burns *et al* 2007). The authors stated that

the introduction of intensive case management teams would not lead to substantial reductions in hospital use where average hospital use is already low. Teams can best reduce hospital use by organising themselves in the assertive community treatment model and by focusing on patients with a history of frequent hospital use. Assertive case management by multidisciplinary teams may reduce mental health admissions.

This finding echoes that of an earlier systematic review and meta-analysis, which compared outcomes for assertive community treatment and clinical case management. It found that assertive community treatment had some demonstrable advantages over clinical case management in reducing hospitalisation (Ziguras and Stuart 2000). The total number of admissions and the proportion of clients hospitalised were reduced in assertive community treatment programmes and increased in clinical case management programmes. In both types of programme, the number of hospital days used was reduced compared with usual treatment, but assertive community treatment was significantly more effective. An even earlier systematic review of case management for people with severe mental illness in the community showed that more people remain in contact with psychiatric services, but it also increases hospital admission rates. Case management approximately doubled the numbers admitted to psychiatric hospital (Marshall *et al* 1998).

Recommendations:

- **Commissioners and providers should consider implementing multidisciplinary interventions and telemonitoring for patients with heart failure.**
- **Commissioners and providers should consider implementing assertive case management for people with mental health illnesses.**

Hospital at home

A systematic review of trials comparing ‘hospital at home’ schemes with inpatient care found that, for selected patients, avoiding admission through provision of hospital care at home yielded similar outcomes to inpatient care, at a similar or lower cost (Shepperd *et al* 2009a). Elderly patients with a medical event such as stroke or COPD, who are clinically stable and do not require diagnostic or specialist input, had slightly more subsequent admissions in the hospital at home group, but had greater levels of satisfaction, and their care at home was less expensive.

Recommendation:

- **Commissioners should consider implementing hospital at home.**

Intermediate care

One previous review has concluded that most available evidence on intermediate care shows no reduction in admissions (Ham 2006). However, one systematic review of nurse-led units in the UK compared with usual inpatient care, for patients over 18 following an acute hospital admission for a physical health condition, found that early re-admissions were reduced by around 50 per cent, but that costs on the nursing-led unit were higher than inpatient stays (Griffiths *et al* 2007).

There was no evidence identified in relation to rapid response teams and their effectiveness in preventing admissions.

Integrated primary and social care

There is evidence from a recent review by The King’s Fund that integrating primary and social care reduces admissions (Curry and Ham 2010). One trial from Italy showed that integrated social and medical care for frail elderly people in the community was

associated with fewer hospital admissions. A second study from the United States showed that elderly people with long-term conditions who received shared health and social care had fewer unplanned admissions than those receiving usual care. Data from Torbay in the UK shows that providing integrated care to the highest-risk older people, who require intensive support, has resulted in a reduction in hospital admissions. There is an ongoing evaluation of integrated care pilot programmes in the UK (RAND Europe 2010).

Recommendation:

- **Commissioners should consider closer integration of primary and social care, and should evaluate the outcomes of any new interventions.**

Integrated primary and secondary care

Most of the evidence around integration of primary and secondary care comes from the United States but there is increasing information from the NHS. The literature supporting the effectiveness of integration has been reviewed in detail by The King's Fund (Curry and Ham 2010). This review concludes that the evidence is supportive of the concept of integration. The authors highlight the importance of integrating not just at the health system level, but also at the disease management and individual patient levels. The frequently cited example of Kaiser Permanente suggests that integrated care can result in fewer admissions (Feachem *et al* 2002). Within the Kaiser system there is a view that patients who require hospital treatment that has not been planned have not received optimum care at an earlier stage in their illness. Other examples of integrated care include the medical home concept in which the financial mechanisms provide an incentive for physicians to co-ordinate care over time and across sectors. In one health care system, a community-based advanced medical home for individuals with multiple chronic conditions, all-cause hospital admission rates declined by around 20 per cent whereas there was no change among other similar patients in the plan (Curry and Ham 2010).

There is evidence from The King's Fund review that integrating primary and secondary care to provide disease management for patients with certain conditions can reduce unplanned admissions. Similarly, managed disease networks in Scotland demonstrated a reduction in emergency admissions for ambulatory care-sensitive conditions in the three years after networks were implemented. This was evident for angina and diabetes, but not heart failure (Guthrie *et al* 2010).

There is very little evidence to suggest that clinics provided by hospital specialists in primary care reduce hospitalisation rates when delivered in isolation (Gruen *et al* 2003). However, this systematic review found that specialist outreach, as part of more complex multifaceted interventions involving collaboration with primary care, education or other services, is associated with less use of inpatient services.

Recommendation:

- **Commissioners should consider closer integration of primary and secondary care, and should evaluate the outcomes of any new interventions.**

Interventions in A&E*Acute assessment units and wards*

Short-stay units, in or attached to emergency departments, may provide observation, assessment and diagnosis and/or short-term management. Research studies show that both observation wards and acute assessment units seem to have advantages over traditional admission to a general hospital ward, including reducing the number of admissions to general wards and the length of stay, but benefits to the patient are unclear (Cooke *et al* 2004). Many diagnostic groups benefit from this type of unit, excluding

those who will inevitably need longer admission. Rigorous financial studies have yet to be undertaken in the UK, but a study in Singapore demonstrated that by using observation wards, it was possible to achieve a 6.4 per cent saving (Lateef and Anantharaman 2000).

A systematic review of paediatric hospital-based acute assessment units also demonstrated that they are a safe, efficient and acceptable alternative to inpatient emergency admissions (Ogilvie 2005). Thirteen studies of assessment units based in a paediatric department were identified. Three showed a decrease in emergency medical admissions, one found a reduction in the number and proportion of admissions requiring overnight stay, and one found reduced admissions for certain groups. Nine studies of assessment units based in A&E were included. One showed that an ongoing rise in paediatric admission rates had stopped, despite a continuing rise in A&E attendances. One study showed that after the intervention, the proportion of children with asthma who were admitted fell from 31 to 24 per cent. Two studies from Australia showed that annual paediatric admissions fell by 10 per cent after the introduction of assessment units.

However, when the impact of short-stay or acute assessment units is examined in a system-wide context, the picture becomes less clear. One major contributing factor to the overall rise in emergency admissions is the increase in short-stay admissions (that is, less than 48 hours) (Blunt *et al* 2010; Saxena *et al* 2009). The recent study by the Nuffield Trust showed that in England almost 600,000 more patients were admitted for one day or less in 2008/9 than was the case five years earlier (Blunt *et al* 2010). It showed that the increase in short-stay admissions was associated with the introduction of the four-hour wait target for emergency departments in 2003. As the number of breaches of this target decreased, the number of short-stay admissions increased. The authors also suggest that the practice of more defensive medicine may be influencing the number of short admissions for assessment and diagnosis. This increase is set against a background of an ageing population and increased A&E attendance, but the authors raise a concern that, as providers move towards shorter length of stay and quicker 'turnaround', more beds will become available and the admission threshold will be reduced.

Clinicians in A&E

A recent systematic review of the evidence for the effectiveness of GPs working in emergency departments found that this intervention may result in fewer referrals for admission (Carson *et al* 2010). However, although cost benefits may exist, the evidence for these is weak. The authors suggest that focusing on 'walk-in' patients, which many GPs based in A&E do, is unlikely to affect admission numbers, as these patients are unlikely to be admitted. A study of a GP service aimed at patients who are referred for urgent medical admission by a GP in the community showed a small reduction in admissions to the medical assessment unit (Rogers *et al* 2010).

Making a senior emergency medicine clinician (a consultant equivalent or middle-grade experienced specialist trainee) available to review patients in the emergency department has been shown to reduce inpatient admissions by 12 per cent, and specifically reduced admissions to the acute medical assessment unit by 21 per cent (White *et al* 2010). This study did not include patients sent in for emergency medical admission by a GP.

Social care in A&E

A Canadian study demonstrated that 5 per cent of admissions could have been avoided if seen by a social worker in A&E (Boyack and Bucknam 1991). A French study found that a similar proportion of admissions was potentially preventable by a social work intervention (Monsuez *et al* 1993). A study of a US emergency department demonstrated that having social workers available 24 hours a day can be economically beneficial (Gordon 2001). There were greater advantages in larger departments in terms of fewer

return visits, prevention of admissions for social reasons only, and savings in terms of other staff time. The applicability of this study to the UK is limited by the differences in costing health care in the two systems. Overall, there seems to be uncertainty about the effectiveness of social workers based in the emergency department in terms of reducing inappropriate admissions among older people (McLeod *et al* 2003).

Recommendations:

- **Commissioners and providers should continue to implement acute assessment units, but should consider the overall impact on number of admissions.**
- **Providers should conduct early senior review in A&E.**

Interventions in hospital – reducing re-admissions

The policy implications of payment schemes for hospitals are beyond the scope of this paper, but the concept of supplier-induced demand has been demonstrated in the United States and the UK where higher levels of bed availability are associated with higher admission rates (Purdy *et al* 2010b; Wennberg *et al* 1982).

Patients who are admitted frequently

A Spanish study of a personalised health care programme for medical outpatients who were admitted three or more times in a year showed a 45 per cent decrease in admissions (Gamboa *et al* 2002). It also found a 50 per cent decrease in visits to the emergency department, and 26 per cent fewer hospital days.

Hospital-based case management

A systematic review of hospital-based case management defined this intervention as a system of care that includes the construction of interdisciplinary protocols, continual monitoring and the facilitation of a treatment plan (Kim and Soeken 2005). Twelve studies were included, comparing case management with usual care. Studies conducted in the United States were found to be effective, but not studies conducted elsewhere. Overall, results showed no benefit; but case management may reduce re-admissions by around 6 per cent.

Discharge from hospital

There is strong evidence from a systematic review of randomised controlled trials that an individualised discharge plan for hospital inpatients is more effective than routine discharge care that was not tailored to the individual. Re-admissions to hospital were significantly reduced by around 15 per cent for patients allocated to structured individualised discharge planning (Shepperd *et al* 2010).

A previous systematic review of early discharge from an acute hospital ward to a hospital at home service showed that it was associated with higher rates of re-admission (Shepperd *et al* 2009b). Re-admission rates were significantly increased for elderly patients with a mix of conditions allocated to hospital at home.

There is no evidence from another systematic review that telephone follow-up initiated by a hospital-based health professional for post-discharge problems reduces re-admission rates (Mistiaen and Poot 2006). Evidence was available only for cardiac and post-surgery patients.

A systematic review of the effectiveness of nurse-led interventions pre- and post-discharge for COPD patients showed that brief (one-month) nurse-led interventions post-discharge did not reduce admission rates (Taylor *et al* 2005b). The evidence for longer (one-year) interventions is equivocal. A more recent review to determine the effectiveness of post-discharge nurse-led case management of patients with multiple

health needs concluded that there was conflicting evidence on whether it had a positive effect on re-admission rates (Latour *et al* 2007). The relative risk in nine of the studies that were included ranged from much lower to significantly higher rates of re-admission and length of stay in the intervention group.

Evidence about the effects of rehabilitation programmes, both in hospital and post-discharge, is inconsistent (Ham 2006). This partly reflects the wide variety of conditions for which rehabilitation is delivered, and the heterogeneity of the programmes themselves.

Recommendation:

- **Providers should deliver structured discharge planning.**

Summary of research evidence

Our review of available research evidence identified interventions where there is evidence of an impact on hospital admissions, those where there is evidence that the intervention has no beneficial effect and a range of interventions where more evidence needs to be built in order to determine whether they have the potential to significantly reduce admissions.

It is important to remember that the purpose of this review was to examine only the impact of these interventions on hospital admissions; a number of these interventions are intended to have wider beneficial effects, such as reducing length of stay or improving patient experience of care, and may be successful in achieving these.

Interventions where there is evidence of positive effect

Reducing admissions

- Continuity of care with a GP
- Hospital at home as an alternative to admission
- Assertive case management in mental health
- Self-management
- Early senior review in A&E
- Multidisciplinary interventions and telemonitoring in heart failure
- Integration of primary and secondary care

Reducing re-admissions

- Structured discharge planning
- Personalised health care programmes

Interventions with evidence of little or no beneficial effect

- Pharmacist home-based medication review
- Intermediate care
- Community-based case management (generic conditions)
- Early discharge to hospital at home on readmissions
- Nurse-led interventions pre- and post-discharge for patients with chronic obstructive pulmonary disease (COPD)

Interventions for which further evidence is needed

- Increasing GP practice size
- Changing out-of-hours primary care arrangements
- Chronic care management in primary care
- Telemedicine
- Cost-effectiveness of GPs in A&E
- Access to social care in A&E
- Hospital-based case management
- Rehabilitation programmes
- Rapid response teams

Discussion

Despite the size of the problem of unplanned admissions for health care systems, there is still insufficient robust research evidence about the effects of different interventions to inform commissioning and delivery of services. In some areas, such as integrated health care systems, there is little evidence. In others, such as hospital case management, the evidence from the United States is strong, but this is not supported by research in other countries. This presents problems for clinicians and managers who wish to develop and change practice in line with an established evidence base.

This paper does not include evidence on the clinical management of individual patients with particular conditions – for example, use of drugs in asthma management. In many cases, this clinical research has been subject to appraisal and review in disease-specific clinical guidelines that can inform the care of individual patients with these conditions. However, many patients have multiple, chronic health problems and do not fit within the single disease model of care. It is often these patients who could potentially benefit from a generic approach to managing their care in order to reduce the risk of an avoidable admission. Finally, it is important to note that, for some patients, admission to hospital is the best course of action, despite the fact that the clinical condition for which the admission is arranged is categorised as a ‘potentially avoidable admission’. This may be because of the severity or complexity of the condition, associated or underlying health problems, or the patient’s home situation. There are also situations where admission is required in order to obtain a diagnosis, to rule out more serious diagnostic alternatives or to treat a condition in the optimal way.

It is also important to note that real-life practice does not necessarily reflect the environment of research studies, particularly randomised controlled trials. Interventions to reduce emergency admissions take place within a complex environment, in which the nature and structure of existing primary, secondary and social care services, individual professional attitudes, patient and family preferences, and general attitudes to risk management all combine to influence both the implementation process and the eventual outcome of successful implementation.

This presents two issues: one is that, in the real world, interventions will rarely be implemented in isolation. A combination of interventions intended to reduce admissions may be expected to have a ‘cumulative effect’ and, although each may have little effect individually, there may be greater benefit overall than the combined effects of single interventions.

There is a lack of research evidence in many areas on the impact of combined interventions to support or refute this theory. Examples of exceptions to this are the management of heart failure, where there is good evidence that multidisciplinary and multifaceted interventions are successful, and the implementation of hospital at home, which is a complex intervention with several components.

The second issue is that evidence relating to the implementation of change in complex environments suggests that it is the interaction of the intervention with the particular social context in which it is embedded that determines outcomes (Greenhalgh *et al* 2005). Therefore, what works in one health care environment may not be generalisable to another situation. For example, a managed care system has proven to be successful in the United States, but was not beneficial in the NHS.

In order to put the findings of this review into context, it may be useful to reflect on the views of those in the front line of health care delivery. A Delphi study to elicit the views of an expert panel of health professionals on the interventions that were most helpful in reducing unplanned admissions found that the highest-rated interventions involve the direct delivery of rapid access care in the community. Access to rapid response nursing and social care at home, intermediate care and acute nursing home beds, mental health crisis teams, rapid access specialist clinics, and increased nursing home capacity for acute illness were identified as key interventions to reduce admissions (Purdy *et al* 2009).

Conclusion and recommendations

Our summary of the research evidence on the effectiveness of different interventions to reduce avoidable hospital admissions finds that there is insufficient evidence to support many of the interventions currently being implemented. We believe policy-makers, providers and commissioners can introduce a number of changes that have proven to be effective in reducing admissions, and we present our recommendations below.

National policy-makers should:

- encourage commissioners to implement evidence-based interventions for avoidable admissions, and to evaluate their impact in the local context
- consider the impact of socio-economic deprivation and other socio-demographic factors when designing policy around admission rates
- aim to increase self-management among people with long-term conditions where there is evidence of benefit.

Hospital providers and commissioners should:

- be clear about which admissions they consider to be avoidable, what proportion of these admissions are avoidable, and how these admissions should be coded and measured
- implement evidence-based interventions as follows:
 - multidisciplinary interventions and telemonitoring for patients with heart failure, and assertive case management for patients with mental health problems
 - hospital at home
 - closer integration of primary and secondary care
 - conduct early senior review in A&E, and implement structured discharge planning (providers only)
- continue to implement acute assessment units, but consider the overall impact on number of admissions
- aim to increase self-management among people with long-term conditions where there is evidence of benefit.

In addition, commissioners should:

- disinvest in programmes where there is robust evidence that they have little or no effect
- evaluate all new interventions, as even those that have proved beneficial in other settings may not be transferable to the local population.

Primary care providers should:

- aim to increase continuity of care with a GP
- consider the impact of local, out-of-hours primary care arrangements on avoidable admissions
- consider closer integration of primary and social care, evaluating the outcomes of any new interventions
- consider closer integration of primary and secondary care, evaluating the outcomes of any new interventions.

References

- Agency for Healthcare Research and Quality (AHRQ) (2001). *Guide to Prevention Quality Indicators: Hospital admission for ambulatory care sensitive conditions*. Rockville, MD: AHRQ. Available at: www.qualityindicators.ahrq.gov (accessed on 1 November 2010).
- Audit Commission (2009). *More For Less: Are productivity and efficiency improving in the NHS?* London: Audit Commission. Available at: www.auditcommission.gov.uk/nationalstudies/health/financialmanagement/Pages/20091111moreforless.aspx (accessed on 1 November 2010).
- Barlow J, Singh D, Bayer S, Curry R (2007). 'A systematic review of the benefits of home telecare for frail elderly people and those with long-term conditions'. *Journal of Telemedicine and Telecare*, vol 13, no 4, pp 172–9.
- Billings J, Dixon J, Mijanovich T, Wennberg D (2006). 'Case finding for patients at risk of readmission to hospital: development of algorithm to identify high risk patients'. *British Medical Journal*, vol 333, no 7563, p 327.
- Bindman A, Grumbach K, Osmond D, Komaromy A, Vranizan K, Lurie N, Billings J, Stewart A (1995). 'Preventable hospitalizations and access to health care'. *Journal of the American Medical Association*, vol 274, no 4, pp 305–11.
- Blatchford O, Capewell S, Murray S, Blatchford M (1999). 'Emergency medical admissions in Glasgow: general practices vary despite adjustment for age, sex, and deprivation'. *British Journal of General Practice*, vol 49, no 444, pp 551–4.
- Blunt I, Bardsley M, Dixon J (2010). 'Trends in emergency admissions in England 2004–2009: is greater efficiency breeding inefficiency?' London: Nuffield Trust.
- Bodenheimer T, Lorig K, Holman H, Grumbach K (2002). 'Patient self-management of chronic disease in primary care'. *Journal of the American Medical Association*, vol 288, no 19, pp 2469–75.
- Bottle A, Gnani S, Saxena S, Aylin P, Mainous AG, Majeed A (2008). 'Association between quality of primary care and hospitalization for coronary heart disease in England: national cross-sectional study'. *Journal of General Internal Medicine*, vol 23, no 2, pp 135–41.
- Bottle A, Aylin P, Majeed A (2006). 'Identifying patients at high risk of emergency hospital admissions: a logistic regression analysis'. *Journal of the Royal Society of Medicine*, vol 99, no 8, pp 406–14.
- Boyack V, Bucknam A (1991). 'The quick response team: a pilot project'. *Social Work in Health Care*, vol 16, pp 55–68.
- Boyd M, Lasserson T, McKean M, Gibson P, Ducharme F, Haby M (2009). 'Interventions for educating children who are at risk of asthma-related emergency department attendance (Cochrane Review)'. *Cochrane Database of Systematic Reviews*, issue 2, article CD001290. DOI: 10.1002/14651858.CD001290.pub2.
- Burns T, Catty J, Dash M, Roberts C, Lockwood A, Marshall M (2007). 'Use of intensive case management to reduce time in hospital in people with severe mental illness: systematic review and meta-regression'. *British Medical Journal*, vol 335, p 336.
- Calnan M, Payne S, Kemple T, Rossdale M, Ingram J (2007). 'A qualitative study exploring variations in general practitioners' out-of-hours referrals to hospital'. *British Journal of General Practice*, vol 57, pp 706–13.
- Carson D, Clay H, Stern R (2010). *Primary Care and Emergency Departments: Report from the Primary Care Foundation*. Available at: www.dh.gov.uk/en/Publicationsandstatistics/

Publications/PublicationsPolicyAndGuidance/DH_113694 (accessed on 8 November 2010).

Case Management Society of America (2010). 'What is a case manager?' Available at: www.cmsa.org/Home/CMSA/WhatisaCaseManager/tabid/224/Default.aspx (accessed on 8 November 2010).

Chiu WK, Newcomer R (2007). 'A systematic review of nurse-assisted case management to improve hospital discharge transition outcomes for the elderly'. *Professional Case Management*, vol 12, no 6, pp 330–36.

Cooke M, Fisher J, Dale J, McLeod E, Szczepura A, Walley P, Wilson S (2004). 'Reducing attendances and waits in emergency departments: a systematic review of present innovations'. Report to the National Co-ordinating Centre for NHS Service Delivery and Organisation R & D (NCCSDO).

Corben S, Rosen R (2005). *Self-Management for Long-Term Conditions: Patients' perspectives on the way ahead*. London: The King's Fund. Available at: www.kingsfund.org.uk/publications/selfmanagement.html (accessed on 8 November 2010).

Currell R, Urquhart C, Wainwright P, Lewis R (2000). 'Telemedicine versus face to face patient care: effects on professional practice and health care outcomes (Cochrane Review)'. *Cochrane Database of Systematic Reviews*, issue 2, article CD002098. DOI:10.1002/14651858.CD002098.

Curry N, Ham C (2010). *Clinical and Service Integration. The route to improved integration*. London: The King's Fund. Available at: www.kingsfund.org.uk/publications/clinical_and_service.html (accessed on 29 November 2010).

Darkins A, Ryan P, Kobb R, Foster L, Edmonson E, Wakefield B, Lancaster A (2008). 'Care Coordination/Home Telehealth: the systematic implementation of health informatics, home telehealth, and disease management to support the care of veteran patients with chronic conditions'. *Telemedicine and e-Health*, vol 14, no 10, pp 1118–26.

Department of Health, Care Services Improvement Partnership (CSIP) (2008). 'Building an evidence base for successful telecare implementation – updated report of the Evidence Working Group of the Telecare Policy Collaborative chaired by James Barlow'. Available at: www.asap-uk.org/information/45779/46315/46331/46347/telecare_evidence/ (accessed on 8 November 2010).

Deshpande A, Khoja S, McKibbin A, Jadad AR (2008). *Real-time (Synchronous) Telehealth in Primary Care: Systematic review of systematic reviews*. Technology Report No 100. Ottawa: Canadian Agency for Drugs and Technologies in Health.

Dimitri A, Christakis, Mell L, Koepsell TD, Zimmerman FJ, Connell FA (2001). 'Association of lower continuity of care with greater risk of emergency department use and hospitalization in children'. *Pediatrics*, vol 107, pp 524–9.

Donald I, Ambery P (2000). 'Variation in general practice medical admission rates for elderly people'. *Journal of Public Health Medicine*, vol 22, pp 422–6.

Donnan P, Dorward D, Mutch B, Morris A (2008). 'Development and validation of a model for Predicting Emergency Admissions Over the Next Year (PEONY)'. *Archives of Internal Medicine*, vol 168, no 13, pp 1416–22.

Downing A, Rudge G, Cheng Y, Tu Y, Keen J, Gilthorpe M (2007). 'Do the UK government's new Quality and Outcomes Framework (QOF) scores adequately measure primary care performance? A cross-sectional survey of routine healthcare data'. *BMC Health Services Research*, vol 7, pp 166. DOI:10.1186/1472–6963–7-166.

- Duffy R, Neville R, Staines H (2002). 'Variance in practice emergency medical admission rates: can it be explained?' *British Journal of General Practice*, vol 52, no 474, pp 14–17.
- Effing T, Monninkhof EEM, van der Valk PP, Zielhuis GGA, Walters EH, van der Palen JJ, Zwerink M (2007). 'Self-management education for patients with chronic obstructive pulmonary disease (Cochrane Review)'. *Cochrane Database of Systematic Reviews*, issue 4, article CD002990. DOI: 10.1002/14651858.CD002990.pub2.
- Elkan R, Kendrick D, Dewey M, Hewitt M, Robinson J, Blair M, Williams D, Brummell K (2001). 'Effectiveness of home-based support for older people: systematic review and meta analysis'. *British Medical Journal*, vol 323, pp 719–25.
- Feachem RGA, Sekhri NK, White KL (2002). 'Getting more for their dollar: a comparison of the NHS with California's Kaiser Permanente'. *British Medical Journal*, vol 324, pp 135–43.
- Gamboa A, Gómez C, de Villar C, Vega S, López A, Polo J (2002). 'The special attention to re-admitted patients can be effective: cost-benefit analysis of a new health care model'. *Revista Clínica Española*, vol 202, no 6, pp 320–5.
- Gill J, Mainous A (1998). 'The role of provider continuity in preventing hospitalizations'. *Archives of Family Medicine*, vol 7, no 4, pp 352–7.
- Gillam S (2010). 'Rising hospital admissions: can the tide be stemmed? (editorial)'. *British Medical Journal*, vol 340, p c636.
- Gilthorpe MS, Lay-Yee R, Wilson RC, Walters S, Griffiths RK, Bedi R (1998). 'Variations in hospitalization rates for asthma among black and minority ethnic communities'. *Respiratory Medicine*, vol 92, no 4, pp 642–8.
- Giuffrida A, Gravelle H, Roland M (1999). 'Measuring quality of care with routine data: avoiding confusion between performance indicators and health outcomes'. *British Medical Journal*, vol 319, pp 94–8.
- Gordon J (2001). 'Cost-benefit analysis of social work services in the emergency department: a conceptual model'. *Academic Emergency Medicine*, vol 8, no 1, pp 54–60.
- Gravelle H, Dusheiko M, Sheaff R, Sargent P, Boaden R, Pickard S, Parker S, Roland M (2006). 'Impact of case management (Evercare) on frail elderly patients: controlled before and after analysis of quantitative outcome data'. *British Medical Journal*, vol 334, no 7583, p31. DOI: 10.1136/bmj.39020.413310.55.
- Greenhalgh T, Robert G, Bate P, MacFarlane F, Kyriakidou O (2005). *Diffusion of Innovations in Health Service Organisations*. Oxford: Blackwell Publishing Ltd.
- Griffin S, Kinmonth A (2006). 'Systems for routine surveillance for people with diabetes mellitus (Cochrane Review)'. *Cochrane Database of Systematic Reviews*, issue 4 (withdrawn).
- Griffiths C, Kaur G, Gantley M, Feder G, Hillier S, Goddard J, Packe G (2001). 'Influences on hospital admission for asthma in south Asian and white adults: qualitative interview study'. *British Medical Journal*, vol 323, no 7319, p 962.
- Griffiths C, Sturdy P, Naish J, Omar R, Dolan S, Feder G (1997). 'Hospital admissions for asthma in East London: associations with characteristics of local general practices, prescribing, and population'. *British Medical Journal*, vol 314, no 7079, pp 482–6.
- Griffiths PD, Edwards ME, Forbes A, Harris RG, Ritchie G (2007). 'Effectiveness of intermediate care in nursing-led in-patient units (Cochrane Review)'. *Cochrane Database of Systematic Reviews*, issue 2, article CD002214. DOI: 10.1002/14651858.CD002214.pub3.

- Gruen RL, Weeramanthri TS, Knight SS, Bailie RS (2003). 'Specialist outreach clinics in primary care and rural hospital settings (Cochrane Review)'. *Cochrane Database of Systematic Reviews*, issue 4, article CD003798. DOI: 10.1002/14651858.CD003798.pub2.
- Guthrie B, Davies H, Greig G, Rushmer R, Walter I, Duguid A, Coyle J, Sutton M, Williams B, Farrar S, Connaghan J (2010). 'Delivering health care through managed clinical networks (MCNs): lessons from the North'. Report for the National Institute for Health Research Service Delivery and Organisation Programme. National Institute for Health Research website. Available at: www.sdo.nihr.ac.uk/files/project/103-final-report.pdf (accessed on 2 November 2010).
- Ham C (2006). *Reducing Unplanned Hospital Admissions: What does the literature tell us?* Birmingham: Health Services Management Centre, University of Birmingham. Available at: www.hsmc.bham.ac.uk/publications/pdfs/How_to_reduce.pdf (accessed on 8 November 2010).
- Holland R, Lenaghan E, Harvey I, Smith R, Shepstone L, Lipp A, Christou M, Evans D, Hand C (2005). 'Does home based medication review keep older people out of hospital? The HOMER randomised controlled trial'. *British Medical Journal*, vol 330, pp 293–5. DOI:10.1136/bmj.38338.674583.AE.
- Hospital Episode Statistics 2007/8. The Information Centre. Available at: www.hesonline.org.uk
- Hutt R, Rosen R, McCauley J (2004). *Case-managing Long-term Conditions: What impact does it have in the treatment of older people?* London: The King's Fund.
- Kim YJ, Soeken KL (2005). 'A meta-analysis of the effect of hospital-based case management on hospital length-of-stay and readmission'. *Nursing Research*, vol 54, no 4, pp 255–64.
- King's Fund (2006). *Combined Predictive Model: Final report and technical documentation*. London: The King's Fund.
- King's Fund, NHS Modernisation Agency, New York University, Health Dialog (2005). *Predictive Risk Project: Literature review* [online]. Available at: www.kingsfund.org.uk/current_projects/predicting_and_reducing_readmission_to_hospital/#context (accessed on 11 November 2010).
- Lateef F, Anantharaman V (2000). 'The short-stay emergency observation ward is here to stay'. *American Journal of Emergency Medicine*, vol 18, pp 629–34.
- Latour CH, van der Windt DA, de Jonge P, Riphagen II, de Vos R, Huyse FJ, Stalman WA (2007). 'Nurse-led case management for ambulatory complex patients in general health care: a systematic review'. *Journal of Psychosomatic Research*, vol 62, no 3, pp 385–95.
- Lyon D, Lancaster GA, Taylor S, Dowrick C, Chellaswamy H (2007). 'Predicting the likelihood of emergency admission to hospital of older people: development and validation of the Emergency Admission Risk Likelihood Index (EARLI)'. *Family Practice*, vol 24, no 2, pp 158–67.
- Maheswaran R, Haining RP, Brindley P, Law J, Pearson T, Fryers PR, Wise S, Campbell MJ (2005). 'Outdoor air pollution, mortality, and hospital admissions from coronary heart disease in Sheffield, UK: a small-area level ecological study'. *European Heart Journal*, vol 26, no 23, pp 2543–9.
- Mair F, Hiscock J, Beaton S (2008). 'Understanding factors that inhibit or promote the utilization of telecare in chronic lung disease'. *Chronic Illness*, vol 4, no 2, p 110–17. DOI: 10.1177/1742395308092482.

- Majeed A, Bardsley M, Morgan D, O'Sullivan C, Bindman A (2000). 'Cross-sectional study of primary care groups in London: association of measures of socioeconomic and health status with hospital admission rates'. *British Medical Journal*, vol 321, no 7268, pp 1057–60.
- Marno P (2006). 'How different measures of cold weather affect chronic obstructive pulmonary disease (COPD) hospital admissions in London'. *European Respiratory Review*, vol 15, no 101, pp 185–6.
- Marshall M, Gray A, Lockwood A, Green R (1998). 'Case management for people with severe mental disorders (Cochrane Review)'. *Cochrane Database of Systematic Reviews*, issue 2, article CD000050. DOI: 10.1002/14651858.CD000050.
- McLeod E, Bywaters P, Cooke M (2003). 'Social work in accident and emergency departments: a better deal for older patients' health?'. *British Journal of Social Work*, vol 33, no 6, pp 787–802.
- Menec V, Sirski M, Attawar D, Katz A (2006). 'Does continuity of care with a family physician reduce hospitalizations among older adults?'. *Journal of Health Services Research & Policy*, vol 11, pp 196–201.
- Mistiaen P, Poot E (2006). 'Telephone follow-up, initiated by a hospital-based health professional, for postdischarge problems in patients discharged from hospital to home (Cochrane Review)'. *Cochrane Database of Systematic Reviews*, issue 4, article CD004510. DOI:10.1002/14651858.CD004510.pub3.
- Monsuez J, Fergelot H, Papon B, Legall J (1993). 'Early social work intervention in the emergency department'. *European Journal of Emergency Medicine*, vol 2, pp 489–92.
- Moran C, Johnson H, Johnson Z (2000). 'Seasonal patterns of morbidity and mortality in the elderly in Ireland'. *International Journal of Circumpolar Health*, vol 59, no 3–4, pp 170–75.
- NHS Connecting for Health (2010). 'Data model and dictionary service'. Available at: www.datadictionary.nhs.uk/data_dictionary/attributes/a/add/admission_method_de.asp?shownav=1 (accessed on 8 November 2010).
- NHS Institute for Innovation and Improvement (2007). 'Care outside hospital'. www.institute.nhs.uk/care_outside_
- NHS Scotland Information Services Division (2006). *SPARRA: Scottish Patients At Risk of Readmission and Admission*. Information Services Division, NHS Scotland.
- O'Donnell C (2000). 'Variation in GP referral rates: what can we learn from the literature?'. *Family Practice*, vol 17, pp 462–71.
- Oeseburg B, Wynia K, Middel B, Reijneveld S (2009). 'Effects of case management for frail older people or those with chronic illness: a systematic review'. *Nursing Research*, vol 58, no 3, pp 201–10. DOI: 10.1097/NNR.0b013e3181a30941.
- Ogilvie D (2005). 'Hospital-based alternatives to acute paediatric admission: a systematic review'. *Archives of Disease in Childhood*, vol 90, pp 138–42.
- Osman LM, Calder C, Godden DJ, Friend JA, McKenzie L, Legge JS, Douglas JG (2002). 'A randomised trial of self-management planning for adult patients admitted to hospital with acute asthma'. *Thorax*, vol 57, pp 869–74.
- Paré G, Jaana M, Sicotte C (2007). 'Systematic review of home telemonitoring for chronic diseases: the evidence base'. *Journal of the American Medical Informatics Association*, vol 14, no 3, pp 269–77.

- Peikes D, Chen A, Schore J, Brown R (2009). 'Effects of care coordination on hospitalization, quality of care, and health care expenditures among Medicare beneficiaries'. *Journal of the American Medical Association*, vol 301, no 6, pp 603–18.
- Purdy S, Griffin T, Salisbury C, Sharp D (2010a). 'Emergency admissions for chest pain and coronary heart disease: a cross-sectional study of general practice, population and hospital factors in England'. *Public Health* (in press).
- Purdy S, Griffin T, Salisbury C, Sharp D (2010b). 'Emergency respiratory admissions in England: cross-sectional study of general practice, population and hospital factors'. Submitted for publication.
- Purdy S, Griffin T, Salisbury C, Sharp D (2010c). 'Prioritizing ambulatory care sensitive hospital admissions in England for research and intervention: a Delphi exercise'. *Primary Health Care Research & Development*, vol 11, pp 41–50.
- Purdy S, Griffin T, Salisbury C, Sharp D (2009). 'Ambulatory care sensitive conditions: terminology and disease coding need to be more specific to aid policy makers and clinicians'. *Public Health*, vol 123, no 2, pp 169–73.
- RAND Europe (2010). *Evaluation of Integrated Care Pilots*. Available at: www.rand.org/randeurope/research/health/projects.html (accessed on 8 November 2010).
- Reid F, Cook D, Majeed A (1999). 'Explaining variation in hospital admission rates between general practices: cross sectional study'. *British Medical Journal*, vol 319, pp 98–103.
- Richards S, Winder R, Seamark S (2008). 'Accessing out-of-hours care following implementation of the GMS contract: an observational study'. *British Journal of General Practice*, vol 58, no 550, pp 331–8.
- Rogers P, Ward L, Salisbury C, Purdy S (2010). 'Does a GP support unit reduce medical admissions following medical referrals from GPs?' Submitted for publication.
- Roland M, Dusheiko M, Gravelle H, Parker S (2005). 'Follow up of people aged 65 and over with a history of emergency admissions: analysis of routine admission data'. *British Medical Journal*, vol 330, no 7486, pp 289–92.
- Rossdale M, Kemple T, Payne S, Calnan M, Greenwood R (2007). 'An observational study of variation in GPs' out-of-hours emergency referrals'. *British Journal of General Practice*, vol 57, pp 152–4.
- Royal S, Smeaton L, Avery A, Hurwitz B, Sheikh A (2006). 'Interventions in primary care to reduce medication related adverse events and hospital admissions: systematic review and meta-analysis'. *Quality & Safety in Health Care*, vol 15, pp 23–31.
- Saxena S, Bottle A, Gilbert R, Sharland M (2009). 'Increasing short-stay unplanned hospital admissions among children in England; time trends analysis '97–'06'. *PLoS ONE*, vol 4, no 10, p e7484. DOI:10.1371/journal.pone.0007484.
- Saxena S, George J, Barber J, Fitzpatrick J, Majeed A (2006). 'Association of population and practice factors with potentially avoidable admission rates for chronic diseases in London: cross sectional analysis'. *Journal of the Royal Society of Medicine*, vol 99, pp 81–8.
- Shepperd S, McClaran J, Phillips CO, Lannin NA, Clemson LM, McCluskey A, Cameron ID, Barras SL (2010). 'Discharge planning from hospital to home (Cochrane Review)'. *Cochrane Database of Systematic Reviews*, issue 1, article CD000313. DOI: 10.1002/14651858.CD000313.pub3.
- Shepperd S, Doll H, Angus R, Clarke M, Iliffe S, Kalra L, Ricauda N, Tibaldi V, Wilson A (2009a). 'Avoiding hospital admission through provision of hospital care at home:

a systematic review and meta-analysis of individual patient data'. *Canadian Medical Association Journal*, vol 180, no 2, pp 175–82.

Shepperd S, Doll H, Broad J, Gladman J, Iliffe S, Langhorne P, Richards S, Martin F, Harris R (2009b). 'Early discharge hospital at home (Cochrane Review)'. *Cochrane Database of Systematic Reviews*, issue 1, article CD000356. DOI: 10.1002/14651858.CD000356.pub3.

Smith J, Mugford M, Holland R, Candy B, Noble M, Harrison B, Koutantji M, Upton C, Harvey I (2005). 'A systematic review to examine the impact of psycho-educational interventions on health outcomes and costs in adults and children with difficult asthma'. *Health Technology Assessment*, vol 9, no 23, pp 1–182.

Sundquist J, Johansson S, Yang M, Sundquist K (2007). 'Low-linking social capital as a predictor of mental disorders: a cohort study of 4.5 million Swedes'. *Social Science & Medicine*, vol 64, no 1, pp 21–34.

Tapp S, Lasserson T, Rowe B (2007). 'Education interventions for adults who attend the emergency room for acute asthma (Cochrane Review)'. *Cochrane Database of Systematic Reviews*, issue 3, article CD003000. DOI: 10.1002/14651858.CD003000.pub2.

Taylor S, Bestall J, Cotter S, Falshaw M, Hood S, Parsons S, Wood L, Underwood M (2005a). 'Clinical service organisation for heart failure (Cochrane Review)'. *Cochrane Database of Systematic Reviews*, issue 2, article CD002752.

Taylor S, Candy B, Bryar R, Ramsay J, Vrijhoef H, Esmond G, Wedzicha J, Griffiths C (2005b). 'Effectiveness of innovations in nurse led chronic disease management for patients with chronic obstructive pulmonary disease: systematic review of evidence'. *British Medical Journal*, vol 331, no 7515, p 485.

Tüchsen F, Endahl LA (1999). 'Increasing inequality in ischaemic heart disease morbidity among employed men in Denmark 1981–1993: the need for a new preventive policy'. *International Journal of Epidemiology*, vol 28, no 4, pp 640–44.

Wanless D (2003). *The Review of Health and Social Care in Wales*. Cardiff: Welsh Assembly Government.

Welsh Assembly Government Department for Health and Social Services (2007). *Designed to Improve Health and the Management of Chronic Conditions in Wales: An integrated model and framework*. Cardiff: Welsh Assembly Government. <http://wales.gov.uk/topics/health/publications/health/strategies/designedimprovechronic?lang=en> (accessed on 8 November 2010).

Wennberg J, Barnes B, Zubkoff M (1982). 'Professional uncertainty and the problem of supplier-induced demand'. *Social Science & Medicine*, vol 16, no 7, pp 811–24.

White A, Armstrong P, Thakore S (2010). 'Impact of senior clinical review on patient disposition from the emergency department'. *Emergency Medicine Journal*, vol 27, no 4, pp 262–5.

Yeung S, MacLeod M, Sutton M (2005). 'Population, practice and hospital influences on emergency admissions for chronic conditions'. Scotland: NHS Quality Improvement.

Ziguras S, Stuart G (2000). 'A meta-analysis of the effectiveness of mental health case management over 20 years'. *Psychiatric Services*, vol 51, pp 1410–21.

Appendix 1

Table A1. Predictive risk models

Model	Population	Data source	Variables	Time	Outcome	Goodness of fit 1= perfect ^a
PEONY	>40 years Registered with GP	3 years linked dispensing, admission and socio-demographic data	Prescribed drugs, British National Formulary chapter and number of prescriptions dispensed in past 3 years. Number of previous emergency admissions, number of previous admissions, total bed days and mean length of stay in past 3 years. Age, sex, social deprivation.	12 months	First emergency hospital admission	0.79
SPARRA	>65 years Previous emergency admission in past 3 years	3 years linked hospital admission and demographic data	Age, gender, number of emergency inpatient admissions (past 3 years), time since most recent emergency admission, number of elective inpatient admissions (past 3 years), number of day case admissions, total number of inpatient bed days, total number of bed days (past 3 years), broad diagnosis group, number of diagnostic groupings, Scottish Index of Multiple Deprivation, NHS Board of Residence.	12 months	Emergency inpatient	0.68
Combined model	Random sample of data from two PCTs All patients.	Inpatient (IP), outpatient (OP), and A&E data from secondary care sources as well as GP electronic medical records	Multiple	12 months	Emergency admission	Not available
PARR (++)	(over 65 years PARR), over 16 years for revised PARR ++ model. Previous emergency admission. PARR reference conditions only. All admissions for PARR ++ model	Hospital Episode Statistics admission data from previous 3 years used to predict admission in subsequent 12 months 2003-4	Previous hospital admission in past 3 years, diagnoses and co-morbidities, frequency of admission, day case, specialty, demographics (age, gender, ethnicity), community characteristics inc. demographics and admission rates for ACSCs, hospital of admission.	12 months	Emergency (re-)admission	0.685
PRISM	All GP-registered patients	TBC	TBC	12 months	Emergency admission	TBC
EARLI	>75 years. Registered with GP	Patient receives 6-item mailed self-complete questionnaire	Six-item score	12 months	Emergency admission	0.69

a = Goodness of fit (area under Receiver Operating Curve, ROC).

About the author

Sarah Purdy is Consultant Senior Lecturer in Primary Health Care at the University of Bristol, and she is also a GP. She leads a research programme on unplanned hospital admissions, funded by the Medical Research Council and the National Institute for Health Research. She has worked in health policy and health research in the United States as well as in the United Kingdom, at Harvard, York and Newcastle universities. She is an adviser to several government and NHS bodies. She has a Masters in Public Health, an MD, and is a Fellow of the Royal College of General Practitioners.

Acknowledgements

The author would like to thank Professor Chris Ham, Dr Anna Dixon, and their colleagues at The King's Fund for their helpful comments.

ISBN 978-1-85717-607-0



The King's Fund
11-13 Cavendish Square
London W1G 0AN
Tel 020 7307 2400

Registered charity: 1126980
www.kingsfund.org.uk

The King's Fund is a charity that seeks to understand how the health system in England can be improved. Using that insight, we help to shape policy, transform services and bring about behaviour change. Our work includes research, analysis, leadership development and service improvement. We also offer a wide range of resources to help everyone working in health to share knowledge, learning and ideas.
