

Predicting and preventing avoidable hospital admissions: a review

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This review is based in part on a presentation given by Dr Purdy at the Care of the Elderly Symposium on 12 April 2013 at the Royal College of Physicians of Edinburgh

ABSTRACT The strongest risk factors for avoidable hospital admission are age and deprivation but ethnicity, distance to hospital, rurality, lifestyle and meteorological factors are also important, as well as access to primary care. There is still considerable uncertainty around which admissions are avoidable. In terms of services to reduce admissions there is evidence of effectiveness for education, self-management, exercise and rehabilitation, and telemedicine in certain patient populations, mainly respiratory and cardiovascular. Specialist heart failure services and end-of-life care also reduce these admissions. However, case management, specialist clinics, care pathways and guidelines, medication reviews, vaccine programmes and hospital at home do not appear to reduce avoidable admissions. There is insufficient evidence on the role of combinations or coordinated system-wide care services, emergency department interventions, continuity of care, home visits or pay-by-performance schemes. This highlights the importance of robust evaluation of services as they are introduced into health and social care systems.

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KEYWORDS Hospital admissions, older people, systematic reviews

DECLARATION OF INTERESTS No conflicts of interest declared.

INTRODUCTION

Approximately 40% of hospital admissions in the United Kingdom are unplanned (2011/12).¹ This paper sets out to summarise research evidence about who is at risk of admission, which admissions are avoidable and which service interventions are effective in reducing emergency admissions. It is based on the results of both systematic reviews and individual studies and has a focus on the care of older adults.

Over the last ten years, emergency admissions have risen by more than a third.¹ The majority of emergency admissions are in elderly people with co-morbidities; the bed days occupied by those over 75-years-old rose by two-thirds in the last ten years.² At the same time, there are a third fewer general and acute beds than there were 25 years ago.

Some areas are more successful than others in reducing emergency admissions. A five-year analysis of routine data by the Nuffield Trust has yielded some interesting findings behind the rise in admissions.³ On average, emergency admissions rose by 12% between 2004 and 2009; for some hospitals they fell by up to a third over this period, while in others they almost doubled. Although there has been much debate about the effect of demographics on healthcare use, the

ageing population accounted for less than half of the increase in emergency admissions in this study. Of particular note in this analysis was the marked increase in short stay admissions, suggesting changes in clinical thresholds for admission over time and impacts of other initiatives, such as four-hour targets in emergency departments (ED).

In order to try and address this increase in short stay admissions, healthcare organisations in the UK and other countries including the USA, Canada and Australia are trying different care service interventions to prevent and reduce avoidable emergency admissions including risk prediction tools, case management, hospital care at home, telemedicine and different ways of organising acute admissions in hospitals.

WHICH ADMISSIONS ARE AVOIDABLE?

Ambulatory care sensitive conditions (ACSC) are conditions for which hospital admission could be prevented with care delivered in the primary care setting. The concept originated in the United States, where universal primary healthcare is not available.⁴ Other healthcare systems have adapted the concept and various definitions and sets of ACSCs are in existence.^{5,6} However, there are no absolute categories of avoidable

admission. For example, it may be appropriate to admit a frail elderly woman with a chest infection who lives on her own in an area without effective intermediate care.

WHO IS MORE LIKELY TO BE ADMITTED?

The interaction of risk factors for hospital admission is complex but some messages are clear. People who live in deprivation are more likely to be admitted to hospital, with 45% of the variance across GP practices explained by socio-demographic characteristics.⁷ Even after taking into account other factors, GP practices serving the most deprived quintiles of the population in England have 60–70% higher rates of admission for asthma, chronic obstructive pulmonary disease (COPD) and respiratory infections compared with those serving the least deprived.⁸ Lower educational achievement is also associated with a higher number of emergency admissions.^{9,10}

Independent of deprivation, those who live in urban areas have higher admission rates than rural areas e.g. 16% higher rate for asthma, after adjusting for prevalence and deprivation.⁸ Living close to an ED also increases the risk of admission e.g. a 12% higher rate of asthma admission for each kilometre closer to the ED.⁸

The presence of chronic diseases is independently associated with greater admissions.¹¹ Lifestyle factors are also important, for example the risk of admission goes up by about 1% for each 1% increase in smokers among COPD or asthma patients in a general practice.⁸ The number of previous hospital admissions and length of stay by a patient in the previous year increases admission as does less primary care use.¹² Other factors that increase risk of emergency admission include meteorological factors and pollution, particularly in respiratory admissions.¹³

HOW GOOD ARE MODELS THAT PREDICT FUTURE EMERGENCY ADMISSIONS?

There has been a recent growth in the use of predictive modeling to identify people at high risk of future admission. Predictive modelling uses routine data which are entered into a statistical model in order to calculate the risk.¹⁴ This approach is thought to be the best available predictive technique as it reduces the risk of regression to the mean which is a problem with models that use a simpler threshold or cut-off e.g. people with more than one previous admission in the past 12 months. However, it requires linking datasets, ideally including social care. It is therefore constrained by the range and accuracy of information available in the datasets e.g. data on living alone. The goodness of fit of currently available models ranges from 0.68–0.79 (area under receiver operating characteristic [ROC] curve).¹³ Implementation of a predictive model requires a definition of the risk

threshold score. This is the level above which people are to be defined as 'high risk' and above which services or interventions are to be put in place. Assumptions about the potential reduction in emergency admissions and the costs of the additional services required to reduce future admissions need to be as robust as possible when selecting and targeting interventions.

WHAT FEATURES OF GENERAL PRACTICE ARE ASSOCIATED WITH FEWER ADMISSIONS?

Larger practices have been purported to have lower rates of emergency admissions, as these practices can potentially offer a wider range of services such as acute care services.¹⁵ Some studies have found that rates of asthma admission may be higher in smaller and single-handed practices.^{16–19} The same relationship has not been demonstrated for other conditions, for instance COPD and cardiovascular admissions.^{8,16,20} The ratio of patients to practitioners is also a factor, as is the presence of GP trainers within a practice, both of which appear to reduce emergency admissions.^{20,21}

One ecological study from the UK has shown that being able to consult a particular GP is associated with lower emergency admission rates, and that greater satisfaction with telephone access is associated with lower ED attendance.²² Research conducted in the USA and Canada suggest high continuity of care with a family doctor may be associated with lower risk of admission.^{23–25} 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.²⁶

OUT-OF-HOURS CARE

There is some evidence that the rise in emergency admissions in the UK may be partly attributable to changes in out-of-hours provision that occurred in 2004 with the new GP contract.^{27,28} There were also other changes including the introduction of the four-hour waiting time targets in the ED and payment-by-results that have not had an impact.³ A five-fold variation in out-of-hours admission rates has been observed between GPs, suggesting that clinician factors play an important part in determining admission rates.^{29,30} A more recent study of clinicians' views found that factors influencing decisions to admit included: distribution of beds between community and sub-acute care, lack of health and social care resources, the admitting (generalist) clinician's lack of knowledge of the patient or condition, communication difficulties between primary and secondary care clinicians, patient preferences and the perceived benefits of admission to hospital.³¹ However, there are also studies that suggest that a GP with specialist knowledge or increased involvement with secondary care can lead to an increased referral rate to the ED.^{32,33}

QUALITY OF PRIMARY CARE

Most research does not identify any association between Quality and Outcomes Framework (QOF) scores and hospital admission for patients with asthma, COPD or coronary heart disease.^{8,34,35} However, a more recent longitudinal study suggests that improvements in the quality of diabetes management in general practices were associated with a reduction in admissions.³⁶ Medication reviews conducted by pharmacists in the community don't reduce admissions in older patients.³⁷

WHICH SERVICE INTERVENTIONS HAVE BEEN EVALUATED?

Telemedicine

The evidence around telemedicine is mixed and mainly from the United States. The most compelling evidence showing the impact on reduced health service use was for automated vital signs monitoring and telephone follow-up by nurses, although the cost-effectiveness of interventions is less clear.³⁸ Recent UK evidence from the Whole System Demonstrator cluster randomised trial showed no difference in emergency admissions when the analysis adjusted for differences in baseline characteristics.³⁹

Case management

A recent systematic review of the use of case management for reducing admissions in older people identified 11 randomised controlled trials including a range of case management interventions. Nine of the 11 trials showed no reduction of emergency hospital admissions with case management compared with usual care.⁴⁰

Home nursing care

The evidence from a Cochrane review appears stronger for the effect of hospital at home on admission avoidance rather than supported discharge, where costs appeared higher with increased levels of admission compared to hospital care. Outcomes of hospital at home for admission avoidance were similar to inpatient care.⁴¹ However, a more recent review suggests that the effect of intermediate care especially in the frail elderly is not known.⁴² The outcome of a recent evaluation of virtual wards has yet to be published.⁴³

Interventions in the Emergency Department

All types of assessment and observation wards seem to reduce the number of general ward admissions, but benefits to the patient are unclear.⁴⁴ General practitioners in the ED may result in fewer referrals for admission and cost benefits may exist but the evidence is weak.⁴⁵ One non-randomised study showed that senior clinician review reduced inpatient admissions by 11.9% and specifically reduced admissions to the acute medical assessment unit by 21.2%.⁴⁶

Discharge from hospital

A systematic review showed that structured discharge planning tailored to the individual patient results in fewer readmissions.⁴⁷ Readmissions to hospital were statistically significantly reduced for patients admitted to hospital with a medical diagnosis and who were allocated to discharge planning.

A further systematic review shows that medication review by pharmacists in hospital does not reduce readmissions in general in older patients.³⁷ Medication reviews conducted by hospital (seven trials) or community (nine trials) pharmacists did not reduce emergency admissions in the older population. There was some evidence that medication reviews provided by hospital pharmacists pre-discharge with follow-up post-discharge in older people with heart failure (three trials) reduced emergency admissions by 25%.

Preventing readmissions

Specialist clinics for heart failure reduce admissions after 12 months⁴⁸ and it looks as though heart failure patients do benefit from intensive patient-focused 'transition' case management on discharge.⁴⁰ Pulmonary rehabilitation for COPD works to reduce readmissions.⁴⁹

Exercise-based cardiac rehabilitation for coronary heart disease results in reduced hospital admissions in the shorter term (less than 12 months follow-up). But beyond 12 months there was no significant difference in total hospitalisations.⁵⁰ There is no evidence that emergency hospital admissions are reduced with rehabilitation in stroke or hip fracture patients following surgery. There are limited data on the effect of fall prevention interventions for at-risk elderly patients. The data suggest they did not influence admissions.⁵¹⁻⁵³

Self-management with education is effective for patients with COPD.⁵⁴ The studies show a significant reduction in the probability of at least one hospital admission among patients receiving self-management education compared to those receiving usual care. In a Cochrane review of education for coronary heart disease patients overall, no reduction in risk of emergency hospital admissions was seen.⁵⁵ A systematic review on education for heart failure patients included a total of 2,686 patients in 19 randomised controlled trials; 15 demonstrated a significant effect from their intervention in at least one of their outcome measures, but there was weak evidence for its effect on emergency admissions.⁵⁶

Care at the end of life

Early palliative care could reduce admissions and deaths in hospital. For example one study from the USA examined the effect of introducing palliative care early after diagnosis among ambulatory patients with newly diagnosed metastatic non-small-cell lung cancer and looked at patient reported outcomes and end-of-life

care use. The number of deaths in hospital was lower among those with early introduction of palliative care.⁵⁷

The coordination of end-of-life care also reduces admissions. An evaluation of the Marie Curie Delivering Choice Programme found that service users were 67% less likely to die in hospital and were 51% less likely to have an emergency hospital admission in the last month of life.⁵⁸

Integration of care

A recent evaluation of 16 integrated care pilot programmes in the UK (mainly horizontal integration of health and social care) found no evidence of an anticipated general reduction in emergency admissions but there were reductions in planned admissions and in outpatient attendance.⁵⁹

CONCLUSION

There are some evidenced-based service interventions that reduce generic admissions. These include: continuity of care with a GP, early senior review in the ED, structured discharge planning and advanced care planning and coordination of care at the end of life. In addition, there is some good evidence on services that reduce respiratory and cardiac admissions including: self-management in COPD and adults with asthma, especially if this includes a self-management plan, pulmonary rehabilitation in COPD, specialist clinics in heart failure and exercise-based cardiac rehabilitation in the short-term. The lack of effective interventions and the lack of good data about combinations of interventions highlight the importance of robust evaluation of services as they are introduced into health and social care systems

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