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)

January 2004

prepared by

Matthew Cooke
Joanne Fisher
Jeremy Dale
Eileen McLeod
Ala Szczepura
Paul Walley
Sue Wilson

Address for correspondence

Dr. Matthew Cooke
Warwick Medical School
The University of Warwick
Coventry, CV4 7AL

E-mail: M.W.Cooke@warwick.ac.uk
Telephone: 02476 572905

Contents

Appendices

Index of tables

Index of case studies

Acknowledgements

This research was undertaken with the support of a project grant from the NHS Service Delivery and Organisation R&D Programme (SDO/29/2002).

Roshni Mangalore of Centre for Health Service Studies undertook the work on the economic analysis.

We are grateful to the Warwick Emergency Care Advisory Group for their comments on the early phase of this project:

Sir George Alberti
Bill Alexander
Tina Ambury
Derek Bell
David Carson
Tim Coats
Mark Davies
Michael Hake
Malcolm Hazell
Rob Hemmings
John Heyworth
Linda Holt
Kevin Mackway-Jones (Chair)
Lis Nixon
The Right Reverend Anthony Priddis
Michael Scott

Sincere thanks are due to all the reviewers:

Bill Alexander
Tina Ambury
Michael Ardagh
Margaret Bamford
Sheila Bonas
Ravi Chauhan
Sarah Connor
Sarah Crawford
Dharini Ram Cumarasany
Angela Dancocks
Ben Disney
Andrea Docherty
Matthew Dunn
Orla Dunn
David Fatovich
John Heyworth
Michiyo Iwami
Nema Jaberwi
Ellen Jorstad-Stein
Gerry Kearns
Tom Kippax
Antje Lindenmeyer
Pam Lowe
Kevin Mackway-Jones
Cliona Magee
Eileen McLeod
Kal Murali
Matthew O'Meara
Rajan Paw
Bridget Penhale
Vicky Poon
Neil Raymond
Victoria Richards
Rachel Roberts
Douglas Rolland
Krysia Saul
Ash Singal
Maria Stutterford
Gillian Surr
Kim Tolley
Maria Tsouroufli
Ursula Eddington
Anton van Dellen
Jim Wardrope
Richard Whitfield
Andi Wild

We thank the Emergency Services Collaborative of the NHS Modernisation Agency and the individual contributors for the provision of the case studies listed in this review.

Executive Summary
Key themes and messages

Title

Reducing the waits in emergency departments is important for patients and is a government priority. In order to reduce waits the whole system must be considered. The flow of patients before arrival at the emergency department determines the workload of the department. The staffing, resources and systems within the emergency department are key to providing high quality timely care. The flow of patients after leaving the emergency department until their return home will determine whether they can be discharged from the department in a timely manner. Despite the present focus on emergency care in the NHS there have been no reviews of the literature to inform the present changes to reduce waits.

Objectives

1. To conduct focused systematic reviews to address the following questions:
   - What initiatives in emergency departments have been demonstrated to reduce waiting times and attendances?
   - What initiatives outside emergency departments have been shown to reduce waiting times and attendances?
   - What evidence is there of the clinical and cost-effectiveness of such interventions?
2. To inform policy makers and health and social care providers of evidence-based initiatives.
3. To assist providers by providing vignettes of good practice and contact details.
4. To highlight areas where further research should be commissioned.

Methods

The systematic review was designed to find all articles relating to reducing attendances at emergency departments and reducing waits in emergency departments. Clear search strategies, inclusion criteria, criteria for the assessment of relevance and validity, and procedures

for the extraction of data and its synthesis were established. A broad initial search was undertaken of electronic databases (BIDS(ISI), BIND, CINAHL, COIN, EMBASE, HTA, Index to Theses, LIBCAT, MEDLINE, NHS Database of Abstracts of Reviews of Effectiveness, NRR, POINT, PsychLit, PsycINFO, SIGLE, The Cochrane Library, The NHS Database of Economic Evaluations, Trip+). Key journals were manually and electronically searched, relevant web sites were searched and internet searches were conducted (BIOME, Search.Com, Google). Key researchers were contacted and adverts placed in key journals, the Emergency Care Network and on internet mailing lists.

All studies were considered eligible if they included waiting time in emergency departments or attendance numbers at emergency departments as outcome measures. After the initial search, the abstracts of all articles (or full articles if no abstract was available) were reviewed to determine if they contained an appropriate outcome measure. The full article was then studied and if the appropriate outcome measures were used then the article was appraised, including quality scoring. Reviewing was undertaken by a specialist in the appropriate clinical field and an appropriate academic. The information from this appraisal was synthesised into this report.

Results

A large amount of literature has been published concerning the international problem of waits and delays in emergency departments. Most of the literature, however, describes the extent and opines on the causes of delays. It does not focus on innovations to reduce waits and attendances. In this type of research the gold standard of a randomised controlled trial (RCT) is often impossible and sometimes an inappropriate technique. Therefore all designs of study with appropriate outcome measures have been included.

Within the ambulance service proposals have been made to divert some low priority emergency ambulance (999) calls to NHS Direct and to enable paramedics to either discharge patients or transport them to alternative sources of care. The literature supports the feasibility of both processes but raises concerns about the safety of such systems. In primary care there is a large programme of re-organisation, however there is little evidence of the impact that this will have on emergency departments. The presence of minor injury services and introduction of NHS walk-in centres and NHS Direct has not been shown to have any effect on emergency department attendances.

There is evidence that attendance rates among the chronically ill, older people and high users may be amenable to reduction via a number of educational, social and medical interventions, including the use of community based admission avoidance schemes.

Within the emergency department the key areas where innovations have reduced waits are the introduction of near-patient testing and fast track systems for minor injuries. Systems of diverting people away from emergency departments (for example triage out, co-payment) can be effective but their safety is as yet unproven. Other areas such as the use of nurse practitioners, more senior medical staff, bedside registration and IT solutions need more study but evidence suggests they may be effective.

Surprisingly little research has been undertaken in the areas of bed management, innovations to reduce delayed discharges, working practices and workforce numbers.

The lack of consistent outcome measures and definitions in the area studied has made it difficult to combine study results and to assess whether they can be generalised. It is however apparent that extensive research programmes in emergency care would help to inform the major changes occurring in the delivery and organisation of emergency health care.

Terminology

The term accident and emergency department is currently being replaced in the UK with the term emergency department, which is also used internationally. In this report we will use the term emergency department (or abbreviation ED) rather than accident and emergency department.

The term ‘minor’ is used throughout this document to mean less severe (for example minor injuries/illness) rather than applicable to children.

Key points of evidence

- It is possible to divert some 999 calls to advice lines but the safety of such systems is still being evaluated.
- The role of paramedics in either discharging patients from the scene or deciding on appropriate destinations has not been adequately studied to confirm its safety and effectiveness in the UK.
- There is no evidence around the effects on waiting times of general practitioners (GPs) working in emergency departments.
- Primary care gatekeeping can reduce emergency department attendance but its safety is unknown.
- Walk-in centres and NHS Direct have not been demonstrated to reduce attendances at emergency departments.

- Triage is a risk management tool for busy periods, it may cause delays in care.
- Triaging out of the emergency department can reduce numbers but more work is required to assess the safety of such systems.
- Co-payment systems reduce attendances but may equally reduce attendances by those requiring emergency care.
- Fast track systems for minor injuries reduce waits, ideal configurations include senior staff.
- Attendance by the elderly, those with chronic disease and those with multiple attendances may be reduced by various interventions. Trials are needed in this area, including the role of social workers.
- The benefit of patient education is unproven in most areas except chronic disease management.
- Phoning for advice before going to the emergency department may reduce attendances.
- Specialist nurse care in heart failure, chronic obstructive pulmonary disease (COPD) and deep vein thrombosis (DVT) can reduce hospital admissions.
- Home support (medical and social) can reduce hospital admissions.
- Observation wards may reduce length of stay and avoid admission.
- There is a lack of evidence of innovations in bed management.
- Allowing emergency department staff to admit patients to wards will reduce delays.
- There is a lack of evidence about innovations to reduce delayed discharges from hospital.
- Most evidence looks at the causes of delays rather than solutions.
- Teams of staff available for unpredicted surges in activity may reduce delays.
- Rotational allocation of patients may be better than clinician self-determination.
- Senior staff may reduce admissions and delays.
- Nurse practitioners are safe and effective but their effect on waits is unknown.
- The role of other health care professional in emergency care needs evaluation.

Safety

In some areas innovations are being undertaken where the safety has not been assessed. It is therefore vital that this assessment is made before they are widely adopted. The first two listed below are being

widely introduced in the UK and therefore should be prioritised for safety assessment.

- The role of paramedics in either discharging patients from scene or deciding on appropriate destinations has not been adequately studied to confirm its safety in the UK. Some US studies suggest an unacceptably high critical incident rate but these studies are not directly applicable to the UK.
- The safety of diverting some 999 calls to advice lines, such as NHS Direct, is still being evaluated.
- Primary care gatekeeping can reduce emergency department attendance but its safety is unknown.
- Triaging out of the emergency department can reduce numbers but more work is required to verify the safety of such systems.
- Co-payment systems reduce attendances but may equally reduce attendances by those requiring emergency care. There are no studies to demonstrate the safety of such systems.

Policy

This work has been actively informing Department of Health policy throughout its production. Hence most of the innovations have already helped to inform developing policy.

Policy that is not supported by good evidence of reducing attendances:

- NHS walk-in centres
- NHS Direct
- patient education.

Absence of evidence does not mean evidence of the negative. These initiatives have however been shown to have other advantages and benefits to patient care and the NHS.

Good evidence exists to support the following policies:

- fast track systems for minor injury patients
- chronic disease case management, home support and specialist nurse care to reduce emergency admissions.

Policy areas with a lack of evidence but having expert support include:

- bed management
- reducing delayed discharges
- reorganisation of emergency primary care.

Co-payments have been shown to reduce attendances but safety has not been assessed and they go against the current philosophy of the NHS of free care for all.

Local decisions

Initiatives that are appropriate for local development include:

- senior staff seeing patients at an earlier stage
- emergency department staff admission rights
- changes to the present triage systems
- escalation clinical teams
- rotational allocation of patients on arrival.

The Report

Chapter 1 Introduction

1.1 General introduction

Waiting time has been cited as the most important cause of dissatisfaction of patients attending emergency departments (Trout *et al.*, 2000). In a recent MORI survey of patients attending emergency departments reduction of the waits was the most important area for improvement (Cooke and Jenner, 2002). Delays have also been associated with adverse outcomes (Derlet and Richards, 2000) and increased violence in emergency departments (Stirling *et al.,* 2001).

Patients follow a complex pathway through the emergency care system, of which the visit to the emergency department may be a small component. The time a person spends within the department is dependent on many factors before, during and after their journey through the emergency department.

Patients arriving at the emergency department may have come via many routes including:

- self-referral
- emergency ambulance
- general practitioner referral
- other health care professionals (for example NHS Direct, walk-in centre)
- other service providers (for example police).

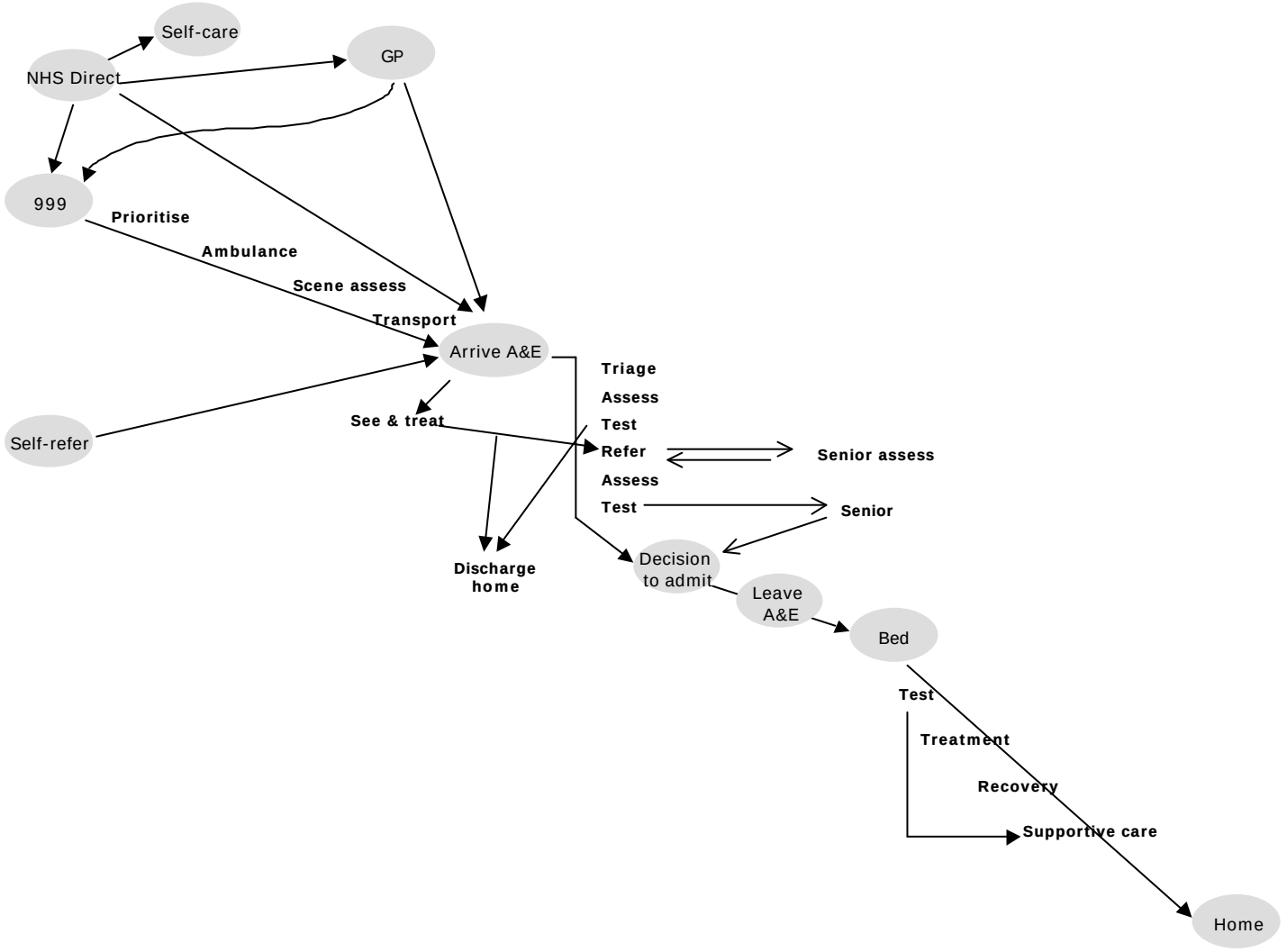
The way in which all these services are provided and the ease of access to alternative services will determine how many patients attend the emergency department. The volume of patients attending an emergency department will be a major determinant of the waiting time, if resources (financial and personnel) are fixed.

The resources and systems in the emergency department can control the flow of patients. The common causes of delays within the emergency department process are an imbalance between resources and workload, availability of staff and tests and processes creating delays. The resources in the department need to be matched to the workload on an hour by hour basis, despite the inherent variation in that workload.

If the outflow of patients from the emergency department is obstructed this upstream bottleneck will also cause delays in the department. Lack of available beds will not only delay those requiring a bed but create a log jam effect, leading to unavailability of space, and consequent delay of other patients who can be discharged from the emergency department.

Figure 1 (overleaf) demonstrates the flow of patients through the emergency care system.

Figure 1 The flow of patients through the emergency care system



1.2 Extent of the problem

UK

More than 15 million patients attend emergency departments in England and Wales every year. Time spent in the emergency department has dramatically improved over the last 15 months from over 25% spending more than four hours to less than 10% waiting more than four hours in total in the emergency department (Department of Health, 2005a). However for those needing admission, the percentage waiting more than four hours from the decision to admit, to arriving in a bed has only decreased from 10% to 6%, suggesting that most progress has been in those discharged from the emergency departments (Department of Health, 2005b).

However it has been recognised that figures collected for national performance monitoring may be subject to inaccuracies when perverse systems are adopted to improve their performance figures (Lipley, 2000).

International

Increasing delays in emergency departments has been recognised as a growing problem throughout the developed world (Kollek and Walker, 2002; Graff, 1999; Schafermeyer and Brent, 2003; McManus, 2001; Derlet *et al.*, 2001). In 2001 over a third of hospital emergency departments in USA were forced to divert patients because of overcrowding and 85% of state emergency medicine chapters described overcrowding of emergency departments as a serious threat to their emergency departments (Franaszek *et al.,* 2002). The measures of waits vary in different countries making it difficult to compare waits. The American College of Emergency Physicians has established some definitions around overcrowding but these lack the rigid approach required for research purposes (Franaszek *et al.,* 2002). Boyle *et al.* (1992) reported that emergency departments in Quebec, Canada, frequently experienced overcrowding, resulting in long patient waiting times, ambulance diversions, and both patient and physician dissatisfaction. One of the key factors for Canadian overcrowding was lack of inpatient hospital beds and the Quebec government successfully improved this situation with a $178 million, 28-component plan to increase the number of inpatient beds and decrease hospital length of stay for inpatients. The study also notes that in Australia, diversion of ambulances away from emergency departments has become a problem in several metropolitan areas. Shih *et al.* (1992) stated that overcrowding in one Taiwan hospital was so severe that 4% of admitted patients actually remained in the emergency department four days or longer.

Increasingly emergency departments are organised in similar ways in the USA, Canada, Australia and New Zealand, but the systems in Europe are very different. The former have a specialty of emergency medicine and these specialists are the first contact for many patients presenting with emergencies to hospital. European systems rapidly triage patients to inpatient specialties for care and have a wider system of community facilities for those with less severe conditions. Britain has more similarities with the non-European systems except it has traditionally undertaken less extensive investigation of complex medical problems, although this is changing with time. The organisation of whole health care systems is very different in all these countries. Therefore it can be difficult to extrapolate changes in one system to the UK system.

1.3 Recent reports on emergency care in the UK

The NHS Plan (Department of Health, 2000) has set a target for the NHS that 'by 2004 no-one should be waiting more than four hours in emergency department from arrival to admission, transfer or discharge'.

Reforming emergency care

Reforming Emergency Care (Department of Health, 2001) was launched as government strategy in 2001 by the Secretary of State for Health. It recognised that problems in emergency departments are often the result of problems elsewhere in the system. It built on the work of previous Department of Health programmes, including the out-of-hours review (the Carson report), the Emergency Services Action Team (ESAT), the Winter and Emergency Services Team (WEST) and the work of the A&E Modernisation Programme.

The overcrowding in emergency departments had been referred to as 'winter pressures' in the NHS in the late 1990s. It has subsequently been demonstrated that winter pressures were not due to any increase in attendance at emergency departments or increase in admissions but to an increase in length of stay, particularly among those with cardiovascular and respiratory disease (Douglas *et al.*, 1991). Reviews were undertaken of methods used to relieve winter pressures (Scrivens *et al.*, 1998).

The current key problems of NHS emergency care in 2001 were identified in *Reforming Emergency Care* as:

- staff capacity in emergency departments is too stretched
- hospitals do not have sufficient capacity
- delays in discharge cause a log jam effect in hospitals
- the needs of elective patients compete with those for emergencies both in terms of facilities and staff

- the availability of diagnostic services does not match emergency care needs
- patients wait too long in the single queue system of emergency departments
- demarcation of professional working practises
- patients end up in the wrong part of the service
- the system is fragmented
- standards vary across the system.

Plans to increase both medical and nursing staffing were described as well as the development of new ways of working with increased use of new practitioners and new roles such as emergency care practitioners working across the primary-secondary care sectors. Processes in emergency departments were challenged with proposals on streaming of patients both in emergency departments and other parts of the emergency care system. From this evolved the policy of introducing 'see and treat' into the emergency departments. This is a process of having dedicated senior staff seeing the less severe ambulatory cases in a dedicated area as a separate stream of patients in a one-stop type process. It is described further in chapter 4, section 4.3.5. The importance of speedy diagnostics and the role of the admitting speciality teams were highlighted as was the need to try to undertake more emergency work in the community rather than in the emergency department.

Importantly, *Reforming Emergency Care* also emphasised that there was no single solution and that local assessment was required to determine solutions. Key to all the solutions was the involvement of the whole healthcare community and the development of emergency care networks to support this change. To enable this work to take place the Emergency Services Collaborative was established (NHS, 2003a). This programme uses a methodology of improvement that allows staff from different organisations to learn from each other and share good practice. It involves front line staff in analysing problems then leading testing, implementing and measuring changes in patient care. .

Improving the flow of emergency admissions

The NHS Modernisation Agency's programme on 'improving the flow of emergency admissions' (NHS, 2001) developed four key steps in improving delays in the emergency admission process:

1. Where are we now?
2. How can we match the system to the patient's needs?
3. How can we improve patient flow?
4. How can we maximise staff potential?

In this way it highlighted that individual organisations have different problems. Bottlenecks for an individual reorganisation need to be

identified and then solutions can be found. These solutions may be within the hospital or within the community.

Warwick report

This report (Walley, 2003) was prepared for the Modernisation Agency to inform the Ideal Design of Emergency Access (IDEA). It produced nine key findings:

1. The emergency care system has to deal with a significant level of demand from patients where the illnesses presented are not in themselves of a life-threatening or serious nature.
2. The demand for emergency care follows relatively predictable seasonality patterns. It is suggested that most agencies should be able to forecast demand to within useable levels of accuracy, using a relatively small number of parameters.
3. Most agencies have a reactive approach to demand seasonally, often with little awareness of the improvements to the service that might be achieved with more careful planning of resource levels and skill mix. Effective capacity is reduced by a reluctance to use some skill sets to their full potential.
4. The early summer months have the greatest numbers of patients requiring emergency department treatment. However, this period does not coincide with the highest demand for critical care resources because the mix of patients and illnesses changes seasonally. This is the primary cause of problems within emergency access processes during the winter months. The variation in cases is arguably the most important factor when considering medium-term capacity decisions.
5. Treatment processes are currently poor at coping with variation and this results in unnecessary delays. For many patient categories, the level of demand and process requirements are so predictable, it should be possible to design and implement faster, more efficient treatment processes.
6. Capacity bottlenecks are not always recognised and this can result in long delays for patients. Control systems should be used to highlight these problems and to maintain the flow of patients within the system. Rate limiting stages in the process can then be targeted for improvement or additional resource.
7. It is possible to identify distinct categories of patient (or segments) where well-defined and efficient treatment processes can be designed to suit the patients' needs.
8. Many of the delays within the system occur at the interface between different agencies, both external and internal to the NHS.
9. Performance reporting systems should focus on time-based measures. Efficiency and effectiveness can be conveyed by comparing patient throughput time to the time that patients

receive value-adding treatment. This measure is often referred to as the micro-JIT (just-in-time) ratio. It is the ratio of total throughput time (including delays) to value adding time (excluding delays).

Audit Commission

The Audit Commission originally examined emergency department services in 1996 when it found:

- long waiting times for emergency treatment or admission
- poor provision for some vulnerable patients such as children
- poor supervision and support for junior doctors
- poor provision and use of information in many departments.

It re-examined emergency department services in 1998 and found that waiting times had increased despite reduced growth in numbers attending emergency departments. In 2001 it reported again and the key findings were that waiting time to see a doctor and to be admitted varied widely between hospitals and that the long waits were commoner in large hospitals and in London. Staff workloads varied considerably and there was no evidence that understaffed departments experienced longer waits; there was also poor use of emergency nurse practitioners. They could find no single answer to what was causing the delays, which confirmed the belief that delays are caused by a host of organisational and managerial differences as much as by resources and staff levels.

Other official documents are available on the national electronic library for health's emergency care specialist library's emergency care management section at: http://www.nelh.nhs.uk/emergency.

Best practice guides have been issued by a range of bodies including:

- Arizona College of Emergency Physicians (2000)
- Massachusetts Health Policy Forum (McManus, 2001)
- New Jersey Hospital Association (2001)
- American College of Emergency Physicians (n.d.)
- Department of Health (2005c).

The American guides have principles that are equally applicable in the UK but may need modification in their detail.

1.4..Epidemiology of emergency department attendances

Many factors have been identified as affecting the use of emergency departments, including:

- Deprivation and poverty (Hull *et al.*, 1998; Lambe *et al.*, 2003; Milner *et al.*, 1988; Monsuez *et al.*, 1993).
- Loneliness is a predictor of emergency department use, independent of chronic disease (Geller *et al.*, 1999). Similarly, children who have a grandmother involved in their care are less likely to attend emergency departments (Fergusson *et al.*, 1998)
- Lack of a regular physician in the elderly (Rosenblatt *et al.*, 2000).
- 2% of attendances are return visits of which 61% are due to illness related factors (Kelly *et al.*, 1993; Keith *et al.*, 1989; Pierce and Kellerman, 1990).
- The ability to read and understand health-related materials is related to a reduced risk of hospital admission (Baker *et al.*, 1998).
- Convenience for parents (Doobinin *et al.*, 2003; McKee *et al.*, 1990).
- Ramadan causes an increase attendance rate in Muslims (3.6% to 5.1%) (Langford *et al.*, 1994).
- Distance from the emergency department (Doobinin *et al.*, 2003; McKee *et al.*, 1990).
- Particular gaseous and particulate pollutants have specific effects on emergency department attendance (Delfino *et al.*, 1997 & 1998; Sunyer *et al.*, 1993; Norris *et al.*, 1999; Xu *et al.*, 1995) .
- Thunderstorms cause an increase in asthma exacerbation's (Marks *et al.*, 2001; Celenza *et al.*, 1996).
- Warm weather is associated with higher incidence of paediatric injuries (Macgregor, 2003).
- Influenza-associated respiratory disease (Menec *et al.*, 2003; Schull and Mamdani, 2001a & 2001b), especially among children and adults over 65 years.
- Non-compliance with prescribed drug treatment (Olshaker, 1999).

At the same time, however:

- Ethnicity is not an important determinant (Baker *et al.*, 1996).
- The occurrence of a full moon has no effect on emergency department attendance or ambulance journeys (Thompson and Adams, 1996).
- Uniform drinks licensing times has no effect on emergency department attendances (Graham *et al.*, 1998).

Many papers have described the temporal and demographic variations of emergency department attendances at single sites but few have done so across a generalisable sample.

Studies reporting temporal variations have focused on specific populations. For example, Airey and Franks (1995) investigated the incidence, distribution and clinical patterns of life-threatening and multiple injuries for a 12-month period. They found that patients

sustaining major trauma were more likely to arrive at emergency department 'out of hours' (between 6.00 pm and 8.00 am) on Fridays, Saturdays, and Mondays, and that only 28% of patients arrived during 'office hours', that is, 9.00 am to 5.00 pm Monday to Friday. There was no significant difference in the monthly incidence of major trauma.

For patients sustaining minor injuries, most are likely to present in the late morning and early afternoon, and only 6% present in the period from 1.00 am to 8.00 am (Nicholl *et al.*, 1998).

Presentations for respiratory conditions such as influenza and bronchitis vary throughout the year with higher incidence reported in the winter months (Whiting *et al.*, 1999).

No differences were found in attendance patterns in respect of sex. Attendances by children under 15 years peaked in the evening between 6.00 pm and 7.59 pm. In contrast, peak attendance in those over 15 years was between 9.00 am and 11.59 am. The percentage of 'out of hours' attendances in this data set was highest in the under-one age group (58.5%), the 15 to 24 age group (57.1%), and the 25 to 44 age group (54.6%). The highest proportion of patients attended emergency departments on a Monday, while the percentage of weekend attendances decreased with age. In children aged 1 to 14 years, there were more attendances in summer than winter. In those aged below one and over 65 there was a winter peak with December having the most attendances (Downing and Wilson, 2002).

By using a range of variables (day of the week, month of the year, holiday/weekend and a three year time series) it is possible to predict 65% of the variation in emergency department attendances (Rotstein *et al.*, 1997). Another study which added weather factors could explain 84% of the daily variance (Holleman *et al.*, 1996).

1.5 What is an excessive wait?

In England, the NHS plan (Department of Health, 2000)has defined an excessive wait as more than four hours total time in the emergency department (measured from the time a patient arrives until they leave the emergency department).

Internationally a variety of definitions are used and the issue is referred to as overcrowding rather than prolonged waits. The definition of emergency department overcrowding is elusive. In Canada a definition is 'a situation in which demand for service exceeds the ability to provide care within a reasonable time, causing physicians and nurses to be unable to provide quality care' (Drummond, 2002). Although this definition has intuitive appeal, it is difficult to operationalise for research purposes. However, in most Canadian studies only major cases are considered. A survey (Derlet *et al.*, 2001) of US emergency department directors suggested five different possible definitions:

1. patients waiting more than 60 minutes to see physician
2. all emergency department beds filled more than six hours a day
3. patients placed in corridors more than six hours a day
4. emergency physicians feel rushed more than six hours a day
5. waiting room filled more than six hours a day.

The length of time patients spend in the emergency department has long been the subject of debate. In 1989, Rutherford *et al.* argued that for patients with serious illness or injury to be kept waiting in the emergency department for up to four hours was not 'justifiable' and that such delays resulted in irritation for some patients and relatives. They argued that between 80% and 90% of patients are seen and a decision made within one hour of arrival and that 'where there are repeated delays, either the staff does not understand how to do its work well, or the allocation of staff is insufficient for the workload'.

1.6 Causes of wait

Little of the time spent in the emergency department adds value to the patient experience (for example staff contact time, undergoing investigations). Triage takes approximately 15 minutes (Smeltzer and Curtis, 1987) and examination and treatment 13 to 15 minutes (Smeltzer and Curtis, 1987; Rodriguez *et al.*, 1992). For admissions the assessment period takes longer. Time for x-rays was 69 minutes and blood tests had a turnaround of 77 minutes (Smeltzer and Curtis, 1987).

Many papers have considered the causes of the waits using a wide variety of techniques. It is recognised that intuitive thinking without analysis may lead to incorrect conclusions on the causes of waits (Chan *et al.*, 1997 and Lagoe *et al.*, 2003). The variety of responses probably indicates that causes vary between hospitals and may be multifactorial.

Published causes of waits include:

- alternative levels of care in the community unavailable (Schull *et al.*, 2001a)
- access to home resources (Schull *et al.*, 2001a; Estey *et al.*, 2003)
- closure of community hospitals (Derlet, 1992)
- poor linkage of hospital and out of hospital services (Andersson and Karlberg, 2001)
- other commitments of admitting staff (Regan, 2000; The Schumacher Group, 2002)
- admitting teams demanding test results before referral (Regan, 2000)

- response time from admitting teams (Derlet, 1992; Fletcher *et al.*, 2004; Schull *et al.*, 2001a; Derlet *et al.*, 2000; Andersson and Karlberg, 2001; Yoon *et al.*, 2003; Estey *et al.*, 2003))
- delays in diagnostics (Schull *et al.*, 2001a; Derlet *et al.*, 2000; Andersson and Karlberg, 2001; The Schumacher Group, 2002; Fletcher *et al.*, 2004).and shortage of radiologists (Derlet, 1992)
- access to diagnostics (Schull *et al.*, 2001a; Yoon *et al.*, 2003; Estey *et al.*, 2003)
- bed unavailability (Fletcher *et al.*, 2004; Regan, 2000; Derlet, 1992; The Schumacher Group, 2002; Derlet *et al.*, 2000)
- access block / bed availability (Richardson, 2001)
- patients held in emergency department awaiting admission (Schull *et al.*, 2001a)
- lack of agreed protocols (Regan, 2000)
- increased documentation requirements (The Schumacher Group, 2002)
- inexperienced medical staff (Derlet, 1992; Regan, 2000)
- physicians and their characteristics (Schull *et al.*, 2001a; Lambe *et al.*, 2003; Derlet, 1992)
- nurse staffing and profile (Schull *et al.*, 2001a; Lambe *et al.*, 2003; Estey *et al.*, 2003; The Schumacher Group, 2002)
- hospital restructuring with fewer in patient beds (Schull *et al.*, 2001b)
- changing role of emergency medicine (Estey *et al.*, 2003; The Schumacher Group, 2002)
- hospital bed flow, including length of stay, bed occupancy and critical care bed availability (Schull *et al.*, 2001a)
- daily total patient care time (Richardson, 2003a, b and c; The Schumacher Group, 2002)
- no of ambulance cases (Chan *et al.*, 1997)
- total census of majors (Redmond and Burton, 1993; Chan *et al.*, 1997)and increasing complexity (The Schumacher Group, 2002)
- number of children attending (Chan *et al.*, 1997)
- number of admissions (Chan *et al.*, 1997)
- increased psychiatric and substance misuse attenders (Derlet, 1992)
- overload with non urgent cases (Siddharthan *et al.*, 1996)
- rural *versus* urban hospitals and size of hospital (Solomon and Johnson, 1999; Audit Commission, 1998)
- other departments diverting cases (Schull *et al.*, 2001a)

1.7 Effects of delays and overcrowding

Effects on patients: clinical

A study of overcrowding in an emergency department in Spain observed a significant, positive correlation between mortality rates and weekly number of visits ($p=0.01$). Although a similar trend was also found for revisit rates, such an increase did not reach statistical significance ($p=0.06$). It concluded that since revisit and mortality rates constitute good health care quality markers, emergency department overcrowding implies a decrease in healthcare quality (Miro *et al.*, 1999). Numbers of adverse incidents increase with department workload ($p=0.02$), increased numbers of patients in the emergency department more than three hours ($p=0.03$) and total turnaround time ($p=0.02$) (Erickson *et al.*, 2001). Overcrowding has also been attributed as the cause of communication errors resulting in medical errors, and with increasing numbers of patients, errors such as mislabelled specimens or radiology request forms also increase in frequency (Derlet and Richards, 2000). Nurses in an overcrowded department reported compromised care (Pearce, 2002).

An American survey (Derlet *et al.*, 2001) found that 33% of emergency department directors reported that a few patients experienced actual poor outcomes as a result of overcrowding. Deaths have been attributed to the delay because of overcrowding (Thompson, 1999). One case report attributed a patient's death to overcrowding (Wrenn and Rice, 1994). Another case in the UK resulted in death because of delays in finding a neurosurgical bed (Kennedy, 1996). Cases of delayed care of myocardial infarction, delayed recognition of hyperthermia, delayed care of subdural haemorrhage have all been described (Derlet and Richards, 2000). A study of patients with acute appendicitis showed that those who had an emergency physician delay or a delay in the surgeon performing the operation had a worse outcome (Chung *et al.*, 2000). In a study in an Australian emergency department nearly 12 000 admissions were studied of whom 7.7% experienced prolonged total time in the emergency department. The mean length of stay in hospital was 4.9 days in those who experienced a prolonged wait in the emergency department compared to 4.1 days in those who did not (an increase of nearly 20%). This effect was seen in all patients except those in category 1, which implies that it is not related to sick patients needing a longer stay in emergency department (Richardson, 2002). Delay in administration of antibiotics in pneumonia (Magalski *et al.*, 1999) and diuretics in heart failure will increase length of stay in hospital (Rosenstein *et al.*, 2000). Increased average inpatient length of stay caused by overcrowding of the emergency department has been shown to result in increased costs per patient (Krochmal and Riley, 1994). During times of overcrowding, patients may experience

prolonged pain and suffering unnecessarily because the emergency department staff are too busy to attend to them (Derlet and Richards, 2000).

Effects on patients: satisfaction

Patient satisfaction is an indicator of quality of care. Trout *et al*. (2000), performed a literature review to identify factors associated with overall patient satisfaction following attendance at emergency departments. They found 16 studies relating satisfaction to service and patient factors. Key themes were observed. Perceived waiting time was consistently associated with overall satisfaction but little is known of the relationship between actual waits and satisfaction. One study suggested that actual wait (as opposed to perceived wait) is not associated with overall satisfaction (Thompson and Yarnold, 1995). Provision of information, and patient-carer interpersonal skills were also important factors. This dissatisfaction is reflected in an increasing number of patients who leave without being seen. The consequence of this is the potential for minor medical problems to become more serious from delay in care (Derlet and Richards, 2000). Patients are less likely to leave the department without being seen if waits are reduced (Fernandes *et al.*, 1997) although studies have been variable in whether those leaving without being seen may have significant problems or not (Cooke *et al.*, 2000).

Patient attendance rate is recognised as being a predictor of numbers leaving the department without being seen; for every 2.8 extra patients, one extra will leave without being seen but Hobbs *et al.* (1999) did not correlate this with waiting times.

Effect on staff

The many causes of overcrowding have had a negative effect on physician productivity. Emergency physicians have attempted to fill in the gaps, as they must stretch their ability to see many patients at the same time. At a certain limit of patients, productivity declines and patient care is compromised (Derlet and Richards, 2000). Staff retention and recruitment is adversely affected by overcrowded emergency departments (Pearce, 2002).

Violence

A systematic review of violence in emergency departments demonstrated the association between increased violence against staff and longer waiting times (Stirling *et al,* 2001).

Academic pursuits

Focused bedside teaching has been cited as one of the first casualties of overcrowded emergency departments when trainers are too busy to

teach (Derlet and Richards, 2000; Dolan *et al.*, 1997). However, studies have shown that the presence of residents has only a minimal effect on the length of stay of patients in the emergency department (Lamnes *et al.* 2003). French *et al.* (2002) looked at emergency activity on the days when residents were absent because of educational commitments. Comparing dates without residents to those with, there was a longer decision to admit time (333 *versus* 313 mins, p=0.003) and a longer length of stay for admissions (490 *versus* 445 minutes, p<0.0001) but no difference in 'treat and release' patients. Test usage was the same. Staffing numbers were the same on both types of day. There is conflicting evidence on the effects of medical students. One prospective time series study over 86 days showed the presence of medical students did not seem to affect patient transit times (New, 2000). However another study (Gerbeaux *et al.*, 2001) demonstrated the median length of stay decreased by 24% (31 minutes, 95% confidence interval 24 to 38) during a medical student strike from 110 minutes (95% confidence interval 65 to 178) to 79 minutes (95% confidence interval 40 to 135) p<10(-4). Other effects of the strike may have confounded the results. In a study of 1287 patients, average treatment times were not significantly different whether a medical student was present or not in an emergency ambulatory care facility (Denninghoff and Moye, 1998). The study did examine only one physician and his students. All these studies were in America and therefore will have limited applicability to other academic situations.

Ambulance diversions

The incidence of ambulance diversion has increased, especially in urban areas which affects the clinical effectiveness of all hospitals in the area (Schull *et al.*, 2003). Redelmeer *et al.* (1994) demonstrated that overcrowding resulting in ambulance diversion caused longer times at the scene (13.5 *versus* 12.4 minutes; p<0.005) and greater transport times (13.3 *versus* 11.6 minutes, p<0.005). But there was no evidence of increase in the rate of transport-associated deaths (0.460 deaths per 1000 population in 1986 *versus* 0.464 deaths per 1000 population in 1989; p=ns).

Financial

In funded systems, the hospital may loose revenue because of failure to admit patients to a bed and holding them in the emergency department. Bayley *et al.* (2002) estimated the cost in America as $190 per patient waiting more than three hours.

Some individuals believe that decreasing waiting times will increase the number of attendances to the emergency department for non-urgent conditions. An American study (Cardin *et al.*, 2003) where the wait was reduced from a mean of 13.8 hours to 5.9 hours demonstrated no

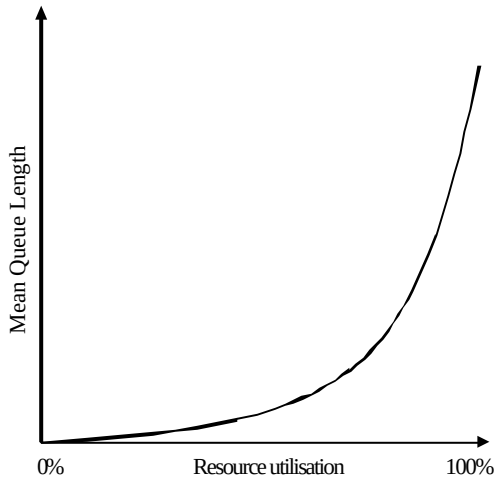
increase in return visits. As returns are a proxy measure for quality of care, this also implies that faster care is not poorer care.

1.8 Queue theory and applications in health care

Queuing theory is a widely studied topic within operations research. Queuing theories started to be developed a century ago, particularly due to the work of A.K. Erlang (Brockmeyer *et al.*, 1948). The basic concept relates to high volume, short transaction service systems such as telephone connections, where the system operates close to effective capacity. Variations in demand and capacity lead to occasional periods where all the demand cannot be met, causing a backlog or queue to develop even though long-term capacity exceeds demand.

Treated in its purest mathematical form, a general principle can be established that relates the utilisation of resources to system performance. Figure 2 shows how the expected length of a queue increases with utilisation.

Figure 2 The approximate relationship between queue length and resource utilisation



The graph demonstrates that a queue rapidly forms when demand variation occurs and resource utilisation is moderately high. Furthermore, once a system is designed to operate at relative high utilisation, it becomes very sensitive to short-run increases in demand or decreases in effective capacity. The assumptions built into queuing theory mean that care has to be taken with its application (Green and Kolesar, 1987). The precise behaviour of a queue depends on a series of characteristics. Van Looy *et al.* (2003) structure the elements of a queuing system as follows:

1. Arrival characteristics

Mathematical queuing models make assumptions about the pattern of arrival into the system. Depending upon the behaviour of the population entering the queuing system, arrival patterns such as negative exponential or Poisson distributions are used to represent arrival behaviour. In practice, arrival patterns are normally quasi-random. For example, some outpatient clinics smooth the arrival pattern without allocating individual appointment slots to one particular patient. In other cases, demand is 'batched' because work arrives or leaves a system as a group. Generally, batching leads to larger queues.

2. Characteristics of the service

The time that a customer or patient spends with a server influences queue dynamics or queue length. In situations where the time taken to provide the service is highly variable, queue length will increase. Hence, standardisation of services tends to reduce the level of queuing.

The design of the service system implicitly defines the design of the queues that are seen. The classic queue is a single server, single queue model, where all work queues at one single stage. In most systems there are multiple servers, but the question arises of whether the queue should be split into multiple queues, each corresponding to one server. Erlang queue theory is very clear that, as a rule, the greater the pooling of demand, the more effective a given system will be in minimising queues. For an illustration of this see Kolesar and Green (1998).

3. Queue characteristics

Queue length will be affected by the way the queues behave. In sequential processes, there may be a queue in front of most stages in the process (for example to see doctor, to have x-ray, to be reviewed after x-ray). This impacts upon the flow in the system. The discipline in the queue is also a factor (for example if people are pushed to the front of the queue, as with clinical prioritisation systems). Management theory also considers the change in behaviour of queue participants and staff. For example, people are known to assess both the length and speed of some queues, reneging (i.e. leaving the queue early, equating to patients leaving without being seen) or balking (refusing to join the queue), if the queue length is deemed unsatisfactory. Similarly, behaviour can be managed, for example, by keeping participants informed of waiting times or keeping them occupied with other tasks (Maister, 1985; Davies and Heineke, 1994; Jones and Peppiatt, 1996).

Applications in health care

Recently, queuing theory has been more widely applied in health care, Preater (2002) reports his own bibliography containing nearly 150

academic papers that apply queuing theory to health care. There is a collection of work that relates to managing appointments, outpatient clinics and waiting lists. Recent work has focused on the use of Erlang theory to relate bed capacity to patient turn-away. This has demonstrated the positive impact of pooling resources, leading to suggestions that it is still better to keep elective and emergency care beds pooled. However, the mathematical models do not necessarily incorporate changes in system behaviour caused by such structural decisions.

The lessons from Erlang theory feature in NHS training material (NHS Modernisation Agency, 2002). Lessons from manufacturing that relate to the emergency department have recently been summarised by Walley (2003a). It is now accepted that the unnecessary splitting of work into ring-fenced groups ('carve-out') causes capacity losses and longer waiting times (see Steyn [n.d.] for a demonstration of the principles). In this sense, the Manchester triage system can be regarded as a queue-splitting decision that makes queues in emergency departments worse, unless other procedures change simultaneously.

Chapter 2 Methods

Objectives

The objectives of this systematic review were:

1. To establish the evidence for innovations designed to reduce waiting times in and attendance at emergency departments, specifically:
   - What initiatives in emergency departments have been demonstrated to reduce waiting times and attendances?
   - What initiatives outside emergency departments have been shown to reduce waiting times and attendances?
   - What evidence is there of the effectiveness of such interventions?
2. To inform policy makers and health and social care providers of evidence-based initiatives.
3. To assist providers with vignettes to illustrate innovations in place in the UK.
4. To highlight areas where further research should be commissioned.

The factors that contribute to waits in the emergency department are many and complex due to interdependence with other departments, disciplines and organisations such as social care, pre-hospital care, primary care, radiology, and pathology. It is generally accepted that solving waits will require a system-wide approach necessitating the application of multiform initiatives. In order to retrieve all relevant articles including those from allied departments, disciplines and organisations a broad search strategy was adapted.

Expert advisory group

An expert advisory group was convened representing all organisations allied to emergency care including: Ambulance Service Association, Audit Commission, Royal College of General Practitioners, Emergency Services Collaborative, Out of Hours Primary Care Team (Department of Health), Faculty of Accident and Emergency Medicine, Emergency Care Strategy Team (Department of Health), the Association of Directors of Social Services, Performance Quality and Regulation (Welsh Assembly), British Association for Emergency Medicine, NHS Modernisation Agency, Royal College of Nursing and user representation.

Inclusion criteria

We sought to identify any intervention that had waiting time in or attendance at the emergency department as outcome measures. Waiting time in the emergency department is differentially defined

nationally and internationally and measures may include: waiting time to triage, waiting time to see a doctor, waiting time for results, trolley wait or total time in the emergency department. Studies that included single elements but did not report data on the overall impact on total waiting time in the emergency department were excluded.

Studies focusing on accident prevention and falls prevention were not included. Articles related to length of hospital stay that did not consider its effect in emergency care patient flows were also excluded.

Studies were included that were published from January 1985 until July 2003. No restriction was placed on country or language.

Outcomes

To be included in the review a study must report an outcome measure that impacts on waits in or attendance at the emergency department including: waits/delays in the emergency department, attendance/re-attendance at the emergency department, length of inpatient stay following emergency admission, emergency department admission avoidance, transfer of care following emergency admission.

Type of study

In this type of research the gold standard of an RCT is often impossible and sometimes an inappropriate technique. Therefore all designs of study with appropriate outcome measures have been included:

- RCTs
- quasi-experimental studies
- cohort studies
- cross-sectional studies
- descriptive studies.

Search strategy

The search strategy was devised by the research team and presented to the Expert Advisory Group for comment.

Because of the broad nature of the review topic a comprehensive search strategy was developed and cycled through a number of iterations in order to maximise comprehensiveness and precision. Searches for relevant literature both published and unpublished was undertaken on a broad range of databases (Table 1).

Table 1 Databases searched

BIDS (Bath Information and Data Services)	LIBCAT
BIND	MEDLINE
CINAHL	NRR (National Research Register)
COCHRANE	PIONT
COIN	PSYCINFO
DARE	SIGLE
NHS EED (NHS Economic Evaluation Database)	THESIS
HTA	TRIP+
EMBASE	

In addition relevant journals were searched electronically and by hand.

Journal search (electronic):

Academic Emergency Medicine
American Journal of Emergency Medicine
Annals of Emergency Medicine.
Applied Nursing Research
Clinical Excellence
EMS Insider
EMS Manager and Supervisor
International Journal of Operations and Production Management
International Journal of Trauma Nursing
JEMS
Journal of Accident and Emergency Medicine
Journal of Emergency Nursing
Journal of Management in Medicine
Journal of Professional Nursing
Nurse Practitioners
Nursing Outlook
Prehospital Emergency Care
RCN Publishing.

Journal search (hand)

Academic Emergency Medicine
Accident and Emergency Nursing
Ambulance UK
Annals of Emergency Medicine
British Medical Journal

Emergency Medical Journal

Emergency Nurse

Journal of A&E Medicine

Journal of Emergency Medicine

Journal of Emergency Nursing

Nurse Practitioner

Nursing Times

Pre-Hospital Immediate Care

Royal Nurse

Today's Emergency.

Internet search

Internet searches were undertaken using the biomedical search engine BIOME (www.biome.ac.uk), the meta-search engine Search.com (www.search.com) and the Google search engine (www.google.com/.

Reference lists from retrieved articles were searched. Key researchers were contacted and adverts placed in key journals, the Emergency Care Network and on internet mailing lists.

Citations were imported and stored using ProCite (version 5.0) bibliographic database. All citations were allocated a unique identification number in the database. Duplicate citations were deleted from the database.

Chapter 3 Review procedures

The titles and abstracts from all studies identified from the searches were initially sifted by one reviewer (JDF) to eliminate studies unrelated to the primary focus of this review.

Following the initial sift the title, and abstract of the remaining studies were assessed independently by two reviewers (MWC and JDF) under masked conditions. Relevant studies were those that had evaluated an intervention and where the outcome measures were:

- waits in emergency department
- delays in emergency department
- attendance or re-attendance emergency department
- length of inpatient stay following emergency admission
- admission avoidance
- transfer of care following emergency admission.

Full copies of all the documents retrieved in the search were obtained for further review if the abstract contained any of the relevant outcome measures listed above or where the relevance of the paper could not be ascertained. These documents included journal articles, letters, reports and conference proceedings. Disagreements concerning the relevance of studies were resolved by discussion between the reviewers (MWC and JDF).

Data extraction

The extraction sheet was completed by two reviewers, an academic (MWC or JDF) and an expert in the relevant topic field (see reviewer list).

Data extraction sheets were prepared for all relevant studies to extract:

Study details

- document type
- area of health care
  - emergency department
  - in-hospital care
  - pre-hospital care
  - primary care
  - social care
- study type
- country
- language

Intervention details

- nature of intervention
- duration of intervention
- who delivered the intervention
- whether any training was needed/given.

Study design

- hypothesis
- an appropriate spectrum of patients
- exclusion appropriate
- control group or comparison to any other system
- were the intervention and control groups comparable.

Results

- unit of analysis
- descriptive data
- statistical test.

Generalisability

- hospital type
- size of emergency department
- whether the intervention is restricted to certain types of hospital
- whether the intervention is applicable to the UK.

Assessment

- were the methods described sufficiently to permit replication?

Results

The search strategy generated a total of 61 860 studies. Following the initial sift the titles and abstracts of 3178 were reviewed and of these 334 were fully reviewed, and 109 met the selection criteria.

Analysis

Due to heterogeneity of studies in terms of outcome measures, design, intervention and settings, no meta-analysis were undertaken.

The data were tabulated and only those studies satisfying the criteria for full review are included in the tables, in particular only those with a specific intervention. Quality, applicability to UK, presence of control group, the size of emergency department studied and number in study are all included in the table where they are available, to enable readers to asses the quality and generalisability of each study.

Other studies are referred to in the text if considered relevant to the discussion but should not be considered as being robust studies with appropriate outcome measures. Many are epidemiological rather than intervention studies or consider a small component of the time in the emergency department that may not influence total waits. Studies quoting figures without any statistical analysis, hypothetical studies and modelling studies, and systematic reviews are also excluded from the tables.

Where Cochrane reviews were available, these were utilised and only articles published since the Cochrane review were then considered in these areas.

In addition case studies are provided to illustrate good practice. These are supplied by the NHS Modernisation Agency's Emergency Services Collaborative and further examples are available at www.modern.nhs.uk/emergency. The case studies utilised were those which illustrated most appropriately the key messages of that section of the study. They were selected from case studies submitted to the Emergency Services Collaborative as examples of good practice.

Chapter 4 Results

The results of this study have been divided into the nine sections listed above. In each section, a brief background is given of the present UK system. This is followed by a series of subsections detailing the literature in the defined areas. This text includes some relevant articles without the defined outcomes where they add to the findings.

The section is then completed with overall conclusions and key messages. These are followed by tables of all the articles with relevant outcome measures. These tables contain some information that may not be present in the text and includes the reviewer's quality score and other factors to enable the reader to assess applicability to their circumstances. Particular attention is drawn to the country of the study as findings may be limited because of the organisational differences between the various health care systems.

An illustrative case study is the final component of each section.

4.1 Out of hospital care

4.1.1 Background

When a person phones 999 they have traditionally received an ambulance response and, since 1996, this has invariably been a paramedic response.

The United Kingdom ambulance services use priority dispatch systems to determine which calls are potentially life threatening and hence determine who has a faster response because of life threatening conditions, but also it allows downgrading of some calls such that lights and sirens may not be needed in some cases, therefore increasing the safety. Research evidence about safety and accuracy of call prioritisation is limited and there is some conflict in the results. Two British studies (Cooke *et al.*, 1999; Nicholl *et al.*, 1996) have shown marked variances with up to 30% error rate in one study A systematic review of ambulance dispatch and prioritisation systems, by Wilson *et*

al. (2002), showed there was poor evidence for their safety and clinical effectiveness. The number of emergency calls received by ambulance services in the UK has risen consistently over recent years. The vast majority of patients are usually taken to emergency departments.

In a review of the literature Snooks *et al.* (1998), have shown that in nine out of ten studies 30% to 52% of ambulance calls did not warrant an emergency ambulance response. It is recognised that the lay person lacks the knowledge and ability to assess the seriousness of the call and that communication difficulties may impede the ability to assess this (Higgins *et al.*, 2001). It has therefore been suggested that it is more appropriate to modify the response from the ambulance service in order to increase the appropriateness of care.

The changes suggested are also likely to reduce attendances at emergency departments and are:

- diversion of non serious 999 calls to a system of nurse advice
- ability of ambulance crew to treat people at the scene and then discharge them
- use of alternative destinations to emergency department.

The alternatives for 999 cases that are neither life-threatening nor serious have been summarised by Snooks *et al.* (2002). They conclude that the evidence supports the need for alternatives to be developed. In 2001, the US National Association of EMS (emergency medical system) Physicians issued a concept paper discussing the new models of care as discussed below.

4.1.2 Divert 999 calls to nurse advice

In the only UK study, a study by Dale *et al.* (2000; 2003) investigated the potential impact of telephone assessment and triage for callers who present with non-serious problems (category C calls) as classified by ambulance service call-takers in a pragmatic controlled trial. During intervention sessions, nurses or paramedics within the control room used a computerised decision-support system to provide telephone assessment, triage and, if appropriate, advice to permit estimation of the potential impact on ambulance dispatch. Of 635 in the intervention group, 330 (52.0%) were triaged as not requiring an emergency ambulance, and 119 (36.6%) of these did not attend an emergency department. This compares with 55 (18.1%) of those triaged by a nurse or paramedic as requiring an ambulance (odds ratio 2.62; 95% confidence interval 1.78 to 3.85). Patients triaged as not requiring an emergency ambulance were less likely to be admitted to an inpatient bed (odds ratio 0.55; 95% confidence interval 0.33 to 0.93), but even so 30 (9.2%) were admitted. Nurses were more likely than paramedics to assess calls as requiring an alternative response to emergency ambulance dispatch (odds ratio 1.28; 95% confidence interval 1.12 to 1.47), but the extent to which this relates to aspects of training and

professional perspective is unclear. The authors did advise that the acceptability, reliability, and cost consequences need to be considered further.

In a prospective cohort study (Schmidt *et al.*, 2003), callers to an urban EMS dispatch system were studied. It was possible to predict a population of callers who could be described as being low risk of having need to attend emergency departments. However negative predicted value only reached 98%. Transfer of non-urgent 911 calls to a nurse adviser have resulted in no adverse patient outcomes while maintaining patient satisfaction (Smith *et al.*, 2001b).

The NHS Service Delivery and Organisation (SDO) Programme has commissioned research to assess the costs and benefits of managing low priority 999 ambulance calls by NHS Direct nurse advisors (see www.sdo.lshtm.ac.uk for more information).

4.1.3 Not taking patients to emergency department

A postal questionnaire study showed that ten of 36 replying UK ambulance services had investigated non-conveyance of some groups of 999 callers and 13 reported looking at other models of care for category C patients. Only three services had evaluated such work (Snooks *et al.*, 2000). Before such systems can be instituted they need to be assessed for feasibility, safety and effectiveness.

The US Emergency Medical Services Committee has issued guidance (2001) on the non-transport of patients, stating it should only occur in the presence of on-line physician direction or detailed off-line protocols supported by appropriate educational programmes.

One UK study (Cooke, 2001) suggested that as many as 28% of cases were not transported by the ambulance service. An American study suggested that it was 26% of 911 callers (Selden *et al.*, 1991). However, concerns have been expressed about the risk of litigation associated with non-transportation (Goldberg *et al.*, 1990).

Use of standard emergency department triage is not sufficiently accurate for use as a tool to help paramedics determine whether a patient needs to be transported to hospital (Asplin, 2001). A retrospective study of 500 consecutive patients who were not transported following a 999 call in the East Midlands area of the UK showed that 26% of these had been assigned an ‘advanced medical priority dispatch’ (AMPDS) Delta code (the most urgent category) at dispatch prioritisation stage. This study therefore demonstrates that use of prioritisation codes is not a reliable way of determining disposal of the patient. It also illustrated that the high number of falls in the elderly which do not require a 999 response can be dealt with by alternative means (Marks *et al.*, 2002).

A cluster RCT in London involved 409 cases and 425 controls (London Ambulance Service, 2002). The study group were attended to by

ambulance crews who had had training and extra protocols to enable transport to a minor injuries unit rather than the main emergency department. The study group had no increase in the use of the minor injuries unit and made no more discharges from the scene. Factors found to influence destination were distance from emergency department and minor injuries unit, time of day, presence of head injury and sex of patient. Those taken to the minor injuries had shorter ambulance turnaround times. The study therefore did not confirm that the intervention would decrease number of attendances at the emergency department.

Snooks *et al.* (2001) undertook a study of 'treat and refer' protocols which allowed London ambulance crews to leave appropriate patients at home with referral or self-care advice. Protocols were developed by a local team using published evidence where available and the system was developed with local stakeholders. A total of 719 patients participated in the study, 260 in the intervention arm and 537 in a control group. The two groups were demographically the same but the study group were more likely to have attended during the day on a weekday. The rate of conveyance to hospital was no different in the two groups and the intervention group had a 5.9 minutes greater job cycle time ($p<0.001$). This equates to 1001 extra hours of ambulance time per week if applied across the whole of London. The 9% of patients who were left at home, 'according to protocol', were subsequently admitted to hospital within 14 days and were judged by clinical reviewers to have been subject to inappropriate use of the protocols by the paramedics (London Ambulance Service, 2002).

Use of protocols by emergency medical technicians to determine patients who did not require treatment and transport was evaluated in the US system (Schmidt *et al.*, 2000). The 3% of patients determined as not requiring an ambulance by on scene assessment by emergency medicine (ambulance) Technicians subsequently had a critical event in the ambulance and 11% had potentially critical events according to ambulance service notes. Another study was conducted in an urban emergency medical service in the United States. Paramedics triaged patients for, study purposes only, into whether they needed to be taken to the emergency department, to see a physician within 24 hours or not need any physician evaluation. The records of all these patients were then subsequently reviewed. Paramedics rated that 85% of patients needed to be taken to an emergency department and 15% were not required to be taken there, of which 12.5% needed to see a physician at some point. On review, the review panel determined that 9.6% of patients were under-triaged, of whom 48.7% were misclassified because the paramedics misused the guidelines. In addition, 8.4% were incorrectly classified as not needing to come to the emergency department. This represented 55% of the patients categorised as triage category 3 or 4 by the paramedics. The authors therefore conclude that the paramedics using written guidelines do not

reach an acceptable standard of accuracy to determine disposition of patients in the field (Pointer *et al.*, 2001).

In the Selden study (1991) 22% of non-transported cases were inappropriate and he reviews three other studies in the United States that have also described serious and occasional fatal outcomes. It is also of note that up to 65% of patients leaving the scene needed further help within a week, with up to 20% needing emergency medical care. A trial of treat and release protocol in Albuquerque was suspended owing to safety concerns (Anon., 1999). When such protocols were introduced in California, it was found that only a very small proportion of eligible patients were taken to alternative sources of care (Plorde *et al.*, 2001).

In an American study to look at whether paramedics could safely determine which patients did not need emergency transportation, paramedics completed a questionnaire for each patient they transported and the notes of these patients were subsequently reviewed to determine whether they needed ambulance transport (defined as needing care in an ambulance on the route to hospital) or emergency department care (defined as needing treatment according to diagnoses that was not available in local urgent care centres). A total of 236 patients were transported and 183 of these had their charts reviewed. The agreement between the paramedics and the need for emergency department attendance was low (*k* 0.47, 95% CI, 0.34-0.60), as was agreement between paramedics and the emergency department care (*k* 0.32, 95% CI = 0.172 - 0.46). Paramedics recommended alternative treatment for 97 patients, 23 of whom needed ambulance transport and the paramedics recommended non-emergency department care for 71 patients, 32 of whom needed emergency care. Therefore, the proportion of patients who could potentially have not been transported who actually needed emergency department care was high (Hauswald, 2002).

A prospective study of consecutive patients transported by a private paramedic service required paramedics to complete a survey detailing the necessity of transport to emergency departments for each patient. The paramedics had been informed that the patients should be designated requiring emergency department care if they were to be admitted, required surgical subspecialty obstetrical or gynaecological consultation, or required advanced radiological procedures excluding plain x-rays. A total of 313 patients were enrolled. Paramedic assessment was 81% sensitive (95% confidence interval 72% to 80%) and 34% specific (95% confidence interval 28% to 41%,). In predicting requirement for emergency department care, in 85 cases paramedics felt transport to the emergency department was unnecessary, while 27 (32%) met the criteria for emergency department treatment, including 18% who were admitted and five who were admitted to the intensive care unit (Silvestri *et al.*, 2002).

An American study (Kamper *et al.*, 2001) evaluated the feasibility of paramedics treating minor illness and injury conditions in the field. Data from 1103 ambulance report forms was analysed to determine whether there were any high volume groups of minor conditions. Of the 115 commonest conditions suitable for paramedic in-field treatment all contained 24% to 100% of complex conditions believed to be beyond the remit of pre-hospital care, requiring facilities of a hospital. It did not address whether the paramedics could identify these cases, so they could safely treat the others.

Most UK ambulance services have protocols indicating transport of patients following treatment of hypoglycaemia. A Copenhagen study (Andersson *et al.*, 2002) shows that these patients can be safely treated and 84% left at home if they satisfy certain criteria, although 8% needed subsequent care within 72 hours, with 5% experiencing a second hypoglycaemia and one needing hospital admission, but none suffered long-term adverse outcome.

The NHS Modernisation Agency is currently looking at developing emergency care practitioners, one of whose roles is to undertake treatment and then discharge patients from the scene. This is discussed further in section 4.9.4.

A study of community paramedics for older people with minor injuries has been commenced in Sheffield and is presently being evaluated (Mason *et al.*, 2003).

Out of hospital care: conclusions

The evidence in this area is generally poor and most refers to the American system, where ambulance staff receive different training.

Diversion of 999 calls to an advice line has the potential to reduce the number of ambulance responses and therefore may affect the number of emergency department attendances, although no study has directly measured this. The studies suggest that 20% of category C calls could not receive an ambulance response but safety still needs to be confirmed with up to one in ten cases thought suitable for diversion to advice still needing admission. Research is in progress in this area.

The evidence has not defined the role of ambulance crews in either discharging patients at the scene or transporting them to other destinations. The present triage and prioritisation systems in use do not detect which patients may be suitable for alternative care and high rates of error have been detected in various studies that raise concerns over the safety of such systems.

Because of the planned expansions in the roles of paramedics that are already occurring, it is important that prospective studies are undertaken to ensure the safety and effectiveness of discharging patients from the scene of incidents.

Key points

- It is possible to divert some 999 calls to advice lines but the safety of such systems is still being evaluated.
- The role of paramedics in either discharging patients from the scene or deciding on appropriate destinations has not been adequately studied to confirm its safety and effectiveness in the UK.

Table 2 Divert 999 calls to nurse advice (4.1.2)

Study details	Domain	Study design	Study population	Intervention	Findings/conclusion
Smith *et al.*, 2001 Applicable to UK: **Yes** United States	Prehospital care	Observational study Control: No n=38 non-intervention calls n=133 intervention calls	911 callers identified as basic life support/yellow response – patients considered to be of low risk for poor medical outcome excluding: - extremity fractures - direct patient assists - police involvement. Population served: 650,000	Telephone referral program Diverting non-urgent 911 calls to a 24-hour telephone-consulting nurse.	Reduction in basic life support/yellow response: Callers referred to: - home/self care (31%) - primary -care (24%) - 911 (17%) - community resource (11%) - ED (6%) - urgent care clinic (5%) - hospital ED (4%)
Dale *et al.*, 2003 Applicable to UK: **Yes** United Kingdom	Prehospital care	Pragmatic controlled trial n=635 intervention calls n=611 control calls	999 callers identified as category C (non-serious) excluding: - hoax calls - alarm calls - category A and B - comprehension and language difficulties children <2 years.	Telephone assessment Diverting calls category C calls to nurses/paramedics for assessment, triage and advice assisted by computer decision support.	Alternative responses possible 36.6% triaged as not requiring an ambulance did not attend ED. But 9% admitted to hospital

Note. ED: emergency department

Table 3 Not taking patients to the emergency department (4.1.3)

Study details	Domain	Study design	Study population	Intervention	Findings/conclusion
London Ambulance Service NHS Trust 2002 [328] Applicable to UK: **Yes** United Kingdom	Prehospital care ED	Cluster RCT n=409 intervention n=425 control	Patients contacting 999 emergency service	Protocols to transport appropriate patients to MIUs by ambulance *vs.* usual practice.	Significant reduction in total time for patients: MIU (103.8 minutes) *vs.* ED (312.2 minutes), p=0.0001

Note. ED: emergency department; MIU: minor injuries unit.

Case study 1: Role exchange to facilitate streaming in rural areas

Starting point

There was a high number of inappropriate ambulance journeys to the emergency department of Cumberland Infirmary (Carlisle). These journeys caused additional pressure on the ability of the ambulance service to meet response time targets and increased pressure in the emergency department.

Impact of this change

The nurse practitioner worked in Carlisle and reduced non-urgent ambulance attendances to the emergency department by 33% (n.b. the numbers were very small however).

As a result four experienced paramedics commenced an emergency care practitioner course in early 2001.

As the four paramedics have developed their knowledge and skills, the Trust has now identified two areas in which the paramedics can have a greater benefit.

- Supporting a rural GP out–of-hours co-operative in the rural South Lakes area.
- Supporting an Urban GP out-of-hours co-operative in Carlisle.

At the time of writing the roles are still to be introduced so their impact cannot yet be measured. However an audit of current provision without the role of the emergency care practitioner shows that 10% to 20% of current referrals could be treated safely at home. This has tremendous benefits in a rural community like Cumbria.

Next steps

At the time of writing the trials are due to commence and be reviewed on a monthly basis.

For further information please contact:

Nick Smith
Director of Operations & Training
Cumbria Ambulance Service NHS Trust
Salkeld Hall
Infirmary Street
Carlisle
CA2 7AN
nick.smith@cas.nhs.uk

4.2 Primary care

In this section we will consider various initiatives by primary care within the emergency departments (for example GPs working in the emergency department) and initiatives in the community that may help to reduce the number of attendances in emergency departments (for example organisation of out-of-hours work, the effect of minor injury units and walk-in centres on emergency departments and the effect of telephone advice lines, including NHS Direct on Emergency departments).

This section has particular importance because of planned reorganisation of primary care out-of-hours services that is taking place in the UK at present. Fears have been expressed that patients may use the emergency department as a point of first contact for primary care, therefore increasing the number of emergency department attenders.

The concept of diverting non–urgent attenders away from emergency departments will be dealt with in section 4.3.2. Educational interventions to reduce attendances are discussed in 4.4.

Primary care attenders in emergency departments have been cited by many as a source of problems for emergency departments. They are seen as causes of prolonged waiting times, inefficient care, staff stress and preventable costs (Rajpar *et al.*, 2000). The issue is seen on a worldwide basis (Cunningham *et al.*, 1995; Kellerman, 1994; Jaarsma-van Leeuwen, 2000; Shah *et al.*, 1996; Blanco *et al.*, 2003). However from a patient's perspective, they are seeking care at what they consider the most appropriate resource in the timeliest manner. It must be remembered that the majority manage to seek their care in what the carers consider an appropriate location, despite a lack of guidance or uniformity. More emergency contacts are with the GPs (45%) than with emergency departments (27%), community nursing services (24%) or the ambulance service (4%). Self-referrals account for 79% of those attending emergency departments (Brogan *et al.*, 1998). The concept of inappropriate attendance is now being dropped in the UK (Department of Health, 2002) and Europe preferring to look at the response that is required for these patients. However there are few studies of interventions in primary care that have looked at their effect on waits and attendances at emergency departments. Most studies concentrate on helping these patients avoid attending the emergency department with the aim of improving the care of the remaining emergency department patients and reducing their waits by decreasing the workload. An appraisal of the literature as part of the New Zealand Health Technology Assessment looked at the appropriateness of emergency department attendance and its causes (Hider, P. 1999).

Effects

Staff in emergency departments appear to have a negative attitude to 'inappropriate patients' believing they should attend appropriate services and that they use up excessive time and are unrewarding (Sanders, 2000; Crouch and Dale, 1994). This may also be responsible for the negative perceptions of general practice by emergency department staff (Dale and Green, 1991; Gibney *et al.*, 1995).

Extent of problem

The incidence of the primary care attenders varies widely with papers quoting from 6% to 60% in UK hospitals (Murphy, 1998). The Audit

Commission (1998) estimated the problem at 2% to 7% using nurses' opinion. Some emergency department staff consider that over 70% of patients attending with minor ailments should have seen their GP (Beecham, 1999). Some of this variation is due to the conceptual issue of what could be treated by a GP or emergency department doctor and what is best treated by a specific specialty. Variation may be true or may be due to differing interpretations of which primary care problems either could or should be treated in an emergency department (Cottingham, 1998; Lowy *et al.*, 1994). True factors include a complex mixture of social, psychological and medical factors; inner city areas appear to have particularly high rates (Murphy, 1998).

Some classifications depend on a definition of being able to be treated by a GP (Dale *et al.*, 1995b), for example needing no hospital investigations. Others depend on the urgency of care or duration of symptoms (Benz and Shank, 1982) and others on symptom based criteria (Derlet and Nishio, 1990). Equally it has been shown that triage category does not relate well in predicting those who require admission (Brillman *et al.*, 1997). As most of the research retrospectively labels people as inappropriate on the basis of patient assessment and treatment, it is difficult to apply this to patient decision-making (Murphy, 1998).

Patients and doctors do not share a common understanding of what constitutes an emergency, and it cannot therefore be expected that doctors could successfully influence patients to reduce their attendance for non-urgent conditions (Foldes *et al.*, 1994). However, it is also apparent that professionals do not agree over what types of cases should be cared for in an emergency department. Consensus of two physicians reviewing the notes demonstrated that there was only moderate agreement and suggested that further refinements are needed before such tools can be used to determine inappropriate emergency department visits (O'Brien *et al.*, 1996). Similarly, another study looking at judging inappropriateness by the triage nurses' assessment and by retrospective chart review show the variation in inappropriate levels ranged from 10% to 90%. Kappa values showed poor agreement, therefore limiting access to emergency department without a more valid and reliable standard could be hazardous (Lowe and Bindman, 1997). Other studies have confirmed the failure of emergency department staff to agree in case reviews (Gill *et al.*, 1996; Foldes *et al.*, 1994). There is however evidence that there is no higher level of primary care attendance among self-referrals than among GP referrals (Anthony and Dunne, 1997; Thomson *et al.*, 1995). This variability in perception of usage of the emergency department may account for the fact that 40% of the non-urgent cases in one study in Montreal were referred by a health care professional (Burnett and Grover, 1994).

Therefore between 6% and 80% of visits are judged to be non-urgent or inappropriate. This enormous variability is not surprising if all

definitions rely completely on implicit and subjective judgements (Cooke, 1999).

How and why people choose the emergency department

Many reasons are cited in the literature for people attending emergency departments with a primary care problem. This partly relates to a confusion of terminology – papers use the terms 'non-urgent', 'inappropriate' and 'primary care' in varying roles. Reported reasons include relative distance from the emergency departments and primary care facilities, lack of awareness of other facilities, perceived seriousness or urgency of care, judgement that emergency departments will give better care, poor availability of general practice out of hours, inability to attend the GP, poor knowledge of GP services, convenience of 24-hour access, time of day, parental caring experience, ethnicity, age, socio-economic status, social deprivation, homelessness and health insurance status. Presence of chronic illness has a negative relationship (Cooke, 1999).

One study in Amsterdam looked at 21 potential motives for attending emergency departments for minor complaints. The 403 questionnaires administered showed that motives relating to the GP played a small role in the patient's decision-making. Two groups emerged, one with a mainly financial motive (which would not be applicable in the UK) and one who believed the emergency department had the appropriate expertise and facilities; this latter group were of a lower socio-economic group than the average (Rieffe *et al.*, 1999). Studies have demonstrated that high emergency department usage occurs in the same population who have high usage of primary care, namely the socially deprived (Hull *et al.*, 1998; Carlisle *et al.*, 1998). Thakker (1994) identified the fact that smaller practices were associated with more emergency department attendances for minor trauma. It is recognised that lower levels of primary care provision for individuals is associated with higher use of the emergency department (Christakis *et al.*, 2001).

Poor access to GP services has been suggested as an important cause of people attending the emergency department (Foroughi and Chadwick, 1989; Brogan *et al.*, 1998). But this is not supported in the literature relating to the UK, which shows that practices with a low level of urgent appointment provision and a low number of unbooked appointments at surgery opening have the same rates of emergency department self-presenters (Campbell, 1994).

Three descriptive studies have investigated the relationship between various practice characteristics (the number of primary care practitioners, the availability of a female GP, the provision of same day appointments, and practice list size) and patient attendance rates at the emergency department. No significant relationship was found between practice characteristics and emergency department

utilisation. However, the deficiencies of the descriptive study design used in this research must be recognised (Campbell, 1994; Hull *et al.*, 1998; McKee *et al.*, 1990). Proximity to the emergency department has been identified as an important determinant (Ingram *et al.*, 1978). When patients attending a US emergency department were interviewed, 45% said difficulty in access to primary care was their reason for attending the emergency department and 38% were happy to visit primary care within three days instead (Grumbach *et al.*, 1993). Access to primary care may be difficult for some groups, accounting for higher rates of emergency department attendance among tourists, commuters, those who have recently moved and the homeless (Jankowski and Mandalia, 1993). At University College London non-residents account for 48% of attenders with 4% being homeless (Owens *et al.*, 1993). Whereas a few miles away, 71% of emergency department primary care attenders are registered with a GP (Ward *et al.*, 1996).

Ease of access by telephone did not change rate of emergency department attendance (Darnell, 1985). In Sweden an improved primary care access and availability of greater range of services decreased emergency department attendances (Sjönell, 1986).

It appears that the most important factors are the perceived appropriateness of the condition for the emergency department, the emergency department's accessibility and GP availability but there is a major deficiency in most of the research in that they have all been retrospectively labelled by medical personnel (Campbell, 1994). Analysis of the 1998 national health interview survey in America showed that poverty, lack of insurance, younger age, male gender, minority ethnicity or ethnicity all predicted identifying emergency departments as their usual source of health care(Walls *et al.*, 2002).

Concern over symptoms is an important reason for using the emergency department (Young *et al.*, 1996).

The manner in which primary care was provided (based on how local the service was) and distance from hospital were key determinants of emergency department usage in a Spanish study of 15 290 patients using a logistic regression model (Benavent and Casares, 1994).[35]

In another study (Singh, 1988), out of 217 patients interviewed, only 15 had contacted their GPs and 89 considered the severity or their perceived need for x-ray meant they needed the emergency department.

Patients' choice between emergency departments and GP out-of-hours centres appears to be related to a perception that waiting times may be greater at out-of-hours centres, although actual time was shown to be less. Once patients have used the GP out-of-hours centre they are more likely to use it again. Education needs to be targeted at young adults, unemployed and white people who appear to use emergency

department services more than other groups for primary care (Rajpar *et al.*, 2000). It is recognised the patients who are dissatisfied with their usual source of care or perceive access barriers are more likely to attend the emergency department for a non-urgent condition (Sarver *et al.*, 2002). Ethnicity, lack of insurance and education are not associated with non-urgent use (Petersen *et al.*, 1998).

Interventions to reduce primary care attendances at emergency department

Various methods have been published including:

- the role of GPs working in emergency department
- primary care interventions in emergency department
- regular primary care provision
- role of GP as gatekeeper
- improved access to primary care
- organisation of primary health care
- telephone triage (see section 4.2.4)
- education (see section 4.4)
- the effects of co-payments (see section 4.3.4).

A Kings Fund review was undertaken to assess whether and to what extent primary care-based emergency services can substitute for traditional hospital emergency department models of emergency care. The results of the review were that expanding primary care services caused a marked reduction in emergency department utilisation (Roberts and May, 1997).

If primary care was reorganised there were concerns over certain aspects of primary care organisations, such as appointment systems, deputising, single-handed practitioners or primary care emergency centres. These changes may result in patients choosing to attend the emergency department rather than primary care. This may inadvertently increase pressure on emergency departments, but the evidence behind this seems largely unfounded.

Integrating primary and hospital care can result in substitution. All studies found that there was a lower use of diagnostic investigations by GPs and fewer referrals to secondary services. By reorganising acute care through the use of minor injuries services there did not appear to be any significant difference in emergency department attendance usage.

4.2.1 GPs working in the emergency department

Many studies have compared GP and usual medical care in emergency departments but few have looked at the effect of GPs on length of stay in the emergency department. If it is accepted that primary care

attenders will attend emergency departments, then there is a strong argument to adjust the system so that the response is appropriate to the patient rather than adjusting patient behaviour to fit the system (Murphy, 1998).

A postal questionnaire has revealed that there is a wide variety of different models of provision of primary care within the emergency department and there is some confusion over whether these services aim to improve emergency department-based care or to divert it to general practice. There is minimal information on how this affects waiting time (Freeman *et al.*, 1999).

Studies have shown significant differences in the care given by GPs and emergency department doctors to primary care attenders (Dale *et al.*, 1995a; Murphy *et al.*, 1996) although studies may not have fully accounted for the seniority of the doctors (Cooke, 1996). It is also known to be cost-effective to utilise GPs in the emergency department (Dale *et al.*, 1996). These studies did show decreased resource utilisation but did not however show whether they reduced waiting times. A descriptive study in London using nurse practitioners to run a primary care unit within the emergency department showed that 40% of patients were seen by the nurse practitioner within 30 minutes. It did not record total length of time in the emergency department or how it affected the number of patients attending (Beales, 1997). One smaller study has shown similar or increased resource utilisation by GPs working in an emergency department (Gibney *et al.*, 1999). The primary care provided within an emergency department is however not analogous to that provided by the patient's own GP as the latter has access to full health records and has continuing care facilities. However, providing a primary care service in the emergency department has been shown to increase the numbers of primary care attenders to the emergency department with a consequent increase in waiting times of 14% in the long-term in the US (Krakau and Hassler, 1999).

A single contact with a GP working in an emergency department does not appear to have a long-lasting effect on health service use and in particular on subsequent emergency department attendance (relative risk 0.58-1.02) (Murphy *et al.*, 2000). However, brief focused interventions have been shown to have lasting effects in other settings (Raw *et al.*, 1999).

4.2.2 Interventions in primary care

Continuity of primary care may decrease the number of emergency department attendances. A cross-sectional study across five emergency departments in America looked at patients with chest pain, abdominal pain and asthma. Analysis of a questionnaire done at the time of presentation to the hospital revealed that absence of a regular physician (GP) was an independent predictor of presentation for non-

urgent visits, (odds ratio 1.6, 95% confidence interval 1.2 to 2.2) (Petersen *et al.*, 1998). In Florida, another study (Haddy *et al.*, 1987) showed the relationship between regular primary care and reduced use of the emergency department for non-urgent problems (85.8% *versus* 78.4%, $p<0.05$). A study of older people showed that those with a regular relationship with either a primary (odds ratio 0.47) or secondary care doctor (odds ratio 0.58) had a decreased usage of emergency care, regardless of illness severity (Rosenblatt *et al.*, 2000). The study excluded members of any health care organisation. The emergency department utilisation by children was studied with respect to their enrolment in a health maintenance organisation in America(Christakis *et al.*, 2001). Those with high continuity of care were less likely to attend the emergency department than those with low continuity of care (relative risk 1.54; 95% confidence interval 1.33 to 1.75). (Christakis *et al.*, 2001). However, another study of infants in America revealed that early linkage with the primary care system did not result in a decreased risk of emergency department use (Kotagal *et al.*, 2002). However, incomplete routine well-child screening does decrease the risk of emergency department attendance (relative risk 1.6; 95% confidence interval 1.4 to 1.98) (Hakim and Ronsaville, 2002).

In America systems have required the primary care physician to authorise any non-emergency attendance at the emergency department. At a children's hospital this was reported to result in a decrease of 23% in attendances, with 25% in self-pay patients but a 6% increase in non-paying, with no change in admissions (Badgett, 198). As the NHS is a non-pay system, this suggests that contacting primary care physicians may have little effect on paediatric emergency department attendances in the UK. Another American study (Franco *et al.*, 1997) demonstrated an overall fall of non-urgent visits from 41% to 8% by using primary care gate keeping. Further study, by Hurley *et al.* (1989), required patients to gain permission from the GP before any non-urgent use of the Emergency Department, linked with the insurers. It recorded large decreases in emergency department attendance up to 45% in adults and 37% in children.

However concerns have been expressed over gatekeeping as the reductions in children's attendances have not only been in non-urgent cases and do not appear to affect long-term emergency department attendance. In the 237 children refused care there were no adverse outcomes and there was no effect on subsequent emergency department usage (Gadomski *et al.*, 1995). There is further discussion of the use of co-payments to reduce emergency department attendances in section 4.3.4.

Several studies have found that poor access to primary care is a major factor in why patients choose to seek care in the emergency department (Grumbach *et al.*, 1993; Young *et al.*, 1996; Shesser *et al.*, 1991; Buesching *et al.*, 1985). Most of the research looking at primary care access has been based in America and may therefore not be

applicable to the NHS. A 'before and after' study found that an increase in the number of primary care physicians in an area resulted in a reduction in emergency department attendances (Hilditch, 1980). A trial by Franco *et al.* (1997) found a significant reduction in emergency department visits where patients were given 24-hour access to a primary care physician, in a Medicaid system in America. This effect was most marked but not exclusive to non-urgent cases. Similarly a retrospective analysis of children's emergency department attendances in Carolina showed a decrease of 24% ($p<0.001$) for all cases and a fall of 37% ($p<0.001$) for non-urgent cases, following introduction of 24-hour primary care access (Piehl *et al.*, 2000). A before and after study by Sjönell (1986) examined the effects of the introduction of a primary care health centre in Stockholm, Sweden. The study found that emergency department visits were reduced by 40% in relation to a 19% increase in primary care visits in the area. One study in Glasgow (Stoddart *et al.*, 1999) showed that the introduction of out-of-hours centres had no effect on new attendance numbers at the emergency department although there was a significant decrease in the number of non-urgent patients. This latter decrease was matched by an increase of urgent patients. Some studies have however found that improved access to a primary care physician was not associated with a reduction in attendance at the emergency department (Straus *et al.*, 1983) or hospital readmission for the severe chronically ill (Weinberger *et al.*, 1996). The establishment of an urgent care centre resulted in people who had attended the centre once subsequently decreasing their emergency department usage by 48% ($p<0.001$). The location of the urgent care centre relative to the emergency department is not described (Merritt *et al.*, 2000). A new community health centre in a small town in New Zealand did not change the emergency department use at the local hospital (Maynard and Dodge, 1983). People failing to attend their primary care follow up after an emergency department attendance were more likely to re-attend the emergency department (Lanter *et al.*, 2001a and 2001b; Smith *et al.*, 2001a). This has led to the suggestion that guaranteed appointment times may be better than asking the patient to arrange an appointment (Lanter *et al.*, 2001a).

Different models of care in general practice produce different outcomes, for example we know that patients are more satisfied with care from their own GP than from deputising services (McKinley *et al.*, 1997).

A key development in primary care has been the introduction of new services for out-of-hours GP care. Very little research has been published on the effects of this change. The impact of co-operatives on emergency departments was assessed as part of a health technology assessment (Hallam and Henthorne, 1999). Interviews revealed concerns of emergency department staff about the potential increase in workload but the effect was expected to be small. It was felt that co-located co-operatives would promote joint working. The

study did not however look at actual changes. A study comparing co-operatives with deputising services showed that co-operatives had a higher admission rates (Salisbury, 1997a) but Cragg *et al.* (1997) showed no significant difference with a similar study in a different city suggesting that local factors may be more important than the organisational structure.

A small number of researchers have examined whether patients preferentially attend a deputising service or their local emergency department for their after-hours medical care. The observational study by Williams *et al.* (1973) found there was no increase in emergency department attendance in relation to an expansion of deputising services in Leicester. A similar result was obtained in the cross-sectional study by Ferber (1983), who found emergency department attendance in certain areas of the United States that included free-standing after-hours clinics was not significantly lower than rates in corresponding areas without these facilities. By contrast, another study (Novak and Pross, 1983) found that the development of a deputising service in a region was associated with reduced emergency department use and it was assumed that improved access to primary care after hours had reduced emergency department attendance.

The general lack of recent evidence on the effect of new out-of-hours services on emergency department utilisation is surprising given that recent patient surveys have found mixed results in relation to their preference for out-of-hours care (Cragg *et al.*, 1997; Salisbury, 1997b).

The use of a co-located out-of-hours centre and emergency department is theoretically an opportunity to remove the responsibility of choice from the patient to the health care providers. The patient decides they need medical care and therefore contacts one location. This location can provide all types of emergency care.

There is some anecdotal evidence that out-of-hours centres may cause a decrease in primary care attenders at emergency departments (Heyworth and Egleston, 1998; McLauhlan and Harris, 1998). One study of a co-located but independent service showed persistent inappropriate attendance attributable to lack of knowledge (80%) of the new system and incorrect perceptions of relative waiting times. Of the 48 patients attending the GP co-operatives out-of-hours centre, based in the same building as the emergency department, 35 (72.9%) had found out about the GP emergency service on the day of the attendance and 81.3% were first time attenders (Rajpar *et al.*, 2000). One other study supported the lack of knowledge of primary care centres for excess attendance in emergency departments (Hakim and Ronsaville, 2002).

The reasons for patients' choice of emergency department or primary care for minor injury and illness are complex. In the UK system, there is little evidence that changing provision of primary care services will alter

patient flow. Availability of information or advice before arrival in emergency department has the potential to ensure the patient is seen by the most appropriate health carer. Financial disincentives work in some countries but are not appropriate within the present NHS.

The use of GPs in emergency departments has some short-term benefits but may reinforce care-seeking behaviour and increase emergency department attendances. Many new models such as co-location of out-of-hours centres are being developed but research evidence is not yet available to support these developments.

Further change is likely with the onset of the new GP contract. It is important that these are properly evaluated for their effects across the whole system.

4.2.3 Walk-in centres and minor injuries units

Very few articles have been written assessing the impact of minor injuries units. They have been shown to be acceptable to patients (Mabrook and Dale, 1998; Jones, 1993; Pencheon *et al.*, 1998).[424] They can provide effective evidence-based care for a local population (Brebner *et al.*, 1996; Sakr *et al.*,1999) but services provided and standards are highly variable (Cooke *et al.*, 2001). There is some evidence that they can provide a locally responsive and accessible service (Pencheon *et al.*, 1998). Patients have been shown to be able to determine whether their needs are appropriate for a minor injuries unit (Dale and Dolan, 1996). A study of minor injuries units demonstrated that half their patients stated they would have otherwise attended emergency department (Dolan and Dale, 1997). The use of minor injuries units has provoked debate about whether minor injuries are the role of emergency department specialists, with some holding the view that all minor injuries should be seen in consultant-led departments (Leaman, 2001).

Minor injuries units are often established as part of a service reconfiguration but these have not been extensively studied. Centralisation of services in one city from two hospitals to one for adults did not result in increased waiting times for admission but did cause an increased time to see the clinician in emergency department. The waiting times at the associated minor injuries unit that replaced one emergency department were very short (Simpson *et al.*, 2001). The SDO Programme has commissioned a project on service reconfiguration which will address the effects on access to emergency care (see www.sdo.lshtm.ac.uk for more details).

In a questionnaire survey and notes review of 267 adults presenting to the emergency department, patients were classified by the suitability of the presenting health problem to be managed by alternative immediate care services or only by emergency departments, and also by the likelihood, in similar circumstances, of patients presenting to other services given their reasons for seeking emergency department

care. Using objective criteria, it is estimated that 55% (95% confidence interval 50% to 62%) of the health problems presented by a non-urgent population attending emergency department are suitable for treatment in either general practice, or a minor injuries unit, or a walk-in centre or by self-care after advice from NHS Direct. However, in almost one quarter (24%) of low priority patients who self-referred, the emergency department was not the first contact with the health services for the presenting health problem. The reason for attending emergency departments cited most frequently by the patients was a belief that radiography was necessary. Taking into account the objective suitability of the health problem to be treated elsewhere, and the reasons for attending the emergency department given by the patients, it is estimated that, with similar health problems, as few as 7% (95% confidence interval 3% to 10%) of the non-urgent emergency department population may be expected to present to providers other than emergency department in the future (Coleman *et al.*, 2001).

A 'before and after' observational study undertaken in the UK looked at the rates of emergency GP consultations and the attendance rates at out-of-hours services, minor injuries units and emergency departments before and after the introduction of an NHS walk-in centre. A second similar town was used as control over the same time period. The change in GP emergency consultations did not differ between the two towns, however attendance at a local minor injury unit was higher in the town having the walk-in centre. Non-ambulance attendances at the emergency department fell less in the town having the walk-in centre than in the control town. It was therefore concluded that although NHS walk-in centres did not affect the workload greatly of GPs they did have an effect on the local minor injuries unit of increasing workload which was thought to be probably related to the fact that it was situated in the same building (Hsu *et al.*, 2003).

The change of service provision in Edinburgh resulted in the creation of a minor injury service after an emergency department was closed. The initial report revealed that it caused a 5% decrease in attendances at the remaining emergency department with a 24% fall in attendances for those living in the direct vicinity of the minor injuries service (Heaney and Paxton, 1995) Six months later the decrease in attendances at the emergency department was 6% and for local people was 14% (Heaney and Paxton, 1997). One unit reported that its creation caused an increase in workload in the whole system rather than simply diverting work away from the local emergency department (Dale and Dolan, 1996).

In a study of minor injuries services in London using teleconsultations it was found that they were performed in approximately 3.6% of cases and most concerned patients with fractures. It was shown that the telemedicine allowed local decision-making in the majority of cases and that over a four-year period the number of patients referred to either the GP or the main hospital had halved from 75% to 38%. However, the

study was not designed so that it was able to differentiate between the effects of telemedicine and the effects of increasing experience of the staff and the maturity of the service (Tachakra *et al.*, 2002).

As part of the national evaluation of NHS walk-in centres, Salisbury (2002) conducted a study of eight general practices, an emergency department and an out-of-hours provider close to each of ten walk-in centres in the year before and after the centre opened. There was a small decrease in emergency department attendances that was not statistically significant. In 2003 a series of new walk-in centres adjacent to emergency departments was announced and will be analysed for their effect on emergency department attendances.

A study of the walk-in centres in London by the Kings Fund (2001), confirmed that they were developing links with the local emergency departments but there were still issues with direct referrals to admitting teams. The study did not look at the impact of the centres on the emergency departments.

4.2.4 NHS Direct and nurse telephone advice

NHS Direct was established in 1998 to provide health care information and advice to the public through a telephone helpline and associated on line service. It received 5.3 million calls in 2001-2002. Among its objectives were to decrease the numbers of attendances at emergency departments by giving advice to the public on appropriate (and alternative) sources of care, by handling out-of-hours primary care calls and by receiving non-emergency 999 calls.

By diverting advice calls to NHS Direct, emergency departments can save time for emergency department staff. One study (Griffiths and Collier, 2000) showed that, of 979 callers diverted from an emergency department to NHS Direct, 59% of calls were given health information. Of the remainder 28% went to the emergency department, 1% were directed to 999 and therefore also potentially went to the emergency department, 27% were directed to self-care and the remainder advised to contact their GP in varying time scales. The study demonstrates that the work of 979 calls in a three-month period was transferred from the emergency department to NHS Direct but it cannot determine the change in workload. In another unit, the introduction of NHS Direct caused a reduction by 72.6% of calls for advice being dealt with by the emergency department, therefore freeing up staff for other duties (Jones and Playforth, 2001).

A telephone nursing triage service was introduced in Quebec. Structured interviews were conducted with 850 patients who were waiting in either hospital emergency rooms or walk-in medical centres. Among those who were at the emergency centre, 56% were advised to consult a walk-in centre, 28% their family doctor and only 12% the hospital emergency room. It appears that using the telephone system was significantly related to the duration of the health problem (more

than two days), a new health problem or being used as a walk-in rather than an emergency centre. It appears therefore that in Canada the advice given is only loosely taken (Lafrance and Leduc 2002).

Calls to NHS Direct were studied over a 24-month period in three areas of England and their associated GP co-operatives (Munro *et al.*, 2000). During the study period NHS Direct received 68 500 calls from a population of 1.3 million, of which 72% were out-of-hours. There was no significant change noticed in the trend of use of emergency departments or ambulance services during this study period. There were only small changes in use of general practice from an increase of 2% a month before the introduction of NHS Direct to -0.8% afterwards (relative change of -0.29%, 90% confidence interval, -4.2% to -1.5%). A similar system in Canada was studied. It noted that few users of emergency departments make use of the telephone system (17%) and they only loosely follow the advice. Only 12.8% of those who had used the telephone advice system had been advised to go to the emergency department (Lafrance and Leduc 2002). Use of a telephone advice system in a Scottish primary care emergency centre resulted in an increase in referrals to the emergency department from 1% of calls to 3% but did have benefits in primary care units with slightly more patients being dealt with solely over the telephone and fewer having a shorter wait. There was no statistical analysis in the study and some outcome measures were ambiguous (Strachan *et al.*, 2001). Reorganisation of out-of-hours general practice in Denmark brought about mandatory telephone triage by GPs and county-based health centres. This change in system brought about an increase in the number of people attending emergency departments but the continuing increase was constant and the regression model showed that it was not related to the reforms (Velsted and Christensen, 2001). Use of nurse telephone consultation calls can reduce the overall workload of GPs by 50%, while allowing callers faster access to health care information. It did not however show any significant change in the attendance rate at the local emergency department or in admissions and attendances at hospital. Other adverse outcomes were not assessed (Lattimer *et al.*, 1998). If a nurse telephone triage is used rather than standard management of requests for same day referrals it can reduce the number of same day appointments with GPs, but results in busier routine clinics and a small but significant increase in out-of-hours and emergency department attendances (Richards *et al.*, 2002).

A similar system now operates in Australia but evaluation of its effect on emergency departments is still underway by Curtin University of Technology (Turner *et al.*, 2002).

Primary care: conclusions

There has been a large amount of work demonstrating that significant numbers of patients attend emergency departments with non-urgent or

primary care problems, although figures vary widely for a variety of service and methodological reasons.

Some hospitals have introduced GPs into emergency departments but studies have not assessed the effect this has on delays.

Studies have shown that those who have good access to primary care are less likely to use the emergency department but equally that high users of primary care are also high users of emergency departments. American systems of authorising access, except in true emergencies, does reduce attendances but safety has not been demonstrated.

Walk-in centres and urgent care centres (for example minor injuries services) have the potential to divert patients away from the emergency department, but this has not been demonstrated in studies yet. Similarly nurse manned advice lines, including NHS Direct, have not been shown to change the number of people attending emergency departments, although they have freed up staff time who previously answered such calls in emergency departments.

With the changes in provision of out-of-hours primary care, it is important that they are fully evaluated for their effect across the whole health care system, including the effects in emergency departments. Such studies need to determine the impact of changes in primary care provision on emergency department attendances and also analyse new initiatives that bring together the provision of primary and secondary emergency care.

Key points

- There is no evidence around the effects on waiting times of GPs working in emergency departments.
- Primary care gatekeeping can reduce emergency department attendance but its safety is unknown.
- Walk-in centres and NHS Direct have not been demonstrated to reduce attendances at emergency departments.

Table 4 Primary care interventions (4.2.2)

Study details	Domain	Study design	Study population	Intervention	Findings / conclusion
Gadomski *et al.*, 1995 Applicable to UK: **No** **United States**	Primary health care Paediatric ED	Cohort study N= 216 intervention - not authorised for visit n=193 control - age match comparison	All children not authorised to emergency department care ED size: 17 500 p.a.	Diverting managed care Medicaid patients Referral to primary care	Only 57% saw their primary care provider following referral No difference in subsequent ED use between authorised and non-authorised ED care No adverse health outcomes were recorded
Sjönell, 1986 Applicable to UK: **Limited** **Sweden**	Primary health care ED	Observational study Study district n=44911 – study district n=48 749 – control district	All inhabitants ED size: NK	Primary health care centre Establishment of health centre increasing primary health care resources by 50%	ED visits decreased 40%
Franco SM, Mitchell CK, *et al*. 1997 [184] Applicable to UK: **Limited** United States	ED Primary care	Cohort study n=4766 - study period n=2798 - control period	All children attending ED ED size: 4,766 p.a.	Primary Care Physician Access Improved 24-hour primary care access. Primary care gate-keeping	Significant reduction in ED attendance (10% to 7.6%; p=0.0005) Non-urgent visits reduced (41% to 8%; p<0.00001)

Table 4 (continued)

Study details	Domain	Study design	Study population	Intervention	Findings / conclusion
Piehl *et al.*, 2000 Applicable to UK: **No** United States	Primary health care	Cohort study Historical control n=20 663 Medicaid patients n=34 079 non-Medicaid patients	Children aged 0-18 years Excluded: -children without ICD-9ED size: 54,742 p.a.	Decreasing ED use by Medicaid patients Ensuring children had their own GP with 24-hour access (Institution of Carolina Access Program)	Significant reduction in ED attendance for children on the program 24%/158 Monthly rate per 1000: 33.5 pre intervention 25.6 post intervention ($p<0.001$).
Stoddart *et al.*, [569] Applicable to UK: **Yes** United Kingdom	ED Primary health care	Survey Control: No n= 1206 pre-introduction n= 1,390 12 weeks post-introduction n=1 year post-introduction	ED attenders ED size: 68 000 p.a.	Introduction of out of hours primary care centre	No significant change in total numbers attending ED Reduction in those attending with problems of over one week duration (8% *vs.* 5%)

Note. ED: emergency department; ICD-9: International Classification of Disease (Version 9)..

Table 5 Walk-in centres and minor injuries units (4.2.3)

Study	Domain	Study design	Study population	Intervention	Findings / conclusion
Heaney & Paxton, 1995 Applicable to UK: **Yes** United Kingdom	Community	Observational study	All ambulatory patients	Creation of a minor injuries service	Decrease of 5% in attendances at local ED with a 24% reduction in attendances for those living in the direct vicinity of the minor injuries unit.
Hsu *et al.*, 2003 Applicable to UK: **Yes** United Kingdom	Community	Observational study n=9 intervention general practices n=3 control general practices	NHS WIC patients and ED patients	Creation of NHS WIC	Minor injuries service attendance rate ratio increase 1.22(95% CI 1.12 to 1.33) Less marked fall in ED attendances than in control area (rate ratio 1.17, 95% CI 1.03-1.33)
Heaney & Paxton Applicable to UK: **Yes** United Kingdom	Prehospital care Primary health care	Observational study	Patients attending with a minor injury	Introduction of a nurse-led minor injury clinic (WIC and telephone advice) Open 9.00 am – 9.00 pm	Overall 5% reduction in attendances at local ED Large variation in attendance at local ED by postcode area.
Salisbury *et al.*, 2002 Applicable to UK: **Yes** United Kingdom	Primary health care Emergency care	Observational study Impact of WIC on other providers: n=10 intervention sites n=10 control sites		Creation of ten NHS WICs	Non-significant decrease in ED attendances

Note. ED: emergency department; WIC: walk in centre; CI: confidence interval.

Table 6 NHS Direct and nurse telephone advice (4.2.5)

Study	Domain	Study design	Study population	Intervention	Findings/conclusion
Griffiths & Collier 2000 Applicable to UK: **Yes** United Kingdom	ED	Observational study Control: No n=979 callers	Patients telephoning the emergency department for advice; 3-month trial (July, August & September)	Telephone triage Advice call to ED redirected to NHS direct	27% advised self-care 43% advised to visit GP
Velsted & Christensen 2001 Applicable to UK: **Yes** Demark	Primary health care	Time-trend study Historical control	Community population: 630,000	New out-of-hours GP service including telephone triage and setting up of county-based health centres	Mean rate of contact increased significantly from 0.1722 (1988-1991) to 0.191 (1992-1997) (p=0.0002). Rise in ED attendances already occurring and not related to the reforms.
Lattimer *et al.*, 1998 Applicable to UK: **Yes** United Kingdom	Primary health care ED	RCT n=7184 intervention n=7308 control	Patients using out-of-hours service during study times: Mon-Fri: 6.15 pm to 11.15 pm Sat: 11.00 am to 11.15 pm Sun: 08.00 am to 11.15 pm Serving population: 97,000	Telephone nurse-led consultation service using decision support software.	50% of calls managed with nurse telephone advice No increase in attendance at ED in 3 days following consultation Nurse phone consultations did not produce significantly more adverse outcomes than usual out-of-hours system No significant change in ED attendance

Richards *et al.*, 2002 Applicable to UK: **Yes** United Kingdom	Primary health care ED	Interrupted time series (N=4685) n=3452 intervention triage n=1233 control standard management	All patients requesting same day appointment after offer of routine appointment by receptionist during study period.	Telephone advice service with computerised management protocols (six experienced nurses).	Significant increase in ED visits for patients in triage 0.033 intervention compared to standard management 0.010 ($p<0.001$).

Note. ED: emergency department.

Case study 2: Streaming to primary care

Patients attending the emergency department are assessed at the point of triage and a decision is made as to whether their needs are most appropriately met by emergency department medical staff, an emergency department nurse or a member of the primary health care team (PHCT). An experienced member of the nursing team helps the patient to access the services needed or where appropriate, provides nursing care or treatment, or directs the patient to self-care.

Audit has shown that nurses are practising safely and making correct judgements. Waiting times for minor injuries rarely exceeds two hours, and patients treated by nursing staff are seen within minutes rather than hours. There is a reduced incidence of patient complaints and nurses report increased job satisfaction.

For further information please contact:

Ana Kimche, Clinical Nurse Manager

Mr N Jenkins, Consultant

Accident & Emergency
Neville Hall Hospital
Brecon Road
Abergavenny
Gwent
NP7 7EG

4.3 Emergency department

The studies reported in this section are related to clinical, structural and procedural changes introduced in emergency departments. Literature has not been found on cultural attitudes and changes in emergency departments, which affect waits and attendances.

The SDO Programme has commissioned research to investigate organisational factors influencing waiting times in the emergency department (see www.sdo.lshtm.ac.uk for more information).

4.3.1 Registration and administration

A quasi-experimental design study comparing patients who were triaged and then went to reception or vice versa showed they were more likely to report to the reception in the first place and they reported a better understanding of this system. There was no case reported where patients in triage category 1 or 2 suffered an adverse outcome because of any delay with attending reception first. Door-to-triage time was however slightly reduced where triage happened first (ten minutes). If reception was undertaken first it took 13 minutes to reach triage ($p<0.001$). It is unlikely that this change is of any operational significance (Goodacre *et al.*, 2000).

One study (Anon., 2000a) looked at simplifying the registration process on entry to the emergency department. The changes involved use of laptops to enable bedside registration (which was undertaken simultaneously with triage), partial registration of only essential details before triage and a system to ensure full details were obtained later during a 'waiting period'. These changes reduced the arrival to physician time from 42.3 minutes to 22.5 minutes with only 0.3% having incomplete registration. The study did not give details of methods and no statistical analysis was available to determine the significance of the change. Another unit reported a reduction from 25 minutes to five minutes for the registration process when undertaken at the bedside, but methods and analysis were not reported. It appears this was associated with better patient tracking systems (Lau *et al.*, 2000). Wireless laptops have also been successfully used but no papers were found undertaking full evaluation (Trudeau and Ladue, 1996). Another prospective cohort study of bedside registration of all non-fast track patients found that this process had no effect on emergency department transit time for critically ill patients but did reduce time for other patients from 59 minutes to 42, 44, 50, 53 and 48 minutes in consecutive months. Further statistical analysis was not available (Takakuwa *et al.*, 2003).

Getting patients to start completing their own records as part of the sign-in process was used at one New Jersey hospital. This was seen to

decrease triage time and saved ten to 15 minutes per patient on overall flow. The study methods were not described (Trossman, 2000).

Staff in an American level 2 trauma centre developed new admission forms. This reduced the documentation time from 22 minutes to four minutes. No details of the previous documentation were given but a sample of the new flow sheet showed use of tick boxes on a two-page form (Petersen, 1985). Another prospective randomised study used a series of templates in 1228 patients. There was no significant decrease in emergency physician total evaluation time with the use of templates (Marill *et al.*, 1999). Templates may however improve the quality of notes (Humphreys *et al.*, 1992).

A prospective study by Witt (1995) looked at the introduction of a transcription service. A direct observation time and motion study was undertaken measuring the documentation time. Dictation was notably faster than writing (155 seconds *versus* 220 seconds, $p<0.0002$) and the total productivity of the department improved by 3.8% (from 2.20 patients per physician per hour to 2.28, $p<0.05$). Legibility and completeness of notes also improved. Introducing compulsory transcription may not lengthen the patients stay (Higgins and Becker, 2000). Another study (Zick and Olsen, 2001) compared traditional transcription via tape to voice recognition software in 47 sets of case notes. Accuracy was comparable (99.7 *versus* 98.5%) and turnaround time was better with the voice recognition software (3.65 minutes *versus* 39.6 minutes).

Use of computer monitoring of progress through the emergency department is feasible (Hu, 1993) and undertaken by some units (Fletcher *et al.*, 2004). Patient on-screen tracking systems have been described (Nathanson, 2003). Use of an electronic tracking board rather than a white board resulted in fewer patients waiting more than six hours (4.4% *versus* 3.7% but no statistical analysis) and was associated with improved patient satisfaction (Boger, 2003). Use of real time data is more reliable than staff perceptions of when an emergency department is becoming overcrowded (Reeder *et al.*, 2003). It is recognised that successful organisations have the information to act on changes in real time. Live information using statistical process control enables early decisions to be made (Rosow *et al.*, 2003). Electronic white boards have been used to improve patient tracking but their effects on waits have not been assessed (Jones, 2002).

Using a computer simulation it was possible to design a central transporting team of porters and a nurse to help transfer patients on a hospital site. It was found to decrease delays but was not trialled in the emergency department. Requests were made using the IT system rather than phones with an average time to dispatch of six minutes (McGinty and Ghiz, 1993).

In summary, the evidence in the area of registration and documentation is poor. There is weak evidence that bedside

registration, self-completion of forms by patients and transcription of notes may accelerate the process in the emergency department.

4.3.2 Triage and initial assessment

Triage was introduced into UK emergency departments in the mid 1980s as a risk management tool to prevent patients with time critical illness waiting an excessively long time for care. A variety of three or five level triage systems are used around the world. The five level systems have demonstrated a high degree of accuracy and inter-rater reliability (Mahon, 2003). In 1992 the government introduced the Patients Charter which stipulated that all patients 'will be seen immediately and their need for treatment assessed' (Department of Health, 1997). The effect of this initiative was to isolate the triage nurse from the patient flow which Read *et al.* (1994) cites as the main contributory factor in the resultant increase in waiting times. Others, however, have stated it was due to the nursing time of triage being taken from patient care. Studies have claimed to demonstrate that triage reduces waits in the emergency department. However these studies have all incorporated the prioritisation component of triage with other interventions (for example test ordering). The effects of triage nurse ordering of x-rays and tests is discussed in section 4.5.3.

A study comparing patients who were triaged with those not triaged showed that patients in the triage group waited longer than those in the no triage group in all four of the priority categories but it was most marked in triage category 1 and 2 patients suggesting therefore that those in most urgent need may have had their care delayed by triage. Only 48% of the triage group had complete records (George *et al.*, 1992). In another smaller study of triage it was shown that triage delayed the waiting time for non-urgent patients to see both the nurse and the doctor but the study did not look at urgent cases (Ryan, 1995). In a comparison between 1986 without triage and 1988 with triage it was shown that time to see a doctor was unchanged, but time to an initial assessment was reduced. However the study did not present adequate data or allow comparison of the two years. In the second year, the department saw more patients but staffing and training differences are not known (Mallett, 1990). Others have argued for the important clinical safety net function of triage when there are delays in the system (Windle and Mackway-Jones, 2003).

In redesigning triage in an emergency department, one system was adopted which allowed the triage nurse to initiate diagnostic protocols for frequently-occurring medical problems based on physician-approved algorithms. These were developed for abdominal pain, eye trauma, chest pain, gynaecological symptoms, substance abuse, orthopaedic trauma, minor trauma, paediatric fever and paediatric emergencies. Following a comprehensive educational programme the advanced triage was initiated. After one year the evaluation was undertaken which showed that the average length of stay was found to be 46 minutes

less than the length of stay for patients who went through the standard triage system. The greatest saving was for those in the urgent category where there was a saving of 76 minutes. The components of time where there was most saving was the patients' length of stay after physician assessment, presumed to be due to the fact that diagnostic results were already available at this stage in the advanced triage group. However this study had no statistical analysis and it is not clear how the random selection of 250 studied were selected (Cheung *et al.*, 2002). In another system of advanced triage, a triage nurse could initiate diagnostic protocols according to algorithms. In the emergency patients there was a time saving of 40 minutes in the total length of stay, in the urgent category there was a time saving of 74 minutes and in the non-urgent there was a time saving of ten minutes. Overall, there was an average time saving of 46 minutes within the department against a normal total length of time of approximately 200 minutes (Kokiko and Mayer, 1997).

Development of a specific mental health triage scale and its implementation showed that mean emergency waiting times and transit times were reduced. There was also a reduction in the number of mental health patients waiting to be seen. This was accompanied by education of both emergency department and psychiatric department staff with a greater understanding of each other's perspectives (Smart *et al.*, 1999).

A two-tiered trauma response was developed whereby the most severe trauma was seen by a surgical-based trauma team. The next tier was an emergency medicine supervised trauma alert team with senior personnel from the emergency department. Those patients who were categorised into the new (second) trauma alert group had a significant reduction in their length of stay by 139 minutes. Overall the length of stay was reduced from 289 minutes to 241 minutes. The system therefore demonstrated that those with urgent (as opposed to emergency or routine) care needs had their care times reduced by this new system (Tinkoff *et al.*, 1996).[591]

In summary, if the only purpose of triage is to prioritise patients then it may delay care, but if it adds extra value by initiating investigations or treatment then it may save time. It may however provide a clinical safety net at busy periods.

4.3.3 Triage out

'Triage out' is the system whereby after people arrive at the emergency department they are redirected to an alternative source of care, usually from triage.

Emergency departments have traditionally offered care for all who present. However it is realised that many who present to the emergency department do not have emergency needs. By reducing the numbers of patients seen in the emergency department, then waits will

reduce if resources are maintained. One way of reducing numbers being treated in the emergency department is to redirect those patients who do not have any emergency needs. Some disagree with this principle because it is considered that the patient has the perception of urgency or that emergency departments should act as a safety net (Henry, 1990). The Society for Academic Emergency Medicine has written a position statement on the ethics of triage and, in particular, on triaging out of the emergency department (Schmidt *et al.*, 1995). If the principle of 'triage out' is to be adopted then its acceptability to patients, its safety and its efficacy must all be assessed.

The willingness to wait for a clinic appointment rather than going to the emergency department was assessed for six conditions in five hospitals in 2757 patients. A third of patients were willing to wait in a non-emergency setting. Those most likely to be prepared to wait were older people and those without a regular primary care provider. It was found that 20% were willing to wait up to 24 hours and 6% up to 48 hours (Rucker *et al.*, 1999). The study looked at patients with conditions with potential for severe illness (abdominal pain, chest pain, hand lacerations, head injury and vaginal bleeding) whereas many of those who would be triaged out would have simpler conditions; this study may therefore underestimate the willingness to defer care. In one study (Morrison *et al.*, 1990) 89% of GPs agreed that their patients should be sent back to their surgery if they attend the emergency department with a non urgent problem and 73% still agreed if the patient was attending for a second opinion.

In an RCT, Washington *et al.* (2002) studied 156 patients who were referred to a next day primary care clinic according to criteria (all were abdominal, respiratory or musculoskeletal conditions). The self-reported health status of those deferred to clinic was no different from those seen immediately, although the power of the study would not detect a one day additional period of infirmity at home.

As a result of overcrowding a hospital developed a programme of referring certain types of patients not needing emergency care and sending them to other sources of care. In the three-year study 15% of patients were refused care and referred elsewhere. Letters and calls to referral clinics, eight local emergency departments and the coroner's office identified no patients who had been grossly mis-triaged and only 'insignificant' adverse outcomes were identified. Follow-up of 3740 individuals triaged away was performed by telephone. This indicated that 42% of persons received care elsewhere the same day and 37% within two days and 22% decided not to seek any other medical care. A group of 1.6% sought care at other emergency departments for their minor complaints (Derlet *et al.*, 1992).

But another study showed that up to 1% of patients suitable for triage out were subsequently admitted (Birnbaum *et al.*, 1994). Use of standard triage systems with acuity as the determinant is not

sufficiently sensitive to identify those needing emergency department care (Lowe *et al.*, 1994) and one third of those designated suitable for triage out would have been inappropriate. Referral to primary care did not result in subsequent less usage of emergency department (Straus *et al.*, 1983). Triage out of the emergency department by a nurse showed that 15% were referred elsewhere. No significant adverse outcomes were detected by telephone follow-up and coroners' notes review. Only 16% sought care at another emergency department (Derlet *et al.*, 1992).

A prospective study looked at the use of a screening examination by a triage nurse to determine whether patients were eligible to be seen in the emergency department. Patients with vital signs within a specific category or with one of 50 minor chief complaints were refused care in the emergency department and referred to off-site clinics. In the first six months 19% of ambulatory patients were referred off-site, 84% were referred to off-site non-university clinics and 15% were referred to a University affiliated hospital-based clinics. Follow-up letters and telephone calls identified no patients who needed re-triage to an emergency department. Only 54 patients (1.3%) complained of their referral out of the emergency department. Of 41 patients who returned to the emergency department within 48 hours none had a deterioration of their condition. The authors conclude therefore that it is safe to selectively triage people out of the emergency department to reduce the workload within the department (Derlet and Nishio, 1990). In a study of paediatric patients a study in Memphis showed that 61% of the 748 studied were triaged out of the emergency departments. Of these, 31% were sent to community health centres, 17% to physicians' offices and 13% advised on self-care. There was a high rate of recovery but the significance of this cannot be judged because of the absence of any comparator group (Rivara *et al.*, 1986). Kelly (1994) demonstrated that emergency department attendance could be reduced by 27%, or 68% of non-urgent cases, using a triage out system.

A similar system of presence of non-emergency chief complaint, absence of key factors, absence of chest pain, abdominal pain, severe pain, inability to walk and normal vital signs was used as the criteria to refer patients to off-site clinics. Over a five-year study period, more than 176 000 patients were seen in the ambulatory triage area of an emergency department. Of these, 18% were defined as non-urgent, and were referred elsewhere. A letter and telephone calls to all the clinics to the eight local emergency departments and coroners' offices identified no instances of gross mistriage. A telephone follow-up was successful in 34% of cases and showed that 39% had received care elsewhere the same day, 35% had received care elsewhere within three days and 26% decided not to seek medical care. A group of 1% sought care at another emergency department (Derlet *et al.*, 1995).

An American veterans administration study undertook a Delphi process to establish criteria for deferred care. The criteria were then used on 1187 consecutive ambulatory patients presenting with abdominal pain, musculoskeletal symptoms or respiratory infection. The patients meeting the deferred care criteria were then offered an appointment within one week in the ambulatory care clinic at the study site. All other patients were offered same-day care. Of the 226 patients who met the screening criteria for deferred care none of them experienced subsequent hospitalisation or death in the next seven days or 30 days respectively (Washington *et al.*, 2000).

In a Swedish study (Hansagi, 1990), the triage nurse re-directed any patients with a non-urgent problem to more appropriate care. Of these, 27% were considered appropriate for care elsewhere and 84% of patients agreed to referral following the advice. Patient satisfaction with such a system was equal to that in a normal emergency department referral pattern. In another Swedish study 38% of adult attenders were triaged out, follow up by looking at emergency department notes revealed no adverse outcomes. A greater number could have been triaged out if there had been increased capacity in primary care. There was however, no follow up of other adverse outcomes (Hansagi *et al.*, 1997).

Driscoll *et al.* (1987) concluded that attempts to divert patients with non-urgent illnesses from the emergency department were generally a failure because of the differences in the language and culture of health care between doctors and patients.

In summary, studies show that 15% to 27% of patients can be triaged out with only 1% dissatisfied (Derlet and Nishio, 1990) but only a third may be willing if asked. GPs were happy with the concept in the one study found. However up to a third may be triaged out inappropriately (Lowe *et al.*, 1994), up to 1% may be subsequently admitted (Birnbaum *et al.*, 1994) and up to 1.6% may attend another emergency department (Derlet *et al.*, 1995; Derlet *et al.*, 1992). Many studies reported no adverse outcomes. There were however no prospective studies in the UK of such systems.

4.3.4 Co-payment and financial systems

It is recognised in America that there are significant variations in how people use emergency departments and this is associated with their financial responsibility for 'unnecessary use'. Those with responsibility for partial or full payment were associated with fewer non-urgent attendances at the emergency department. The percentage of non-urgent cases varies from 61% with welfare insurance to 13% with Medicare insurance (Dickhudt *et al.*, 1987). But no causal link has been established. Many co-payment schemes are linked with primary care gatekeeping, which has already been discussed in section 4.3.4.

A prospective survey was performed after the introduction of a new 'fee for service' managed care programme in a paediatric emergency department. A convenience sample of 200 patients under two years old receiving primary care at the walk-in centre were enrolled. Six months after the introduction of the fee for service, paediatric emergency department visits for minor illness had decreased significantly for the fee for service group (68%, p=0.001) but not for the capitated plan group (82%, p=0.92). However at one year the utilisation rates were similar to those of the initial phase, suggesting that introduction of a new plan temporarily led to fewer visits to the paediatric emergency department for minor illness but within one year users had reverted to their prior utilisation habits (Chande, 1997).

Selby *et al.* (1996), examined the use of the emergency department before and after the introduction of co-payment systems by Kaiser Permanante. The study used a control group not affected by co-payment systems. After adjusting for age, sex and socio-economic status the use of emergency departments declined by 14.6% more than the control group (p<0.001). Visits for other urgent care did not increase. The decline was most marked in the non-emergency cases. The study did not detect any adverse outcomes but accepts the study design was limited in this respect and its ability to detect changes in disadvantaged groups. Mortality was not changed nor was the number of potentially avoidable admissions.

In a randomised trial of 3973 patients, O'Grady (1985) found that co-payments reduce attendances. The size of the payment seemed to have little effect but some reduction in attendances occurred across all severity groups, indicating the potential risks of such systems. Without any cost-sharing the attendances for less serious diagnoses increased three times as much as visits for more serious conditions. With no cost-sharing, emergency department visits for less serious diagnoses increased three-fold.

It has been reported that introducing a system of free payment for care if the wait to be seen was more than 30 minutes resulted in 67% of patients being seen and treated within two hours. Details were not given of the interventions behind this although fast track systems were included (Solomon and Johnson, 1999). In New Jersey a system of 'be seen under 30 minutes or your money back' was instituted and acted as a catalyst to several changes, including a reduction in triage time. However, although the initial assessment period was short, it may not include test ordering.

In Ireland, a system was introduced in which those not eligible for free health care were given financial disincentives (IR£6) to attend emergency department before the GP for minor conditions. A retrospective analysis revealed that this resulted in a small reduction in fee-paying patients attending for non-emergency conditions (a fall from 45.3% to 44.0%; 95% confidence interval -0.6% to 1.9%) but the

overall workload of the emergency department was unaffected (Murphy, 1997).

Requiring pre-authorisation for reimbursement of emergency department care has now become common practice with managed care organisations in the United States. A review was undertaken to assess whether adverse outcomes occurred because of this. Of 143 cases reviewed, 29 cases were found which had been denied emergency department payment. Adverse outcomes were found in four cases (14%) including meningococcal septicaemia, ruptured ectopic pregnancy, hypoglycaemia, cardiac arrest and ruptured duodenal ulcer. There were also four cases at increased risk and 21 cases of near-miss. Those at increased risk included epiglottitis, myocardial infarction, ruptured ectopic pregnancy and delayed treatment of septic arthritis. Near misses included a large variety of conditions, but in particular various sources of sepsis and intra-abdominal bleeding and psychiatric conditions. It was therefore concluded that in this small study there were a significant number of adverse outcomes related to managed care gatekeeping (Young and Lowe, 1997).

However a study of patients seeking emergency care because of myocardial infarction did not experience delays because of modest ($25 to $100) co-payments. The length of time from onset of chest pain to presentation was no different in those having to make co-payments than those not (135 *versus* 137; 95% confidence interval of difference – 19 to +16 minutes). This study only looked at people enrolled in one health maintenance organisation (Magid *et al.*, 1997).

Co-payment systems are often associated with systems of pre-authorisation for attending the emergency department. These have been discussed in section 4.3.4.

Financial incentives have also been applied to emergency departments. For example, in Australia a system of bonus payments to emergency departments for fulfilling their triage-related waiting time targets was shown to produce a sustained change over three years. The number of occasions when ambulance bypass occurred decreased from 600 to 100, although as there were set criteria for this it may have been related to a change in threshold. However the number of patients waiting longer than 12 hours showed a non-significant decrease (Cameron *et al.*, 1999).

In summary, co-payment systems have a demonstrable ability to reduce attendances. The greatest impact is in non-urgent attendances at emergency departments. However, there is also evidence that it reduces attendance of urgent cases, with one study suggesting potentially life-threatening cases may be diverted away. Therefore the safety of such systems must be questioned. Use of free care if delays occur has been used as an internal incentive within the hospital to encourage more rapid care.

4.3.5 Fast track for minors

Canadian Health Technology Assessment commissioned a review of fast track systems by Yoon (2003). It concluded that emergency department fast track systems appeared efficient, cost-effective, safe and satisfactory for patients. Low acuity patients were confirmed as being seen quicker.

One view is that emergency departments experience congestion mainly when staff are diverted to care for high acuity patients. Clinical priorities often mean that those needing the earliest care often need the longest time interventions. If a system slows down because of increased workload or inadequate resources (for example staff or cubicles) then those with the lowest acuity will start to experience prolonged waits. According to operations research theory average waiting time in a system utilising one queue can be reduced by attending to the users with the shortest time requirements. Fast track systems were therefore developed to ensure that certain groups have their care expedited. The 'fast track for minors' is an organisational system designed to prevent excessively long waits for those with lesser injuries and minor illness.

Fast track systems for 'minor' patients have been described for many years (Karpiel and Williams, 1998). The NHS Modernisation Agency has encouraged the national use of fast track systems using the 'see and treat' principles (NHS, 2002) It is not known how widely this has been adopted, but unpublished data from the Department of Health shows that there are many different models of staffing and the number of hours that fast track systems operate is highly variable.

The key principle of all these systems is that ambulant patients with non-urgent conditions are treated in a dedicated area by dedicated staff with the competence to make discharge decisions and, wherever possible, one person should undertake this care to prevent multiple handovers of the patient between professionals.

The introduction of see and treat has provoked great debate (Leaman, 2003) suggesting that its introduction was a management decision, without scientific assessment, risks senior staff burn-out and could delay other cases. This was disputed by Castille and Cooke (2003). American staff, who were initially concerned that quality of care would diminish, began to support it as they saw satisfied patients and received more compliments (Cardello, 1992).

Modelling using a serial subtraction of various interventions showed that 29% of patients were discharged after clinical assessment but without any specific treatment or investigation. The methodology has the potential bias of using routinely coded data. Of these patients 15% were conveyed by ambulance, 3% had already consulted primary care and 11% were children (Cooke *et al.*, 2003).

A UK study, in 1993, using a consultant at the triage desk demonstrated that 34% were given advice only or a simple treatment and discharged from the triage room, with an average time in the department of less than five minutes. The average time for all the patients triaged in this way was 'about 50 minutes', compared to one hour eight minutes without the consultant at triage. This study was only a small sample and data was not described in detail with little statistical analysis (Redmond and Buxton, 1993).

In Copenhagen it was noted that 30% of attendances could have been dealt with by an 'older and more broadly-educated colleague' without needing any further investigation or treatment (Ramussen *et al.*, 1997). A UK study using routinely collected data showed that when a separately staffed stream was developed for ambulatory patients the risk of waiting more than one hour to see the doctor decreased by 30% and this was increased to 50% with increased presence of consultants in the department. However the generalisability of the study is limited by the fact that the cases presenting to this department were mainly trauma patients (Cooke *et al.*, 2002).

An American interrupted time study looked at positioning a senior doctor at the triage desk. This doctor was additional to normal staffing. This person expedited care by rapid evaluation for diagnostic studies, basic therapeutic interventions and by moving serious patients to appropriate areas. They were not provided with detailed instructions or protocols. Comparing similar days when faculty triage was undertaken with the senior doctors not present, there was a significant decrease in total time in the emergency department of 82 minutes against the original background of 445 minutes across all patients ($p=0.005$). The savings were seen in both admitted and discharged patients. The other staffing on these days was not significantly different. It was also noticed that the number of patients leaving without being seen halved to 8%. The changes could however be partly due to the increased staffing level as well as the system change (Partovi *et al.*, 2001).

In a randomised trial whereby fast-tracking was undertaken on alternate days, patients in specific groups were designated to be treated by a fast-track team. When the fast-tracking was not undertaken, the staff were used in the emergency department. The median length of stay was 36 minutes for fast-tracked patients compared with 63 minutes for the control group. The application of fast-tracking decreased the emergency department length of stay and improved satisfaction for these patients. There were no complications or hospitalisations to any other hospital (Kilic *et al.*, 1998).

One RCT introduced two extra staff who were randomised between normal emergency department duties and running a rapid access clinic. When all patients passing through the emergency department were analysed, the waiting times to be seen by a doctor showed no difference in triage category 2 and 3 patients, with a difference of

several minutes for triage category 4 and 5 patients. The time spent in the emergency department showed no difference in category 2 and 3 but showed a 20 to 25 minute advantage in categories 4 and 5 for those using the rapid assessment clinic (Ardagh *et al.*, 2002).

In another system, a rapid assessment team was developed whereby a doctor and triage nurse saw the patient before the expiry of their waiting time according to national triage. The doctor would undertake a rapid assessment, undertaking a focused history and examination, deciding on early investigation and treatment. If the patient was unstable they would be passed over to another doctor. In an interrupted time series study, this system resulted in more rapid initial assessment of the patient across all triage categories (59% within target compared to 39% when no team was working, $p<0.001$) except category 1 patients. The median length of stay was unchanged (Grant *et al.*, 1999).

In a British unit where triage was replaced with a direct consultation with either nurse practitioner or senior doctor a study demonstrated an increase in the patients seen within one hour from 52% to 75% without an increase in staffing. There was no analysis of the time other patients spent within the department (Shrimpling, 2002). In Roland and Morris (1988) one hospital noted an improvement of 75 minutes in the average length of stay after introducing a fast track system for patients not requiring extensive treatment but the paper gave insufficient information to determine if this is generalisable. A service evaluation in North Tyneside used a 'before and after' design to assess a system whereby low priority patients were assessed using decision support software. They demonstrated that of 2696 emergency department attenders, 27% could be discharged home after this assessment in an average of 36 minutes. The overall time for all patients in the emergency department was reduced by an average of 36 minutes. There was no detailed statistical analysis or description of the two groups, so it is not possible to assess the generalisability or applicability of this study (New, 2000).

An American study showed that patients were very satisfied with care rendered by physicians' assistants in a fast track system and that few patients would be willing to wait longer in such a setting to be seen primarily by an emergency physician (Counselman *et al.*, 2000). An American study of 126 patients demonstrated that overall satisfaction was more strongly associated with perception that the wait was shorter than expected than with the actual estimated wait. Efforts to improve emergency department patient satisfaction may therefore be better focused on improving the patients' perception that waiting times are short rather than simply just shortening the waits *per se* (Hedges *et al.*, 2002).

An interrupted time series study using the classic 'plan-do-study-act' (PDSA) approach developed a set of guidelines for fast tracking of non-

urgent cases over several cycles and had dedicated registration nursing and medical staff. This reduced the mean total time for non-urgent patients in the emergency department from five hours 57 minutes to one hour 47 minutes but no tests of significance were undertaken. No assessment was made as to the effect on other patients in the emergency department (Docimo *et al.*, 2000).

A study in a paediatric unit looking at a fast track for ambulatory paediatric patients showed an average length of stay of 28 minutes shorter in fast track than in the main emergency department. The groups were comparable for age, clinical condition, ethnicity and insurance status and vital signs but were not randomised; the fast track did not operate at night when illness profile and parental anxiety may differ. Fast-tracking was undertaken by a board certified paediatrician with a registered nurse, rather than emergency department staff (Hampers *et al.*, 1999). In another study, Simon *et al.*, (1996) examined a paediatric fast track system for triage accuracy and turnaround times. During a nine-month period 2243 patients in the fast track system had a quicker turnaround time than the aggregate of all patients seen in the emergency department (107 [95% confidence interval 0 to 245] minutes *versus* 149 [95% confidence interval 0 to 341] minutes, $p<0.01$). Their total turnaround time was also less than that for patients with similar acuity levels seen during the hours that the fast track system was not in operation (120 [95% confidence interval 0 to 300 minutes], $p<0.01$). Only 63 of the 2243 (2.8%) patients initially assigned to fast track were found to have higher acuity levels than suspected at initial triage and all cases were appropriately cared for in the fast track area. The study did not however use a matched control group, so findings must be limited for this reason.

Saywell *et al.*, (1995) undertook an economic evaluation of fast track systems and showed that in his hospital the system did not cover all its costs but still continued. This is likely to be because it was developed for reasons other than cost-effectiveness. However, this analysis undertakes a conservative approach to analysis of costing with many employment costs considered as truly variable costs for the emergency department. Equally, some of the time estimates appear low, for example two minutes to triage a patient. This study was in a centre where only 8% went through the fast track system, much lower than in other studies referenced above. The study also does not account for the beneficial effects that a fast track system may have on the overall functioning of the emergency department. Therefore this article may give an outline to how people should consider cost effectiveness of fast track systems but does not supply a generalisable answer. A Saudi Arabian study diverted medical staff to the triage area. This reduced the mean waiting time from 58 minutes to 25 minutes ($p<0.005$) but the paper did not allow comparison of the control and study groups and

it did not look at the effect on other patients from whom the doctor was diverted (Bond, 2001).

Many of the studies supporting the fast tracking of minor illnesses and injuries have significant weaknesses but all demonstrate improvements in waiting times. None of these studies showed any adverse effects from introducing fast track systems although many did not look at the effect on other patients in the emergency department. Those that did consider this aspect found that waits were no longer than waits in the more major cases. Another potential disadvantage of such systems is stated to be the potential for increasing attendances of minor cases as access is improved. There is no evidence to support or refute this. Although some departments studied instituted fast track systems with no extra resources, it is unlikely that this is generalisable. However, studies above demonstrate that waits may be more effectively reduced by investing extra staff in a fast track system rather than simply increasing the overall workforce.

There have been many studies of fast track systems, including several RCTs, however none of these have been in the UK system. The evidence suggests that fast track systems do reduce waits of non-urgent patients and are safe and satisfactory to them. Various fast track models are available using medical and nursing staff. There is a need to assess the optimal system and which is effective in the UK.

4.3.6 Other fast tracks

Fast track systems have also been developed for patients with fractured neck of femur, strokes and acute myocardial infarction (see section 4.6.3). There are no quality studies of these fast track systems. The three studies found all have major flaws and do not show what effect they had on other patients or on the emergency department as a whole.

Fast tracking protocols were developed for patients with hip fractures. A review (Rajmohan, 2000) of 104 patients showed in the first phase that many patients spent more than two hours in the emergency department. After implementation it showed that the transfer time was reduced from two hours 45 minutes ± 57 to one hour 32 minutes ± 41 minutes ($p<0.001$).

Another system of fast-tracking with proximal neck of femur resulted in a decrease in the admission time from 4.5 to 2.5 hours, however patients were excluded if there was no identifiable orthopaedic bed which would then result in an increased time of just over four hours (Ryan *et al.*, 1996). However, subsequent non-availability of beds caused the length of stay of patients to increase by 40% in one of these studies; clinical consequences were not mentioned (Ryan *et al.*, 2000). In a similar system Finlayson (1996) found the major delays lay in performing the x-ray and in junior orthopaedic staff resisting admission directly to the ward.

A group of 50 patients with hip fractures admitted to a hospital in Manchester via the emergency department were studied prior to the introduction of a fast-track hip fracture protocol. The 16 patients admitted via the emergency department following the introduction were then studied. The new protocol included a trauma co-ordinator who liaised with emergency department staff to reduce the transfer times. The system only operated during daytime Monday to Friday. On arrival of the patient the co-ordinator was informed and ensured that all radiological and haematological investigations were done promptly and that admission to the ward was undertaken rapidly. The orthopaedic admitting team would then see the patient on the ward. Introduction of this new system reduced the median emergency department to ward transfer time by 43% from 7 hours 4 minutes (range two hours 46 minutes to 11 hours 50 minutes) to four hours (range one hour eight minutes to 11 hours 58 minutes, $p<0.0001$). There was no significant change in the emergency department to ward transfer time for patients transferring out of hours when the co-ordinator was not present (Charalambous *et al.*, 2003).

Fast track for strokes

An American study (Gomez *et al.*, 1994) instituted a system whereby members of a stroke team were all given pagers that were activated by the emergency department staff as soon as the patient arrived in the department with a stroke. They prospectively studied the response time and the treatment interval for patients who were treated using this system. It was a small study with only 12 patients available for analysis, representing just 12% of the patients seen in the emergency department for stroke during the study period. The mean time to evaluation by the stroke team was less than five minutes and mean time to treatment was 30 minutes. This was a significant improvement ($p<0.05$) in consultation times but the difference in time to treatment completion was not significantly improved. They did not study the total time in the emergency department of these patients. Another study looked at factors affecting the emergency department evaluation time for stroke patients. In this institution it was found that use of the emergency department as the site of treatment abbreviated the care (Timerding *et al.*, 1989).

Fast track systems for fractured neck of femur patients and those with strokes have been described and evaluated, however no controlled trials have been undertaken to determine their effectiveness or their effect on other patients utilising the emergency department.

A fast track system for psychiatric patients whereby a small cadre of nurses were specifically trained to undertake psychiatric assessment resulted in (those patients 44% less time) waiting times for those patients falling by 44%. Details of the study and its design were not available (Dunn, 1989).

4.3.7 Emergency department clinical changes

A wide variety of changes to clinical procedures were found in this review. However time in the emergency department was a secondary measure in most studies with clinical outcome as the primary measure. Thrombolysis, heart failure, DVT and hospital at home issues are covered separately in section 4.6 of this chapter.

Use of three care pathways in paediatric conditions presenting to an emergency department in an interrupted time series study showed that admission rate could be reduced three-fold to 9% with a two-fold reduction in length of stay. The waiting time to see a doctor in the emergency department was also reduced by 29 minutes. The impact on the total time in the emergency department was not calculated (Brown *et al.*, 2001).[62] Development of a clinical pneumonia pathway resulted in a decreased time to antibiotics. This was studied using a retrospective chart review of groups three months prior to the pathway implementation, nine to 12 months after implementation and 33 to 36 months after implementation. The mean time from arrival to antibiotic administration decreased from 315 minutes pre-pathway, to 167 and 174 minutes one year and three years post-pathway introduction respectively ($p<0.001$). There was an increase in the number of patients receiving their antibiotics within the emergency department. Hospital length of stay also decreased, as did mortality (Magalski *et al.*, 1999). Various other studies have shown that protocols can reduce the time to antibiotics in children, reducing from 142 minutes to 105 minutes in one study (Sharieff *et al.*, 2001) and from 5.0 hours to 3.2 hours ($p=0.04$) in another study (Natsch *et al.*, 2000).

An RCT was undertaken in a paediatric emergency department whereby children with simple lacerations either had topical anaesthetic applied at triage or a placebo. Those who had a topical anaesthetic ($n=161$) had a reduced median treatment time (77 *versus* 108 minutes; 95% confidence interval of 15 to 47, $p=0.0019$). There was no difference in any other clinical outcomes but only 40% of cases who had topical anaesthesia applied required suturing (Priestley *et al.*, 2003). Sedation with ketamine or midazolam increases the length of stay for patients requiring minor laceration repair (Lawrence and Wright, 1998). Another retrospective study of 120 patients demonstrated an increase length of stay of 17.1 minutes ($p=0.03$) for those having midazolam sedation (Nelson *et al.*, 2000). In a study looking at the use of oral diazepam and oral and intranasal midazolam for the sedation of children under six for laceration repair, it was noted that oral diazepam resulted in longer recovery time (53.9 ¦16 minutes compared to 48 ¦12 minutes) when compared with intranasal midazolam. However this was not clinically significant (Everitt and Barnett, 2002).

A study of stapling of lacerations in which 45 patients had stapling and 43 had suturing showed that there was no significant difference in the study groups but that stapling resulted in shorter wound closure times

(65 *versus* 397 seconds, p<0.0001) and overall shorter times for wound care and closure (395 *versus* 752 seconds, p<0.0001). It was also noticed to be less expensive (Kanegaye, 1997). Use of tissue adhesive is now widely undertaken but time savings have not been published.

Use of a burn triage protocol, such that immediately on arrival patients were triaged directly to an outpatient burns clinic or a burns centre without registering in the emergency department, meant that 73% of patients could be directly referred to the burns centre. The average emergency department visit time for these patients reduced to 44 minutes in those going through the emergency department subsequently (Brandt *et al.*, 2000).

The use of inhaled corticosteroid after emergency department discharge is associated with a significant reduction in the risk of subsequent emergency department visits for patients with asthma. In Sin and Man (2002), patients using inhaled steroids had 45% fewer return visits (adjusted relative risk of 0.55; 95% confidence interval 0.44 –to 0.69). A Cochrane review has confirmed that a short course of oral corticosteroids following assessment for an acute exacerbation of asthma significantly reduces the number of relapses (Rowe *et al.*, 2004). The type of therapy used in asthma may affect the length of stay in the emergency department. One study compared continuously nebulised albuterol with albuterol plus ipratropium in a prospective randomised double blind placebo controlled trial. The patients given the combination therapy had a greater improvement in their respiratory flow rate and the odds ratio for admission with combination therapy was 0.88 (95% confidence interval, 0.28 to 2.8). The immediate length of stay in emergency department was 35 minutes shorter for those receiving combination therapy (210 *versus* 245 minutes, p=0.03). However when adjusted for the initial peak flow there was no statistical significance (p=0.26).

A comprehensive programme of emergency department staff education, aggressive medication interventions, use of standard regimes, patient follow-up and patient education resulted in a decrease in emergency department utilisation of 25% but data did not specify any other figures or undertake any analysis (McGillis, 1996). A similar programme for children included attendance at a specialist clinic and caused a non-significant reduction in emergency department attendance (32 *versus* 46 patients reattending, p=0.11) but the mean number of visits was significantly less (0.1 *versus* 0.3, p=0.01) (Harish *et al.*, 2001).

Use of preventative medication in a migraine management regime has been demonstrated to reduce the use of other migraine medication as well as reducing the number of visits to physicians' offices and emergency departments (Silberstein *et al.*, 2003).

4.3.8 Frequent attenders

The characteristics of those attending emergency departments have been described in chapter 1. Of particular interest is a small group of patients who account for a disproportionate number of emergency department visits. Studies suggest that 3% to 4% of patients may account for 12% to 20% of the emergency department visits per annum (Mandelberg *et al.*, 2000; Spillane *et al.*, 1997; Hansagi *et al.*, 2001; Kne *et al.*, 1998; Santos Martin *et al.*, 2000; Audit Commission, 1998).

Understanding the characteristics of these patients may help to reduce their attendances. A Swedish study interviewed ten adult patients who had visited the emergency department six to 17 times in the previous 12 months. The frequent emergency department visitors perceive pain or other symptoms as a threat to life or to personal autonomy and revealed difficulties with adverse life circumstances and medical, psychological and/or social problems, including alcohol or other substance misuse. Occasional referrals from the emergency department to a psychiatrist seem not to lead to any continuous change in the patients' health-seeking behaviour. Satisfaction with care becomes adversely affected when the patients perceive that the staff classifies their use of the emergency department as inappropriate or when their symptoms are belittled (Olsson and Hansagi, 2001).

An American study which undertook cross-sectional intake surveys, medical chart reviews and telephone follow up looked at the predictors and outcomes of frequent emergency department attendances. A total of 2333 records were completed (67.5% of potential total). The demographics predicting frequent use included being a single parent, single or divorced marital status, high school education or less and income of less than $10 000 in 1995. Health status predictors included hospitalisation in the preceding three months, high ratings of psychological distress and asthma. Health access predictors included identifying an emergency department or hospital clinic as a primary care site, having a primary care physician and visiting a primary care physician in the past month. Choosing the emergency department for free care was the only health preference predictor of heavy use. Illness severity measures were higher in the frequent visitors but they were not an independent predictive on the multi-variant model. The outcomes correlating with heavy use included increased hospital admissions, higher rates of emergency department return visits and lower patient satisfaction (Sun *et al.*, 2003).

An American study compared 100 frequent attenders (those attending four plus times in one year) with a similar number of non-frequent attenders who were matched for sex, age and triage category by undertaking interviews in the emergency department. The results showed that frequent attenders also made more visits to their GP in the past year (median of 12 *versus* 3). They also made more use of

public health nursing, community welfare services and social work, addiction counselling and psychiatric services, as well as spending more nights in hospital than the control group. In the general health questionnaire their scores were higher, indicating poor mental health and they also had lower levels of social support (Byrne *et al.*, 2003). A retrospective study of adults with more than ten visits to a university hospital emergency department showed that 76 patients made more than 1000 visits, corresponding to 1.2% of the total workload. Of these, 46% had been evaluated in three or more emergency departments in the 12-month study. Medical problems accounted for the majority of the emergency department visits in 55% of people. Of those making more than ten visits in one year 58% had psychiatric or substance abuse problems (Kne *et al.*, 1998).

At a teaching hospital, 134 frequent attenders completed a survey. Of these, 73% had a usual source of medical care. Only 27% said they had difficulty in seeing a primary care physician. Existing or recurrent medical problems were cited as the reason for the visit by 60% of the study group; 72% believed their chief complaint was moderately or very serious, 59% thought they needed immediate attention. Participants had a 28% admission rate to hospital, compared with 16% for the general emergency department population. Participants were more likely to be black patients who had medical aid as their primary insurance and were less likely to have workers' compensation insurance (Lucas and Sandford, 1998).

In one interventional trial for frequent attenders, patients who were admitted three or more times in a year were recruited to a prospective study whereby a personalised health care programme was established. This resulted in a 45% decrease in admissions and a 50% decrease in visits to the emergency department (Gamboa *et al.*, 2002). Patients attending another emergency department of one hospital more than five times in a year were assigned to a psychiatric social worker who used a case management model of care. The median number of emergency department visits decreased (5 *versus* 9, $p<0.01$) as did emergency department costs and general hospital costs. Alcohol use, drug use and homelessness all decreased in the intervention group. The study was a time series with no control group, so could not account for the natural history of such cases (Okin *et al.*, 2000).

Another study using the case management approach to frequent users showed that those in the study had a combined emergency department usage of 616 visits (median 26.5) and this reduced to 175 (median 6.5 visits) after the intervention. Detailed analysis was not described. In this study case management was decided by a multi-disciplinary group and was co-ordinated by a social worker (Pope *et al.*, 2000). However another case management approach in an RCT of patients with more than ten visits per year, did not show any improvement. However this intervention was simpler and mainly consisted of an established plan of

care within the emergency department, after a psychiatric or social work intervention (Spillane *et al.*, 1997).

In a study in Canada (Redelmeier *et al.*, 1994), homeless people who could communicate were randomised to receive compassionate care. A total of 133 consecutive adults were randomly assigned. Following the intervention there was a 28% reduction in emergency department attendances (95% confidence interval 14 to 40) and a decrease in return rate of 20% (95% confidence interval 3 to 30).

Older people (>65years) wait longer in emergency departments (Duffin, 2001) and are at particular risk of reattendance with 9% to 16% readmitted within one month, 27% in 90 days and 335 within six months (Petrie *et al.*, 1999; Friedmann *et al.*, 2001). Simple triaging screening tools have been developed to detect older emergency department patients who are at increased risk of emergency department use. A presence of two or more risk factors from a list of five items demonstrated a relative risk of 1.7 (95% confidence interval 1.2 to 2.3) of reattending emergency department at both 30 and 120 days (Meldon *et al.*, 2003). A literature review has highlighted the special needs of older people, service needs of older people and the policy implications (Bridges *et al.*, 1999). Position statements have been written for their care in the emergency department (Sowney, 1999).

A concurrent controlled trial of 543 patients in an American system compared usual primary care with care supplemented by social care home visits, education and development of a risk reduction plan, followed by regular monitoring by a nurse and social worker, with at least monthly team meetings. This resulted in a static admission rate for the control group and an increasing rate of 0.34 to 0.52 ($p<0.05$) in the control group (thought to be the natural history of the age group); there was also a significant fall in visits to doctors' surgeries. It has been suggested that more involvement by geriatricians in emergency department care may decrease attendances (Sommers *et al.*, 2000).

Miller *et al.*, (1996) undertook a non-randomised cohort study of 770 patients (after many exclusions, with 375 in the study and control groups) whereby a geriatric nurse clinician undertook a 30 minute structured interview and then advised on future care and arranged appropriate follow up. There were trends for fewer subsequent visits to emergency departments (0.26 intervention *versus* 0.39 control, $p=0.06$). However time in the emergency department was increased (292mins *versus* 231, $p=0.001$). No other health outcomes changed. The authors suggested that this might be because presentations at the emergency department were for late stage disease that is less amenable to treatment.

Use of a dedicated falls and syncope day case unit was assessed in Newcastle. In a retrospective analysis, the opening of the new unit resulted in a decrease in the length of stay of patients from 10.9 days

to 2.7 days and lower emergency activity (Kenny *et al.*, 2002). A system of reviewing elderly patients medication every six months by a pharmacist and giving education, reported by Catellier *et al.* (2000), resulted in a decrease in emergency department attendances. After correcting for other factors the risk was reduced by 23% at six months ($p=0.08$) and 58% at 12 months ($p<0.001$). The study was a time series with no control group without intervention. It was not clear how patients were enrolled but only included those with a low income and it excluded some people because they were members of a small racial minority. Social care interventions in the emergency department have been described in section 4.3.9.

Sending a series of letters to parents of children who regularly attended the emergency department for acute illness had no effect on subsequent attendance (O'Shea *et al.*, 1984). Another study supplying parents with pamphlets and video material about common illnesses and injuries was utilised to attempt to reduce attendance at the emergency department. No effect was demonstrated in the population of 118 interventions compared to a control group (Rosenberg and Pless, 1993).

Other interventions and studies about frequent attenders relate to those with chronic disease and older people and are covered in sections 4.3.9, 4.4 and 4.6.

4.3.9 Social care in the emergency department

As well as its effect on delayed discharge of care (see section 4.8), the role of social services can have a direct effect within the emergency department. The impact of social care on emergency medicine has recently been summarised by Bywaters and McLeod (2003), who highlighted that most of their conclusions were based on cumulative small studies. The aim of projects to introduce social workers into emergency departments is to facilitate safe discharge home either directly from the emergency department or following admission. The use of social workers in the emergency department is seen as positive by patients and staff (Bywaters *et al.*, 2002).

Brady *et al.* (2000), have demonstrated that elderly patients with unmet social needs are commonly encountered in emergency departments. In patients over 60 years of age, 16.9% had social needs and half of these were not recognised by the physician. UK studies have recognised that there is inadequate social screening of patients (Rowland *et al.*, 1990; Nankhonya, 1994). Graffeo *et al.* (2000) suggested that a simple screening tool (only two questions) can detect high risk elders, who have unmet social needs. Early discharge can be facilitated by undertaking a questionnaire on admission which results in earlier referral to social work and other support services (Parfey *et al.*, 1994). A Scandinavian study revealed an extra 33% of patients whose social needs had not been recognised, identified by use of telephone

follow up (Olsson *et al.*, 1986). However this was not repeated in an Israeli telephone follow up study (Soskoline, 1993).

In a French study (Monsuez *et al.*, 1993) in an inner city hospital, 1.2% of all attenders at the emergency department (representing 6.85% of admissions) required a social intervention. This resulted in housekeeping help (34.5%), arranging residential/nursing home care (28%), help to disadvantaged groups (23.5%) and help with health insurance (10%). In 82% of cases the intervention resulted in an alternative to hospital admission. This implies that 5.6 % of all admissions were preventable. A Canadian study by Boyack and Bucknam (1991) demonstrated that 11.6% of emergency department patients needed social work assessment and that 5% of admissions could have alternatives to admission if seen by a social worker. It also demonstrated a decreased rate of non-urgent attendances but the study is limited by its small size and lack of a control group. In another study, the use of two teams, one based in the community and one based in the emergency department in the hospital, aimed to facilitate home care. The authors reported reduced length of stay (1.7 days *versus* 6.3 days) and readmission rates (1.2% *versus* 1.5%) but no statistical analysis was reported (Hardy *et al.*, 2001).

In a study of a US emergency department Gordon (2001) demonstrated that social workers covering the department 24 hours a day can be economically beneficial. There were greater advantages in larger departments, when looking at decrease in return visits, prevention of admissions only for social reasons and saving in other staff time. The applicability of this study to the UK is limited by the variation in costing health care.

One UK study (Lewis *et al.*, 1994) concluded that the presence of a social worker provided care to a previously ignored group and helped relieve medical and nursing staff time. The study had no control group and purely measured numbers of intervention and no outcomes. However a trend to increasing referrals, resulting in social worker support and decreasing use of community care services was noted.

The patients seen by social workers in an emergency department were older and more acutely ill than the other attenders at the emergency department. Those most commonly seen were the elderly, adolescents and children under five years (Wrenn and Rice, 1994). They spent an average of one hour with each patient. This study also noted a reduction in the demands on medical and nursing staff to arrange home care, nursing home placement and other social services facilities.

Telephone follow-up of patients has been shown to reveal inadequacies in home support for elderly people that may require simple advice, referral to the GP or a visit. It is recognised that 6% of elderly patients discharged from emergency departments are admitted within 14 days after deterioration (Rowland *et al.*, 1990). This system does therefore have potential for initiating interventions that could potentially

decrease the number of return visits to the emergency department as well as improving the quality of care (Poncia *et al.*, 2000).

In a study of 177 patients attending an emergency department who were eligible for a supported discharge, 121 were entered into a support programme, 68% were over 65 years old and 54% lived alone. Patients were very satisfied with the service and 50% required no further service but 20% were readmitted. The study did not have any control group and therefore it is impossible to assess the true impact (Sinclair and Ackroyd-Stolarz, 2000).

Another scheme in the UK developed a joint initiative between four GP practices, a health authority, a community Trust and the local social services department. A nurse co-ordinator and six support workers offered a 24-hour service which reduced emergency admissions, cut the length of hospital stays and improved home support (Powell and Peile, 2000). It is recognised that improved liaison between the emergency department and community services (Monsuez *et al.*, 1993; Brookoff and Minitti-Hill, 1994) can reduce the return rate to the emergency department.

In Copenhagen, a trial of three-monthly scheduled medical and social preventative interventions was shown to reduce the number of emergency medical calls from older people. The intervention group had increased distribution of aids and more modifications to their homes (Hendrickson *et al.*, 1984).

Social work students nearing graduation have been used as liaison personnel between medical staff and emergency department patients. This was found to improve patient satisfaction (Evans *et al.*, 1993).

In a study (Coleman *et al.*, 2001) of 295 older people with chronic illness, those having monthly meetings with doctor, nurse and pharmacist had fewer emergency department visits (0.65 *versus* 1.08 visits p=0.005). Developing a practice guideline for the care of falls in elderly patients, which included health information and a one-off educational intervention directed at primary care providers, failed to reduce the incidence of subsequent falls or emergency department attendance (Baraff *et al.*, 1999). But a community support scheme using care attendants was able to reduce subsequent hospital readmission. This randomised controlled study involved 903 patients and showed that intervention patients had a 5% readmission rate compared to 12% in the control group. This study did not look at emergency department usage (Townsend *et al.*, 1988). However regular education interventions in another study have been reported to reduce over-utilisation of the emergency department (Small and Seime, 1986).

In a Swedish study 189 patients were referred from the emergency department to primary care. Over the next 12 months the proportion who returned decreased from 48% the year before the study to 42%

the year after compared to an increase from 41% to 51% in a control group ($p<0.01$). Of these patients, 7% account for 45% of the visits and this subgroup showed no change in their presentation rate (Hansagi *et al.*, 1989). Among repeat attenders, 80% given help by the hospital social worker had decreased attendance rates at the emergency department (Andren and Rosenquvist, 1985).

An American study looked at seven different models of intervention by social care professionals in the emergency department and its effect on re-use of the emergency department (defined as return to the emergency department within three months). After the introduction of the scheme the return rate of individuals reduced from 26.9% to 22.9% and the proportion of attenders who were 'returners' reduced from 42.3% to 27.6%. The greatest decline in re-use was seen where the social work team used a proactive intervention strategy. However strategies were not determined randomly and reflected patient needs. Knowledge of local community resources was considered critical to their effectiveness but this was not supported by evidence. There was no follow up at other sources of medical care (Keehn *et al.*, 1994).

However, social care provision is not a substitute for either medical or nursing care. A recent report has highlighted four cases where patients admitted to the emergency department received necessary social care provision but no further medical assessment of their underlying condition (Mcleod and Olsson, 2004).

Social care issues are also covered in the sections on

Admission avoidance (section 4.6).

Patient education (section 4.4).

Delayed discharge (section 4.8).

Social care supporting discharge (section 4.6.5).

4.3.10 Altering patient perception of waits

Patients who are kept informed, kept occupied while waiting and feel involved in their care have higher satisfaction perceptions (Naumann and Miles, 2001).

In a French study (Frank-Soltysiak and Court, 2002) it was shown that there was insufficient information provided on waiting time and reasons for delay and that this was a cause of people's perception of waiting time being extended.

A telephone questionnaire revealed that patients' perceptions of technical quality of care were more important than perceived timeliness of care or bedside manner in determining patient satisfaction (Rhee and Bird, 1996).

A study of 776 patients treated in an emergency department were sent a questionnaire two to four weeks after admission. This showed that only 22% could accurately estimate the waiting time to see a

physician. More respondents over-estimated than under-estimated, with nearly half over-estimating. In contrast, the total waiting time was accurately estimated by over a third of respondents, with a quarter of the respondents over-estimating. (Accuracy was defined as the actual time being in the same 15-minute time band as the perceived time.) The over-estimation may be for several reasons, most notably because unoccupied time will always feel longer than occupied time. Anxiety makes the wait seem longer and waiting alone will feel longer than group waiting. The difference between the two components of the wait may be due to the fact that pre-process waits (before anything active starts) often feel longer than in-process waits (in this case after having been initially seen until discharge) (Maister, 1985; Thompson *et al.*, 1996).

An American study utilised a video tape, lasting approximately six minutes and describing what could be expected within the emergency department, and services available, to patients and families. Possible delays were explained. Those who saw the informational video tape had significant improvements in scoring on questions about level of anxiety and appropriateness of any delays that occurred (Corbett *et al.*, 2000). It has also been shown that an informative brochure decreases the anxiety level of patients (Nelson *et al.*, 1997). The authors suggested a formulation of such a leaflet. Other distractions while waiting have been described but not evaluated (Sahnd, 1991).

A prospective randomised trial was undertaken to determine whether provision of clinical information to patients during their emergency department visit improved their perception of clinical care (Tran *et al.*, 2002). A total of 619 patients were entered into the study. In the intervention group the research assistant periodically provided patients with information regarding process and medical information at 15-minute intervals. On departing they were asked to fill out a validated questionnaire. There was no difference in the two groups in their demographics, their actual waiting time or their actual length of stay. However the perceived length of stay was significantly shorter, 92.6 *versus* 105.5 minutes ($p=0.03$). In addition, the number of patients who rated the physician as excellent or very good was significantly higher in the intervention group, 87.1 *versus* 80.0 ($p=0.03$).

Emergency department: conclusions

The evidence in the area of registration and documentation is poor. There is weak evidence that bedside registration, self-completion of forms by patients and transcription of notes may accelerate the process in the emergency department. The use of IT solutions in patient tracking has been described but not evaluated. Triage is universally used in emergency departments but if its only purpose is to prioritise patients then it may delay care, although it can provide a clinical safety net at busy periods. However, if it adds extra value by initiating investigations or treatment then it may save time. Some units

use triage as an opportunity to redirect up to one third of patients. Patients and their doctors are usually happy with this but up to a third may be triaged out inappropriately, up to 1% may be subsequently admitted and up to 1.6% may attend another emergency department. However many studies reported no adverse outcomes. There were however no prospective studies in the UK of such systems. Co-payment systems also have a demonstrable ability to reduce attendances. But the safety of such systems has not been established.

There have been many studies of fast track systems, including several RCTs, however none of these have been in the UK system. The evidence suggests that fast track does reduce waits of non-urgent patients and are safe and satisfactory to patients. Various models of fast tracks are available using medical and nursing staff. There is a need to assess the optimal system and which is effective in the UK system, but studies suggest that the earlier the person is seen by a senior person, the shorter their stay in the emergency department. Other fast track systems, for example for patients with fractured neck of femur, have not been adequately studied.

A wide variety of clinical initiatives have been shown to speed up care in the emergency department including use of local anaesthesia at triage, and wound closure techniques. Others have been shown to reduce reattendance rates, such as the use of steroids in asthma. Some initiatives increased length of care, for example use of sedation for suturing, but also improve quality of care.

A small number of frequent attenders account for the large workload of emergency departments. Various studies have looked at their characteristics but there are few interventions that have been tested. In those with chronic disease and in the elderly, there is stronger evidence with a variety of medical, social care and pharmacy interventions being shown to reduce reattendance. Such studies need to be undertaken in the UK. A variety of studies in the UK and abroad have confirmed that social workers working in the emergency department can reduce admissions. However most of the studies are small and have inherent weaknesses in their design.

Key points

- Triaging out of the emergency department can reduce numbers but more work is required to assess the safety of such systems.
- Co-payment systems reduce attendances but may equally reduce attendances by those requiring emergency care.
- Fast track systems for minor illnesses and injuries reduce waits. Ideal configurations include senior staff.
- Attendance by the elderly, those with chronic disease and those with multiple attendances may be reduced by various interventions. Trials are needed in this area, including the role of social workers.

Case study 3: Multi-disciplinary improvements

Summary of improvement

- A reduction in overall waiting times was demonstrated by an increase to 98% from 82% of patients seen within four hours attending the emergency department.
- A multi-disciplinary team (including GP, emergency nurse practitioner (ENP), accident and emergency consultant, x-ray staff and reception staff) to identify constraints, which resulted in faster assessment by an average of 20 minutes in all groups.
- Patients with major illnesses and injuries assessed and treated in a timelier manner.
- A realisation that a more focused approach to minor conditions frees resources for major condition management.

Changes made

- The primary change was eliminating triage.
- Minor conditions are now seen by the first available professional (nurse or doctor) within 15 to 30 minutes of arrival. Nurse and/or doctor treat to their abilities to discharge or refer, assessing, treating, initiating investigations (x-ray, bloods etc) or administering analgesia if required.
- A comprehensive assessment for major conditions was instituted, including an early investigation initial assessment pathway carried out by nurses for patients with major conditions.
- Better resource allocation, via identifying an area for early initiation of testing and investigations.
- Pathology identified neutral cost methods of eliminating the batching of samples, which had caused huge delays.
- Training up the nursing and healthcare team for venepuncture, cannulation, electrocardiogram (ECG) and plethysmography training for healthcare assistants, empowering individuals along the patient pathway.
- Nurses apply the use of patient group directions, enabling them to administer medication to patients under agreed criteria with specific conditions.
- Doctors were trained in basic dressings, dispensing medicines, applying slings etc. and giving follow-up information. This reduced handoffs.
- An extra nurse was allocated as a coordinator for improving patient flow and encouraging the new ways of working between 8.00 am and –4.00 pm.

Implementation advice

- Empower individuals to act as soon as clinically appropriate, driven by a nurse consultant and modern matron.
- Teach new junior doctors to adopt new working practices as soon as possible.
- Act on problems as soon as they arise, implement solutions as soon as feasible.
- Establish a flexible escalation policy, tailored to local working arrangements.
- Make even small changes: place kit in more user friendly areas; get more keys cut to reduce the time taken to find keys for drugs; make trays for notes to keep paperwork together; set up a new location board with tracing times.

Next steps

- ENPs are training at a recognised institution supported by clinical practice and will return to the emergency department. Initially they will be focused on minor illness and injury patients but with direct referrals for other conditions being developed.
- In-depth assessment by nursing teams of major patients planning investigations and working with specialist teams to optimise the patient journey.
- Improve management of chest pain patients by initially assessing chest pains, faxing ECG to the coronary care unit and setting up thrombolysis in the emergency department.
- Direct referrals to speciality for certain conditions by nurses to nurses and doctors. This has commenced with eye problems, so that any patient attending with an eye problem other than a chemical injury can have an assessment by a nurse or doctor, and is sent straight to the ophthalmic practitioner the same day during working hours.
- Reduce planned and unplanned returns to A&E by care pathways to primary care teams.
- Link with medical assessment and surgical assessment to train nurses to work up patients in a more timely manner.
- Develop wound care service and management of early sprains and strains by nursing staff working with physiotherapy and GP practice teams and direct referral to eye practitioners.
- Development of emergency care technicians which will enable the access to investigations for diagnosis to happen at the earliest point.
- Conversion of locum to Trust-grade posts – to practice at senior house officer level, working shifts.

For further information please contact:

Suzie Robinson
Nurses Consultant for A&E
Hinchingbrooke Healthcare NHS Trust
Hinchingbrooke Park
Huntingdon
Cambridgeshire
PE18 8NT

Table 7 Emergency department - registration (4.3.1)

Study	Domain	Study design	Study population	Intervention	Findings/conclusion
Goodacre *et al.*, 2001 Applicable to UK: **Yes** United Kingdom	ED	Nonrandomised study n = 1850 intervention triage first n = 1522 control usual presentation - reception first	All ambulatory patients presenting to ED in the time periods: Mon – Fri: 10.00 am – 2.00 pm & 5.00 pm – 9.00 pm Sat & Sun:12.00 pm – 8.00 pm - Fri, Sat & Sun 10.00 am - 2.00 am October and November 1999 ED size: 75,000 p.a.	Comparison of presentation protocols: 1. Reception first - patients registered before being seen in triage 2. Triage first – current practice triage preceded registration	Significant reduction in arrival-booking-assessment time interval for ambulant patients, if seen at reception first: - reception first (12.9 minutes); triage first (15.8 mins) ($p<0.0001$) - satisfaction greater with reception first (79.6%); triage first (48%).

Note. ED: emergency department.

Table 8 Triage and initial assessment (4.3.2)

Study	Domain	Study design	Study population	Intervention	Findings/conclusion
George S, Read S, *et al*. 1992 [193] Applicable to UK: **Yes** United Kingdom	ED	Nonrandomised study (N = 5954) n = 2515 intervention - triage n = 2522 control - no triage	All patients presenting to ED between8.00 am and 9.00 pm for six weeks. Exceptions: patients attending by appointment. ED size: 60, 000 p.a.	Nurse triage *vs.* no triage: Nurse triage group assessed by trained triage nurse and assigned to triage category (1-4). No triage group – assessed informally by nursing staff after registration at reception.	Significant increase in median waiting time (first attendance to medical treatment) for nurse triage group for category 1 & 2 patients, 16 mins to 26.5 mins and 37.5 mins to 46 mins respectively. No significant difference in median waiting time for category 3 & 4.
Ryan B 1995 #1389[487] Applicable to UK: **Yes** United Kingdom	ED	Observational study n=4548 intervention - formal triage n=5575 control - informal triage	50 randomly chosen patients from target hospital (N4585 from categories 2 & 3) ED size: medium	Formal triage system: 1. see immediately 2. semi-urgent 3. delay acceptable	Formal triage did not reduce waiting times for non/semi-urgent patients.
Mallett J & Woolwich C 1990 [341] Applicable to UK: **Yes** United Kingdom	ED	Observational study n=1027 intervention –triage n=822 historical control – pre-triage	ED department – inner London ED size: NK	Introduction of triage nurse	Time taken to be seen by a doctor or nurse 81.4% (seen within the hour) pre introduction of triage compared to 52.6% post triage introduction (p<0.001).

Note. ED: emergency department. NK: not known.

Table 9 Triage out (4.3.3)

Study details	Domain	Study design	Study population	Intervention	Findings/conclusion
Derlet *et al.*, 1992 Applicable to UK: **Yes** United States	ED	Cohort study (N=136,794) n=21,069 intervention – triage out Control: No	Adults attending ED Three-year study. ED size: 60 000 p.a.	Triage out by protocol	A group of patients can be safely triaged out: - 15% triaged out, no adverse outcomes detected. - 22% did not seek medical care. - 1.6% sought care at another ED
Birnbaum *et al.*, 1994 Applicable to UK: **Yes** United States	ED	Cohort study (N=534) Control: No	Adults attending ED ED size: 50 000 p.a.	Triage out by protocol	Could not validate the protocols to triage out 1.1% of triage out patients were hospitalised
Rivara *et al.*, 1986 Applicable to UK: **Yes** United States	ED	Cohort study (N=748) Control: No	Selected children (1 week to 17 years old) attending during day time ED size: >40,000	Triage out by protocol	61% of the 748 studied were triaged out: -31% to community health centres -17% to physicians offices - 13% self care
Kelly, 1994 Applicable to UK: **Yes** United States	ED	Cohort study Control: No	ED patients ED size: 2700 per month following intervention	Triage out by protocol	ED attendance reduced by 27%; attendance of non-emergency cases reduced by 68%
Lowe *et al.*,. 1994 Applicable to UK: **Yes** United States	ED	Cohort study (N=927) Control: No	All non-emergency ED patients ED size: 78 000 p.a.	Triage out by protocol	Guidelines were not adequate to allow triage out 33% (95%CI=32-51) of triage out patients were appropriate visits

Table 9 (continued)

Study details	Domain	Study design	Study population	Intervention	Findings/conclusion
Washington *et al.*, 2000 Applicable to UK: **Yes** United States	ED	Cohort study (N=1187) n=226 intervention – deferred care Control: No	Adults attending ED ED size: 30 000 walk-in-visits p.a.	Triage out by protocol	Criteria can be used for determining patients suitable for deferred care 19% met criteria for deferred care No adverse incidents were detected
Straus *et al.*, 1983 Applicable to UK: **Yes** United States	ED	Cohort study n=398 intervention – referred to PC n=500 historical control	Adults attending ED with no regular source of primary care ED size: 60 000 p.a.	Referral to primary care from triage	No reduction in ED utilisation among those enrolled in primary care
Derlet & Nishio, 1990 Applicable to UK: **Yes** United States	ED	Cohort study (N=22 390) n=4186 triage out Control: No	Adults attending ED ED size: 50 000 p.a.	Triage out by protocol	Triage out can be safely performed -19% triaged out -no adverse outcomes -1.3% dissatisfied
Derlet *et al.*, 1995 Applicable to UK: **Yes** United States	ED	Cohort study (N=176 074) n=31 065 triage out Control: No	Adults attending ED ED size: 60 000 p.a.	Triage out by protocol	Triage out can be safely performed. - 18% of attenders triaged out - no adverse outcomes detected

Hansagi *et al.*, 1997 Applicable to UK: **Yes** Sweden	ED	Cohort study n=345 – advised group n=107 - control group – when advisor not available	Patients attending ED between 8.00 am – 5.00 pm Mon-to-Fri (4-week trial) Excluding: children <16 yrs and patients attending by ambulance ED size: 90 000 p.a.	Assistant nurses triaged patients into urgent or non-urgent categories. Non-urgent were seen by a nurse-adviser who provided medical advice, advice on alternative sources of health care, or made an appointment with appropriate health care providers	The nurse-advisor interviewed 21% (n=454) of patients attending in the trial arm, 11% (n=192) were referred to alternative sources of health care

Note. ED: emergency department. NK: not known.

Table 10 Co-payment systems (4.3.4)

Study	Domain	Study design	Study population	Intervention	Findings/conclusion
Chande, 1997 Applicable to UK: **No** United States	ED	Observational study (N=200) - Medicaid managed care plan n=117 - capitated Medicaid plan n=83 - historical control	Child ED attenders in different insurance schemes ED size: NK	Introduction of new fee for service plan.	At 6 months fee usage reduced attendance from 86% to 68% (p=0.001). No reduction in non-fee group. At 12 months no significant difference
Selby *et al.*, 1996 Applicable to UK: **No** United States	ED	Nonrandomised study: n=30,276 - co-payment n=60,408 control 1 n= 37,539 control 2	ED attenders affected by co-payment ED size: NK	Introduction of $25-$35 co-payment	Co-payment for ED use was associated with 15% decline in ED use, mostly with non-emergent conditions
Murphy *et al.*, 1997 Applicable to UK: **No** Ireland	ED	Observational study: n=45,302 post intervention n=43,202 historical control	All ED attendances ED size: 45 302 p.a.	Removal of a perverse financial incentive to attend ED rather than primary care	A small reduction in non-urgent attenders occurred. GMS-ineligible patients decreased from 45.3% to 44% (95% CI -0.6 to -1.9%)
O'Grady *et al.*, 1985 Applicable to UK: **No** United States	ED	RCT (N=3973) - 0% co-insurance - 25% co-insurance - 50% co-insurance - 95% co-insurance	ED attendances <62 years ED size: NK	Introduction of co-payments	Significant reduction in ED attendance 20%-35% (p<0.05)
Cameron *et al.*, 1999 Applicable to UK: **Yes** Australia	ED	Observation study Historical control	Patients attending ED in 21 hospitals ED size: 700 000 p.a. (21 hospitals)	Introduction of emergency service enhancement program - a bonus payment to hospitals to improve emergency access	Significant reduction in ambulance diversions <100 pre-introduction of ESEP *vs.* 600 post-introduction (p<0.001) Significant improvement in waiting times for triage category 2 & 3 patients (p<0.05)

Note. ED: emergency department; GMS: general medical services.

Table 11 Fast track for minor injuries patients (4.3.5)

Study details	Domain	Study design	Study population	Intervention	Findings/conclusion
Cooke *et al.*, 2002 Applicable to UK: **Yes** United Kingdom	ED	Pre-post intervention comparison (N=13,918): n=6,801 intervention – separate stream n=7,117 control period	All minor injuries patients attending ED during 10 week period. ED size: 68 000 p.a.	Setting up a separate stream for minor injuries care	Separate minor injuries stream significantly decreased number of trauma patients waiting 1 hr+. Patients waiting less than 30 mins: - 35.4% (pre) - 44% (post) (chi=103.34 p<0.0001)
New, 2000 Applicable to UK: **Yes** United Kingdom	ED	Pre-post intervention comparison (N=2,696) Historical control	All ED attenders ED size: 52 000 p.a.	UNAS assessment nurse advice/triage service/minor injury facilities . Algorithm tools (computerised) as aid to decision making	ED LOS: - UNAS self-care discharges =36 minutes - UNAS non-self-care discharges = 75minutes A&E = 100 minutes
Partovi *et al.*, 2001 Applicable to UK: **Yes** United States	ED	Non-randomised study: n=920 intervention – faculty triage n=814 control – no triage	Patients using ED on 8 Mondays 9.00 am to 5.00 pm ED size: 52 000 p.a.	Faculty triage at trauma centre — an ED faculty member added to the regular triage area staff	Faculty triage offers moderate reduction in LOS - waiting time reduced from 445 mins to 363 mins (reduction of 82 mins)
Ardagh *et al.*, 2002 Applicable to UK: **Yes** New Zealand	ED	Non-randomised study: n=2263 intervention – RAC period n=2204 control – non-RAC period	All ED attenders ED size: 65 000 patients p.a.	Rapid cases seen by separate doctor and nurse team alternate weeks, extra staff used in main ED other weeks	Significant reduction in ED LOS for: - triage category 4 for RAC period 34.5 mins compared to 42.7 non-RAC period (p=0.004) – triage category 5 for RAC period 34.3 mins compared to 45.4 non-RAC period (p=0.02) - no significant change for triage categories 2 and 3 patients

Table 11 (continued)

Study details	Domain	Study design	Study population	Intervention	Findings/conclusion
Grant *et al.*, 1999 Applicable to UK: **Yes** Australia	ED	Pre-post intervention comparison: n=10,476 intervention RAT period n=10,691 historical control	Patients attending ED between July-October 1997 ED size: approx 42 000 p.a.	Rapid Assessment Team (RAT) comprising triage nurse and doctor	Significant reduction in median LOS 32 mins compared to 50 minutes in the same period the previous year ($p<0.001$)
Docimo *et al.*, 2000 Applicable to UK: **Yes** United States	ED	Pre-post intervention comparison: n=573 intervention – triage guidelines n=169 control – pre triage guidelines	Non-urgent ED users ED size: 48 000 p.a.	Creation of a fast track system and new triage guidelines for patients with minor injuries	Placing non-acute in fast track significantly decrease total LOS in ED to 1 hr 47 mins (M)
Simon HK *et al.*, 1996 Applicable to UK: Yes United States	ED	Cohort study Control: Biased	Paediatrics with a low triage score ED Size: 33 000 p.a.	Fast track clinic	Significant reduction in ED LOS for paediatrics fast track 107 mins compared to 149 mins for all other patients in ED ($p<0.01$)
Bond, 2001 Applicable to UK: **No** Saudi Arabia	ED	Pre-post intervention comparison Control: Yes	All non-urgent patients attending the unit ED size: 68 000 p.a.	Setting up of physician/nurse assessment/treatment area for non-urgent patients.	Reduction in ED waiting time 58 to 25 mins - not a statistical test analysis.

Note. ED: emergency department; LOS: length of stay; UNAS: urgent needs assessment service.

Table 12 Other fast tracks (4.3.6)

Study details	Domain	Study design	Study population	Intervention	Findings/conclusion
Rajmohan, 2000 Applicable to UK: **Yes** United Kingdom	ED	Pre-post intervention comparison: n=90 intervention – fast track n=104 control – pre fast track	Patients with suspected hip fractures – December 1997-June 1997. ED size: 43 000 p.a.	Fast track protocol: - suspected hip fractures assessed by ED SHO - patients with hip fractures but no other medical injuries or acute medical problem were fast tracked to ward. - patients with isolated fractures fast tracked <1 hour of arrival	Reduction in mean transfer time to the ward 2 hrs 45 mins ± 57 pre-intervention to 1 hour 32 mins ± 41 ($p<0.001$). The number of patients transferred within 1 hr increased from 3 out of 104 (pre-intervention) to 24 out 90 (post-intervention)
Ryan *et al.*, 1996 Applicable to UK: **Yes** United Kingdom	ED	Prospective audit (N=30) Control: No	Older patients with fractured neck of femur ED size: 54 000 p.a.	Fast track protocol	Reduction in time from ED to ward from 4.5 to 2.5 hrs $p<0.001$)
Charalambous *et al.*, 2003 Applicable to UK: **Yes** United Kingdom	ED	Pre-post intervention comparison: n=116 intervention – protocol period n=50 control – pre protocol period	Patients with hip fractures – presenting Mon to Fri 7.30 am – 5.00 pm ED size: 96 000 p.a.	Trauma co-ordinator informed of the arrival in ED of patients with suspected hip fracture. Trauma co-ordinator liaises with key departments and services (radiology, haematology, ward, portering) to ensure timeliness of patient journey.	Reduction in median transfer time from ED to ward (7hrs 4mins pre-intervention to 2hrs 46mins post). Increase in the number of patients with hip fracture in a ward bed within 3 hrs (4% pre-intervention to 39% post intervention)
Dunn, 1989 Applicable to UK: **Limited** United States	ED	Observational study	Acute psychiatric patients attending ED ED size: NK	Institution of a 'fast track' nurse managed system for psychiatric assessment of patients attending ED	Reduction in ED psychiatric evaluation from 108 mins to 48 mins Also reduction in chance of violence

Note. ED: emergency department.

Table 13 Emergency department clinical changes (4.3.7)

Study details	Domain	Study design	Study population	Intervention	Findings/conclusion
Browne *et al.*, 2001 Applicable to UK: **Yes** Australia	ED	Pre/post intervention: n=2854 intervention – clinical pathways n=2680 control - pre-clinical pathways	Paediatric patients with gastro-enteritis, asthma, or croup ED size: 42 000 p.a.	Use of clinical pathways for gastro-enteritis, asthma and croup in children clinical pathway	Clinical pathways keep children out of hospital, decrease readmission rates, reduce length of stay with a 30% reduction in waiting times (32.9 versus 17.5 p<0.001).
Gill *et al.*, 2000 Applicable to UK: **Yes** United States	ED	Survey (N=121) Control: No	Children with lacerations <10-years of age ED size: 27 000 p.a.	Midazolam sedation versus no sedation	Midazolam increased LOS in the ED. LOS control=116.7 Trial=133.8 mins p=0.03
Brandt *et al.*, 2000 Applicable to UK: **Yes** United States	ED	Pre-post intervention comparison Control: Yes	Burn patients in ED referred to outpatient burn clinic ED size: NK	Triage protocol referring minor burns (<15% surface) to burn clinic	Triage protocol reduces LOS in ED 103 mins versus 44 mins
Sin & Man , 2002 Applicable to UK: **Yes** Canada	ED	Retrospective case note review Control: No	Asthma patients on a govt-sponsored drug plan ED size: NK	Use of inhaled steroids after ED discharge	Users of inhaled steroids had 45% less relapses requiring an ED visit (adjusted risk ratio 0.55, 95%CI 0.44-0.69)
Harish *et al.*, 2001 Applicable to UK: **Limited** United States	Community	RCT n=60 intervention n=69 control group	Asthma patients aged 2-17 years ED size: NK	Specialty clinic care	No significant reduction in total ED attendance. Mean number of visits for individual decreased (0.3 versus 0.1, p0.01)
Silberstein *et al.*, 2003 Applicable to UK: **Yes** United States	ED	Retrospective case note review Control: No	Migraine sufferers ED size: NA	Use of preventative medication in a migraine management	Reducing number of visits to emergency departments by 81.8%.

Note. ED: emergency department; LOS: length of stay.

Table 14 Frequent attenders (4.3.8)

Study	Domain	Study design	Study population	Intervention	Findings/conclusion
Gamboa *et al.*, 2002 Applicable to UK: **Limited** Spain	Hospital	Cohort study Control: No	Patients with more than 3 admissions in a year ED size: NA	Hospital consultation and subsequent telephone access	Personalised health plan reduces health needs 50% reduction in ED visits, 26% decrease in hospital days.
Catellier *et al.*, 2000 Applicable to UK: **Limited** United States	Community Pharmacy	Cohort study: n=211 6 months n=121 12 months n=387 baseline	Patients =65 (June 1994 - May 1996) - patients with an income less than 140% of federal poverty level - no private prescription insurance - not eligible for Medicaid ED size: NK	Senior PHARMAssist program. Review of medication regimes by pharmacist every 6months	Decrease in ED visits. Probability of an ED visit was reduced 23% at 6 months (OR=0.77, p=0.077) and 58% at 12-months (OR=0.42, p<0.001)
Miller *et al.*, 1996 Applicable to UK: **Limited** United States	ED	Non-randomised study (N=770) n=385 intervention n=385 control	Older patients attending ED with acute illness on alternate days from 12.00 pm - 8.00 pm . February – December 1992 Excluded: - <1-hour stay - left without being seen - re-visit of patient - trial patient - refusal to participate ED size: 24 000 p.a.	Evaluation by geriatric nurse clinician to identify medical, dental and social problems. Recommendations to patient, family, attending ED physician, follow-up services arranged.	Non-significant (p<0.1) decrease in visit to ED: trial (0.26), control (0.39). Significant (p<. 001) increase in time in ED trial (292 mins) control (231 mins).

Table 14 (continued)

Study	Domain	Study design	Study population	Intervention	Findings/conclusion
Redelmeier *et al.*, 1995 Applicable to UK: **Yes** Canada	ED	RCT n=65 intervention n=68 control	Homeless patients who were: - not psychotic - inebriated - able to speak English ED size: NA	133 consecutive adults were randomly assigned to compassionate care, involving multiple sessions using befriending type techniques	Significant reduction of 28% in ED attendances for intervention (95%CI 14-40, p<0.01) and a decrease in return rate of 20% (95%CI 3-30, p=0.02)
O'Shea *et al.*, 1984 Applicable to UK: **Limited** United States	ED	RCT n=445 intervention n=215 control	Children (=18-years) with acute illness attending ED more than 4 times in 2 years ED size: NK	Parents were sent 3 letters emphasising the importance of continued health care for children and providing information about community and hospital ambulatory paediatric services	No significant reduction in attendance at ED
Rosenberg & Pless, 1993 Applicable to UK: **Yes** Canada	ED	RCT n=118 intervention n=128 control	Children with more than 2 visits in previous year ED size: 15 000 p.a.	Pamphlet and video presentation	Intervention group had ED visit rate of 0.43 compared to 0.52 (p=NS)

Note. ED: emergency department; NK: not known.

Table 15 Social care in the emergency department (4.3.9)

Study	Domain	Study design	Study population	Intervention	Findings/conclusion
Boyack & Bucknum, 1991 Applicable to UK: **Yes** Canada	ED Social care	Cohort study (N=455) Control: No	Patients presenting to emergency department ED size: NK	Quick response team comprising physician, nurses, social worker	24 acute admission deferred
Coleman *et al.*, 2001 Applicable to UK: **Limited** United States	Primary health care ED	RCT (N=295) n=146 intervention n=149 control	Older people =60 with frequent hospital usage and chronic disease Serving population: 317 000	Monthly home visits with GP, nurse and pharmacist	Intervention resulted in reduction in ED attendance (0.65 vs. 1.08 visits, p=0.005)
Keehn *et al.*, 1994 Applicable to UK: **Limited** United States	ED	Cohort study (N=1,758) n=385 intervention n=474 comparison	Older people ED size: 40 000 p.a.	Seven different models of intervention by social care professionals in the emergency department	Reattendance reduced from 26.9% to 22.9% The greatest decline in reattendance for proactive intervention strategy.
Baraff *et al.*, 1999 Applicable to UK: **Yes** United Kingdom	ED	Pre-post intervention comparison (N=1,899) n=759 post-intervention n=1,140 pre-intervention	Patients =65 attending the emergency department with falls. ED size: 3 EDs 372 197 p.a.	Practical guidance on falls reduction given to ED physicians to improve their understanding.	No reduction in falls or hospital admissions - 18% pre-intervention - 21% post-intervention (p=0.162).
Hansagi *et al.*, 1989 Applicable to UK: **Yes** Sweden	ED	Pre-post intervention comparison (N=454) n=192 intervention n=107 control group:	Patients with non-urgent conditions ED size: 90 000 p.a.	Referral to primary care from triage if condition not urgent	Significant reduction in ED visits in the intervention group (48% to 42%) compared to an increase in the control (41% to 51%) (p<0.01)

Note. ED: emergency department.

Table 16 Patient education (4.4)

Study details	Domain	Study design	Study population	Intervention	Findings/conclusion
Murphy *et al.*, 2000 Applicable to UK: **Yes** Ireland	ED	Cohort study (N=4459)	Patients using ED in triage categories 3 and 4 between Aug 1993-Oct 1994 ED size: NA	Employed a GP to treat triage category 3 (semi-urgent) and 4 (delay acceptable) patients in ED	No reduction in ED reattendance following single contact with GP - 42% of patients reattended at least once within 2 years of index visit
Johnston *et al.*, 2002 Applicable to UK: **Limited** United States	ED Level I paediatric trauma centre	RCT (N=631) n=318 intervention n=312 control	Adolescents attending ED with injury ED size: NK - urban	Behaviour change counselling with social worker exploring injury-related risk behaviour *vs.* routine ED care. Behaviours including: - seat belt use - bicycle helmet use - drink-driving - driving with an impaired driver - binge drinking - carrying a weapon	No significant differences in injury rate over the 6-month follow-up period although more likely to use seat belts and cycle helmets
Grossman *et al.*, 1998 Applicable to UK: **Limited** United States	Paediatric ED	Non-randomised study (N=709) n=135 minimal intervention n=180 case management n=613 comparison	Medicaid funded children attending with non-urgent conditions ED Size: NK	Case management group: - information from health care professionals - assistance with making an appointment - support provided for 3 months post index ED visit Minimal intervention group: -clerical assistance about the importance of GP	Significant reduction in attendance at 6 months for the case management group (14.5%); 11.5% for the minimal management group ($p<0.01$)

Note. ED: emergency department; NA: not available; NK: not known.

4.4 Patient education

Education of patients as to what types of condition are appropriate for the emergency department is widely advocated and government campaigns are run regularly (Department of Health, n.d.). Educational programmes have had some success in reducing attendances at the emergency department. An early study stressing the importance of a telephone call before attending caused a drop from 29% to 18% in 'inappropriate' emergency department attendance (Benz and Shank, 1982).

Hobday (1988) suggested that more education is needed on the role of GP and emergency department. These campaigns hope to reduce the workload of emergency departments. However, a questionnaire study of 117 trained emergency department nurses, using case vignettes, revealed a wide discrepancy in what staff believed was appropriate for emergency department (Green and Dale, 1990).

Self-management education of COPD patients showed it had no effect on hospital admissions and emergency room visits (Monninkhof *et al.*, 2004).

In a Cochrane review (Gibson *et al.*, 2003) of education of adults with asthma, 12 trials were included. In one study, limited asthma education was associated with reduced emergency department visits (reduction of -2.76 average visits per person per year, 95% confidence interval -4.34 to 1.18). A systematic literature review was undertaken to assess whether asthma education leads to improved outcomes in children who attended an emergency department. Eight trials involving 1407 patients were included. In all, the education was provided either by nurses or researchers. Compared to the control group, education did not reduce subsequent emergency department visits (four trials, relative risk 0.87, 95% confidence interval 0.372 to 2.08) hospital admissions (five trials, relative risk 0.74, 95% confidence interval 0.382 to 1.46) or unscheduled doctors' visits (five trials, relative risk 0.74, 95% confidence interval 0.492 to 1.12). A subgroup analysis did not reveal any differences for either the scale of the intervention or the timing of the intervention and recruitment (Gibson *et al.*, 1998). In another study, 27 patients who presented with asthma were asked to complete a questionnaire exploring the attitudes and self-efficacy of their care using a validated questionnaire. This demonstrated that attitudes and self-efficacy rather than knowledge had the most significant impact both on treatment compliance and on the number of emergency department visits and hospitalisations (Scherer and Bruce, 2001).

On the basis of the published trials, there is no firm evidence to support the use of asthma education for children who have attended the emergency department for asthma as a means of reducing subsequent visits, hospital admissions or unscheduled doctor visits.

Some trials appeared to show clear evidence of benefit, but reasons for differences between these and the negative studies is not clear. More research is required (Haby *et al.*, 2001).

A study looking at behaviour change counselling offered to injured adolescents enrolled 631 patients and had a 75% follow-up rate by six months. The behaviour change counselling produced an increased use of seatbelts (relative risk 1.34, 95% confidence interval 1.00 to 1.79) and an increase in use of bicycle helmets (relative risk 1.81, 95% confidence interval 1.02 –to 3.18). However it did not have any effect on other behaviours and produced no change in the likelihood of needing medical attention in the next six months (Johnston *et al.*, 2002). Another education programme for adolescents who had presented to emergency departments with self-destructive behaviour managed to reduce the number of emergency admissions and increase early help-seeking (Deykin *et al.*,1986).

A prospective trial in a paediatric emergency department in Ohio gave Medicaid families information about the importance of primary care provision and provided assistance with making an appointment. The health professional then continued to work with the family for up to three months in improving their access to primary health care. This decreased the emergency department attendances by 11.1% over the next six months but there was no difference in utilisation beyond six months up to 24 months (Grossman *et al.*, 1998). This intervention may however not be applicable in the UK NHS system.

Nearly 7000 households were mailed with a booklet informing them about common non-urgent conditions and encouraging the use of alternatives to emergency care. It did not significantly reduce the attendance at emergency departments (Rector *et al.*, 1999).

Single contact with a GP in the emergency department without a specific education strategy has been shown to be ineffective in reducing subsequent attendances. However this study was in a fee paying system so may not be applicable elsewhere (Murphy *et al.*, 2000).

Patient education: conclusions

The effects of patient education have been highly variable; no studies of leaflets had an effect. Education of those with chronic disease has been more successful. More research should be undertaken to find out the reasons for the variability before further mass publicity schemes are launched.

Key points

- Patient education is of unproven in most areas except chronic disease management.

- Phoning for advice before going to the emergency department may reduce attendances.

4.5 Diagnostics

4.5.1 Laboratory tests

Waiting for results of tests is recognised as one of the four commonest reasons for patient delays in the emergency department (Fletcher *et al.*, 2004). Emergency physicians believe that delays in laboratory results often delay treatment and admission. One study reported that laboratory control of specimen handling and rapid transport times were key issues (Steindel and Howanitz, 2001).

The process from taking a blood sample until delivery of results to the clinic is a complex process involving ordering the tests, collecting the blood, delivering it to the laboratory, analysing it, reporting the results and delivering the results to the clinician. Studies have undertaken root cause analysis of the delays that can happen in this process. One study showed that the root causes of delays were laboratory assistant availability, the rate when repeat samples were needed, the volume of tests for patients being admitted to hospital and the order processing time (Fernandes *et al.*, 1997). This is likely to be highly variable between different institutions, but may form a basis for individual organisations to analyse where changes are most needed. A Belgian study showed laboratory tests added an extra 81 minutes to emergency department turnaround times (Askenasi *et al.*, 1989).[1]

Several strategies can be used to reduce these delays:

- reducing those needing tests
- reducing the delivery time of the specimen to the laboratory
- performing the tests and making results available more quickly
- reducing the delivery time of the result to the clinician.

In one study (Knott and Meyer, 2003) of 256 patients, 53% of patients in an emergency department had blood tests requested. Their expected disposition was not altered by the results of the blood tests in 87%, but staff were poor at prospectively identifying those who would be admitted irrespective of the results (sensitivity 44%, specificity 72%). Having nurses taking bloods rather than residents reduced the emergency department length of stay by 49 minutes (258 mins *versus* 307 mins, $p<0.05$) in a randomised trial (Singer *et al.*, 2002).

Point of care testing has been shown to deliver results within two minutes and has good accuracy (Woo *et al.*, 1993), including cardiac markers (Azzazy and Christenson, 2002). However, another study suggested that resources required to establish a dedicated ‘stat’ (emergency) laboratory in the emergency department would be more beneficial if directed toward reducing the pre-analytic delays (Saxena and Wong, 1993). A systematic review (Fermann and Suyama, 2002) has been undertaken of point of care testing and emergency

department application. It concluded that compared to central laboratory models, point of care testing decreased the total test turnaround time (the interval between the time a test is ordered and the time a treatment decision is made). However when point of care testing is compared with near site satellite laboratories the improvement in total test turnaround time is less marked. There is however discrepancy in whether a decreased total test turnaround time results in a decreased length of stay. An RCT was undertaken to examine the use of point of care testing in an emergency department and the extent to which it resulted in differences in clinical outcome. In 7% of cases there was change in management that was considered to be critical, with decisions made 74 minutes earlier when point of care testing was used for haematological tests and 86 minutes earlier for biochemical tests. There was however no difference between the groups and the amount of time spent in the department, the length of stay in hospital and the admission rates (Kendall *et al.*, 1998). A randomised controlled study in Canada showed a median stay that was significantly shorter in those randomised to point of care testing, particularly in those who were destined to be discharged home but not in those destined to be admitted (Murray *et al.*, 1999). A prospective non-randomised clinical study by Sands *et al.* (1995) showed point of care testing reduced length of stay by 17% and physicians reported that treatment would have commenced earlier or changed in 9.5% of cases. However the various systems in hospitals are important in this situation in that total test turnaround time is made up of several components from the time the blood is taken to arriving at the lab, analysis being undertaken and the result being returned. In a study by van Heyningen *et al.* (1999), the turnaround time varied according to delivery systems, with near-patient systems needing no delivery system and therefore achieving turnaround times of five minutes. This study showed that those using portering systems had turnaround times which were longer by 58 minutes and those with pneumatic systems 49 minutes. However in the study, the results did not directly relate to shortened length of stay as the total patient waiting time was significantly different among the three groups and the authors believe that the impact of external factors such as bed availability and other tests were important. The study did not give details of methodologies or statistics. It appears therefore that point of care testing can eliminate the majority of pre- and post-analytical delays. The establishment of a point of care satellite testing laboratory that can undertake pregnancy testing, urine dipstick and cardiac markers resulted in a decreased length of stay for those patients requiring these tests of 41.3 minutes ($p=0.006$) (Lee-Lewandrowski, 2003). A prospective trial of point of care testing by non-laboratory staff analysed 15 000 visits and it demonstrated acceptable accuracy for hand-held devices. However it failed to demonstrate any change in length of stay in any patient sub-group and the authors therefore considered it unlikely that routine use of hand-held point of care

testing devices in a large emergency department was sufficient to decrease length of stay (Parvin *et al.*, 1996). When looking at laboratory turnaround time it was found that the therapeutic time was only one to two minutes shorter for bedside testing compared with satellite lab and nine to 14 minutes shorter in a satellite lab compared to a centralised lab (Meredith *et al.*, 1998).

In point of care testing, samples were processed significantly faster (median 5 mins, $p<0.05$) than using the laboratory with porters (median 58 mins) or using a vacuum system (median 49 mins) (van Heyningen *et al.*, 1999). However the shorter turnaround time did not result in reduced patient waiting time because other factors had a greater impact. Introduction of an air tube system and a results printer in the emergency department, without any point of care testing, resulted in a 26 ⁋3 minute saving in transport time and 18 minute saving in results accessing. However analysis was limited and not described. (Johnston *et al.*, 1997)

Using a broad range of continuous quality improvement techniques, the turnaround time in a laboratory was reduced by 62% along with cost savings (Bluth *et al.*, 1992). This process involved streaming tests into 'stat' (emergency), 'ASAP' and 'routine', and redesigning the process to eliminate unnecessary steps. Another study showed that streaming was not necessary if complete system automation including the use of robotics was introduced (Sarkozi *et al.*, 2003).

In a retrospective observational study of more than 3000 emergency requests for biochemistry tests including more than 1800 medical admissions, an assessment was made of the proportion of the biochemistry tests that were accessed via a ward terminal within one or three hours of becoming available. Only a quarter of emergency department requests were seen within one hour of being made available, a further 15% within the next two hours. The authors suggest that the use of terminals may therefore slow down the process compared to telephone requests for tests. The study is unable to differentiate the reason for staff not accessing the tests, which may reflect the proportion of urgent tests that are not truly urgent, or alternatively may be because of the additional hurdle in obtaining results via a ward terminal as opposed to their previous system within the hospital of results being telephoned. They therefore suggest that the use of local printers to high intensity areas may be better at ensuring results are appropriately delivered (Kilpatrick and Holding, 2001). The number of times a person logs on looking for results can be reduced by having test status with continuous updating, on the live clinical information system (Marinakis and Zwemer, 2003).

4.5.2 Imaging

Approximately 35% to 50% of emergency department attenders require some form of imaging. The majority require plain x-rays of limbs or

chest. A Belgian study showed x-ray investigations added an extra 40 minutes to emergency department turnaround time (Askenasi *et al.*, 1989). Innovative use of data has enabled some emergency departments to reduce the x-ray cycle time and improve patient satisfaction. The data was used to help track patients and therefore identify delays, resulting in a revamped x-ray process cutting the cycle time by more than half and with consequent shorter stays for all emergency department patients (Anon., 1998b). But studies of such innovations have not been published.

There is extensive literature describing the reductions in waiting times resulting from the ordering of x-rays in an early stage of the emergency department process. This is usually by the triage nurse, so that the patient has already had the x-ray undertaken by the time they see the clinician who will make the definitive clinical management decisions. This is described in section 4.5.3.

American systems often require reporting by a radiologist before the patient was seen again by the emergency physician. This adds 70-90 minutes to their transit time compared to letting the emergency physician see the films directly. The report (Espinosa, 1997) gives no details of how these figures were obtained. Although the UK system has always had direct viewing, it is important to bear this figure in mind for future quality improvements in reporting.

Implementation of the Ottawa knee rule for ordering x-rays after acute knee injury resulted in a relative reduction of 26.4% in the number of patients referred for knee x-ray compared to a relative reduction of only 1.3% in the control group ($p<0.001$) in a trial of 3907 consecutive adult patients (Stiell *et al.*, 1997). This caused a reduction in time spent in emergency department in the non-fracture patients (85 minutes *versus* 118 minutes). A before and after study of 2342 patients with ankle injuries (Stiell *et al.*,1994), demonstrated that the introduction of the Ottawa ankle rules reduced the number of x-rays taken and those not having x-rays spent less time in the emergency department (80 minutes *versus* 116 minutes, $p<0.0001$). In a small prospective study of 152 patients, use of the Ottawa ankle rules by nurses was not shown to decrease the time a patient spent in the emergency department compared to the previous system of physician ordered x-rays. However in the system studied it was acknowledged that the radiograph turnaround was not the rate limiting step (Fiessler *et al.*, 2002).

McNally undertook a prospective trial of the use of posters to increase the uptake of guidelines for ordering x-rays. He showed that the posters caused a decrease in referral for skull x-rays and abdominal x-rays but not ankle and cervical spine x-rays (McNally *et al.*, 1995). But the study was criticised because the outcome measured was the proportion of patients referred for particular x-rays which is not the same as the proportion of patients managed in accordance with

guidelines. The follow-up of patients who did not undergo radiography appeared inadequate and was not detailed; the reduction in the proportion of patients undergoing radiography therefore may have been inappropriate. It is therefore important to remember that a reduction in radiograph numbers may not be the same as improvement in quality of care (Hardern and Harmer, 1995).

Introduction of a picture archiving communication system (PACS) was studied whereby ten computerised topography (CT) studies were each looked at by residents on a film system and on a work station system. The average time required to transmit the images was reduced from approximately 40 minutes to 16 minutes using the archiving system. The actual interpretation times were comparable. It is therefore suggested that if a system has a delay because of the need to print and transport images to an on-call radiologist this could be reduced by a PACS system (Hirschorn *et al.*, 2001). A three and a half year study looked at the effect of changing to a filmless image management system on the time required to produce x-ray images in the emergency department. A regression model was developed that explained 22% of the variability in the time. The model predicted a time saving of two to three minutes per patient from notification of the need for x-ray until the image availability by the implementation of PACS. A delay of four to six minutes per patient was caused by inexperienced technologists and a delay of 18 to 27 minutes by the arrival of a serious trauma case (Redfern *et al.*, 2002). A small interrupted time series study (Horii *et al.*, 2001) looked at using automated pager notification of when films were available on a PACS system rather than doctors looking for results. The total time in the emergency department changed from 6 hours 34 minutes to 5 hours 32 minutes ($p<0.05$).

Use of CT scanning in patients with non-traumatic abdominal pain obviated the need for admission in 17% of patients with abdominal pain judged by clinical examination. It also reduced by a half the number needing immediate surgery. A large number of these changes were in the diagnoses of suspected appendicitis (Rosen *et al.*, 2003).

4.5.3 Nurse ordering of x-rays

Nurse ordering of x-rays and lab tests according to guidelines has a moderate to substantial clinical correlation with physician ordering but over-ordering was markedly increased without presence of the guidelines (Seaberg and Macleod, 1998). No studies have been found that correlate nurse-ordering of laboratory tests with delays in emergency care. Nurses can order x-rays appropriately (Lee *et al.*, 1996) and interpret them as well as senior house officers (Meek *et al.*, 1998).

A UK RCT of nurses ordering x-rays in 1833 patients showed there was a 14-minute saving when the nurse ordered the x-rays at triage against a background of 51 minutes when a doctor ordered the x-ray

at time of first examination ($p<0.001$). X-rays were restricted to those in the distal limbs. Radiographers were not blinded and could change the area x-rayed when ordered by nurses. However this benefit was largely lost because of the increased referral rate by the nurses with no overall difference in the proportions of relevant abnormalities (a non-significant saving of four minutes). The training levels were different in the four hospitals and it is noted that one hospital had greater training input and their reduction in time was greater (Thurston and Field, 1996).

Nurse requesting of x-rays was studied in another prospective RCT of 675 patients (Lindley-Jones and Finlayson, 2000). There was a 36% time reduction from time of triage to time of treatment decision in the nurse-requested group from 102.7 minutes (95% confidence interval 96.4 to 109.0), to 65.5 minutes (95% confidence interval 60.5 to 70.5). Triage nurses requested fewer x-rays than doctors (8% less; $p=0.002$) having a higher positive hit rate therefore triage nurse x-ray system appears to speed up the process of walking wounded patients.

In an Australian prospective trial of 175 patients, Parris reported that patients having triage-initiated x-rays showed no significant reduction in transit times, it was thought this was due to the transit time being dependent on other factors and the existing good x-ray system. The trial was restricted to ankle and wrist injuries and was randomised according to date of presentation. The trial was not blinded. The study noted that only 77% of those for whom an x-ray was ordered by a nurse had it performed before the review by the doctor.

Lee *et al.* (1996) studied 934 patients but they were not randomised to nurse-ordering and the control group was 'a random selection' of cases outside the study group in the study period. The standard was case review by the doctor of the need for an x-ray as well as presence of a fracture. There was no significant difference in the ordering of x-rays by the nurses and the nurse-ordered x-ray group had an average of 18.5 minutes less total emergency department time ($p<0.001$) but this was severely reduced to only a 2.5 minute advantage if a procedure was also needed ($p<0.005$).

A non-randomised controlled study of 193 patients undergoing extremity and skull x-rays at Changi Hospital showed an average time saving of 24.5 minutes on total time in the emergency department compared to a matched control group ($p=0.001$), with appropriate ordering in over 99%. The control group were 'randomly selected' and information did not allow comparison of control and intervention groups for comparability (Ching *et al.*, 1999).[90]

A prospective non-controlled study of 579 'randomly selected' patients (but not randomised) suggests that nurses are capable of requesting appropriate x-rays, avoiding unnecessary ones and with this the actual time a patient spends in emergency department is reduced. The mean time savings ranged from 8.5 minutes for ankle x-rays to 60.5 minutes

for knee injuries but no statistical analysis was undertaken. Data quality was poor with only 30% data completion rate. Inclusion criteria were not clearly stated. The nurse's ability was assessed by the emergency department physician who managed the patient but their level of seniority was not recorded (Macleod and Freeland, 1992).

A UK study of nurse ordering of x-rays 'saved 29 minutes' but does not state if this was an average over all attendances or only those on whom x-rays were ordered. No details of any of the differences in care of patients who had nurse ordered x-rays were given (Davies, 1994). Another UK study (Allerston and Justham, 2000) investigated using the Ottawa ankle guidelines at triage. The study was not randomised as it was a retrospective case control study. It demonstrated that emergency nurse practitioners using the Ottawa ankle rules at triage resulted in faster transit times than in a traditional system whereby the doctor ordered an x-ray. The time from assessment to discharge decreased from a mean of 98 minutes 52 seconds to 73 minutes 59 seconds ($p=0.001$) and of total time in the emergency department of 106.59 minutes to 81.25 minutes ($p=0.001$).

A prospective RCT with clear inclusion and exclusion criteria is still required in this area to determine whether x-rays at triage are of benefit but should also include developments in fast track systems that mean the delay from triage to decision-maker may be significantly reduced, removing the advantage of triage-ordered investigations and potentially creating a delay in the process.

4.5.4 Emergency department performed imaging

A recent review (Brenchley *et al.*, 2000) of the use of ultrasound in UK emergency departments highlighted that ultrasound is now increasingly being used by emergency department staff but that most of the literature emanates from America. The review confirms a wide variety of uses including assessment of abdominal trauma, abdominal pain, renal colic and musculo-skeletal disorders and describes the training requirements. Most work has addressed the clinical safety and effectiveness, however the papers below have also addressed the issue of whether ultrasounds undertaken by staff in the emergency department reduce patients' time in the department.

The use of transvaginal ultrasonography in the assessment of patients with pelvic pain or vaginal bleeding in the first trimester of pregnancy was assessed. When the emergency physicians undertook transvaginal ultrasonography the mean time in the emergency department was 165 minutes. When it was undertaken by an obstetric consultant the mean time was 235 minutes ($p<0.0003$). In this series of 84 patients there was no difference in detection of ectopic pregnancies or other critical incidents (Burgher *et al.*,1998).

A prospective observational convenience sample of women in early pregnancy was studied using a multi-variant model. Among the 115

patients those who underwent sonography had a decrease median length of stay compared with those who received sonography by a radiologist or obstetric consultant (60 minutes *versus* 180 minutes, p<0.001). The obstetric consultation was associated with an increase in length of stay of 60 to 170 minutes (p<0.001) and was most significant in patients with a viable intra-uterine pregnancy, and was not seen in those with abnormal pregnancies. This was attributed to the fact that the latter group needed urgent consultations. Sensitivity of the test was 94% and specificity of 100%. No patient had an adverse outcome as a result of emergency physician performing tests (Shih, 1997). A retrospective notes review study demonstrated the emergency physician demonstrating a live foetus on ultrasound decreased the patients stay in the emergency department, particularly at night (reduction 59 mins, p=0.0001). However the radiology group was not randomised and included cases where the emergency physician was uncertain (Blaivas *et al.*, 2000).

Doppler ultrasound, for detecting deep venous thrombosis, can also be undertaken by emergency physicians (Theodoro *et al.*, 2002). Emergency physician dopplers resulted in quicker disposal of the patient than radiologist doppler (90 mins *versus* 200 mins, p<0.0001). The emergency physicians and radiologist disagreed on diagnosis in one case in the 70 studied (k=0.95).

Diagnostics: conclusions

Many studies, including several RCTs, have shown that results are made available earlier using point of care testing or satellite laboratories based in the emergency department. Those failing to show decreased overall time have been attributable to other factors, such as bed availability. As these methods have been shown to be safe and reliable their introduction into the emergency department would appear to be appropriate. Delivery of results has been poorly studied but there are suggestions that simply having electronic reporting may delay results delivery.

In imaging, the use of guidelines seems to have a variable effect but generally reduces delays. Nurses ordering x-rays also appears to have benefit over usual triage processes but may have been superseded by fast track systems and may therefore need re-evaluation. Performance of ultrasound scans by emergency department staff can result in quicker scans but trial numbers are small and the increased workload for emergency department staff, if widely adopted, may increase delays for other staff.

Key points

- Point of care testing/satellite laboratories produces quicker results.
- Nurse ordering of x-rays may speed up processes where fast track does not operate.

- Emergency department staff undertaking ultrasounds may reduce delays for those individuals.
- Results delivery needs more investigation as some IT solutions may delay it.

Table 17 Laboratory tests (4.5.1)

Study details	Domain	Study design	Study population	Intervention	Findings/conclusion
Kendall *et al.*, 1998 Applicable to UK: **Yes** United Kingdom	ED	RCT (N=1728) n=860 intervention n=868 control	ED attenders patients having laboratory tests ED size: 50 000 p.a.	POCT for blood, biochem, blood gases	POCT improves speed of decision–making. No significant effect on LOS or long-term clinical outcome
Murray *et al.*, 1999 Applicable to UK: **Yes** Canada	ED	RCT n=93 intervention n=87 control	ED attenders patients having laboratory tests ED size: 41 000 p.a.	POCT *vs.* laboratory-based tests	Significant reduction in ED LOS for POCT, median LOS 3 hrs 28 mins *vs.* 4 hrs 22 mins for laboratory group
Sands *et al.*, 1995 Applicable to UK: **Yes** United States	ED	Non-randomised study (N=960)	ED attenders requiring blood tests ED size: 38 000 p.a.	Patients had simultaneous POCT and laboratory testing	POCT tests were available 31-43 mins earlier depending on test. Modelling showed a reduction of 17% in ED LOS could be achieved by POCT
Parvin *et al.*, 1996 Applicable to UK: **Yes** United States	ED	Pre/post comparison n=2067 intervention n=1818 control 1 n=1100 control 2	ED attenders patients having laboratory tests (5-weeks) ED size: NK	Introduction of hand-held POCT device in ED testing: Na, K, Cl, glucose and blood urea nitrogen	Point of care testing did not make any impact on patient waiting time in ED.
van Heyningen *et al.*, 1999 Applicable to UK: **Yes** United Kingdom	ED	RCT n=130 POCT n=191 porter n=192 pneumatic tube	ED attenders having laboratory tests ED size: NK	POCT	POCT reduces laboratory results turnaround time but not patient waiting time

Lee-Lewandrowski *et al.*, 2003 Applicable to UK: **Yes** United States	ED	Pre/post comparison (N=369) Test undertaken n=316 POCT n=271 pre-POCT	ED attenders patients have blood tests ED size: 70 000 p.a.	POCT satellite laboratory in ED testing: blood glucose, human chorionic gonadotropin, urine dipstick, creatine kinase-MB, troponin tests	Reduction in test turnaround time of 87%. Significant reduction in ED LOS 41 minutes (p=0.006) - for patients who underwent pregnancy testing, urine dipstick and cardiac marker tests

Note. ED: emergency department; LOS: length of stay; NK: not known; POCT: point of care testing.

Table 18 Imaging (4.5.2)

Study	Domain	Study design	Study population	Intervention	Findings/conclusion
Stiell *et al.*, 1994 Applicable to UK: **Yes** Canada	ED	Non-randomised study (N=2342) n=,1250 intervention n=1,092 control	Adults attending the ED with ankle injuries. ED size: 60 000 p.a. (2hospitals)	ED physicians implementing OAR	Significant reduction in ED LOS no radiography (80 mins *vs.* 116 mins p<0.001) Reduction of 28% for ankle radiography
Fiessler *et al.*, 2002 Applicable to UK: **Yes** United States	ED	Pre-post intervention comparison (N=132) Intervention n=76 Historical control n=76	Adult ED patients with ankle injuries ED size: NK	Use of OAR guidelines	No reduction in ED LOS was observed by the introduction of OAR 82!37mins *vs.* 92 !34 mins; p=39)
Redfern *et al.*, 2002 Applicable to UK: **Limited** United States	ED	Pre-post intervention comparison n=1085 intervention – filmless system n=307 control – conventional system	Patients requiring an x-ray in ED ED size: NK	Change to filmless radiology system	Regression analysis predicted 2-3 mins saved by filmless system
Espinosa, 1997 Applicable to UK: **NK** United States	ED	Observational study 500 pre-redesign	All ED patients plain x-ray ED size: 30 000 p.a.	X-rays returned direct to ED physician without radiologist report	Reduction in wait for patient x-ray from 74 mins to 35 mins Reduction in wait time has increased patient satisfaction
Horii *et al.*, 2001 Applicable to UK: **Yes** United States	ED	Pre-post intervention comparison n=334 intervention – pager notification n=283 control period	ED patients needing radiology ED size: NK	Pager notification for radiological results	Significant reduction in ED LOS 6 hrs 49 mins at baseline compared to 5 hrs 32 mins for pager period (p<0.005)

Table 18 (continued)

Study	Domain	Study design	Study population	Intervention	Findings/conclusion
Lee, Wong TW, *et al.*, 1996 Applicable to UK: **Yes** Hong Kong	ED	Observation study n=934 intervention cases n=699 control cases	Patients attending ED with blunt injury to one region of a limb (Mar - May 1995) Excluding: - <3-years of age - multiple limb injuries - hip/pelvis injuries ED size: 380 per day	Nurse ordering of x-rays by protocol	Significant reduction in ED LOS by mean 18.59 mins for patients in nurse ordering group (p<0.001)
Thurston & Field, 1996 Applicable to UK: **Yes** United Kingdom	ED	Simultaneous prospective study (N=1833) n=918 doctor first n=915 nurse first	ED patients with limb injuries ED size: 4 ED 1) 50 000 p.a. 2) 43 000 p.a. 3) 86 000 p.a. 4) 55 000 p.a.	Patients allocated to doctor first (DF) or nurse first (NF)	Significant reduction in ED LOS when no x-ray requested p<0.001 DF: mean time saved 51 mins NF: mean time saved 36 mins
Lindley-Jones & Finlayson, 2000 Applicable to UK: **Yes** United Kingdom	ED	Randomised controlled study n=335 intervention – nurse requesting n= 340 control	Attenders at ED with limb injuries (2 separate 2 week study periods, 6 months apart) excluding: - elbows - knees - femurs over ED size: 59 000 p.a.	Experienced triage nurses request x-ray, by protocol, at time of first contact/assessment.	Significant reduction in triage-to-treatment time interval by 37 mins (p=0.000) Triage nurses did not over request x-rays.

Table 18 (continued)

Study	Domain	Study design	Study population	Intervention	Findings / conclusion
Parris *et al.*, 1997 Applicable to UK: **Yes** Australia	ED	Randomised Controlled Study (N=175) Control: Yes	Patients =14 presenting with ankle injuries. Exclusions: - no x-ray needed - patients with severe pain - patients admitted ED size: 35 000 p.a.	Nurse-initiated radiology request	Nurse-initiated x-ray does not save time (p=0.37)
Ching *et al.*, 1999 Applicable to UK: **Limited** Singapore	ED	Case-control study n=193 nurse requesting n=83 matched control	Patients attending ED excluding: - extremity - skull injury - pregnant - multiple injuries ED size: NK	Trained nurse in triage requested x-ray by protocol	Significant reduction in mean ED LOS by 24.45 mins (p=0.0013)
Macleod & Freeland 1992 Applicable to UK: **Yes** United Kingdom	ED	Observational study (N=1833) Control: Limited	ED patients presenting for triage with the exclusion of serious injuries ED size: 29 000 p.a.	Trained nurse in triage requested x-ray by protocol	That nurse-instigated x-rays save time and broadly are not unnecessary. Mean time saving: - sprained ankle 8.5 mins - scaphoid fracture 21.5 mins - ankle fracture 20 mins - clavicle fracture 10 mins - sprained knee 60.5 mins - soft tissue foot 23 mins

Table 18 (continued)

Study	Domain	Study design	Study population	Intervention	Findings / conclusion
Allerston & Justham 2000 Applicable to UK: **Yes** United Kingdom	ED	Case control study n=79 case group n=104 control group	Patients reporting ankle trauma who attended the ED ED size: NK	Nurses trained in OAR requesting x-rays at triage *vs.* x-ray ordering at assessment	Significant reduction in total time in ED for patients sent to x-ray from triage 81.25 compared to x-ray from assessment 106.59 ($p<0.001$)
Burgher *et al.*, 1998 Applicable to UK: **Limited** United States	ED	Observation study Control: Limited	Patients presenting to ED with pelvic pain or vaginal bleeding in the first-trimester ED size: NK	Patients having ultrasound scans performed by ED physician or obstetric/gynaecologist	Significant difference in time to ultrasound performed by ED physician 164.7 mins compared to obstetric/gynaecologist 234.79 mins ($p<0.003$)
Shih, 1997 Applicable to UK: **Limited** United States	ED	Observational study Control: limited	ED users with vaginal bleeding in early pregnant between Oct 1995 and Aug 1998 (115) ED size: 30 000 p.a.	Patients having ultrasound scans performed by EPPPS or non-EPPPS	Significant difference in LOS ultrasound performed EPPPS 60 mins compared to radiology performed ultra sound 4hrs 39 mins ($p<0.001$)
Blaivas, Sierzenski P, *et al.*, 2000 Applicable to UK: **Limited** United States	ED	Case note review (N=1,419) Control: Limited	Patients presenting to ED in the first-trimester who undergo ultrasound scan ED size: 65 000	Patients having ultrasound scans performed by ED physician or radiology department	Significant reduction in ED LOS for ED performed ultrasound 3 hrs 4 mins compared to non-EPPPS 180 mins ($p<0.001$)
Theodoro *et al.*, 2002 Applicable to UK: **Yes** United States	ED	Observational study (N=70) Control: Limited	Patients presenting to the ED with suspected DVT ED size: NK	Emergency department physician trained to use doppler scan compared to radiologist	Significant difference in LOS to disposition. ED doppler-performed scan 110 minutes; radiologist-performed scan 200 mins ($p<0.001$)

Note. ED: emergency department; EPPPS: emergency physician-performed pregnancy scan; LOS: length of stay; NK: not known; OAR: Ottawa ankle rules.

Case study 4: Path pals for blood tests

Summary of improvement

Introduction of a dedicated pathology link person ('path pal') to reduce the time taken from request for blood test to time patient seen with the result for emergency department patients. The goal was to reduce the overall waiting time for emergency patients.

The time between blood being taken from the patient, to the time the patient was seen with the results fell to an average of 72 minutes from 152 minutes.

Changes made

- An analysis of work flow indicated that significant time was lost between the decision to request diagnostic test and the availability of those results at the point of care.
- Recruitment of path pals jointly between the emergency department and the pathology department.

New system

1. Path pal collects blood sample, logs blood sample on to pathology computer system.
2. Path pal takes sample to lab, spins sample, distributes samples to biomedical scientists for analysis.
3. Path Pal retrieves result from computer in emergency department, hands results to relevant doctor or nurse for action.

Implementation advice

- Make the path pal a joint appointment with the pathology department.
- Provide adequate training and support.
- Address concerns that could lead to delays with other pathology services.

Next steps

- To look at expanding the role to take blood samples from patients.
- To examine the impact of this fast track system on other aspects of pathology work.
- To examine the role to see if it can be expanded to include other direct patient tests, for example ECG and temperature, pulse and respiration (TPR).
- To secure recurrent funding.

For further information please contact:

Robin Davis
Northwick Park Hospital
Northwest London Hospitals NHS Trust
Robin.Davis@nwlh.nhs.

Case study 5: Bedside ultrasonography

Summary of improvement

This service focused on the management of patients following trauma and those with the possibility of an abdominal aortic aneurysm. Patient journey times to definitive treatment and to diagnosis were reduced by as much as 60% in patient groups who previously would have had to wait for further imaging and another medical opinion. All patient groups have benefited from this ultrasound practice.

Changes made

- Introduce bedside ultrasound for the emergency department: The ultrasound system is based within the department, combining sufficient portability for easy movement between patients with the resilience to perform well in the busy environment. It also has a basic recording facility for maintaining quality assurance.
- Consultants and middle grades receive a day's training for skilled ultrasound operation.
- The 'rule-in' practice of ultrasound is used to confirm diagnoses.
- Clear patient information is provided on those conditions that can benefit from early diagnostic work through bedside ultrasound. This clarifies the use for medical staff within the department and potentially standardises implementation. Patients receive information about the procedure, as do primary care physicians, through our emergency department letter.
- We communicate regularly between A&E, radiology and nursing staff so that uniform information is provided to patients and their carers.

Implementation advice

- Overcome any reluctance to bedside ultrasound from the radiology department with discussion and presentation of the better care that could be provided to patients and the realisation that dedicated ultrasonography in the emergency department might help to rationalise and prioritise emergency diagnostic requests. This process began in 1998.
- Obtain intra-department support through discussion within the A&E department and incorporating radiology and other specialties.
- Ensure full participation of clinical staff in ultrasound teaching and develop departmental change in practice through persistence.
- Develop inter-departmental interest from surgery, intensive care unit, obstetrics and gynaecology, urology, and cardiology.

Next steps

- Incorporate training regularly in local and regional programmes.
- Ensure staffing mix sufficient for use of ultrasound on a 24 hour basis.
- Use ultrasound for central line placement, as suggested in National Institute of Clinical Excellence (NICE) guidelines.
- Focused cardiac ultrasound within the emergency department for hypotensive/ peri-arrest patients.
- Use of ultrasound within the emergency department for foreign body and soft tissue infection.

For further information please contact:

Peter K. Thompson
A&E Consultant, Emergency Department
King's College Hospital
Denmark Hill
London SE5 9RS

peter.k.thompson@kingsch.nhs.uk

4.6 Admission avoidance

Inappropriate or preventable admissions may account for 4.7% to 37% of hospital admissions but criteria are highly variable, as summarised by Glasby and Littlechild (2000), who suggest that new methodologies are required.

The emergency admission review tool is a validated assessment tool to determine whether a patient's care is appropriate for an acute bed. Use of this in one study shows that 44% to 46% of inpatient bed days were inappropriate for acute care in one hospital. This was due to them receiving active rehabilitation and in others it was due to short-term waiting (Armstrong *et al.*, 2001).

In a study across seven Canadian hospitals, reducing length of inpatient stay did not result in increased rates of readmission or visits by a doctor within 30 days of discharge (Harrison *et al.*, 1995).

A variety of schemes have been developed to prevent admission by providing the type of clinical care in the community that had previously been restricted to the hospital environment. These include:

- specialist nurses working across primary and secondary care caring for heart failure, obstructive airways disease and other conditions
- DVT out-patient diagnostic and treatment service
- hospital-at-home service (including intravenous antibiotics)
- access to next day medical one-stop clinic.

Accident prevention has a key role in reducing the number of attendances at emergency departments. This review has not considered aspects of accident prevention, which have been reviewed elsewhere (Millward *et al.*, 2003) including falls prevention in the elderly which have been covered in other reviews (Weigland and Gerson, 1995 and 2001; Robertson *et al.*, 2001; Oliver *et al.*, 2000; Evans *et al.*, 1999; Hill-Westmoreland *et al.*, 2002).

Other components of admission avoidance are considered in the sections on:

- Social care in the emergency department (see section 4.3.9)
- Education (see section 4.4)
- Frequent attenders (see section 4.3.8).

A comprehensive programme of long-term care of diabetes in 115 patients delivered an 83% drop in inpatient admissions within six months and emergency department attendance fell by 67%. This pilot study was only small and was in an American self-funded insurance system. Details of the study methodology were not described (Anon., 1998c).

4.6.1 Heart failure

Management of heart failure by specialists has been shown to decrease (by 53%) the number of admissions (Hanumanthu *et al.*, 1997). Other interventions (Rich *et al.*, 1995; Singh, 1995) and telephone consultation in heart failure and other chronic diseases (Wasson *et al.*, 1992) may also decrease hospitalisation rates.

A study using an educational programme on self management and easy access nurse-led clinic follow-up, resulted in longer periods before readmission (141 *versus* 106 days, $p<0.05$) as well as less time in hospital and similar survival compared to a control group (Cline *et al.*, 1998).

The use of a heart failure centre providing aggressive outpatient therapy and extensive patient education was instituted in America. After 16 months initial analysis showed that hospital admissions had decreased by 30%, hospital days by 42% and average lengths of stay by 17% (Chapman and Torpy, 1997).

4.6.2 DVT

In a Cochrane review of home *versus* inpatient treatment for DVT all RCTs were collated that compared a home treatment regime of low molecular weight heparin (LMWH) with hospital treatment of LMWH or unfractionated heparin (UH), for the initial phase of treatment. It compared the safety, efficacy, patient acceptability and cost implications of home *versus* inpatient treatment. Three RCTs with comparable treatment arms were found. All three had fundamental problems including high exclusion rates, partial hospital treatment of many in the LMWH arms, and comparison of UH in hospital with LMWH at home. The trials showed that home treatment was no more liable to complications than hospital treatment (Schraibman *et al.*, 2001).

4.6.3 Thrombolysis

Thrombolysis has been extensively studied and reviewed (Morrison *et al.*, 2000; Boland *et al.*, 2003; Williams, 1998; Ornato, 1990). The Department of Health has also issued best practice guidance with a review of the literature (Carver *et al.*, 2003).[77]

Studies have addressed the time to deliver thrombolysis rather total time or waits in emergency department. Because of the importance of this area, key messages are given below but readers should refer to the reviews above for more detailed information.

Key messages are that the following systems improve thrombolysis:

- use of criteria-based decision rule for performing ECGs (Graff *et al.*, 2000).
- pre-hospital transmission of ECGs (Kereiakes, 1992)

- fast track admission to cardiac team or CCU (Pell *et al.*, 1991; Catnach *et al.*, 1992; Ranjadayalan *et al.*, 1992; Prasad *et al.*, 1997; Quinn *et al.*, 1991; Banerjee and Rhoden, 1998)
- direct admission to CCU (Sandler, 1999; Prasad *et al.*, 1997) although may be selective
- nurse administered or initiated thrombolysis (Wilmshurst *et al.*, 2000; Caunt, 1996; Bloe, 2001)
- thrombolysis in emergency department (Edhouse *et al.*, 1999; Gonzalez *et al.*, 1999)
- nurse co-ordinator or thrombolysis nurses (Gamon *et al.*, 2002).

4.6.4 Observation units

Observation wards have been proposed as a way of reducing the time spent in the main emergency department and providing the patient with more comfortable and appropriate surroundings during their early investigation and treatment phase (Department of Health, 2003). Four systematic reviews of the literature on observation wards/short stay wards have been found.

In 1989, Krome published a review spanning 15 years and made the following conclusions:

- they were a safe location for initial treatment
- patients should have regular observation
- care must be time limited
- all patients need a plan and clear objectives to their stay in the short stay ward
- they should be managed by the emergency department
- they should not replace inpatient beds.

He did not draw conclusions about the effect on waiting or length of stay.

In 1998, Goodacre examined the use of short-stay units in the UK and undertook a review of the literature. He found that use of these facilities is highly variable and that evidence of clinical value and cost effectiveness compared with other methods of care were lacking.[2]

In 2003, Cooke *et al.* concluded that all types of assessment/admission wards seem to have advantages over traditional admission to a general hospital ward, including reducing the number of admissions and length of stay. A successful ward needs proactive management and organisation, senior staff involvement, and access to diagnostics and is dependent on a clear set of policies in terms of admission and care. Many diagnostic groups benefit from this type of unit, excluding those who will inevitably need longer admission. Vigorous financial studies have yet to be undertaken in the UK. In 2003 Daly *et al.*, found that short stay and observation units have the potential to benefit patients,

reduce length of stay, improve the efficiency of emergency departments and improve cost effectiveness. However, the benefits reported were variable.

A further review by Hassan (2003) looked at clinical decision units for patients needing a longer period of investigation than is usual in the emergency department but not requiring full admission to hospital. The study did not quote any evidence of their effect on emergency department waiting times.

As an extension of emergency department evaluation, an observation unit has also been shown to reduce the workload in the emergency department, thus giving staff better flexibility and improving the flow of patients (Brillman *et al.*, 1995; Cooke *et al.*, 2003). Patients may also benefit from the increased time available for monitoring their clinical condition after emergency department treatment, and as a direct result of this, referral to a specialist team (for example, cardiology) can be made earlier (Hanlon *et al.*, 1997).

Only two studies were found that focused on the effect of overcrowding on the emergency department. In Kelen *et al.* (2001) a 14-bed acute care unit was established remote from the main emergency department. The unit was designed for those patients needing more than four hours' evaluation. During the first ten weeks 1589 patients were seen, representing 14.5% of the emergency department volume. Approximately a third were classified as post-emergency department management, 20% were admission processing and the rest (nearly half) were for primary evaluation. The number of patients who left without being seen decreased from 10.1% to 5%. The ambulance diversion was a mean of 6.7 hours per 100 patients immediately before the unit opened and 5.6 hours per 100 patients during the same time in the previous year and decreased to 2.8 after the unit opened ($p<0.05$). The monthly hours of ambulance diversion decreased by 40% (202 hours to 123 hours, $p<0.05$).

Bazarian *et al.* (1996), examined the impact of using a short-stay inpatient medicine unit (to reduce the number of admitted patients held in the emergency department) on the amount of time that patients spend in the emergency department. The mean (± standard deviation [SD]) number of admitted patients per day waiting in the emergency department for more than eight hours for an inpatient bed dropped from 9.6 ±4.2, before instituting the surgical observation unit (SOU), to 2.3 ±2.6. The authors reported that, after implementation of the SOU, there was a significant reduction in the average time spent in the emergency department for 'treat and release' patients with chest pain (from 7.3 ±6.0 hours to 5.5 ±4.8 hours per patient; $p<0.001$) and asthma (from 5.0 ±3.6 hours to 4.2 ±2.9 hours per patient; $p<0.05$), but not for those with sickle cell crisis or seizure. However, these findings were confounded by an increase in the average number of beds during the study period from 722 to 736.

Length of stay appears to decrease with the use of observation / short stay wards. In a retrospective analysis of an emergency department observation unit, Williams *et al.* (2000), found that the average length of stay and number of admissions remained the same for the ten most common diagnostic groups. In the group suitable for admission to the observation ward the average length of stay decreased from 3.97 to 2.59 days in the study period. The number of patients in the suitable groups increased by 19% over the four-year study period but the total bed days fell by 23%. When compared to patients in the same diagnostic groups in other hospitals in the same town it was discovered that the original length of stay had increased in the other hospitals by 8%. However, it is not possible to conclude that this difference was due to the initiation of a short stay ward.

Saunders and Gentile (1988) studied patients with mild exacerbations of pancreatitis and compared 27 consecutive patients managed through the observation ward with 27 randomly selected patients admitted directly to hospital. The condition of 14 of the observation ward patients improved sufficiently for discharge within 24 hours, with a mean stay of 14.4 hours. The remaining 13 observation ward patients required continuing hospitalisation, with an average length of stay of 7.5 days, which exceeded the average length of stay for patients admitted directly to hospital (5.8 days). There may be bias in the sample in that the observation ward patients had significantly lower serum amylase levels than patients admitted to hospital, suggesting less severe disease. Hadden *et al.* (1996) also found, in a prospective study of 214 patients, that observation in a general ward resulted in the patient being seen later and having an increased the length of stay in hospital when compared with observation unit stay. Patients also had to wait longer in a ward before being seen by a senior doctor. No studies have been found that show that observation units increase patient length of stay.

Medical admissions may also be avoided by use of observation/short stay wards. Many studies were excluded as they use an analysis that counts an admission to a short stay ward only as having avoided an admission, when in reality it is an admission to a different area of the hospital. A study in Singapore (Lateef and Anantharaman, 2000) demonstrated that by using observation wards it was possible to achieve a 6.4% saving to direct inpatient admissions to the hospital. Ross (2001) showed that if patients were admitted to an observation unit where they had an accelerated process of investigation and care this could be effective in improving inpatient bed availability and each emergency department observation unit bed would keep between one and three patient beds available for other uses.

McDermott *et al.* (1997) used a prospective RCT in patients with acute asthma who did not meet discharge criteria within three hours of presentation to the emergency department. Patients were randomly allocated to receive ongoing care in either the emergency diagnostic

and treatment unit or in a hospital ward. Of the 110 patients managed through the emergency diagnostic and treatment unit, 59% were discharged home and 41% were transferred on to a ward. In this study, 45 patients avoiding an inpatient admission.

Brillman and Tandberg (1994) undertook a retrospective comparative cohort analysis of patients with asthma — 834 before the observation ward was opened and 390 after it was opened. They found that use of an observation unit for patients with asthma reduced initial discharge rates from the emergency department and did not change admission rates. A 'before and after' study (Gouin *et al.*, 1997) investigating the introduction of a paediatric observation ward noted a reduction in admissions of 31%. The frequency of under 24 hour admissions decreased from 17% to 10% but with an increased rate of repeat visits to the emergency department within 72 hours (from 3% up to 5%). However, Willert *et al.* (1985) in a randomised clinical trial of 103 children with asthma, showed no difference between groups in the rate of re-presentation to emergency.

A study in an emergency care tertiary centre with 46 000 annual visits looked at whether there was a cost reduction in providing observation beds to avoid full hospital admission. Only 32% of the admissions could have been treated in an observation ward and the potential savings from inpatient bed closures would only have amounted to 1.68 full-time equivalents because they would have been evenly spread across the hospital. This would not be enough to staff a four-bed observation unit, which would require at least five full-time equivalents (Sinclair and Green, 1998).

The purpose of chest pain assessment units is to rule out myocardial infarction or other serious cardiac pathology and are therefore a specialised type of observation ward or clinical decision unit. Present regimes take six to 12 hours.

In a systematic review of the literature on chest pain units Goodacre (2000) concluded that chest pain assessment unit care is safe and costs are well defined. There is no strong evidence that a chest pain assessment unit will improve outcomes if routine practice is good. Cost savings have been shown when compared with routine care in the United States but may not be reproduced the UK. The studies did not specifically look at the time spent in emergency department or the effects of chest pain assessment units on this time. Eighty per cent of patients seen in chest pain assessment units avoided full hospital admission. In an RCT involving 100 chest pain patients, Gomez *et al.* (1996) evaluated the efficacy of their 'rapid' protocol, which included a period of observation in a chest pain unit to exclude the diagnosis of myocardial ischaemia. The average length of stay for 'rapid' protocol patients was 15.4 ±12.2 hours, which compared favourably with 54.6 ±12.6 hours for patients receiving routine care. As the authors attributed these findings to their protocol, it is not clear what role the

observation unit played. Subsequently Taylor *et al.* (2002), have studied a clinical rule-out strategy and found that the median time for discharge was 23 hours. There was no comparative data on 'routine practice'. A prospective, observational, cohort study by Goodacre *et al.* (2002) verified the safety of such a system but did not look at the time factors.

In conclusion, it appears that assessment/short stay wards may reduce length of stay in emergency department and possibly in the hospital. However, results are variable and confounded by methodological issues. Studies often look at times in specific hospital areas rather than patient-focused times in hospital and 'wasted' time.

4.6.5 Social care supporting discharge

The role of social workers in emergency departments has already been discussed in section 4.3.9 of this chapter.

Hyde *et al.* (2000) undertook a systematic review to investigate the effects of supported discharge after acute admission of older people with undifferentiated clinical problems. They found nine studies but concluded that bias was present in all. There was relative certainty that the proportion of those at home six to 12 months after admission is greater with supported discharge (odds ratio 1.4, 95% confidence interval 1.1 to 2.0). This was associated with a consistent pattern of reduction in admission to long-stay care over the same period, without apparent increases in mortality. There was uncertainty about the effect of supported discharge on hospitalisation.

An Australian system involved a pre-discharge interview and a home follow-up by a pharmacist for patients with chronic illness requiring medication. This resulted in a decreased emergency department attendance rate (236 *versus* 314, $p<0.01$) and unplanned readmission rate (154 *versus* 197, $p=0.22$) compared to a control group (Stewart *et al.*, 1998).

Use of a hospital intervention team with additional in-hospital and post-discharge follow-up of elderly patients did not change survival in one RCT, but the intervention group showed a significant reduction in length of hospital stay (33.49 days *versus* 40.7 days in the assessment group and 42.7 days in the control group; $p<0.05$). There was no difference in survival, acute care hospital readmissions or new admissions to nursing homes but the intervention group had significantly shorter hospital readmissions (22.2 days *versus* 34.2 days and 35.7 days; $p<0.05$). However, there were methodological problems with cross-contamination between study groups (Nikolaus *et al.*, 1999).

A systematic review of preventive home visits to older people reviewed 15 trials and found no clear evidence of their effectiveness for a variety of outcomes, including reduction in hospital admissions but did

not look at emergency department attendance (van Haagstregt *et al.*, 2000).

Social care issues are also covered in the sections on:

- Social care in the emergency department (section 4.3.9).
- Education (section 4.4).
- Delayed discharge (section 4.8).
- Social care supporting discharge (section 4.6.5).

4.6.6 Hospital at home

Hospital at home studies have looked at the effect with respect to hospital bed days but have not looked directly at the effect on the emergency department. It is therefore presumption that decreasing length of stay will decrease bed occupancy and in turn improve emergency care patient flows, resulting in decreased delays in the emergency department. A Cochrane review (Shepperd and Illiffe, 2004) looked at randomised trials of hospital at home care compared with acute hospital inpatient care. The participants were patients aged 18 years and over. Sixteen trials evaluated hospital at home for elderly patients with a mix of medical conditions and those recovering from elective surgery failed to detect a difference for patient health outcomes. The data for those recovering from a stroke was conflicting. One trial reported an increase in independence for those allocated to hospital at home, and another decreased communication and psychosocial well being at three months follow-up but not at six months follow-up. Patients allocated to hospital at home expressed greater satisfaction with care than those in hospital. Carers however expressed less satisfaction with hospital at home compared with hospital care. Allocation to hospital at home resulted in a reduction in hospital length of stay, but hospital at home increased overall length of care. This review does not support the development of hospital at home services as a cheaper alternative to inpatient care. Early discharge schemes for patients recovering from elective surgery and elderly patients with a medical condition may have a place in reducing the pressure on acute hospital beds, providing the views of the carers are taken into account. For these clinical groups hospital length of stay is reduced, although this is offset by the provision of hospital at home. The evidence supporting hospital at home for patients recovering from a stroke is conflicting. There is some evidence that admission avoidance schemes may provide a less costly alternative to hospital care. Future research should focus on admission avoidance schemes, and the effect of early discharge hospital at home schemes for patients recovering from a stroke.

A further review looked at stroke patients specifically and considered controlled clinical trials. It discovered four trials of which three had outcome data available (921 patients; 857 from one controlled trial, 64 from two randomised trials). There were no statistically significant

differences between the patient and carer outcomes of the intervention and control groups either within individual trials or in pooled analyses. There was a trend toward greater hospital bed use and increased costs in the intervention groups (Langhorne *et al.*, 2001).

Admission avoidance: conclusions

A variety of specialist nursing interventions have been shown to be able to reduce the risk of emergency admission and emergency department attendance, including care of heart failure and mild COPD, hospital at home schemes, social support systems and management of DVTs. There is good evidence supported by Cochrane reviews in many of these areas. Observation units can prevent hospital admission and reduce length of stay, but methodological flaws make it difficult to interpret whether the changes are significant to the patient or simply a different environment. Similarly chest pain units may avoid hospital admission and be clinically effective but there is no evidence of their effect on emergency department delays.

Key points

- Specialist nurse care in heart failure, COPD and DVT can reduce hospital admissions
- Home support (medical and social) can reduce hospital admissions.
- Observation wards may reduce length of stay and avoid admission.

Table 19 Admission avoidance (4.6)

Study details	Domain	Study design	Study population	Intervention	Findings/conclusion
Anonymous, 1998 Applicable to UK: **Not known** United States	Not known	Study design NK (N=115)	Diabetic NetCare patients Setting: NK	Not known	Reduction of 67% on ED attendance
Stewart *et al.*, 1998 Applicable to UK: **Limited** Australia	Tertiary hospital	RCT (N=906) n=762 randomised: n=381 home-based intervention n=381 usual care	Medical and surgical patients discharged home with medication. Setting: 440-bed hospital	Home based intervention versus usual care Home based intervention: 1. counselling pre-discharge by nurse and/or pharmacist 2. home visit by nurse and pharmacist one-week post discharge for high risk patients to: - Optimise home-medication management - detect otherwise hidden problems - increase patient/caregiver vigilance for impending crisis - improve liaison with community based services	Significant decrease in ED attendance post intervention: 236 vs. 314, ($p<0.01$)

Table 19 (continued)

Study details	Domain	Study design	Study population	Intervention	Findings/conclusion
Gouin *et al.*, 1997 Applicable to UK: **Yes** Canada	ED	Pre-post intervention comparison n=350 asthma visits post-observation unit group n=352 asthma visits pre-observation unit group	Children (1-18-years) with: - asthma - reactive airways disease bronchospasm Exclusions: - patients referred from other institutions - children with acute bronchiolitis - coexisting pulmonary conditions – cardiac disorders. ED size: >50 000 p.a. 2000 children with asthma	Paediatric observation unit staffed by emergency physician and registered nurses.	Increase in repeat ED visits - pre-observation unit 3.2% - post-observation unit 5.0%
Bazarian *et al.*, 1996 Applicable to UK: **Limited** United States	ED	Pre-post intervention comparison Historical control	Patients with: - chest pain - asthma exacerbation - sickle-cell crisis - seizure. ED size: 60 000 p.a. Setting: short-stay inpatient unit; 135 patients per month from ED	Establishment of short-stay medical unit.	Significant reduction in ED LOS for treat-and-release patients with: - chest pain (7.3 to 5.5 hrs) ($p<0.001$) - asthma exacerbation (5.0 to 4.2 hrs) ($p<0.05$)

Table 19 (continued)

Study details	Domain	Study design	Study population	Intervention	Findings/conclusion
Kelen *et al.*, 2001 Applicable to UK: **Limited** United States	ED	Observational study n=1589 post-ACU Historical control	ACU users during 10 weeks post intervention ED size: 54 000 p.a.	ACU staffed by ED nurses	ACU had significant effect on ED overcrowding: Ambulance diversion - pre-intervention 6.7hrs/100pts. - post-intervention 2.8hrs/100pts ($p<0.05$). Ambulance diversion hrs/per month - pre-intervention 220hrs - post-intervention 123hrs. ($p<0.05$). LWBS – Pre-intervention 10.1% post intervention 5.0%.
Nikolaus *et al.*, 1999 Applicable to UK: **Limited** Germany	University-affiliated geriatric hospital /care home	Randomised controlled study (N=545) n=181 - home intervention n=179 - assessment n=185 - control	Elderly hospitalised patients (>65) with: - acute disease - lived at home prior to admission - multiple chronic conditions - functional deterioration after convalescence - risk of nursing home placement Exclusions: - terminal illness - serve dementia - lived further than 15km away.	1. Geriatric assessment and post-discharge home intervention 2. Comprehensive geriatric assessment alone 3. Usual care.	No difference in hospital readmission rate for the three groups

Note. ACU: Acute care unit; ED: emergency department; LOS: length of stay; LWBS: left without being seen; NK: not known.

Case study 6: Clinical decision unit

The development of a nurse-led, protocol driven clinical decision unit (CDU) led to a 17% reduction (3970 patients) in unscheduled admissions. Patient satisfaction with the service is excellent.

Starting point

Long delays for assessment for emergency patients. GP referrals and emergency patients back logging into the emergency department.

Due to the delays in assessment, patients requiring observation admitted to main wards.

Improvement made:

- Introduction of CDUs into two large emergency departments in Leeds, with the aim of rapid diagnosis, short-term treatment and/or observation of selected emergency patients with chest pain, DVT, pulmonary embolism, cellulitis, renal colic, syncope, self-harm, headache, minor head injury, asthma.
- Development of evidence-based care protocols across a range of conditions.
- Involvement and commitment of key services across the Trust.
- Development of nursing practice to deliver nurse-led services, including nurse-initiated investigations.
- Securing ongoing financial support for further development.

Impact of this change

- In the first 12 months, 4793 patients entered the two CDUs. Of these, 823 were admitted (17%), a saving of 3970 unscheduled admissions.
- Nurse-led management of DVT and cellulitis services.
- Patient satisfaction with service – 84% gave a rating of excellent or very good.

Next steps

- Development of further protocols for new groups of patients.
- Further exploration of nurse-led services.

For further information please contact:

Robert McMaster
Leeds General Infirmary
Great George St
Leeds
West Yorkshire
LS1 3EX

robert.mcmaster@leedsth.nhs.uk

4.7 Bed management

Bed management has been the focus of a lot of attention in the last year, with particular emphasis on the need to predict bed requirements and adopt an anticipatory style of bed management (Department of Health, 2002b; Audit Commission, 2003). Access to beds in a timely manner is key to avoiding waits in the emergency department (Richardson, 2001). Summaries of bed management functions and a literature review have described how it may help solve overcrowding in the emergency department (Bloe, 2001; Boaden *et al.*, 1999; Proudlove *et al.*, 2003). Although summarising the evidence, none of these were designed as systematic literature reviews, however they highlight the lack of trials in this area.

4.7.1 General

It was noted that finding an appropriate bed was consistently the reason for difficulty of access, regardless of time of day (Ball *et al.*, 2000). An automated bed-tracking system in Pittsburgh, using bedside communication devices to inform a central bed system of the status of the bed, was reported to reduce the emergency department length of stay by 30%. The paper did not give any details of how this improvement was measured or any other contributing factors (Szabo, 2003).

A study of when waits occur shows that during times of acute overcrowding (as defined by critical bed status), significant delays occur for patients in being allocated a bed in the emergency department. This was more pronounced in the less severely ill patients. Once in a bed they did not show any difference in the time they waited to be seen by a physician or the time to first intervention, however they did then wait longer to be moved to a new patient bed (Liu *et al.*, 2003). However a UK study shows that waiting for a bed after the decision to admit is one of the top four causes of delays (Fletcher *et al.*, 2004).

It has been found that 65% of the workload variation of emergency departments can be predicted using historical temporal trends, infectious disease notifications and weather information (Met Office, 2002). Forecasting the daily number of occupied beds is possible with an accuracy of 3% of the mean number of beds used for emergency admissions. It is also recognised that volatility in emergency admissions is a better predictor of long waits in emergency department than total bed occupancy (Jones *et al.*, 2002). It has been suggested that calculating a demand value for the emergency department may enable prediction of when an emergency department is decompensating. Demand value is a function of the bed ratio, the acuity ratio and the provider ratio (Reeder and Garrison, 2001).

Modelling the dynamics of a hospital system using a discrete stochastic simulation model revealed that there is a discernible risk of waits in emergency departments when bed occupancy exceeds 85% and that regular bed shortages and crises can occur if bed occupancy rises to more than 90% (Bagust *et al.*, 1999). An observational study using routinely-collected data from a large teaching hospital demonstrated that increased hospital occupancy is strongly associated with emergency department length of stay for admitted patients. The length of stay increased to 80 minutes when there was an absolute increase in occupancy of 10%. It appeared to increase extensively when over 90% occupancy was achieved. During the study period there was only a small variation in occupancy so large changes may not be detectable. The study excluded patients who were discharged home from the emergency department and only considered those admitted. This study demonstrates a link but not a causal relationship (Forster *et al.*, 2003).

By reorganising the method by which emergency patients were assigned within the emergency medicine department it was shown to be possible to reduce the length of stay. Patients from the emergency ward were assigned to the internal medical departments according to a quota system that ensured that each department received a similar share of the admissions, hence preventing some departments having an excessive workload compared to others. The average length of stay was shortened from 8.0 days to 6.3 days ($p=0.0001$). The occupancy rate in hospital was reduced from 94% to 88% ($p=0.002$) during a period in which the number of admissions increased by 19%. However the rate of readmissions within 30 days did also increase from 12.5 to 16.4% ($p=0.0001$). Mortality was unchanged during this period. At a paired hospital in the same area length of stay occupancy and number of admissions were unchanged. It appears therefore that this simple administrative intervention may have influenced physician incentives and significantly reduced hospital length of stay and therefore bed occupancy (Rotstein *et al.*, 1996).

In 1995 a report by the Clinical Standards Advisory Group concluded: 'Assessment of need for admission by a house officer of emergency patients referred to the emergency department has been described as inappropriate since the need for admission has already been assessed by a more senior doctor in the emergency department.' They recommended that handover arrangements should be agreed so that patients may be admitted without repeat examination by junior trainees from other departments. A study in Belfast with 1200 patients (O'Connor *et al.*, 1995) compared the admitting practice in two emergency departments. In one department the patients were seen and admitted by the emergency department doctors. In the other the decision to admit was made by the team on take. This showed that there were no significant differences in the rate of diagnostic error or inappropriate admissions between the two departments. A survey of 153 consultant-led departments has shown that the decision to admit

was the responsibility of the emergency department doctors in only 6% of departments (Dearden, 1995).

4.7.2 Discharge lounges

Discharge lounges are areas of the hospital where patients can wait on the day of discharge until transport and other arrangements are made for their discharge. They help to counter the mismatch between the time beds are required for admissions and the time beds become available from the discharge of patients from the ward. One hospital established a discharge lounge from 10.00 am to 6.00 pm each day. After one year it had saved 6074 bed hours on the wards but it is unknown how this impacted on waits in emergency department (Cowdell *et al.*, 2002).

4.7.3 Nurse-led discharge

If nurses are allowed to discharge patients, it may prevent delays in waiting for medical staff to visit the ward. One study in a gynaecology ward reduced the length of stay of hysterectomy patients from 2.2 to 1.7 days (Brook, 2001).[59] A system of nurse-led discharge has been shown to decrease the time to readmission ($p<0.001$) and the number of readmissions ($p<0.001$). No analysis was undertaken of its effect on the initial length of stay (Parsons and McMurty, 1997).

However a study of a nurse-led inpatient facility for patients requiring no further medical intervention showed that they had longer length of stay than the those randomly assigned to traditional consultant-managed care (median 27.0 days *versus* 15.5 days, $p<0.036$).

4.7.4 Discharge planning

Discharge planning has been described as haphazard in the NHS but no studies were found to evaluate the benefits. The role of discharge co-ordinators has been described but not evaluated (Nazarko, n.d.).

Bed management : conclusions

There is a lack of evidence supporting any innovations in bed management although it has been shown that workload can be predicted. There is weak evidence that allowing direct admission by the emergency department team will reduce waits and has no negative effect.

Managing the beds in a hospital is a key role to its efficient functioning and yet no trials of different bed management strategies were found. This should be a priority area for future research in view of the alleged wastage in beds from unnecessary long stays in hospital.

Key points

- There is a lack of evidence of innovations in bed management.
- Allowing emergency department staff to admit to wards will reduce delays.

Table 20 Bed management (4.8)

Study details	Domain	Study design	Study population	Intervention	Findings / conclusion
Forster *et al.*, 2003 Applicable to UK: Limited Canada	ED In-hospital care	Observational study	ED users admitted to hospital April 1993 - June 1999 ED size: 60 000 p.a.	Effect of hospital occupancy on ED LOS for admitted patients	ED LOS significantly associated with hospital occupancy - increases in hospital bed occupancy (esp. 79%) lead to prolonged ED waiting times

Note. ED: emergency department; LOS: length of stay.

Case study 7: Discharge lounge

Summary of improvement

The introduction of a discharge lounge has improved the utilisation of beds and provided a more efficient service for both elective and emergency admissions, ensuring that care is not compromised.

- Since November 2000, 4658 bed hours have been saved.
- Trolley waits have been reduced.
- There is increased patient /user satisfaction:
  - 'The lounge is a wonderful idea; I gave up my bed four or five hours earlier so use of it could be made for another patient.'
  - 'The most useful part was having a co-ordinator keeping you informed and trying to speed the discharge process; on the wards, nurses are so busy they don't really get time to do that'.

Changes made

- More efficient utilisation of beds and timely admissions.
- Orderly discharge process using dedicated staff.
- More effective use of transport services.
- Quality of care improvement as shown in user questionnaire feed back.

Implementation advice

- Facilitate a change in culture; convince staff it will not be "more work".
- Even if wards are not busy, encourage staff to use the lounge.
- Communicate with transport and relatives; carers need to be aware of the transfer to the discharge lounge.
- Take into consideration the needs of patients and finding a suitable area to provide the service.

Next steps

- Reinforce the message to all staff involved about the benefits of using the lounge for both staff and patients; the results are indisputable.
- Working closely with the clinical site managers has improved the use of the lounge; daily joint visits are made to the wards collecting the names of possible users and discharge information.

For further information please contact:

Sister Ruth Goodland
GOODR@est.nhs.uk

Ann Bull
Discharge Lounge Co-ordinator

East Somerset NHS Trust
Yeovil District Hospital
Higher Kingston
Yeovil
Somerset
BA21 4AT

4.8 Delayed discharges

A review of the literature around delayed discharges was undertaken by Vetter (2003). He highlighted the fact that research is difficult because of the lack of an objective measure of inappropriate delay, although a systematic review of this subject by McDonagh *et al.* (2000) has suggested the appropriateness evaluation protocol (AEP) to be the best validated.

Vetter (2003) also found that no trials have looked at the outcomes for inpatients who were deemed to have been inappropriately discharged. He also found that there have been no robust analyses of discharge planning other than a systematic review of home visits before discharge (Patterson and Mulley, 1999), which found no RCTs. Only five studies (two retrospective surveys, three observational surveys) were identified. In four of these, a possible benefit for home visiting was suggested.

Glasby (2003) has reviewed the literature relating to delayed discharges and has highlighted the key issues as:

- failure to give patients and their carers adequate notice of discharge
- failure to involve patients and their carers in decisions about discharge and ongoing care arrangements
- failure of health and social care partners to work effectively together
- hospital delays in arranging transport and medications
- lack of attention to the needs of carers
- structural barriers for example separate funding streams, organisational and professional barriers.

Glasby also highlights the lack of intervention studies to research innovations that could influence these factors. He is also undertaking a systematic literature review funded by Department of Health (PREP) Policy Research Program, which aims to identify and explore the rate and causes of delayed hospital charges and policies and practices that may reduce delayed discharges and improve the experiences of older people.

In Seattle the most frequent reason for 'overstays' was lack of post-hospital beds (Semke *et al.*, 1989). Overstays were calculated as days in hospital after the patient had been declared medically fit. In the study, 81% of patients had no one available at home to give care. System failures accounted for 90% of overstay days.

A thematic analysis identified the barriers to successful discharge practices in a general hospital in Leeds using four focus groups of staff and ten in-depth patient interviews (Cannaby *et al.*, 2003).[73]

Five themes emerged:

1 communication in the multi-disciplinary team and with patients was variable

2 there was a lack of cohesive teamworking

3 the discharge process had an impact on co-ordination

4 resources, in particular equipment, were not available

5 it is important to plan to ensure referral before the time discharge is required.

Social care issues are also covered in the sections on:

- Social care in emergency department (section 4.3.9).
- Admission avoidance (section 4.6).
- Education (section 4.4).
- Social care supporting discharge (section 4.6.5).

Delayed discharges: conclusions

The literature exploring delayed discharge is limited, hampered by the lack of an objective measure of 'inappropriate delay'.

A number of factors affecting delayed discharge have been identified, however the research base is weak. One systematic review has been found which explored the effect of home visits prior to discharge and although a possible benefit for home visiting was suggested only five studies – two surveys and three observational studies – were found. More research is needed in this important though difficult area.

Key points

- There is a lack of evidence about innovations to reduce delayed discharges from hospital.
- Most evidence looks at the causes of delays rather than solutions.

4.9 Staffing

Matching the number of staff to the caseload arrival is key to ensuring that a queue does not form (Audit Commission, 1998) but this needs to be combined with measures of workload; tools have been developed to assist this (Taylor *et al.*, 1997). By applying the theory of constraints, bottlenecks in the system can be identified and a model created to determine if extra staffing is required to reduce waits (Rotstein *et al.*, 2002). It has been successfully used to predict a senior house officer shift pattern that more closely matched the patient arrival pattern and would produce shorter waiting times (Coats and Michalis).

Most emergency departments have fixed staffing levels. One study (Shaw and Lavelle, 1998) developed an additional team of personnel who were on call during the viral epidemic season. If the hourly number of presentations was greater then 25% of the hourly average for the year then the team would be mobilised. The team was used 32% of the time in the viral season. It resulted in non-significant decreased waits to see a doctor of 15 minutes compared to the previous year when there was no such team. The study was limited to those patients discharged and in whom all data was available (which was only 64% in the control time period). A Chinese study (Chen *et al.*, 2003) looked at developing a team of experienced nurses who were responsible for quality control and had to be available for on call duties overnight as well as working evenings in the emergency department. They reported that it improved pressure on staff and improved quality of care but detailed analysis was not available. In Rochester a system was developed so that at periods of overcrowding a 'code red' was instituted which provided extra staff in the emergency department, increased flexibility of bed usage in the hospital and a transition team to care for patients awaiting admission in the emergency department. The analysis did not allow exact measurement of the improvements (Schneider *et al.*, 2001).

Teamworking was assessed (Anon., 2000b) by a trial whereby physicians and nurses were teamed up compared to a trial of normal practice. Patient satisfaction with waiting time improved with the team system (score 68 *versus* 73, $p=0.01$). Changing from a system of individual doctors determining their own work rate (by seeing the next patient when they are ready) to a system of rotational allocation caused a reduction in length of stay for moderately ill patients (Hirshon *et al.*, 1996). Critically ill, psychiatric and paediatric patients were excluded. After one year the waits had reduced from 7.11 hours to 5.86 hours ($n=425$ pre and 448 post; $p<0.001$). Another system of small teamworking was assessed by Lau and Leung (1997). Before and after the introduction of the new system, the average waiting time of the patients was 35.19 minutes and 22.04 minutes respectively (range 0 to 134.0 minutes and 0 to 106.3 minutes, respectively). The

difference of 13.15 minutes in the average waiting times was clinically and statistically significant (t=2.81; p=0.004), supporting this new system of working.

No high quality studies were found to help predict staffing requirements.

4.9.1 Senior staff

Many of the studies previously mentioned have suggested that increased involvement of senior staff would improve the emergency care system but have not supported this with evidence. The debate about 24 hour senior cover in the emergency department was summarised by Cooke *et al.* (1998)

In a time series study (Wanklyn *et al.*, 1997), a three-week period of medical emergencies receiving normal junior assessment with senior advice if required was followed by a three-week period of being assessed by a single senior registrar then by a group of senior registrars. The same day discharge was better in week two than week one (3.6% *versus* 29%, p<0.001) and still higher than week one in the third week (15%, p<0.001). The readmission rate also reduced (13.3%, 6.9%, 6%). Murphy *et al.* (n.d.), demonstrated that using the emergency department staff grade to determine the need for admission compared to the traditional referral system reduced the wait from decision to admit to bed from 130 minutes to 235 minutes (p<0.0001). However in the emergency department staff grade arm of the trial only one person who was more senior saw the patient.

A British study undertook an RCT reviewing patients who had been referred to the surgical team for intra-abdominal abnormalities which did not require emergency surgery. In the intervention group patients were seen by a senior surgeon (consultant or senior registrar) and then had abdominal ultrasound and/or plain x-rays which were evaluated by a radiologist. The two groups had no significant difference in mean waiting time in emergency department, length of admission, surgical intervention, re-admission rate, and mortality. However, there was a significant difference in the major outcome measure of number of patients admitted. It was therefore successful in avoiding admissions (Cochrane *et al.*, 1998).

One study noted that 2.5% of total emergency department re-attendances were unplanned emergency department attendances. The common reason for this related to persistent pain following injury and approximately half had a significant change in their management. It was also estimated by expert opinion that two-thirds of re-attendances were unavoidable, therefore only 0.8% of all emergency department attendances are avoidable because of changes that reduce reattendance rate. The article suggests that senior emergency department doctors may be able to reduce this number (Armstrong *et al.*, 1991).

In a study of 156 patients potentially needing psychiatric care the assessment given by emergency physicians and psychiatrists was compared. The emergency physicians and psychiatrists had only a moderate agreement regarding danger to self (k=0.44), danger to others (k=0.4) and substance abuse being a primary problem (k=0.5) and the need for psychiatric hospitalisation (k=0.54). The study did not look at which diagnosis was eventually deemed to be correct. It suggested that this only moderate level of agreement means that there should be more shared training and suggested that a policy of direct psychiatric admission following emergency physician assessment may produce some discrepancy of opinion (Garbrick *et al.*, 1996).

Improvements in care may also be achievable by enabling staff to increase their patient contact time. An American study showed low levels of direct contact (Hollingsworth *et al.*, 1998) and Brown (2000) reported UK consultants only able to spend a 30% of their time in patient contact. This study of the activities of emergency department consultants showed that the more consultants present, the more time they spent on clinical duties. None of the consultants studied spent more than 48% of their time in clinical contact, although all worked more than their contracted hours. However the study only used a small convenience sample of staff. A time and motion evaluation of the activities of four emergency department consultants determined that over 20% of their time could have been saved with the use of a physician's assistant. This study only took place in one hospital and the consultants knew they were being observed, so this may not be applicable to all situations (Law and Sloan, 1999).

4.9.2 Nurse practitioners

Nurse practitioners are used widely throughout the UK and schemes are increasing rapidly (Neades, 1997; Tye, 1997). They have been shown to be as safe as junior doctors (Sakr *et al.*,1999; Sakr, 2000) and patients are satisfied with the care they administer (Rhee and Dermyer, 1995). Although, interestingly, in a paying system, patients are prepared to pay more to see a doctor (Larklin and Lesko, 1999). A literature appraisal concluded that depending on the protocols and patients' age restrictions, emergency nurse practitioners could independently treat between 24% and 30% of patients attending emergency department but the cost per case may be higher for emergency nurse practitioners (Sakr, 2003).

It has been demonstrated that emergency nurse practitioners can treat minor injuries equally effectively as senior house officers but that both made significant errors in 9% to 10% of cases (Sakr *et al.*,1999). This study did not assess the time taken by each to examine the patient or complete their care.

A study in a minor injury service showed that practice nurses seem to offer an effective service for patients with minor illnesses although

consultation times were slightly longer. The difference in emergency department visits between the two groups was not significant (Shum *et al.*, 2000). A study of nurse practitioners in various emergency care settings showed that the nurse practitioners spent 12 minutes longer than doctors at the initial consultation but this resulted in greater patient satisfaction. The overall length of stay was also shorter with emergency nurse practitioners. However the study had a significant weakness in that the emergency nurse practitioners were based in a minor injuries unit or a minor injuries team of the emergency department, whereas the doctors were all based in the emergency department. It is therefore impossible to determine if the delays were due to the carer or the environment (Byrne *et al.*, 2000).[66]

A systematic review of nurse practitioners working in primary care showed that in selected groups of patients, patients are more satisfied with care from a nurse practitioner than from a doctor, with no difference in health outcomes. This may be related to the fact that nurse practitioners take longer for consultations, but it also noted that they carry out more investigations. The studies were mainly limited to patients with minor illness (Horrocks *et al.*, 2002). Minor illness in primary care can be successfully treated by nurses who have access to a doctor (Marsh and Dawes, 1995).

An Australian study looked at suturing of minor lacerations by clinical nurse specialists. Patients were randomly assigned to have their lacerations sutured by either doctors or the clinical nurse specialist. Analysis found that the patient length of stay was not significantly different between the two groups. However, those who were cared for by the nurse appeared to be more satisfied with their care and the overall services. Wound healing outcomes were similar for both groups (Charles *et al.*, 1999).

A new concept is now developing in emergency nursing whereby rather than having a division between nurses and emergency nurse practitioners, a spectrum is developed based on individual competencies. This concept has only recently been described by Crouch(2001), and has yet to be evaluated for effectiveness.

4.9.3 Specialist nurses

In a systematic review of COPD specialist nurses, four studies were found. Three assessed mortality following 12 months of care (n=96, 152 and 301), and one after seven months (n=75). Meta-analysis demonstrated that mortality was not significantly reduced by the intervention, (odds ratio 0.72; 95% confidence interval 0.43 to 1.21). Post hoc sub-group analysis suggested that mortality was reduced by the outreach nursing programme in patients with less severe disease. Significant improvements in health-related quality of life were reported in one study in moderate COPD, but not in a study in patients with severe disease. No changes in clinical course were identified. Hospital

admissions were reported in only one study in patients with severe disease and no benefit was observed (Smith *et al.*, 2001).

The presence of a diabetes specialist nurse / nurse case manager may improve patients' diabetic control over short time periods, but from currently available trials the effects over longer periods of time are not evident. There were no significant differences overall in hypoglycaemic episodes, hyperglycaemic incidents, or hospital admissions. Quality of life was not shown to be affected by input from a diabetes specialist nurse/nurse case manager (Loveman *et al.*, 2004).

4.9.4 Emergency care practitioners

'Emergency care practitioners' is a new term that has been adopted to cover a group of individuals working in emergency care who have skills that apply across traditional boundaries. Most frequently it applies to ambulance paramedics with extra skills and training to increase the diagnostic and clinical management abilities. But it has also been applied to nurses who have expanded their skills in prehospital care and other professional groups working in emergency departments. The role of the paramedic in the emergency department has been described (Lewis, 1999) and the different training requirements of nurses and paramedics in the UK has been explored (Morgan and Cooke, 2001).

A study of community paramedics in Staffordshire demonstrated that 25% of patients attended were not transported and there were no adverse outcomes. However, with no control group and no details of the extra training they received, it is not possible to estimate the effect of this scheme or its generalisability (Staffordshire Ambulance Service, 2001). A study in Cumbria looked at emergency nurse practitioners working on ambulances. Without extra training, 20% of the cases were not transported with the nurse on the ambulance and 34% when the nurse was on a fast response vehicle, but as they were selected cases the effect on a whole system cannot be assessed. No figures were analysed for times when the emergency nurse practitioner was not available as a comparator (Walsh and Little, 2001).

In 27% of US emergency departments, emergency medicine (ambulance) technicians are used or are planned to be used (Allerman *et al.*, 1985). An Australian paper has formulated ideas of the practitioner role in pre-hospital care using soft systems methodology and reviews its potential in Australia, much of which is also applicable in the UK. It concludes that most of the development is speculative without research on the innovations being proposed (O'Meara, 2003). Guidelines have been established for the role of physician's assistant in emergency departments in the United States, stressing that they must supplement and assist the emergency physicians and not replace the medical expertise and they must always work under the supervision of emergency physicians and the scope must be clearly delineated. They need to have appropriate credentials to undertake the work and there

must be a dedicated person providing the overall direction of activities of physicians' assistants within the emergency department (Emergency Medicine Practice Committee, 2002). A non-randomised study looking at non-medical technicians in an emergency department undertaking minor procedures such as blood-taking, retrieval of results, suturing, plastering, etc. showed that the mean waiting time was reduced by ten minutes against a background time of three hours ($p<0.0001$). The reduction was confined to those in categories 3 and 4. The number of patients who left without being seen was reduced from 8.2% to 5.3% The technicians were extra staff, so some of the effect may be due to increased staff rather than the specific role (Grouse and Bishop, 2001). A 15-year study of such technicians had similar infection rates for suturing as physicians (Sklar *et al.*, 1989).

In the UK, using paramedics in emergency departments has been undertaken in two ways. The first practice is using paramedics between calls but has raised concerns because their first responsibility must be to respond to emergency ambulance calls, hence risking sudden cessation of the care they are undertaking (Wisecup, 1992). The second role is using them as members of the team in emergency department. This approach is currently being trialled in the UK but no evaluation is yet available (NHS Modernisation Agency, 2003b).

4.9.5 Allied health professionals

In a Cochrane review of pharmacist interventions, one study demonstrated a decrease in admissions (Beney *et al.*, 2001). The review included 25 randomised trials, controlled clinical trials, controlled before and after studies and interrupted time series analyses which compared four interventions:

1. **Pharmacist services targeted at patients *versus* services delivered by other health professionals:** This resulted in a slight increase in utilisation of scheduled services, whereas hospital admissions and emergency room admissions were decreased (one study).
2. **Pharmacist services targeted at patients *versus* the delivery of no comparable service**: Pharmacist services decreased the use of non-scheduled health services, the number of specialty physician visits or the number and costs of drugs, compared to control patients (six studies). Improvements in the targeted patient condition were reported in ten of 13 studies that measured patient outcomes, but patients' quality of life did not seem to change.
3. **Pharmacist services targeted at health professionals *versus* services delivered by other health professionals:** The intervention delivered by the pharmacist was less successful than that delivered by physician counsellors in decreasing inappropriate prescribing (one study).

4. **Pharmacist services targeted at health professionals *versus* the delivery of no comparable service:** 25 studies were included involving more than 40 pharmacists and 16 000 patients. All studies demonstrated that pharmacist interventions produced the intended effects on physicians' prescribing practices.

Only two studies compared pharmacist services with other health professional services and were reported to have some bias and conclusions could not be drawn about comparisons 1 and 3. The other studies supported the expanded roles of pharmacists in patient counselling and physician education. Because of the lack of generalisability, poor definitions of interventions, lack of cost analysis and outcome data, further research was recommended before implementing changes.

The use of occupational therapists in emergency departments has been judged by doctors to prevent 21% of admissions referred to them. The data quality and description do not allow full interpretation of this small study (Hann, 1997).

Staffing: conclusions

There are very few studies looking at the impact of differing staffing levels, skill mix or systems of work. Work looking at increased use of senior medical staff suggests they may reduce admissions and decrease delay, particularly if they have admitting rights. Nurse practitioners have been shown to be safe and effective but their impact on waits has not been assessed. New roles in emergency care for ambulance staff, physiotherapist, pharmacists and occupational therapists have not been systematically assessed and need further research.

Key points

- Teams of staff available for unpredicted surges in activity may reduce delays.
- Rotational allocation of patients may be better than clinician self-determination.
- Senior staff may reduce admissions and delays.
- Nurse practitioners are safe and effective but their effect on waits is unknown.
- The role of other health care professional in emergency care needs evaluation.

Table 21 Staffing (4.9)

Study details	Domain	Study design	Study population	Intervention	Findings/conclusion
Shaw & Lavelle, 1998 Applicable to UK: **Yes** United States	Paediatric ED	Pre-post intervention comparison study n=24,012 intervention - VESAS n=24,657 control – pre-VESAS period	All patients attending ED ED size: 54 000 p.a.	Use of additional staffing as a team and additional space. Plan was activated between 1.00 pm and 12.00 am when 4-hourly totals and numbers attending increased by 25% on the previous years number average.	Reduction in waiting time from arrival to physician of 15 mins (95%CI –10 to -20) LWBS reduced by 37% (95%CI 33% to 41%)
Lau & Leung, 1997 Applicable to UK: **Yes** Hong Kong	ED	Pre-post intervention comparison study (N=2583) n=1319 – intervention (small team consultation system) n=1264 control (usual consultation system)	All ED patients ED size: 400/500 per day	A small team consultation system	The new system reduced waits Mean wait time reduced from 35 to 22 mins (p=0.004)
Hirshon *et al.*, 1996 Applicable to UK: **Yes** United States	ED	Pre-post intervention comparison study (N=2,637) Historical control	All patients =18 except those with ophthalmology disorders. ED size: 48 000 p.a.	Assigning patients in sequential rotation to residents	Significant reduction in mean ED LOS pre=7.11 hrs; post=5.86 hrs (p<0.001) - surgical patients: LOS reduced from 1.88 to 1.43 hrs - medical to 5.36 to 4.95 hrs

Table 21 (continued)

Study details	Domain	Study design	Study population	Intervention	Findings/conclusion
Shum *et al.*, 2000 Applicable to UK: **Yes** United Kingdom	Primary health care	RCT (N=2021) n=1815 entered the trial: n=900 treatment by nurse n=915 treatment by GP	All patients requesting and offered same day in general practice Setting: 5 general practices	Patients with minor injuries allocated to nurse or doctor in GP practices	Nurse consultations: 10 mins; doctor consultations: 8 mins 2% of patients in each group visited ED
Byrne *et al.*, 2000 Applicable to UK: **Yes** United Kingdom	ED	Observational study (N=181) n=57 Traditional ED n=57 MATS n=67 Nurse-led MIU Control: No	Minor injuries ED Size: NK MATS Size: NK MIU Size: NK	Comparison of ED, MIU and nurse led MIU	Nurse led service reduced waiting time – patients waited significantly longer to see a doctor in ED than patients waiting to be seen by ENP by 40 minutes (p<0.001)
Walsh & Little, 2001 Applicable to UK: **Yes** United Kingdom	Prehospital care	Action research study	Emergency requests-999 or GP requesting transfers	Introduction of an emergency care practitioner to the ambulance service.	Reduction in attendance at ED - ECP managed 20% of patients at the scene who were not subsequently admitted to ED
Grouse & Bishop, 2001 Applicable to UK: **Yes** Australia	ED	Cohort study (N=6909) n=3248 intervention days n=3481 control days	ED uses during NMT 'week on' in study weeks ED size: 37 000 p.a.	Recruiting NMTs to carry out minor procedures - 2 trained non-medical technicians (nurses) performed bloods, IVC, plasters etc.	Significant reduction in waiting time reduced from 40 mins to 30 mins (p<0.001) Reduction of LWBSs by 35%

Note. ED: emergency department; IVC: intravenous canellation; LOS: length of stay; LWBS: left without being seen; MATS: minor accident treatment service; MIU: minor injuries unit; NK: not known NMT: non-medical technicians.

Case study 8: Nurse-led assessment areas

Summary of improvement

A nurse-led 'assessment area' was developed using a 'see and treat' model and incorporating advanced triage, near-patient testing and streaming to primary care. This has made an immediate improvement on the emergency department patients' total waiting times and improved the patients' experience. Prior to the change, long waiting lists meant violence was not uncommon in the department, making staff recruitment and retention difficult.

A very short PDSA cycle was initiated to trial the assessment area. A set of very simple criteria were applied to the project. These were to make it safe, make it relatively cost-neutral and make sure that any outcomes were measurable. Following a one-week pilot, the effects were so dramatic on patients' waiting times that the decision was made to make the change permanent.

This improvement has contributed significantly to:

- more than 98% of patients now are seen, treated, admitted, transferred or discharged within four hours of arrival at the emergency department, compared to 93% in December 2002
- elimination of A&E gridlock
- reduced waiting room congestion
- reduced waiting room congestion
- significant reduction in number of complaints received from patients.
- improved atmosphere within the department; patients noticeably happier; lower stress levels among staff; hence improving staff morale. No more overnight patients
- strong support by the emergency department consultants who were fully involved in setting up and trialling the project, thus improving communications and team work between all levels
- raised profile of the department, recent recruitment of staff, students now requesting to do elective placements there
- 'up to date' area with notice boards, resource folders and books – assists with training of junior staff.
- ongoing improvement of communications and referral systems within primary care services
- patients now streamed to the appropriate place for their needs, according to Department of Health guidelines.

Changes made:

- All patients are seen within ten minutes of arrival and triaged according to the Manchester triage model. Because patients are not returned to the waiting room, the triage process has been pared down to a 'two-minute triage' model. Priority 1 and 2 patients are streamed to the majors / resus area, and minors are streamed to the minors area to be seen by an emergency nurse practitioner or doctor.
- All other presenting patients (both walk-in and ambulance) are seen immediately in the assessment area. Patients receive advanced triage and a decision is made by a senior emergency department nurse at F or G grade whether the patient needs to be seen in the emergency department or has a primary care

need.

- Patients undergo a variety of investigations and assessments with near patient testing using an ISTAT® blood machine bought specifically for the area. This follows a 'diagnostic recipe book' developed by the emergency department consultants which ensures that all essential investigations are completed prior to the first medical assessment, with the exception of x-rays.
- Patients suitable for primary care have appointments and referrals made at the time by the assessment nurse and are streamed away from the emergency department with open access to return should their condition worsen.
- Patients' waiting time is better utilised with the patients having a 'full package' of investigations and results readily available when seen by the doctor.

Implementation advice:

- Staffing issues – lack of senior experienced staff to cover.
- Initially open 9.00 am to –5.00 pm; after four weeks, it was open 24 hours daily. Needed staffing to match as well as training and supervision.
- Communication difficulties between assessment area and the rest of the emergency department. Initially seen as 'them and us'. All staff were encouraged to spend time working in the area to familiarise themselves with the concept and this helped relationships.
- Changing staff attitudes and implementing changes in traditional working practice. Changing staff and patients' attitudes regarding emergency department needs and primary care needs.
- A system of streaming to primary care was developed – this has assisted towards target figures by at least 10% to 15% of patients attending the assessment area daily. However this has been largely experimental, thus highlighting the need for training, guidelines, policies, and protocols.
- Liaising with PCT and GP forums to ensure that they are aware that patients will be streamed back to them. British Association for A&E Medicine core service guidelines used.
- Financial impact of near-patient testing (particularly disposables) and staffing needs to be fed into local development planning and PCT forums.

Next steps:

- Development of local guidelines, policies and protocols for the unit.
- Health care assistant's role extended to include IV cannulation / phlebotomy following training and clinical supervision. Increase in the number of emergency medical assistants in the department. (Protocol for staff to highlight abnormal results to senior nursing staff).
- Exploring the role of nurse practitioner for major injuries and illnesses including request of chest/abdominal x-rays and referral to specialties, for example medics following assessment etc.
- Development of primary care streaming guidelines with training and study days to ensure that this is done safely.

Audits to be carried out

- GP uptake and re-presenting or re-admission to the emergency department.
- Match assessment unit demand to activity (data already has been collected).
- Patient experiences in the emergency department, how we can improve.
- Staff questionnaires on current attitudes etc.

For further information please contact:

Kay Bagridge
Senior Sister A&E Assessment Area
Newham Healthcare NHS Trust
Newham General Hospital
Glen Road
Plaistow
London
E13 8SL

4.10 Multi-component studies

Although most of the studies mentioned so far have been single innovations, it is far more common that institutions are undertaking a wide array of changes simultaneously in an effort to reduce their waiting times. This obviously makes it more difficult to determine which of the changes has been effective. However some of these studies are described here. They also illustrate the importance of determining the local causes of delays before introducing changes. Use of simulation models is now increasing to help diagnose where changes can be made and test their effects (McGuire, 1997; Saunders *et al.*, 1989) but it has been noted that it may not be an accurate representation of patient flow because of the large number of assumptions that had to be made in this preliminary model (Coats and Michalis, 2001). Such systems can be used to assist in redesign or resource management (Riley, 2001).

A wide variety of innovations have been tested in emergency care to reduce waits. Many have been undertaken recently as part of the NHS Modernisation Agency's Emergency Services Collaborative using the PDSA methodology but it is not possible to determine whether these case reports are generalisable or universally applicable (NHS Modernisation Agency, n.d.).[396] Reports have been produced that define the effect on the whole system of this array of local measures (NHS Modernisation Agency, 2003b)..

A similar collaborative system operates in Australia (NICS, 2005), Canada (Calgary Health Region, n.d.) and America (Institute for Healthcare Improvement, 2003).

The Institute for Healthcare Improvement has produced a guidebook to reducing waits and delays in health care that focuses on four key areas, of which one is emergency care. This includes many case studies (Nolan *et al.*, 1996) It has also reported on its work in emergency departments (Anon., 1998a).

Use of a continuous process of time analysis over a prolonged period, with a variety of small interventions has been described to improve waiting times. Kyricacou *et al.* (1999) demonstrated a significant reduction in median total length of stay from 6.8 hours to 4.6 hours. However, reduction was not sustained over all the time periods of the study and total length of stay increased in the final two time periods to 6.0 hours. The authors suggest that the increase in length of stay is due to an increase in patient numbers and a decrease in nurse and physician numbers.

Miro *et al.* (2003) described a thorough analysis of issues causing waits in a Spanish emergency department. Increasing staffing levels and increased space in the emergency department were introduced. This resulted in improvements in waiting times to be seen (87 *versus* 24 minutes, $p<0.001$) and a decrease in the amount of time the

department was considered to overcrowded numerically (31% *versus* 8%, p<0.001) and functionally (48% *versus* 15%, p<0.001).

In a French study a series of changes were made that reduced waits (Pourriat *et al.*, 1989). These changes included having a doctor available in the emergency department, allowing staff to admit patients, increasing work of paramedical staff. This resulted in reduction in waits (p>0.001) in all components (to see the patient initially and before discharge). The methods are not fully described so the quality of the study cannot be assessed. Equally the changes due to having a doctor present at all times would not be applicable in the UK, where this is already standard practice. This article does therefore not provide suggestions for practical changes for UK emergency care.

An initiative in Quebec in 1986 consisted of 28 specific components to reduce the overcrowding in 40 hospital emergency rooms but was perceived to have had limited effectiveness (Boyle *et al.*, 1992).

At Kennewick hospital in Washington, a series of interventions were trialled using the Taguchi method of quality improvement (Phadke, n.d.). Those resulting in reduced waits were adding an additional doctor, additional laboratory staff, strong co-ordinator role and right of the emergency physician to admit a patient. However, increasing the number of rooms, dedicated radiology services, a primary care nursing stream in the emergency department and increased pharmacy cover were not found to reduce waits in their system. Many of these factors were not as expected by the task force, illustrating the danger of expert opinion and the need to assess any changes critically (Rinderer, 1996).

An American rapid process redesign system managed to reduce throughput times from four hours to two hours 55 minutes by a series of changes (Spaite *et al.*, 2002). The changes included staffing issues, change in triage and registration, laboratory and radiology systems and an emergency department nursing admit team. It was noted that key to the changes was the high level priority given to the changes by the hospital.

At Kaiser Permanente, Colorado, a review revealed a conflict of work between office setting and hospital, with patients often seeing multiple doctors and a reliance on junior staff for much emergency work. A restructuring was undertaken that consisted of three key elements: a dedicated team of inpatient physicians, enhanced continuity of care and a two-tiered admission process. The triage physicians reviewed all admissions and if they disagreed with the admitting physician, the patient was referred to the emergency room for a further assessment. The study reported reductions in average lengths of stay without any change in readmission rate. It did not record the increased workload of the emergency department as a result of the new system or effects on overload of that department (Collymore *et al.*, 1997).

A retrospective review of the procedures for reducing ambulance diversions was undertaken in New York. System-wide procedures involved the exchange of information concerning diversions. Hospital-specific procedures involved implementation of additional planning and specifying criteria for implementing diversion as well as the development of additional patient care resources. During the study period the number of ambulance diversions declined by 25% and the number of hours on diversion declined by a third. There were a wide variety of problems and solutions at a time when the number of ambulance transports increased by 7%. The study demonstrates that a combination of approaches can produce reductions in ambulance diversions but is unable to differentiate whether this was due to a change in the threshold for diversion caused by establishing criteria or whether it was due to increased resources (Lagoe *et al.*, 2003).

In an Australian system, a series of staffing and administrative interventions produced dramatic changes for the seriously ill (triage category one improved from 52% to 100% in target time, category two from 30% to 65% but little change in other groups, but no statistical analysis was undertaken). The changes included increased senior staff, transfer of junior doctor posts to middle grade posts, change of staff rotations, appointment of a nurse educator, appointment of more clerical staff and reorganisation of nursing duties (Jelinek, 1999).

Multi-component studies: conclusions

These multi-component studies are useful in that they reflect the methods commonly used in health care. They illustrate problems encountered by health care providers and this is reflected by the wide variety of solutions that can produce improvement. It also illustrates that several routes, for example increasing staffing or changing processes, can improve waits and delays.

Table 22 Multi–component studies (4.10)

Study details	Domain	Study design	Patient group	Intervention	Findings/conclusion
Pourriat *et al*., 1989 Applicable to UK: **No** France	ED	Pre-post intervention comparison n=700 intervention period n=385 control period	Patient attending ED in 1985 ED size: NK	Include doctor in ED at all times; ED doctor able to admit patients directly to ward	Significant reduction in time interval to see a doctor 21 ±7 mins to 9 ± 4 mins (p<0.001). Reduction in ED LOS from 98 ±16 mins to 41 ±14 mins (p<0.001)
Rinderer, 1996 Applicable to UK: **No** United States	ED	Observational study Control: Yes	Not specified ED size: 33,190 p.a.	Taguchi method to identify improvements: - additional nurse - additional secretary/clerk: 10.00 am - 4.00 pm & 4.00 pm - 10.00 pm - additional physician - additional laboratory technician-10.00 am – 10.00 pm - dedicated radiology technician-10.00 am - 10.00 pm - primary care nursing 12.30 pm – 7.30 pm - additional pharmacy hours-10.00 - 1.00 am - additional patient rooms - auto-hold policy - non-patient care coordinator:12.30 pm – 7.30 pm - triage room	Reduction in ED LOS 100.8 mins year before implementation to 79.1 mins year after implementation. Improvements which had most impact on ED LOS: - additional physician - additional laboratory technician - auto-hold policy

Table 22 (continued)

Study details	Domain	Study design	Patient group	Intervention	Findings / conclusion
Spaite *et al.*, 2002 Applicable to UK: **Limited** United States	ED	Observational study Historical control	ED users ED size: 46 000 p.a.	Number of innovations in the following areas: - staffing/internal process - triage-registration - diagnostic radiology - laboratory - bed availability	Reduction in median waiting time interval (triage to patient room) 31 mins in Jan 1998 to 4 mins in July 1998 Reduction of 92% in number of LWBS. Improved patient satisfaction
Jelinek *et al*., 1999 Applicable to UK: **Limited** Australia	ED	Pre-post intervention comparison Historical control	ED users except: - obstetrics & gynaecology – paediatrics - burns & spinal injuries ED size: 35 000 p.a.	Appointing chair/professor in emergency medicine plus 8 consultants changing staffing from residents to mostly registrars. Appointing clinical nurse educator/educational activities.	Improvements in: - thrombolysis time- 89 mins down to 41 mins - complaint rates: 52 to 23 - missed fractures: 95 to 35 Re-engineering in ED can improve quality of care over a range of variables.
Lagoe *et al.*, 2003 Applicable to UK: **Limited** United States	ED Prehospital care	Observational study Historical control	Ambulance transports Four general hospitals, size: 1. 41 000 p.a. 2. 21 000 p.a. 3. 49 000 p.a. 4, 42 000 p.a.	Information exchange concerning ambulance diversion Development of additional patient resource within diversion hospital	Reduction in diversion hours between 24.8% and 33.6%

Table 22 (continued)

Study details	Domain	Study design	Patient group	Intervention	Findings / conclusion
Kyriacou *et al.*, 1999 Applicable to UK: **Yes** United States	ED	Time Study Analysis (N=826) Sep 1993 n=127 Feb 1994 n=119 Jan 1995 n=110 Dec 1995 n=113 Jan 1997 n=106 Sep 1997 n=127 July 1998 n=124	Patients attending the emergency department with: - chest pain - vaginal bleeding - abdominal pain - extremity pain. ED size: 41 000 p.a.	Time flow analysis of the patient journey for 7 periods from Sept 1993 - July 1998 Interventions undertaken as a result of time flow analysis including: - automatic ordering of medical records, - nursing attendants to transport specimens, - printer in ED for laboratory results - pneumatic tube for laboratory	Overall reduction in median total ED LOS from 6.8 to 4.6 hrs during the first 5 time periods. In the last two time periods ED LOS increased to 6.0.

Note. ED: emergency department; LOS: length of stay; LWBS: left without being seen; NK: not known.

Chapter 5 Papers addressing economic issues

5.1 Identification of economic literature

Papers were first identified through the search strategy described in chapter 2, by scanning the abstracts and/or titles for 'cost', 'cost-effectiveness', 'economic evaluation' and other phrases indicative of a paper with potentially relevant economic content. This process identified 240 papers. Of these, 26 were excluded because no abstract or paper could be obtained. A further 26 were excluded because on reading the abstract it was judged that the paper had no relevance to economic evaluation. A further 28 papers were categorised as 'exhortation papers', with no primary economic content but highlighting the *need for economic evaluation* in the area. The largest group of articles was limited to consideration of cost (135). However, 54 of these appeared to only mention cost in passing and provided limited details, while the remaining 81 appeared to contain some information on costs. Only 25 papers were identified as possibly reporting a full economic evaluation (for example cost-effectiveness analysis).

Summary of findings

The most common outcomes studied were:

- time saved for the emergency department, hospital or health sector
- time saved for the patient - waiting time and total length of stay in the emergency department
- number of hospital admissions averted
- number of re-presentations averted
- throughput in the emergency department
- patient satisfaction
- inappropriate demand on the emergency department averted
- patient left without being seen
- ambulance diversion

Table 23: Percentage of studies reporting the outcomes of interest

Outcomes studied	Reported outcome	
	%	N
1. Time saved for the emergency department / hospital	99	69
2. Number of hospital admissions averted	23	16
3. Number of re-presentations averted	13	9
4. Throughput in the emergency department	26	18
5. Time saved for the patient	55	38
6. Patient satisfaction	12	9
7. Inappropriate demand on department averted	10	7
8. Patient left without being seen	9	6
9. Ambulance diversion	4	3

All outcomes stated in section two should be evaluated against the costs associated with the intervention and the comparator. A true economic evaluation should report all cost (direct and indirect) so that the cost-effectiveness of the intervention against the comparator can be assessed. This is an essential requirement for justifying the adoption of the intervention as an alternative that can be generalised to similar settings. If, for example, the benefits of an intervention in terms of time savings (of a few minutes) for the emergency department are associated with a huge increase in direct costs (for example training and set-up) and indirect costs the cost-effectiveness of the intervention is suspect and recommendation of the intervention as beneficial may not be justified. Similarly if cost savings through averted hospital admissions are associated with increased number of re-presentations and patient dissatisfaction, the cost-effectiveness of the intervention may be questionable.

Only a few (17%) of the studies reviewed have information on cost or resources used. Even when costs data are included in the study, they are inadequate to make proper judgements about the cost-effectiveness of the intervention studied or to evaluate the quality of the costs analysis performed. Table 2 summarises the main features and findings of the few studies that have provided cost or resource use data. As can be seen from this brief review, the quality of cost information in most of the studies leaves scope for further research in the field to properly assess the cost-effectiveness of the interventions studied.

Table 24 Main findings of the cost-effectiveness data

Study details	Intervention/comparator	Outcomes studied	Costs/resource use reported	Findings about costs and outcomes	Comments
Rivara *et al.*, 1986	Triage of walk-in-paediatric patients by nurse and referrals outside the institution for non-urgent cases. All walk-in-patients treated in the ED	• Number of appointments kept by the patients • Number of re-presentations	1. Total cost of care for those who underwent triage 2. Total cost if all patients were treated in the ED	**Costs:** 1. = $20,672 2. = $48,620 **Outcomes:** Appointments kept = 74% *vs.* 97% Re-presentations = 8.4%for intervention group	Intervention reported as cost-effective No breakdown of costs given US study 1983. May not be generalisable
Stiell *et al.*, 1994	Use of OAR by ED physicians when considering radiography for ankle injury. / No use of OAR	• Proportions referred for ankle and foot radiography • Time saved for the ED and the patient • Number of re-presentations • Patient satisfaction	1. Charges for all ED and subsequent physician visits and radiography for those discharged without radiography *vs.* those who had radiography 2. Mean time spent in ED from registration to discharge for those discharged without radiography *vs.* those who had radiography	**Costs / resources:** 1. = Mean = $62 *vs.* $173 2. = 80 mins *vs.* 116 min **Outcomes:** - Ankle radiography = 60% *vs* 93% - Foot radiography = 27% *vs.* 33% - Revisits for no radiography *vs.* radiography group = 7% *vs.* 20% - Days off work for no radiography *vs.* radiography group = 3 *vs.* 5 - Patient satisfaction for no radiography *vs.* radiography	Cost data does not refer to the intervention and comparator groups. Comparison is not straight forward US study

	group = 95% *vs.* 96%

Table 24 (continued)

Study details	Intervention / comparator	Outcomes studied	Costs / resource use reported	Findings about costs and outcomes	Comments
Stewart *et al.*, 1998	Home-based intervention (counselling + 1 home visit by a nurse or pharmacist) for patients discharged from acute hospital care. / Usual care	• Number of unplanned readmissions • Out-of-hospital deaths	1. Hospital-based costs of care (salaries, infrastructure, transportation and other professional services) 2. Mean cost per patient visited 3. Other community based health care costs (included primary care, pharmacotheraphy and home-visit costs)	**Cost:** 1. = $A 2190 *vs.* $A 2680 per patient 2. = $A 190 per patient 3. = Same for both groups **Outcomes:** Unplanned readmissions = 154 *vs.* 197 Out of hospital deaths = 1 *vs.* 20	Appears to be a good study Australian study
Nelson *et al.*, 2000 [390]	Sedation by orally administered midazolan for repair of lacerations in children <10 yrs. of age / No sedation	• Length of stay (LOS) in the ED	1. Physician charges 2. Combined nurse/hospital charges (includes nurse fee, cost of medication, a pulse oximetry charge and a facility fee)	**Costs:** 1. = Same for both groups 2. = Intervention costs increased by 18% to 28% depending on the type of lacerations. **Outcomes:** Mean LOS increased by 17.1 min for simple laceration. Mean LOS increased by 30.9 min for layered repairs.	Charges to the patients rather than actual costs are included in the study US study, 1996. May not be generalisable?

Table 24 (continued)

Study details	Intervention / comparator	Outcomes studied	Costs / resource use reported	Findings about costs and outcomes	Comments
Kelen *et al.*, 2001	Managed ACU in ED. / No ACU in ED	• Number of those who left without being seen (LWBS) • Ambulance diversion	1. Extension in total attending coverage (physicians and nurse) per day to accommodate the ACU	**Costs:** 1. = Extension of 7 hrs a day. Outcomes: LWBS = 5% *vs.* 10.1% Ambulance diversion = 2.8 hrs *vs.* 6.7 hrs per 100 patients	No monetary equivalent of costs for extended hours is given. No capital or other costs are considered. Study setting – ED
Gamboa *et al.*, 2002	A new health care model for patients with chronic conditions. / Conventional health care	• Number of visits to ED • Number of hospital admissions • Length of stay (LOS) in hospital	*Cannot understand the details. The paper is in Spanish*	**Costs:** = Monthly savings of over 5 million pesetas for the attended population. **Outcomes:** Visits to ED = decreased by 50% Hospital admissions = decreased by 45 % LOS = decreased by 26%	Appears to be a good study. However, need to look at the details of cost analysis to comment further. Spain
Blaivas *et al.*, , 2000	Ultrasound examination performed by EP. / Ultrasound examination performed by the radiology department	• Length of stay (LOS) • Length of stay for those who presented after hours - 6pm to 6am	1. Only the additional cost of performing an examination at night is reported.	**Costs:** 1. = Estimated at $70 to $100 above that of the examination during the day. **Outcomes:** Median LOS = 3.40 hrs *vs.* 4.39 hrs Median LOS for after hours patients = 3.20 hrs *vs.* 4.37 hrs.	No proper cost data US study, 1995 - 1998

Table 24 (continued)

Study details	Intervention / comparator	Outcomes studied	Costs / resource use reported	Findings about costs and outcomes	Comments
Heaney &, Paxton, 1997	Nurse-led minor injuries clinic /No minor injuries clinic	• Number of attendances in other EDs in the region	1. Cost per episode which includes administrative costs, domestic and portering services costs, supplies and pharmacy, staff and material costs, cost for physiotherapy and radiography	**Cost:** 1. = £32 per patient **Outcomes:** Result for number of attendances in other EDs is mixed, with increases in some and decreases in others.	From the information given, it is not possible to comment on the cost-effectiveness of the intervention Scotland
Richards *et al.*, 2002	Nurse telephone triage of requests for same day appointments in primary care / Standard management	• Time for consultation • Effect on A&E attendances	1. Cost per patient which includes cost of GP, nurse time, prescription costs, cost of tests and emergency care	**Costs:** 1. = Mean difference of £1.48 more per patient for triage. **Outcomes:** Time for consultation = 1.7 mins more than standard management. Increased ED attendances.	Intervention does not appear to be cost-effective. UK study
Nikolaus *et al.*, 1999	Comprehensive geriatric assessment with in-hospital and post-discharge follow-up by an interdisciplinary home intervention team. Assessment of ADL and cognition followed by usual care in hospital.	• Length of stay (LOS) in hospital • Survival rate • Re-hospitalisation rate	1. Total direct costs including staff costs, i.e., nurses, physicians, occupational therapists, social workers	**Costs:** 1. = DM3 365 000 *vs*. DM4 145 000 **Outcomes:** LOS = Reported as shortened by intervention Survival rate = No difference Re-hospitalisation rate = No difference.	Outcomes are not reported properly No synthesis of costs and benefits possible from the information given Germany

Table 24 (continued)

Study details	Intervention / comparator	Outcomes studied	Costs / resource use reported	Findings about costs and outcomes	Comments
London Ambulance Service NHS Trust, 2002	999 call patients triaged to MIU, by ambulance crew All patients taken to ED	• Ambulance service job-cycle time • Time to treatment • Total time of attendance in receiving unit	1. Ambulance service resources used 2. MIU and A&E resources used 3. NHS follow-up resources used 4. Patient costs (time costs - waiting + treatment)	**Costs / resources:** 1. = saving of £2,300 2. = saving of £22,764 3. = saving of £1,303 4. = mean of 93.1 mins *v*s. 198.0 mins. **Outcomes:** Mean ambulance job-cycle time = 43.9 mins *v*s. 56.6 mins. Mean time to treatment = 51.4 mins *v*s. 140.5 mins. Mean attendance time = 103.8 mins *v*s. 312.2 mins.	Detailed analysis of costs and benefits carried out. United Kingdom
Jelinek *et al.*, 1999 [271]	Major staffing and functional changes in the ED. / No staffing and functional changes	• Throughput of short-stay patients	1. Total costs of ED	**Costs:** 1. = Increase of $1.95 million during the study period. **Outcomes:** Short-stay patients treated = 725 *v*s. 392 Throughput = 394 more patients treated.	No break-down of costs provided Australia

Note. ACU: acute care unit; ED: emergency department; EP: emergency physician; LOS: length of stay; MIU: minor injuries unit; NK: not known; OAR: Ottawa ankle rules.

Chapter 6 Discussion

Reducing the time people have to wait is a priority for patients and is a UK government priority. This systematic literature review has demonstrated that waits and delays in emergency department care is a worldwide problem and there is a very extensive literature describing the extent of the problem and its possible causes. Much of the literature on causes is derived from the opinions of staff and considers the emergency department in isolation.

Waits and delays in emergency departments are the symptoms of a variety of problems and many result from inflow problems, internal flow problems or outflow problems for the emergency department. Most of the literature attributes the recent increase in overcrowding of emergency departments to decreases in bed availability and pays little attention to inflow or internal flows. In most systems it is likely that all three contribute.

Unfortunately although there is a vast amount of literature about waits and delays, most is rhetoric and anecdotal and most focuses on the extent of the problem. There is surprisingly little evidence about service delivery and organisation factors in emergency care that provides evidence to change the time course of a person's stay in the emergency department.

The inflow of patients to the emergency department may be affected by a variety of innovations in the community to either reduce people's usage of the health service in general or to divert them to other sources of care. There is some evidence that diversion of some appropriate 999 calls to NHS Direct, or similar advice lines, may reduce the workload of the ambulance service and therefore potentially the emergency department but there are some concerns regarding the safety of such systems that need clarifying. Once an ambulance crew arrives at the scene of an incident, they have traditionally conveyed the majority of cases to the emergency department. This is now changing and various initiatives are in place to allow a wider choice of destinations and to promote discharge of patents at scene. American studies suggest that the present training of paramedics is inadequate for this task and UK studies are needed to determine the safety and effectiveness of such systems, as well as the training requirements of the individuals.

The organisation of primary care is rapidly changing in the UK. There is however a dearth of evidence of the effects these changes are having and are likely to have, in the future, on the workload of emergency departments. The use of GPs in the emergency department has been shown in RCTs to be clinically and cost effective but the effect on patient flows has not been determined. At present there is no evidence

for NHS Direct or NHS walk-in centres causing significant decreases in workload for emergency departments. In other health care systems the gatekeeping role of primary care has been extended and the use of co-payments introduced to reduce emergency department attendances but there are concerns over its safety and whether it may exclude some in need of emergency treatment. Numbers of patients going through the emergency department can be reduced by triaging them out on arrival, however a few studies have suggested that some people may be inappropriately sent away although most studies have not shown any adverse events. None of these studies have been undertaken in the UK health system.

There are great opportunities to reduce the numbers attending emergency departments by secondary prevention. The small group of people who attend more than three times per year account for a large amount of the emergency department workload. Although there are many studies describing the characteristics of these patients, there are only a few studies of innovations most of which suggest that personalised programmes may reduce future use.

For the elderly and those with chronic disease a variety of interventions from educational programmes, to routine visiting and screening have been shown to be effective at reducing emergency department attendances and emergency admissions. Similarly several small studies have indicated that the use of social workers in the emergency department and subsequently can reduce subsequent health care usage. Education schemes across whole communities have not demonstrated any effect on emergency department attendances. Cochrane reviews have shown that those focused on specific groups may have an effect, but this has been variable.

Admission may also be avoided in a variety of conditions, including heart failure and thrombo-embolic disease as well as in hospital at home services, but most have not looked directly at emergency department attendance. Observation wards may also reduce length of stay but most studies have significant biases. Chest pain assessment units have not yet proven their benefit in reducing length of stay.

The internal flow of patients in the emergency department has been the subject of the most intensive scrutiny. There is good evidence, including several RCTs, that instituting near-patient testing reduces the delays for the large number of patients who have biochemical and haematological tests, but there is also evidence that many test results do not contribute to the admission or early management decisions. It may therefore be as effective to reduce the number of tests by having earlier senior opinion as to redesign diagnostic systems. Innovations to reduce delays in undertaking x-rays have received little attention, but again undertaking the tests within the emergency department seems to be effective in some small trials of ultrasound. Effective systems of delivery are important with laboratory results and there is some

evidence that stand-alone electronic reporting systems may delay care.

There is also good evidence, including RCTs, to support the use of fast track systems for minor injuries and the use of extra staff in establishing a fast track, rather than simply increasing the total workforce. Future research should focus on the configuration of such fast track systems and the resource requirements rather than comparing fast track with traditional models of care. Other fast track systems remain unproven. There is no evidence to support the role of traditional triage/prioritisation in reducing waits and some small studies suggest it may cause delays. It is important to remember that it does form an important risk management function so long as it is performed soon after arrival. However triage can reduce delays when it incorporates ordering of x-rays by the nurse; the future of this has to be questioned when fast track systems are introduced.

A wide variety of clinical innovations also help to reduce waits and delays in the emergency department including the application of local anaesthetic on arrival, wound closure techniques and asthma treatment regimes. Some delays in the clerical components may be speeded up by bedside registration and by voice recognition/transcription rather than writing notes but this is only supported by isolated small trials. While reducing waits is important it is also important that patients feel they have waited less. There are a few trials that suggest that better information, either written, by video or by an individual, improve the patient's perception of their wait.

The outflow of patients from the emergency department is dependent on a continuing flow of patients through the whole health and social care system, until the patient returns to their own home or definitive accommodation. In the immediate phase after the emergency department, the flow of patients requires effective bed management within the hospital. There is a small amount of literature describing various systems to improve bed management including use of predictive models and discharge planning but there have been no trials of these systems to determine their effects. Similarly research into delayed discharges has focused on the causes rather than on trialling any interventions to reduce them, whether because of issues in the health or social care sectors.

Human resources account for the largest expenditure in the NHS but most research focuses on system processes. There is no substantial research on the staffing requirements of the emergency care system either within the emergency department or in other areas of the system. Research shows that there are a wide variety of factors that influence emergency department attendances but that it is possible to predict 65% of the workload by hour. Matching this predicted workload to staffing requirements has been an elusive goal, partly because of the difficulty of linking workload, via casemix, to numbers of

attendances. Similarly most of the research on ways of working has been focused on establishing the safety of new models rather than the effect on waits and delays. There is some weak evidence that use of senior staff will reduce delays as well improving quality of care. Historically, emergency nurse practitioners were introduced to take over the role of junior doctors because of their reducing hours; subsequently they have further developed in a more patient-centred approach. Research has established the safety and effectiveness of emergency nurse practitioners but has not established that they help reduce waits per se, they may only be effective because of the increased staffing. A new role of emergency care practitioner is being established in the UK to work across hospital and community sectors with a broad-based training covering areas that have traditionally been across primary care, emergency medicine and ambulance care. There is not yet any evidence on the effect of this new role. The wide area of cultural and internal organisation and its effect on waits and delays in emergency care has not been the focus of any interventional studies.

Comparison of studies has been hampered by the lack of any uniform definition of overcrowding, delays and waits. In the UK there has been concentration on the total time spent in the emergency department, but other countries focus on number of ambulance diversions and cubicle occupancy. An American scale for overcrowding has been suggested recently (Derlet *et al.*, 2002). A wide variety of timings have been utilised as outcome measures including:

- arrival to triage
- triage to see doctor or nurse practitioner
- arrival to see doctor or nurse practitioner
- decision to admit to departure from the emergency department
- arrival to departure time from emergency department
- ambulance diversions.

Studies often state the size of department but rarely give sufficient information to allow case mix to compared; for example some studies exclude minor injuries, some only include those with insurance. As waits in emergency departments are often the symptom of problems across a whole health care system, the organisation of health care across the whole system will cause variation in applicability of studies. Therefore any studies outside the NHS have to be considered carefully before their generalisability in the UK is accepted. In particular, much of the literature emanates from America, where there is an insurance-based system and in some areas some groups are excluded from certain types of medical care.

Chapter 7 Conclusions

The large literature in the area of overcrowding of emergency departments and delays and waits in the emergency care system is mainly anecdotal and tends to focus on assessing the extent of the situation or giving 'expert' opinion on causes and possible solutions. In searching for solutions it is vital to consider three factors.

1. The solutions in any locality are likely to depend on local causes, which are probably variable even within one health care system.
2. For any problem there may be several ways of solving it for example long waits for minor illness and injury patients may be solved by diverting cases away from the emergency department, introducing fast track systems, introducing emergency nurse practitioners or increasing existing staffing.
3. In line with the 'theory of constraints', the apparent cause may only be the most severe bottleneck in the system and other constraints are likely to appear as the initial cause is resolved

It is disappointing that despite a period of great change in the NHS and particularly in emergency care, more evidence has not been produced. This is likely to be because of the very short time frame that government has prescribed for such changes and also the use of the PDSA methodology, which will produce large numbers of case studies and small number trials without formal statistical evaluation.

There are however a few areas that have been supported by RCTs including the use of near-patient testing and fast track systems for minor illness and injury and some admission avoidance schemes, where implementation of present research findings needs to occur. Others have weaker evidence that suggests useful innovations that require studies with increased power, including the wide variety of interventions to reduce emergency department attendances by older people, frequent attenders and those with chronic disease, and the use of observation wards and clinical decision units.

Some areas have early evidence that raises concerns about their safety and that urgently need further evaluation as they are already being widely instituted in the NHS. Managers need to be aware of the risks of instituting such innovations to avoid their premature adoption because of the pressures for change. Full risk assessments to determine both benefits and potential hazards should be undertaken. These include discharge of patients from scene by paramedics and the role of pre-hospital emergency care practitioners. The diversion of some 999 calls to NHS Direct is already being evaluated. Primary care gatekeeping, triaging out of the emergency department and the use of

co-payment systems are also potentially unsafe practices that need evaluation.

Other areas have initial evidence that suggests the innovations have had little effect on the time flows through the emergency department including the introduction of walk-in centres and NHS Direct.

Most areas do however need more high quality evaluation to determine how the NHS should proceed. The key areas needing research are bed management, reducing delayed discharges (both because of internal hospital processes and because of social care issues) and the changes in provision of emergency primary care, including its links with other components of the emergency care system. Research into staffing levels, new roles and utilisation of staff have received little attention and need further work. Some of the cultural issues are already being addressed but aspects such as the new emergency care networks have no planned evaluation (Department of Health, 2004).

It is important to remember that lack of evidence does not mean that the changes being implemented do not work and so should not suppress innovation. But it is also important that such innovations are analysed for the system-wide organisational, clinical and cost effectiveness.

Chapter 8 Further research

This systematic literature review has highlighted the fact that there are very few innovations to reduce attendances at emergency departments and to reduce waits in emergency departments that are supported by high quality evidence. There are therefore, a large number of areas that need to be subjected to more rigorous evaluation. We recommend that the first step should be a prioritisation exercise to explore which areas should be undertaken first. This exercise would need to take account of not only the level of existing evidence but the strategic importance, potential system impact and patient safety issues of the innovation. The exercise should involve a broad spectrum of stakeholders including clinicians and managers from all sectors of emergency care, policy makers, researchers, health economists and representation from users (patients, carers and public) and appropriate national bodies.

The order of the recommendations below reflects this order, in the authors' opinion, but has not undergone a formal prioritisation process:

- Innovations in bed management and patient flow to reduce delays in the inpatient process and in discharge.
- Innovations to reduce attendance at emergency departments and in particular those involving patients with chronic illness and those who already attend frequently.
- Impact of emergency care networks.
- Effect of social care in hospital and home support in reducing emergency department attendance.
- The impact of various new models of primary care provision, especially out-of-hours care, on emergency department attendance.
- The effectiveness and safety of paramedics in discharging patients from the scene and determining destinations.
- The appropriate and effective staffing of emergency departments. The roles of health care professionals in emergency care, including new roles for professional groups and the appropriate training requirements of these individuals.
- The effects of different styles of team working in the emergency care system.
- Delivery of timely imaging in emergency departments.
- The safety of triaging patients out of the emergency department.
- The effect of alternative minor injury and illness services on emergency department attendances.
- Configuration of minor injury fast track systems.

- Factors that make education campaigns effective in assisting patients choose appropriate sources of emergency care.

There was a paucity of studies on patient and public opinion or studies in which they participated. This needs to be considered in all future research.

Work is also required on developing standard definitions and agreed outcome measures for use in research in emergency department waits and overcrowding. Warwick Medical School has already commenced work in this area.

In view of the large amount of work being undertaken in the area of improving access to emergency care, we would recommend that this literature review is updated in a maximum of two years.

Major research projects are underway in the following areas:

- Evaluation of diversion of 999 calls to NHS Direct (SDO Programme).
- Organisational issues in waits in the emergency department (SDO Programme).
- Causes and reduction of delayed discharges (Department of Health).
- Impact of walk-in centres on emergency departments (Department of Health).
- Outcome measures in emergency health care service delivery (Warwick University).

Chapter 9 Implementation of findings

Policy

This work has been actively informing Department of Health policy throughout its production. Hence most of the innovations have already helped to inform developing policy.

There are some key areas of policy that either have no evidence available or, in some cases, are not supported by quality evidence.

NHS walk-in centres and NHS Direct have not been shown to reduce attendances at emergency departments, except possibly when co-located with the ED. Patient education has not been demonstrated to reduce emergency department attendances. Similarly the effect of nurse practitioners on reducing waits has not been studied. All these initiatives have however been shown to have other advantages and benefits to patient care and the NHS.

Good evidence exists to support the following policies:

- fast track systems for minor injury patients
- chronic disease case management, home support and specialist nurse care to reduce emergency admissions.

Therefore these should be instituted locally.

Some policy areas have a marked lack of evidence and rely on expert opinion and experience from within the NHS. These areas should be priorities for future service delivery research and include:

- bed management
- reducing delayed discharges
- reorganisation of emergency primary care.

The effectiveness and safety of diverting 999 calls to nurse advice and of ambulance staff discharging patients at the scene has not been adequately assessed but is part of present policy.

Co-payments have been shown to reduce attendances but safety has not been assessed and they go against the current philosophy of the NHS of free care for all.

Local decisions

Many of the innovations described above that are supported by present policy now require local implementation. Other innovations described in this study are at a level of detail that is not appropriate for national policy and should be explored at local level to determine their applicability. These include:

- senior staff seeing patients at an earlier stage
- emergency department staff admission rights
- changes to the present triage systems
- escalation clinical teams
- rotational allocation of patients on arrival.

Table 25 Policy related to evidence

Evidence	Present policy status	Comments and links to policy	Actions required
It is possible to divert some 999 calls to advice lines but the safety of such systems is still being evaluated.	Supported by present policy		Research evaluation in progress
The role of paramedics in either discharging patients from scene or deciding on appropriate destinations has not been adequately studied to confirm its safety and effectiveness in the UK.	Supported by present policy		Needs safety evaluation results before widely disseminated
Primary care gatekeeping can reduce emergency department attendance but its safety is unknown.	Supported by present policy		Needs safety evaluation results before widely disseminated
Walk-in centres and NHS Direct have not been demonstrated to reduce attendances at emergency departments.	Supported by present policy		Further research evaluation in progress
Fast track systems for minor injuries reduce waits, ideal configurations include senior staff.	Supported by present policy	www.modern.nhs.uk/scripts/default.asp?Site_id=35&id=8196	Widely utilised but optimal configuration needs further evaluation
Attendance by the elderly, those with chronic disease and those with multiple attendances may be reduced by various interventions; trials are needed in this area, including the role of social workers.	Supported by present policy	Pilot sites are underway. See www.natpact.nhs.uk/cms/2.php	Awaiting results of evaluation
Patient education is unproven in most areas except chronic disease management.	Supported by present policy	Several national and local programmes in progress	Less investment in this area may be appropriate

Table 25 (continued)

Evidence	Present policy status	Comments and links to policy	Actions required
Phoning for advice before going to the emergency department may reduce attendances.	Supported by present policy		Needs to be linked with evaluation of and improvements to NHS Direct
Specialist nurse care in heart failure, COPD and DVT can reduce hospital admissions.	Supported by present policy	Pilot sites are underway. See www.natpact.nhs.uk/cms/2.php	Awaiting results of evaluation
Home support (medical and social) can reduce hospital admissions.	Supported by present policy	Pilot sites are underway. See www.natpact.nhs.uk/cms/2.php	Awaiting results of evaluation
Nurse practitioners are safe and effective but their effect on waits is unknown.	Supported by present policy		Further research evaluation required
The role of other health care professional in emergency care needs evaluation.	Supported by present policy		Further research evaluation required
There is a lack of evidence of innovations in bed management.	Present policy supported by experience rather than evidence	www.modern.nhs.uk/scripts/default.asp?Site_id=35&id=16491	More evidence required
There is a lack of evidence about innovations to reduce delayed discharges from hospital.	Present policy supported by experience rather than evidence	Present innovations are not supported by evidence	More evidence required
Co-payment systems reduce attendances but may equally reduce attendances by those requiring emergency care.	Not supported by present policy		No action

Table 25 (continued)

Evidence	Present policy status	Comments and links to policy	Actions required
Senior staff may reduce admissions and delays.	Local decision, with national policy to support more senior staff		
Allowing emergency department staff to admit to wards will reduce delays.	Local decision that is supported by present policy		Introduce unless good reason locally
There is no evidence around the effects on waiting times of general practitioners working in emergency departments.	Local decision	Various models of GP working in the ED and in collocated primary care centres are in place	More evidence required
Triage is a risk management tool for busy periods; it may cause delays in care.	Local decision	Move away from triage for all patients at all times	Move away from triage for all patients at all times
Triaging out of the emergency department can reduce numbers but more work is required to asses the safety of such systems.	Local decision	Collocation and provision of on-site primary care are developing as preferred models in UK	
Observation wards may reduce length of stay and avoid admission.	Local decision		Appropriately managed observation and assessment units should be established
Teams of staff available for unpredicted surges in activity may reduce delays.	Local decision	Unknown if used	Local consideration
Rotational allocation of patients may be better than clinician self determination.	Local decision	Unknown if used	Local consideration

References

Airey, D. and Franks, A.J. 1995. 'Major trauma workload within an English health region', *Injury* 26: 25–31.

Allerman, G,, McKay, J,I, and Novotny-Dinsdale, V. 1985. 'Use of prehospital care providers in emergency departments: A national survey', *Journal of Emergency Nursing* 11:33-9.

American College of Emergency Physicians. [n.d.]. The ACEP have produced a range of best practice resources, available online [March 2005] at www.acep.org/webportal/PracticeResources/

Allerston, J. and Justham, D. 2000. 'A case-control study of the transit times through an accident and emergency department of ankle injured patients assessed using the Ottawa Ankle Rules', *Accident and Emergency Nursing* 8:148-154.

Anderson, S., Hogskilde, P.D., Wettersley, J., Bredgaard, M., Sorensed, Moller, J.T., Dahl, J.B., Hogskilde, S. 2002. 'Appropriateness of leaving emergency medical service treated hypoglycemic patients at home: a retrospective study', *Acta Anaesthesiologica Scandinavica* 46:464-468.

Andersson, G. and Karlberg, I. 2001. 'Lack of integration, and seasonal variations in demand explained performance problems and waiting times for patients at emergency departments: a three year evaluation of the shift of responsibility between primary and secondary care by closure of two acute hospitals', *Health Policy* 55:187-207.

Andren, K.G. and Rosenquvist, U. 1985. 'Heavy users of an emergency department: psycho-social and medical characteristics, other health care contacts and the effect of a hospital social worker intervention', *Social Science and Medicine* 21:761-770.

[Anon]. 1998a. 'These novel strategies decrease ED delays', RN 61:24.

[Anon]. 1998b. 'Data from ED patient tracking system help identify x-ray cycle time improvements', *Data Strategies and Benchmarks* 2:4-8.

[Anon]. 1998c. 'Diabetes program cuts ED visits 67% in first 6 months', *Disease State Management* 4:16-17.

[Anon]. 1999. 'Albuquerque halts EMS triage program', *EMS Insider* 8.

[Anon]. 2000a. 'Creating new emergency center registration process improves patients' satisfaction with time from arrival to treatment', *Joint Commission Benchmark* 2:6-7.

[Anon]. 2000b. 'Teamwork helps cut ED wait times', *Healthcare Benchmarks*7:40-41.

Anthony, M. and Dunne, M.O. 1997. 'The appropriateness of A&E attendances: A prospective study', *The Irish Medical Journal* 90:268-269.

Ardagh, M.W., Wells, J.E., Cooper, K., Lyons, R., Patterson, R. and O'Donovan, P. 2002. 'Effect of a rapid assessment clinic on the waiting time to be seen by a doctor and the time spent in the department, for patients presenting to an urban emergency department: A controlled prospective trial', *New Zealand Medical Journal* 115: U28.

Arizona College of Emergency Physicians. 2000. *Emergency department crowding & ambulance diversion*. Arizona: Arizona College of Emergency Physicians.

Armstrong, A.M., Pennycook, A.G., Swann, I.J. 1991. 'Unplanned re-attendance in the accident and emergency department', *Scottish Medical Journal* 36:111-114.

Armstrong, S.H., Peden, N.R., Nimmo, S. and Alcorn, M. 2001. 'Appropriateness of bed usage for inpatients admitted as emergencies to internal medicine services', *Health Bulletin* 59:388-395.

Askenasi, R., Lheureux, P. and Gillet, J.B. 1989. 'Influence of tests on patient time in the emergency department', *Reanimation Soins Intensifs Medecine d'Urgence* 5:201-202.

Asplin, B.R. 2001. 'Undertriage, overtriage or no triage?', *Annals of Emergency Medicine* 38:282-285.

Audit Commission. 1996. *By Accident or Design: Improving A&E Services in England and Wales.* London: HMSO.

Audit Commission. 1998. *By Accident or Design: A review of progress in A&E*. London: HMSO.

Audit Commission. 2001. *By Accident or Design: Improving A&E Services in England and Wales.* London: HMSO.

Audit Commission. 2003. *Acute hospital portfolio: Bed management*. [Online]. Available (March 2005) at www.healthcarecommission.org.uk/assetRoot/04/00/02/38/04000238.pdf.

Azzazy, H.M.E. and Christenson, R.H. 2002. 'Cardiac markers and point of care testing: A practical approach', *Journal of Clinical Ligand Assay* 25:325.

Badgett, J.T. 1986. 'Can Medicaid format alter emergency department utilization patterns?', *Pediatric Emergency Care*. 2:67-70.

Bagust, A., Place, M., and Posnett, J.W. 1999. 'Dynamics of bed use in accommodating emergency admissions: stochastic simulation model', *British Medical Journal* 319:155.

Baker, D.W., Parker, R.M., Williams, M.V., Scott Clark, W. 1998. 'Health literacy and the risk of hospital admission', *Journal of General Internal Medicine* 13:791-798.

Baker, D.W., Stevens, C.D. and Brook, R.H. 1996. 'Determinants of emergency department use: are race and ethnicity important?', Annals of Emergency Medicine 28:677.

Ball, J., Dixon, M. and Holt, L. 2000. 'Why are we waiting? Snapshots surveys of the impact of emergency pressures on patient care', *Emergency Nurse* 8:22-27.

Banerjee, S. and Rhoden, W.E. 1998. 'Fast-tracking of myocardial infarction by paramedics', *Journal of the Royal College of Physicians* 32:36-8.

Baraff, L.J., Lee, T.J., Kader, S. and Della-Penna, R. 1999. 'Effect of a practice guideline for emergency department care of falls in elderly patients on subsequent falls and hospitalisations for injuries', *Academic Emergency Medicine* 6:1224-31.

Bayley, M., Schwartz, J. Shofer, F., Weiner, M., Sites, F., Traber, K. and Hollander, J. 2002. 'The financial burden of ED congestion and hospital overcrowding for chest pain patients awaiting admission', *Academic Emergency Medicine* 9:367-a.

Bazarian, J.J., Schneider, S.M., Newman, V.J. and Chodosh, J. 1996. 'Do admitted patients held in the emergency department impact the throughput of treat-and-release patients?', *Academic Emergency Medicine* 3:1113-1118.

Beales, J. 1997. 'Innovation in Accident and Emergency management: establishing a nurse practitioner-run minor/ injuries/primary care unit', *Accident and Emergency Nursing* 5:71-75.

Beecham, L. 1999. 'Accident departments are not used properly', *British Medical Journal* 318:1293.

Benavent, A.V. and Casares, R.F. 1994. 'Primary care as a determinant of the utilization of hospital emergency services', *Atencion Primaria* 14:825-828.

Beney, J., Bero, L.A. and Bond, C. 2001. 'Expanding the roles of outpatient pharmacists: effects on health services utilisation, costs, and patient outcomes. (Cochrane Review)', in *The Cochrane Library*, Issue 4. Chichester, UK: John Wiley & Sons, Ltd.

Benz, J.R. and Shank, J.C. 1982. 'Alteration of emergency room usage in a family practice residency programme', *Journal of Family Practice* 15:1135-1139.

Birnbaum, A,, Gallagher, E.J., Utkewicz, M., Gennis, P. and Carter, W. 1994. 'Failure to validate a predictive model for refusal of care to ED patients', *Academic Emergency Medicine* 1:213-217.

Blaivas, M., Sierzenski, P., Plecque, D. and Lambert, M. 2000. 'Do emergency physicians save time when locating a live intrauterine pregnancy with bedside ultrasonography?', *Academic Emergency Medicine*. 7:988-993.

Blanco, A., Pileggi, C. and Angelillo, I.F. 2003. 'Non urgent visits to a hospital emergency department in Italy', *Public Health* 117:250-255.

Bloe, C. 2001. 'Nurse-initiated coronary thrombolysis', *Nursing Times* 97:40-42.

Bluth, E.I., Lambert, D.J. and Lohmann, T.P. 1992. 'Improvements in "stat" laboratory turn-around time. A model continuous quality improvement project', *Archives of Internal Medicine* 152:837-840.

Boaden, R., Proudlove, N. and Wilson, M. 1999. 'An exploratory study of bed management', *Journal of Management Medicine* 13:234-250.

Boger, E. 2003. 'Electronic tracking board reduces ED patient length of stay at Indiana Hospital', *Journal of Emergency Nursing.* 29:39-43.

Boland, A., Dundar, Y., Bagust, A., Haycox, A., Hill, R., Mujica Moto, R., Walley, T. and Dickson, R. 2003. 'Early thrombolysis for the treatment of acute myocardial infarction: a systematic review and economic evaluation', *Health Technology Assessment* 7:1-136.

Bond, P.A. 2001. 'A staffed ED assessment room: impact on wait times for nonurgent patients at a Saudi Arabian hospital', *Journal of Emergency Nursing* 27:394-395.

Boyack, V.J. and Bucknum, A.E. 1991. 'The quick response team: a pilot project', *Social Work in Health Care* 16:55-68.

Boyle, P., Pineault, R. and Roberge, D. 1992. 'Assessing Quebec's multi-component program to reduce emergency room overcrowding', *Canadian Public Policy* 1992;18:189-202.

Brady, W.J., Brauning, N., Lee, D.S., Pietska, J.K., Kelly, P.O., Huff, S. and Martin, M.L. 2000 'Social needs in the elderly, recognition by emergency physicians and impact on additional medical care', *Academic Emergency Medicine* 7:571.

Brandt, C.P., Coffee, T., Yurko, L., Yowler, C.J. and Fratianne, R.B. 2000. 'Triage of minor burn wounds: avoiding the emergency department', *Journal of Burn Care and Rehabilitation* 21:26-28.

Brebner, J.A., Ruddick-Bracken, H., Norman, J.N. and Page, J.G. 1996. 'The nurse practitioner: management of minor trauma', *Accident and Emergency Nursing* 4:43-46.

Brenchley, J., Sloan, J.P. and Thompson, P.K. 2000. 'Echoes of things to come. Ultrasound in UK emergency medicine practice', *Accident and Emergency Medicine* 17:170-175.

Bridges, J., Spilsbury, K., Meyer, J. and Crouch, R. 1999. 'Older people in A&E: literature review and implications for British policy and practice', *Reviews in Clinical Gerontology* 9:127-137.

Brillman, J., Mathers-Dunbar, L., Graff, L., Joseph, T., Leikin, J., Schultz, C., Severance, H. and Werne, C. 1995. 'Management of observation units', *Annals of Emergency Medicine* 25:823-830.

Brillman, J. and Tandberg, D. 1994. 'Observation unit impact on emergency department admissions for asthma', *American Journal of Emergency Medicine* 12:11-14.

Brillman, J.C., Doezeman, D. and Tandberg, D. 1997. 'Triage: limitations in predicting need for emergency care hospital admissions', *Annals of Emergency Medicine* 27: 493-500.

Brockmeyer, E., Halstrom, H.L. and Jensen, A. 1948. 'The life and works of A.K. Erlang', *Transactions of the Danish Academy of Technical Sciences* 2.

Brogan, C., Pickard, D., Gray, A., Fairman, S. and Hill A. 1998. 'The use of out of hours health services: a cross sectional survey', *British Medical Journal* 316:524-527.

Brook, N. 2001. 'Nurse-led discharge planning improves quality of care', *Nursing Times* 97:40.

Brookoff, D. and Minniti-Hill, M. 1994. 'Emergency department based home care', *Annals of Emergency Medicine*23:1101-1106.

Brown, R. 2000. 'Activities of accident and emergency consultants - a time and motion study', *Journal of Accident and Emergency Medicine* 17:122-125.

Browne, G.J., Giles, H., McCaskill, M.E., Fasher, B.J. and Lam L.T. 2001. 'The benefits of using clinical pathways for managing acute paediatric illness in an emergency department', *Journal of Quality in Clinical Practice* 21:50-55.

Buesching, D.P., Jablonowoski, A. and Vesta, E. 1985. 'Inappropriate emergency department visits', *Annals of Emergency Medicine* 14:672-676.

Burgher, S.W., Tandy, T.K. and Dawdy, M.R. 1998. 'Transvaginal ultrasonography by emergency physicians decreases patient time in the emergency department', *Academic Emergency Medicine* 5:802-807.

Burnett, M.G. and Grover, S.A. 1996. 'Use of the emergency department for nonurgent care during regular business hours', *Canadian Medical Association Journal* 154:1345-1351.

Byrne, G., Richardson, M., Brunsdon, J. and Patel, A. 2000. 'An evaluation of the care of patients with minor injuries in emergency settings', *Accident and Emergency Nursing* 8:101-109.

Byrne, M., Murphy, A.W., Plunkett, P.K., McGee, H.M., Murray, A. and Bury, G. 2003. 'Frequent attenders to an emergency department: a study of primary health care use, medical profile, and psychosocial characteristics', *Annals of Emergency Medicine* 41:309-318.

Bywaters, P. and McLeod, E. 2003. 'Social care's impact on emergency medicine: a model to test', *Emergency Medicine Journal* 20:134-137.

Bywaters, P., McLeod, E. and Cooke, M. 2002. 'A diversionary tactic? Social work in an emergency assessment unit', *Nursing Older People* 14:19-21.

Calgary Health Region. [n.d.] 'Regional collaborative for system improvement 2004-2005' [Online]. Available(March 2005) at http://www.crha-health.ab.ca/qihi

Cameron, P.A., Kennedy, M.P. and McNeil, J.J. 1999. 'The effects of bonus payments on emergency service performance in Victoria', *Medical Journal of Australia* 171:243-246.

Campbell, J.L. 1994. 'General practitioner appointment systems, patient satisfaction, and use of accident and emergency services-a study in one geographical area', *Family Practice* 11:438-445.

Cannaby, A., Parker, S. and Baker, R. 2003. 'Identifying barriers to improving the process of discharging patients from hospital', *Primary Health Care* 4:49-56.

Cardello, D.M. 1992. 'Implementation of a one-hour fast-track service: One hospital's experience', *Journal of Emergency Nursing* 18:239-243.

Cardin, S., Afilalo, M., Lang, E., Collet, J., Colacone, A., Tselios, C., Dankoff, J. and Guttman, A. 2003. 'Intervention to decrease emergency department crowding: Does it have an effect on return visits and hospital readmissions?' *Annals of Emergency Medicine* 41:173-185.

Carlisle, R., Groom, L.M., Avery, A.J., Boot, D. and Earwicker, S. 1998. 'Relation of out of hours activity by general practice and accident and emergency services with deprivation in Nottingham: longitudinal survey.' *British Medical Journal* 316:520-523.

Carver, J., Boyle, R., Chamberlain, D., Fisher, J., Quinn, T., Henderson, K. and Dancy, M. 2003. *Review of Early Thrombolysis. Faster and Better Treatment for Heart Attack Patients*. London: Department of Health.

Castille, K. and Cooke, M. 2003. 'One size does not fit all', *Journal of Accident and Emergency Medicine* 20:119-120.

Catellier, D.J., Conlisk, E.A., Vitt, C.M., Levin, K.S., Menon, M.P. and Upchurch, G.A. 2000. 'A community-based pharmaceutical care program for the elderly reduces emergency room and hospital use', *North Carolina Medical Journal* 61:99-103.

Catnach, S., Pinkney, J., Woods, A. and Fairclough, P. 1992. 'Fast track admission for patients with acute myocardial infarction', *British Medical Journal* 304:380-381.

Caunt, J. 1996. 'The advanced nurse practitioner in CCU. Care of the critically ill', 12:136-139.

Celenza, A., Fothergill, J., Kupek, E. and Shaw, R.J. 1996. 'Thunderstorm associated asthma: a detailed analysis of environmental factors', *British Medical Journal* 312:604-607.

Chan, L., Reilly, K.M. and Salluzzo, R.F. 1997. 'Variables that affect patient throughput times in an academic emergency department', *American Journal of Medical Quality* 12:183-186.

Chande, V.T. 1997. 'Effects of a new fee-for-service Medicaid managed care plan on pediatric emergency department utilization... including commentary by Rousseak-Harsany E.', *Ambulatory Child Health* 3:269-274.

Chapman, D.B. and Torpy, J. 1997. 'Healthcare expenditures. Development of a heart failure center: a medical center and cardiology practice join forces to improve care and reduce costs', *American Journal of Managed Healthcare*. 3:431-437.

Charalambous, C.P., Yarwood, S., Paschalides, C., Siddique, I., Paul, A. and Hirst, P. 2003. 'Reduced delays in A&E for elderly patients with hip fractures', *Annals of the Royal College of Surgeons of England* 85:200-203.

Charles, A., Le Vasseur, S.A. and Castle, C. 1999. 'Suturing of minor lacerations by clinical nurse specialists in the emergency department', *Accident and Emergency Nursing* 7:34-38.

Chen, R., Huang, Y. and Liu, X. 2003. 'Probe into the second-line on-duty nurses enhancing night shift nursing work quality in emergency room', *Chinese Nursing Research* 17:42-43.

Cheung, W.H., Heeney, L. and Pound, J.L. 2002. 'An advance triage system', *Accident and Emergency Nursing* 10:10-16.

Ching, T.K., Leng, L.Y. and See, N.B. 1999. 'Initiation of x-rays by the triage nurse: competency and its effect on patients' total time spent in the accident and emergency department', *Professional Singapore Nurse* 26:22-26.

Christakis, D.A., Mell, L., Koepsell, T.D., Zimmerman, F.J. and Connell, F.A. 2001. 'Association of lower continuity of care with greater risk of emergency department use and hospitalization in children', *Pediatrics* 107:524-529.

Chung, C.H., Ng, C.P. and Lai, K.K. 2000. 'Delays by patients, emergency physicians, and surgeons in the management of acute appendicitis: retrospective study', *Hong Kong Medical Journal* 6:254-259.

Cline, C.M.J., Israelsson, B.Y.A., Willenheimer, R.B., Broms, K. and Erhardt, L.R. 1998. 'Cost effective management programme for heart failure reduces hospitilisation', *Heart* 80: 442-446.

Clinical Standards Advisory Group. 1995. *Urgent and Emergency Admissions to Hospital*. London: HMSO.

Coats, T.J. and Michalis, S. 2001. 'Mathematical modelling of patient flow through an accident and emergency department', *Emergency Medicine Journal* 18:190-192.

Cochrane, R.A., Edwards, A.T., Crosby, D.L., Roberts, C.J., Lewis, P.A., McGee, S., Meecham-Jones, S. and Jones, A. 1998. 'Senior

surgeons and radiologists should assess emergency patients on presentation: a prospective randomized controlled trial', *Journal of the Royal College of Surgeons of Edinburgh* 43:324-327.

Coleman, E.A., Eilertsen, T.B., Kramer, A.M., Magid, D.J., Beck, A. and Conner, D. 2001. 'Reducing emergency visits in older adults with chronic illness: a randomized, controlled trial of group visits', *Effective Clinical Practice* 4:49-57.

Coleman, P., Irons, R. and Nicholl, J. 2001. 'Will alternative immediate care services reduce demands for nonurgent treatment at accident and emergency', *Emergency Medicine Journal* 18:482-487.

Collymore, V.A., Roche, V.M.L. and Berman, D. 1997. 'Redesign of a hospital's internal medicine service', *Journal for Healthcare Quality* 19:28-31.

Cooke, M. 1996. 'Employing general practitioners in accident and emergency departments. Better to increase number of consultants in accident and emergency medicine', *British Medical Journal* 313:628.

Cooke, M.W., Wilson, S., Cox, P. and Roalfe, A. 2000. 'Public understanding of medical terminology: non-English speakers may not receive optimal care', *Journal of Accident and Emergency Medicine* 17:119-121.

Cooke, M.W. 1999. *Primary Care Attenders in A&E Literature Review.* Coventry: University of Warwick.

Cooke, M.W. 2001. *The Use of Criteria Based Dispatch in the Prioritisation of 999 Emergency Ambulance Calls*. [PhD]. Birmingham: The University of Birmingham.

Cooke, M.W., Arora, P. and Mason, S. 2003. 'Discharge from triage: modelling the potential in different types of emergency department', *Emergency Medicine Journal* 20:131-125.

Cooke, M.W., Higgins, J., Bridge, P. 2001. 'Minor injuries. The present state', *Emergency Medicine Journal* 18:321-323.

Cooke, M.W., Higgins, J. and Kidd, P. 2003. 'Use of emergency observation and assessment wards: a systematic literature review', *Emergency Medicine Journal* 20:138-142.

Cooke, M.W. and Jenner, T. 2002. *Public Attitudes and Perceptions of Accident and Emergency. Internal Report*. London: Department of Health.

Cooke, M.W., Kelly, C., Khattab, A., Lendrum, K., Morrell, R. and Rubython, E.J. 1998. 'Accident and emergency 24 hour senior cover – a necessity or a luxury?' *Journal of Accident and Emergency Medicine* 15: 181-184.

Cooke, M.W., Morrell, S., Wilson, S., Bridge, P., Edwards, S., Allan, T.F. and Holder, R.L. 1999. 'Does criteria based dispatch of 999 calls adequately detect the critically ill and injured?', *Pre-hospital Immediate Care* 3:191-195.

Cooke, M.W., Wilson, S. and Pearson, S. 2002. 'The effect of a separate stream for minor injuries on accident and emergency department waiting times', *Emergency Medicine Journal* 19:28-30.

Corbett, S.W., White, P.D. and Wittlake, W.A. 2000. 'Benefits of an informational videotape for emergency department patients', *American Journal of Emergency Medicine* 18:67-71.

Cottingham, R.L. 1998. 'Primary care problems in patients attending a semi-rural accident and emergency unit: a prospective study', *Journal of Accident and Emergency Medicine* 15: 168-169.

Counselman, F.L., Graffeo, C.A. and Hill, J.T. 2000. 'Patient satisfaction with physician assistants (PAs) in an ED fast track', *American Journal of Emergency Medicine* 18:661-665.

Cowdell, F., Lees, B. and Wade, M. 2002. 'Discharge planning. Armchair fan', *Health Service Journal* 112:28-29.

Cragg, D.K., McKinley, R.K., Roland, M., Campbell, S.M., Van, F., Hastings, A.M., French, D.P., Manku-Scott, T.K. and Roberts, C. 1997. 'Comparison of out of hours care provided by patients' own general practitioners and commercial deputising services: a randomised controlled trial. I: the process of care', *British Medical Journal* 314:187-189.

Crouch, R. 2001. 'Minor injuries/illness nurse treatment service', *Emergency Nurse* 9:18-22.

Crouch, R. and Dale, J. 1994. 'Identifying feelings engendered during triage assessment in the accident and emergency department: the use of visual analogue scales', *Journal of Clinical Nursing* 3:289-297.

Cunningham, P.J., Clancy, C.M., Cohen, J.W. and Wilets, M. 1995. 'The use of hospital emergency departments for nonurgent health problems: a national perspective', *Medical Care Research and Review* 52:453-474.

Dale, J. and Dolan, B. 1996. 'Do patients use minor injury units appropriately?', *Journal of Public Health Medicine* 18:152-156.

Dale, J. and Green, J. 1991. 'How do nurses working in hospital emergency departments perceive local general practitioners? A study in six English hospitals', *Archives of Emergency Medicine* 8:210-216.

Dale, J., Green, J., Reid, F., Glucksman, E. and Higgs, R. 1995a. 'Primary care in the accident and emergency department: II. Comparison of general practitioners and hospital doctors', *British Medical Journal* 311:427-430.

Dale, J., Green, J., Reid, F., Glucksman, E. and Higgs R. 1995b. 'Primary care in the accident and emergency department: I. Prospective identification of patients', *British Medical Journal* 311:423-426.

Dale, J., Higgins, J., Williams, S., Foster, T., Snooks, H., Crouch, R., Hartley-Sharpe, C., Glucksman, E., Hooper, R. and George, S.

2003. 'Computer assisted assessment and advice for "non-serious" 999 ambulance service callers: the potential impact on ambulance despatch.' *Emergency Medicine Journal* 20:178-183.

Dale, J., Lang, H., Roberts, J.A., Green, J. and Glucksman, E. 1996. 'Cost effectiveness of treating primary care patients in accident and emergency: a comparison between general practitioners, senior house officers, and registrars', *British Medical Journal* 312:1340-1344.

Dale, J., Williams, S., Foster, T. Higgins, J., Crouch, R., Snooks, H., Hartley Sharpe, C., Glucksman, E. and George S. 2000. . *The Clinical, Organisational and Cost Consequences of Computer-Assisted Telephone Advice to Category C 999 Ambulance Service Callers: Results of a Controlled Trial*. Warwick: The University of Warwick. Available (March 2005) at www.nelh-ec.warwick.ac.uk/EMeRG.htm

Daly, S., Campbell, D.A. and Cameron, P.A. 2003. 'Short-stay units and observation medicine: a systematic review', *Medical Journal of Australia*. 178: 559-563.

Darnell, J.C., Hiner, S.L., Neill, P.J., Mamlin, J.J., McDonald, C.J., Hui, S.L. and Tierney, W.M. 1985. 'After-hours telephone access to physicians with access to computerized medical records. Experience in an inner-city general medicine clinic', *Medical Care* 23:20-26.

Davies, J. 1994. 'No problem: establishing a nurse requested X-ray service', *Accident and Emergency Nursing* 2:54-56.

Davies, M.M. and Heineke, J. 1994. 'Understanding the roles of the customer and the operation for better queue management', *International Journal of Operations and Production Management* 14:21-34.

Dearden, C.H. 1995. 'Emergency delays', *British Medical Journal* 310:1199.

Delfino, R.J., Murphy-Moulton, A.M., Burnett, R.T., Brook, J.R. and Becklake, M.R. 1997. 'Effects of air pollution on emergency room visits for respiratory illnesses in Montreal, Quebec', *American Journal of Respiratory and Critical Care Medicine*. 155:568-576.

Delfino, R.J., Murphy-Moulton, A.M. and Becklake, M.R. 1998. 'Emergency room visits for respiratory illnesses among the elderly in Montreal: association with low level ozone exposure', *Environmental Research*. 1998;76:67-77.

Denninghoff, K.R. and Moye, P.K. 1998. 'Teaching students during an emergency walk-in clinic rotation does not delay care', *Academic Medicine*. 73:1311.

Department of Health. 1997. *Patient's Charter: Developing a New Charter and Changes to the Immediate Assessment in A&E Standard*. London: Department of Health.

Department of Health. 2000. *The NHS Plan - A Plan for Investment - a Plan for Reform*. London: Department of Health.

Department of Health. 2001. *Reforming Emergency Care: First steps to a new approach*. [Online]. Available (March 2005) from www.dh.gov.uk/PolicyAndGuidance/OrganisationPolicy/EmergencyCare/ModernisingEmergencyCare/fs/en

Department of Health. 2002. *Information for Action - A Good Practice Guide on Anticipatory Management in Healthcare*. London: Department of Health.

Department of Health. 2003. *Clinical exceptions to the four hour emergency care target*. [Online]. Available at http://www.dh.gov.uk/assetRoot/04/07/95/56/04079556.pdf (accessed 28 March 2005).

Department of Health. 2004. *Emergency Care Networks Checklist*. [Online]. Available (March 2005) at http://www.dh.gov.uk/assetRoot/04/08/69/02/04086902.pdf

Department of Health. 2005a. *Hospital Activity Statistics: Total time in A&E.* [Online]. Available (March 2005) at http://www.performance.doh.gov.uk/hospitalactivity/data_requests/total_time_ae.htm

Department of Health. 2005b. *Hospital Activity Statistics: Admissions from A&E*. [Online]. Available (March 2005) at http://www.performance.doh.gov.uk/hospitalactivity/data_requests/admissions_from_ae.htm

Department of Health. 2005c. *Emergency Care Checklists*. [Online]. Available (March 2005) at http://www.dh.gov.uk/PolicyAndGuidance/OrganisationPolicy/EmergencyCare/EmergencyCareChecklists/fs/en

Department of Health. [n.d.] *NHS Direct Self-help Guide: Get the Right Treatment*. [Online]. Available (March, 2005) at http://www.nhsdirect.nhs.uk/selfhelp

Derlet, R., Richards, J. and Kravitz, R. 2000. 'ED overcrowding: definition and magnitude', *Academic Emergency Medicine* 7:544.

Derlet, R., Richards, J. and Kravitz, R. 2001. 'Frequent overcrowding in U.S. emergency departments', *Academic Emergency Medicine* 8:151-155.

Derlet, R.W. 1992. 'ED overcrowding in New York City', *Journal of Emergency Medicine* 10: 93-94.

Derlet, R.W., Kinser, D., Ray, L., Hamilton, B. and McKenzie, J. 1995. 'Prospective identification and triage on nonemergency patients out of an emergency department: A five year study', *Annals of Emergency Medicine* 25:215-223.

Derlet, R.W. and Nishio, D. 1990. 'Refusing care to patients who present to an emergency department', *Annals of Emergency Medicine* 19:262-267.

Derlet, R.W., Nishio, D., Cole, L.M. and Silva, J.Jr. 1992. 'Triage of patients out of the emergency department: three-year experience', *American Journal of Emergency Medicine* 10:195-199.

Derlet, R.W. and Richards, J.R. 2000. 'Overcrowding in the nation's emergency departments: complex causes and disturbing effects', *Annals of Emergency Medicine* 35:63-68.

Derlet, R.W., Weiss, S.J., Ernst, A.A., Nick, T.G., Arndahl, J., Richards, J.R., Fernandez, M., Schwab, R.A., Stair, T.O., Viccellio, P., Levy, D., Brautigan, M.W. and Johnson, A. 2002. 'Development of an emergency department overcrowding scale: results of the national ED overcrowding study (NEDOCS)', *Academic Emergency Medicine* 9: 366.

Deykin, E.Y., Hsieh, C.C., Joshi, N. and McNamarra, J.J. 1986. 'Adolescent suicidal and self-destructive behavior. Results of an intervention study', *Journal of Adolescent Health Care.* 7:88-95.

Dickhudt, J.S., Gjerdingen, D.K. and Asp, D.S. 1987. 'Emergency room use and abuse. How it varies with payment mechanism*', Minnesota Medicine* 70:571-574.

Kollek, D. and Walker, A.F. 2002. 'Emergency department overcrowding', Canadian *Medical Association Journal* 167:626-627.

Docimo, A.B., Pronovost, P.J., Davis, R.O., Concordia, E.B., Gabrish, C.M., Adessa, M.S. and Bessman, E. 2000. 'Using the online and offline change model to improve efficiency for fast-track patients in an emergency department', *Joint Commission Journal on Quality Improvement* 26:503-514.

Dolan, B. and Dale, J. 1997. 'Characteristics of self referred patients attending minor injury units', *Emergency Medicine Journal* 14:212-214.

Dolan, B., Dale, J. and Morley, V. 1997. 'Nurse practitioners: their role in A&E and primary care', *Nursing Standard* 11:33-37.

Doobinin, K.A., Heidt-Davis, P.E., Gross, T.K. and Isaacman, D.J. 2003. 'Nonurgent pediatric emergency department visits: Care-seeking behavior and parental knowledge of insurance*', Pediatric Emergency Care*. 19:10-14.

Douglas, A.S., Rawles, J.M., Alexander, E. and Allan, T.M. 1991. 'Winter pressure on hospital beds', *British Medical Journal* 303:508-509.

Downing, A. and Wilson, R. 2002. 'Temporal and demographic variations in attendance at accident and emergency departments', *Emergency Medicine Journal* 19:531-535.

Driscoll PA, Vincent CA, Wilkinson M. The use of the accident and emergency department. *Archives of Emergency Medicine* 1987;4: 77-82.

Drummond, A.J. 2002. 'No room at the inn: overcrowding in Ontario's emergency departments', *Canadian Journal of Emergency Medicine* 4:91-97.

Duffin, C. 2001. 'Older people have longer waits for A&E treatment', *Nursing Standard* 15:8.

Dunn, J. 1989. 'Psychiatric intervention in the community hospital emergency room', *Journal of Nursing Administration* 19: 36-40.

Edhouse, J., Wardrope, J. and Morris, F.P. 1999. 'Call to needle times after acute myocardial infarction', *British Medical Journal* 318:597.

Emergency Medical Services Committee. 2001. 'Policy statement. Patient nontransport', *Annals of Emergency Medicine* 38: 618.

Emergency Medicine Practice Committee. 2002. 'Guidelines on the role of physician assistants in the emergency department', *Annals of Emergency Medicine* 40:547-548.

Erickson, C., McErlean, M., Bartfield, J. and Verdile, V. 2001. 'Relationship between maloccurence and ED census and staffing', *Academic Emergency Medicine* 8:499.

Espinosa, J. 1997. 'ED redesign puts all patients on fast-track', *Patient Focused Care* 5:87-90.

Estey, A., Ness, K., Saunders, D., Alibhai, A. and Bear, R.A. 2003. 'Understanding the causes of overcrowding in emergency departments in the Capital Health Region in Alberta focus group study', *Canadian Journal of Emergency Medicine* 5:87-94.

Evans, D., Hodgkinson, B., Lambert, L. and Wood, J. 1999. 'Fall prevention: a systematic review', *Clinical Effectiveness in Nursing* 3:106-111.

Evans, T.C., Lucid, E.J. and Amann, C. 1993. 'Social work technician program', *Annals of Emergency Medicine* 22:841-844.

Everitt, I.J. and Barnett, P. 2002. 'Comparison of two benzodiazepines used for sedation of children undergoing suturing of a laceration in an emergency department', *Pediatric Emergency Care*. 18:72-74.

Ferber, M. and Becker, L. 1983. 'Impact of freestanding emergency centre on hospital emergency department use', *Annals of Emergency Medicine* 12:429-433.

Fergusson, E., Li, J. and Taylor, B. 1998. 'Grandmothers' role in preventing unnecessary accident and emergency attendances: cohort study', *British Medical Journal* 317:1685.

Fermann, G.J. and Suyama, J. 2002. 'Point of care testing in the emergency department', *Journal of Emergency Medicine* 22: 393-404.

Fernandes, C.M., Price, A. and Christenson, J.M. 1997. 'Does reduced length of stay decrease the number of emergency department patients who leave without seeing a physician?', *Emergency Medicine* 15:397-399.

Fernandes, C.M.B., Walker, R., Price, A., Marsden, J. and Haley, L. 1997. 'Root cause analysis of laboratory delays to an emergency department', *Journal of Emergency Medicine* 15:735-739.

Fiessler, F., Szucs, P. and Richman, P.B. 2002. 'Does utilization of the Ottawa Ankle Rules by nurses and physicians reduce emergency department length of stay?', *American College of Emergency Physician (ACEP): Scientific Assembly*.

Finlayson, B.J. 1996. 'Fast tracking patients with a proximal femoral fracture', *Journal of Accident and Emergency Medicine* 13:367.

Fletcher, A., Cummings, J., Cooke, M. and Black, S. 2004. *Emergency Care Waits: Survey Using a National Representative Sample.* London: Department of Health.

Foldes, S., Fischer, L. and Kaminsky, K. 1994. 'What is an emergency? The judgements of two physicians', *Annals of Emergency Medicine* 23:833-40.

Foroughi, D and Chadwick, L. 1989. 'Accident and emergency abusers', *Practitioner* 233: 657-659.

Forster, A.J., Stiell, I., Wells, G., Lee, A.J. and van Walraven, C. 2003. 'The effect of hospital occupancy on emergency department length of stay and patient disposition', *Academic Emergency Medicine* 10:127-133.

Franaszek, J.B., Asplin, B.R., Brunner, B., Epstein, S.K., Fields, W.W., Hill, M.B., Kaplan, J.A., Krakover, B., Mitchiner, J.C., Nedza, S.M., Schneider, S.M., Taylor, T.B. and King, K. 2002. *Responding to emergency department crowding: A guidebook for chapters*. Dallas: American College of Emergency Physicians.

Franco, S.M., Mitchell, C.K. and Buzon, R.M. 1997. 'Primary care physician access and gatekeeping: a key to reducing emergency department use', *Clinical Pediatrics*. 36:63-68.

Frank-Soltysiak, M., Court, C. 2002. 'Waiting time and satisfaction of patients attending the emergency surgery unit of a university hospital center', *Presse Med*. 31(36):1690-1695. Nov 9.

Freeman, G.K., Meakin, R.P., Lawrenson, R.A., Leydon, G.M. and Craig, G. 1999. 'Primary care units in A&E departments in North Thames in the 1990s: initial experience and future implications', *British Journal of General Practice* 49:107-110.

French, D., Zwemer, F.L. and Schneider, S. 2002. 'The effects of the absence of emergency medicine residents in an academic emergency department', *Academic Emergency Department* 9: 1205-1210.

Friedmann, P.D., Jin, L., Karrison, T.G., Hayley, D.C., Mulliken, R., Walter, J. and Chin, M.H. 2001. 'Early revisit, hospitalization, or death among older persons discharged from the ED', *American Journal of Emergency Medicine* 19:125-129.

Gadomski, A.M., Perkis, V., Horton, L., Cross, S. and Stanton, B. 1995. 'Diverting managed care Medicaid patients from pediatric emergency department use', *Pediatrics* 95:170-178.

Gamboa Antinolo, F., Gomez Camacho, E., Villar Conde Ed, E., Vega Sanchez, J., Lopez Alonso, R. and Polo, J. 2002. 'The special attention to re-admitted patients can be effective. Cost-benefit analysis of a new health care model', *Revista Clinica Espanola* 202:320-325.

Gamon, G., Driscoll, P., Cooper, A., Barnes, P. and Parr, B. 2002. 'Can emergency department-initiated thrombolysis supported by a thrombolysis co-ordinator reduce treatment times?', *Care of the Critically Ill* 18:104-106.

Garbrick, L., Levitt, M.A., Barrett, M. and Graham, L. 1996. 'Agreement between emergency physicians and psychiatrists regarding admission decisions', *Academic Emergency Medicine* 3:1027-1030.

Geller, J., Janson, P., McGovern, E., Valdini, A. 1999. 'Loneliness as a predictor of hospital emergency department use', *Journal of Family Practice* 48:801-804.

George, S., Read, S., Westlake, L., Williams, B., Fraser-Moodie, A. and Pritty, P. 1992. 'Evaluation of nurse triage in a British accident and emergency department', *British Medical Journal* 304:876-878.

Gerbeaux, P., Ledoray, V., Liauthaud, H., Torro, D., Takun, K., Thirree, R., Nelh, P. and Jean, P. 2001. 'Medical student effect on emergency department length of stay', *Annals of Emergency Medicine* 37:275-278.

Gibney, D., Murphy, A.W., Barton, D., Byrne, C., Smith, M., Bury, G., Mullan, E., Plunkett, P.K. 1999. 'Randomized controlled trial of general practitioner versus usual medical care in a suburban accident and emergency department using an informal triage system', *British Journal of General Practice* 49:43-44.

Gibney, D., Murphy, A.W., Smith, M., Bury, G., Plunkett, P.K. 1995. 'Attitudes of Dublin accident and emergency department doctors and nurses towards the services offered by local general practitioners', *Journal of Accident and Emergency Medicine* 12:262-265.

Gibson, P.G., Coughlan, L., Wilson, A.J. and Shekelle, P.G. 1998. 'Limited asthma education reduces emergency department visits but does not improve patient outcomes', *Evidence Based Medicine* 3:121.

Gibson, P.G., Powell, H., Coughlan, J., Wilson, A.J., Hensley, M.J., Abramson, M., Bauman, A.and Walters, E.H. 2002. 'Limited (information only) patient education programs for adults with asthma', in *The Cochrane Database of Systematic Reviews* (1), CD001005. Chichester, UK: John Wiley & Sons, Ltd.

Gill, J.M., Reese, C.L. and Diamond, J.J. 1996. 'Disagreement among health care professionals about the care needs of emergency department patients', *Annals of Emergency Medicine* 28:474-479.

Glasby, J. 2003. *Hospital discharge: integrating health and social care*. Abingdon: Radcliffe Medical Press.

Glasby J, Littlechild R. 2000.'Fighting fires? - emergency hospital admission and the concept of prevention', *Journal of Management in Medicine* 14:109-118.

Goldberg, R.J., Zautcke, J.L., Koenigsberg, M.D., Lee, R.W., Nagorka, F.W., Kling, M. and Ward, S.A. 1990. 'A review of prehospital care litigation in a large metropolitan EMS system' *Annals of Emergency Medicine* 19:557-561.

Gomez, C.R., Malkoff, M.D., Sauer, C.M., Tulyapronchote, R., Burch, C.M., Banet, G.A. 1994. 'Code stroke: An attempt to shorten inhospital therapeutic delays', *Stroke* 25:1920-1923.

Gomez, M.A., Anderson, J.L., Karagounis, L.A., Muhlestein, J.B. and Mooers, F.B. 1996. 'An emergency department-based protocol for rapidly ruling out myocardial ischaemia reduces hospital time and expense: results of a randomised study (ROMIO)', *Journal of the American College of Cardiology* 28:25-33.

Gonzalez, E.R., Jones, L.A., Ornato, J.P., Bleecker, G.C., Strauss, M.J., Ballantine, L., Barton, J., Edwards, J., Elledge, C., Fiores, P., Kramer, S., Massie, J., MacKintyre, N., Miller, R., O'Brien, J., Patrizzio, J., Pigg, P., Powell, R. and Price, R. 1999. 'Hospital delays and problems with thrombolytic administration in patients receiving thrombolytic therapy: a multicenter prospective assessment', *Annals of Emergency Medicine* 21:1215-1221.

Goodacre, S., Morris, F., Tesfayohannes, B., Sutton, G. 2001. 'Should ambulant patients be directed to reception or triage first?', *Emergency Medicine Journal* 18:441-443.

Goodacre, S.W. 2000. 'Should we establish chest pain observation units in the UK? A systematic review and critical appraisal of the literature', *Journal of Accident and Emergency Medicine* 17:1-6.

Goodacre, S.W. 1998. 'Role of the short stay observation ward in accident and emergency departments in the United Kingdom', *Journal of Accident and Emergency Medicine* 15:26-30.

Goodacre, S.W., Morris, F.M., Campbell, S., Arnold, J., Angelini, K, 2002. 'A prospective, observational study of a chest pain observation unit in a British hospital', *Emergency Medicine Journal.* 19:117-121.

Gordon, J.A. 2001. 'Cost-benefit analysis of social work services in the emergency department: A conceptual model', *Academic Emergency Medicine* 8:54-60.

Gouin, S., Macarthur, C., Parkin, P. and Schuh, S. 1997. 'Effect of a pediatric observation unit on the rate of hospitalization for asthma', *Annals of Emergency Medicine* 29:218-222.

Graff, L. 1999. 'Overcrowding in the ED: an international symptom of health care system failure', *American Journal of Emergency Medicine* 17:208-209.

Graff, L., Palmer, A., LaMonica, P. and Wolf, S. 2000. 'Triage patients for a rapid (5 minute) electrocardiogram: A rule based on presenting chief complaints', *Annals of Emergency Medicine* 36:554-560.

Graffeo, J., Miller, A., Walter, J.J. 2000. 'Identifying high risk elderly patient being discharged home from the ED and characterising their unmet social needs', *Academic Emergency Medicine* 7:572.

Graham, C.A., McLeod, L.S. and Steedman, D.J. 1998. 'Restricting extensions to permitted licensing hours does not influence the numbers of alcohol or assault related attendances at an inner city accident and emergency department', *Journal of Accident and Emergency Medicine* 15:23-25.

Grant, S., Spain, D. and Green, D. 1999. 'Rapid assessment team reduces waiting time', *Emergency Medicine* 11:72-77.

Green, J. and Dale, J. 1990. 'Health education and the inappropriate use of accident and emergency departments: the views of accident and emergency nurses', *Health Education Journal* 49:157-161.

Green, L.V. and Kolesar, P.J. 1987. 'On the validity and utility of queuing models of human service', *Annals of Operations Research* 9:469-479.

Griffiths, B. and Collier, H. 2000. 'Working with NHS direct', *Nursing Times* 96:42.

Grossman, L.K., Rich, L.N. and Johnson, C. 1998. 'Decreasing nonurgent emergency department utilization by Medicaid children', *Pediatrics* 102:20-24.

Grouse, A. and Bishop, R. 2001. 'Non-medical technicians reduce emergency department waiting times', *Emergency Medicine* 13:66-69.

Grumbach, K., Keane, D. and Bindman, A. 1993. 'Primary care and public emergency department overcrowding', *American Journal of Public Health* 83:372-378.

Haby, M.M., Waters, E., Robertson, C.F., Gibson, P.G. and Ducharme, F.M. 2001. 'Interventions for educating children who have attended the emergency room for asthma', *Cochrane Database of Systematic Reviews (1)*, CD001290.

Hadden, D.S.M., Dearden, C.H. and Rocke, L.G. 1996. 'Short stay observation patients: general wards are inappropriate', *Journal of Accident and Emergency Medicine* 13:166-168.

Haddy, R.I., Schmaler, M.E. and Epting, R.J. 1987. 'Nonemergency emergency room use in patients with and without primary care physicians', *Journal of Family Practice* 24:389-392.

Hakim, R.B. and Ronsaville, D.S. 2002. 'Effect of compliance with health supervision guidelines among US infants on emergency department visits', *Archive of Pediatric Adolescent Medicine* 156:1015-1020.

Hallam, L. and Henthorne, K. 1999. 'Cooperatives and their primary care emergency centres: organisation and impact', *Health Technology Assessment* 3:1-91.

Hampers, L.C., Cha, S., Gutglass, D.J., Binns, H.J. and Krug, S.E. 1999. 'Fast track and the pediatric emergency department: resource utilization and patient outcomes', *Academic Emergency Medicine* 6:1153-1159.

Hanlon, P., Beck, S., Robertson, G., Henderson, M., McQuillan, R., Capewell, S. and Dorward, A. 1997. 'Coping with the inexorable rise in medical admissions: evaluating a radical reorganisation of acute medical care in a Scottish district general hospital', *Health Bulletin* 55:176-184.

Hann, C. 1997. 'Use of occupational therapists in A&E', *Emergency Nurse* 5:26-30.

Hansagi, H. 1990. 'Referral of non-urgent cases from an emergency department: patient compliance, satisfaction and attitudes', *Scandinavian Journal of Social Medicine* 18:249-255.

Hansagi, H., Alleback, P. and Edhag, O. 1989. 'Health care utilisation after referral from a hospital emergency department', *Scandinavian Journal of Social Medicine* 17:291-299.

Hansagi, H., Carson, B., Oslo, M. and Edhag, O. 1997. 'Trial of a method of reducing inappropriate demands on a hospital emergency department', *Public Health* 101:99-105.

Hansagi, H., Olsson, M., Sjoberg, S., Tomson, Y. and Goransson, S. 2001. Frequent use of the hospital emergency department is indicative of high use of other health care services', *Annals of Emergency Medicine* 37: 561-567.

Hanumanthu, S., Butler, J., Chomsky, D., Davis, S. and Wilson, J.R. 1997. 'Effect of a Heart failure program on hospitalisation frequency and exercise tolerance', *Circulation* 96:2842-2848.

Hardern, R.D. and Harmer, D.W. 1995. 'Guidelines to reduce x ray examinations in accident departments. Implementing guidelines may not improve outcome for patients', *British Medical Journal* 311:329.

Hardy, C., Whitwell, D., Sarsfield, B. and Maimaris, C. 2001. 'Admission avoidance and early discharge of acute hospital admissions: an accident and emergency based scheme', *Emergency Medicine Journal* 18:435-440.

Harish, Z., Bregante, A.C., Morgan, C., Fann, C.S.J., Callaghan, C.M., Witt, M.A., Levinson, K.A. and Caspe, W.B. 2001. 'A comprehensive inner-city asthma program reduces hospital and

emergency room utilization', *Annals of Allergy, Asthma and Immunology.* 86:185-189.

Harrison, M.L., Graff, L.A. and Roos, N.P. 1995. 'Discharging patients earlier from Winnipeg hospitals: does it adversely affect quality of care?', *Canadian Medical Association Journal* 153:745-751.

Hassan, T.B. 2003. 'Clinical decision units in the emergency department: old concepts, new paradigms, and refined gate keeping', *Emergency Medicine Journal* 20:123-125.

Hauswald, M. 2002. 'Can paramedics safely decide which patients do not need ambulance transport or emergency department care?', *Prehospital Emergency Care* 6:383-386.

Heaney, D. and Paxton, F. 1995. *First Year Interim Report - Minor Injuries Clinic, Western Gen Hospital, Edinburgh*. Edinburgh University: Edinburgh.

Heaney, D.J. and Paxton, F.M. 1997. *Evaluation of the Minor Injuries Clinic at the Western General Hospital, Edinburgh*. Edinburgh: Edinburgh University.

Hedges, J.R., Trout, A. and Magnusson, A.R. 2002. 'Satisfied Patients Exiting the Emergency Department (SPEED)', *Academic Emergency Medicine* 9:15-21.

Hendrickson, C., Lund, E. and Stromgard, E. 1984. 'Consequences of assessment and intervention among elderly people: a three year randomised controlled trial', *British Medical Journal* 289:1522-1524.

Henry, G.L. 1990. 'Refusal of care-the ethical dilemma', *Annals of Emergency Medicine* 19:1198-1189.

Heyworth, J. and Egleston, C. 1998. 'Telephone triage could help', *British Medical Journal* 317:207.

Hider, P. 1999. 'Emergency department attendance: A critical appraisal of the key literature', *New Zealand Health Technology Assessment* 8.

Higgins, G. and Becker, M.A. 2000. 'Continuous quality improvement approach to IL-372 documentation compliance in an academic emergency department, and its impact on dictation costs, billing practices, and average patient length of stay*', Academic Emergency Medicine* 7:269-275.

Higgins, J., Wilson, S., Bridge, P. and Cooke, M.W. 2001. 'Communication difficulties during 999 ambulance calls: observational study', *British Medical Journal* 323:781-782.

Hilditch, J.R. 1980. 'Changes in hospital emergency department use associated with increased family physician availability', *Journal of Family Practice* 11:91-6.

Hill-Westmoreland, E.E., Soeken, K. and Spellbring, A.M. 2002. 'A meta-analysis of fall prevention programs for the elderly: how effective are they?', *Nursing Research* 51:1-8.

Hirschorn, D.S., Hinrichs, C.R., Gor, D.M., Shah, K. and Visvikus, G. 2001. 'Impact of a diagnostic workstation on workflow in the emergency department at a level I trauma center', *Journal of Digital Imaging* 14:199-201.

Hirshon, J.M., Kirsch, T.D., Mysko, W.K. and Kelen, G.D. 1996. 'Effect of rotational patient assignment on emergency department length of stay', *Journal of Emergency Medicine.* 14:763-768.

Hobbs, D., Sklar, D., Tandberg, D. and Kinzman, S.C. 1999. 'Factors predicting patients who leave without being seen', *Academic Emergency Medicine* 6:399-a.

Hobday, P.J. 1988. 'Patients attending casualty from one group practice', *Practitioner* 232:552-545.

Holleman, D.R.Jr., Bowling, R.L. and Gathy, C. 1996. 'Predicting daily visits to a walk-in clinic and emergency department using calendar and weather data', *Journal of General Internal Medicine* 11:237-239.

Hollingsworth, J.C., Chisholm, C.D., Giles, B.K., Cordell, W.H. and Nelson, D.R. 1998. 'How do physicians and nurses spend their time in the emergency department?', *Annals of Emergency Medicine* 31:87-91.

Horii, S., Redfern, R., Feingold, E., Kundel, H., Nodine, C., Arnold, D., Abbuhl, S., Lowe, R. and Brikman, I. 2001. 'An automated results notification system for PACS', *Journal of Digital Imaging* 14:192-198.

Horrocks, S., Anderson, E. and Salisbury, C. 2002. 'Systematic review of whether nurse practitioners working in primary care can provide equivalent care to doctors', *British Medical Journal* 324:819-823.

Hsu, R.T., Lambert, P.C., Dixon-Woods, M. and Kurinczuk, J.J. 2003. 'Effect of NHS walk-in centre on local primary healthcare services: before and after observational study', *British Medical Journal* 326:530-532.

Hu, S.C. 1993. 'Computerized monitoring of emergency department patient flow', *American Journal of Emergency Medicine*. 11:8-11.

Hull, S., Jones, I.R., Moser, K. and Fisher, J. 1998. 'The use and overlap of AED and general practice services by patients registered at two inner London general practices', *British Journal of General Practice* 48:1575-1579.

Hull, S., Rees Jones, I. and Moser, K. 1998. 'Relation of rates of self referral to A&E departments to deprivation', *British Medical Journal* 317:538.

Humphreys, T., Shofer, F.S., Jacobson, S., Coutifaris, C. and Stemhagen, A. 1992. 'Preformatted charts improve documentation in the emergency department', *Annals of Emergency Medicine* 21:534-540.

Hurley, R.E., Freund, D.A. and Taylor, D.E. 1989. 'Emergency room use and primary care case management: evidence from four Medicaid demonstration programmes', *American Journal of Public Health* 79:843-846.

Hyde, C.J., Robert, I.E. and Sinclair, A.J. 2000. 'The effects of supporting discharge from hospital to home in older people', *Age and Ageing* 29:271-279.

Ingram, D.R., Clarke, D.R. and Murdie, R.A. 1978. 'Distance and the decision to visit an emergency department' *Social Science & Medicine* 12:55-62.

Institute for Healthcare Improvement. 2003. *How to Improve*. [Online]. Available (March 2005) at www.ihi.org (search under 'how to improve')

Jaarsma-van Leeuwen, I., Hammacher, E.R., Hirsch, R. and Janssens, M. 2000. 'Patients without referral treated in the emergency room: patient characteristics and motives', *Nederlands Tijdschrift voor Geneeskunde* 144:428-431.

Jankowski, R.F. and Mandalia, S. 1993. 'Comparison of attendance and emergency admission patterns at accident and emergency departments in and out of London', *British Medical Journal* 306:1241-1243.

Jelinek, G.A., Mountain, D., O'Brien, D., Rogers, I.R. and Wilkes, G. 1999. 'Re-engineering an Australian Emergency Department: Can we measure success?', *Journal of Quality in Clinical Practice* 19:133-138.

Johnston, B.D., Rivara, F.P., Droesch, R.M., Dunn, C. and Copass, M.K. 2002. 'Behavior change counseling in the emergency department to reduce injury risk: a randomized, controlled trial', *Pediatrics* 110:267-274.

Johnston, J.D., Jupp, R.A. and Mitchell, W.D. 1997. 'Near-patient testing by proxy', *Annals of Clinical Biochemistry*.34:104-105.

Jones, G. 1993. 'Minor injury in the community', *Nursing Standard* 7:35-36.

Jones, G. and Playforth, M.J. 2001. 'The effect of the introduction of NHS Direct on requests for telephone advice from an accident and emergency department', *Emergency Medicine Journal* 18:300-301.

Jones, J. 2002. 'Overcrowded VUMC emergency department turns to technology', *The Reporter: Vanderbilt Medical Centre* [Online]. Available (March 2005) at http://www.mc.vanderbilt.edu/reporter/index.html?Show=y&ShowIssue=2002-12-06

Jones, P. and Peppiatt, E. 1996. 'Managing perceptions of waiting times in service queues', *International Journal of Service Industry Management* 7:47-61.

Jones, S.A., Joy, M.P. and Pearson, J. 2002. 'Forecasting demand of emergency care', *Health Care Management Science* 5: 297-305.

Kamper, M., Mahoney, B.D., Nelson, S. and Peterson, J. 2001. 'Feasibility of paramedic treatment and referral of minor illnesses and injuries', *Prehospital Emergency Care* 5:371-378.

Kanegaye, J.T., Vance, C.W., Chan, L. and Schonfeld, N. 1997. 'Comparison of skin stapling devices and standard sutures for pediatric scalp lacerations: a randomized study of cost and time benefits', *Journal of Pediatrics* 130: 808-813.

Karpiel, M. and Williams, M. 1998. 'Developing a fast track program', *Journal of Ambulatory Care Manager* 2:35-48.

Keehn, D.S., Roglitz, C. and Bowden, M.L. 1994. 'Impact of social work on recidivism and non-medical complaints in the emergency department', *Social Work in Health Care* 20:65-75.

Keith, K., Bocka Kobernick, M., Krome, R. and Ross, M. 1989. 'Emergency department revisits', *Annals of Emergency Medicine* 18: 964-968.

Kelen, G.D., Scheulen, J.J. and Hill, P.M. 2001. 'Effect of an emergency department (ED) managed acute care unit on ED overcrowding and emergency medical services diversion', *Academic Emergency Medicine* 8:1095-1100.

Kellerman, A. 1994. 'Nonurgent emergency department visits: meeting an unmet need', *Journal of the American Medical Association* 271:1953-1954.

Kelly, A.M., Chirnside, A.M. and Curry, C.H. 1993. 'An analysis of unscheduled return visits to an urban emergency department', *New Zealand Medical Journal* 106:334-336.

Kelly, K.A. 1994. 'Referring patients from triage out of the emergency department to primary care settings: one successful emergency department experience', *Journal of Emergency Nursing* 20: 458-463.

Kendall, J., Reeves, B. and Clancy, M. 1998. 'Point of care testing: randomised controlled trial of clinical outcome', *British Medical Journal* 316:1052-1057.

Kennedy, D. 1996. 'Judge condemns insensitive NHS over dying boy', *The Times* March 6, 1996.

Kenny, R.A., O'Shea, D. and Walker, H.F. 2002. 'Impact of a dedicated syncope and falls facility for older adults on emergency beds*', Age and Ageing* 31: 272-275.

Kereiakes, D., Gibler, B. and Martin, L. 1992. 'Relative importance of emergency medical system transport and the pre-hospital electrocardiogram on reducing hospital time delay to therapy for acute myocardial infarction: preliminary report from the Cincinnati heart project', *American Heart Journal* 123:835-839.

Kilic, Y.A., Agalar, F.A., Kunt, M. and Cakmakci, M. 1998. 'Prospective, double-blind, comparative fast-tracking trial in an academic emergency department during a period of limited resources', *European Journal of Emergency Medicine* 5:403-406.

Kilpatrick, E.S. and Holding, S. 2001. 'Use of computer terminals on wards to assess emergency test results: a retrospective audit', *British Medical Journal* 322:1101-1103.

King's Fund. 2001. *NHS Walk-in centres in London*. London: King's Fund Publishing.

Kne, T., Young, R. and Spillane, L. 1998. 'Frequent ED users: patterns of use over time', *American Journal of Emergency Medicine* 16:648-652.

Knott, J.C. and Meyer, A.D. 2003. 'Impact of blood testing on patient disposition from the emergency department', *Emergency Medicine* 15:121-125.

Kokiko, J. and Mayer, T.A. 1997. 'Advanced triage/advanced interventions: improving patient satisfaction', *Topics in Emergency Medicine* 19:19-27.

Kolesar, P.J. and Green, L.V. 1998. 'Insights on service system design from a normal approximation to Erlang's delay formula', *Production and Operations Management* 7:282-293.

Kotagal, U.R., Schoettker, P.J., Atherton, H.D., Hornung, R.W., Bush, D., Pomerantz, W.J. and Schubert, C.J. 2002. 'Relationship between early primary care and emergency department use in early infancy by the medicaid population', *Archives of Pediatric Adolescent Medicine* 156:710-716.

Krakau, I. and Hassler, E. 1999. 'Provision for clinic patients in the ED produces more nonemergency visits', *American Journal of Emergency Medicine* 17:18-20.

Krochmal, P. and Riley, T.A. 1994. 'Increased health care costs associated with ED overcrowding', *American Journal of Emergency Medicine* 12:265-266.

Krome, R.L. 1989. 'Observation care units', *Annals of Emergency Medicine* 18:705.

Kyriacou, D.N. and Ricketts, V., Dyne, P.L., McCollough, M.D. and Talan, D.A. 1999. 'A 5-year time study analysis of emergency department patient care efficiency', *Annals of Emergency Medicine* 34:326-335.

Lafrance, M. and Leduc, N. 2002. 'Prior use of a telephone-nursing triage service by patients of emergency services', *Revued Epidemiologie et de Sante Publique* 50:561-570.

Lagoe, R.J., Kohlbrenner, J.C., Hall, L.D., Roizen, M., Nadle, P.A. and Hunt, R.C. 2003. 'Reducing ambulance diversion: A multi-hospital approach', *Prehospital Emergency Care* 7:99-108.

Lambe, S., Washington, D., Fink, A., Laouri, M., Liu, H., Scura Fosse, J., Brook, R.H. and Asch, S.M. 2003. 'Waiting times in California's emergency departments', *Annals of Emergency Medicine* 41: 34-44.

Lammers, R., Roiger, M., Rice, L., Overton, D. and Cucos, D. 2003. 'The effect of a new emergency medicine residency program on patient length of stay in a community hospital emergency department', *Academic Emergency Medicine* 10:725-730.

Langford, E.J., Ishaque, M.A., Fothergill, J. and Touquet, R. 1994. 'The effect of the fast of Ramadan on accident and emergency attendances', *Journal of the Royal Society of Medicine* 87:517-518.

Langhorne, P., Dennis, M.S., Kalra, L., Shepperd, S., Wade, D.T. and Wolfe, C.D.A. 2001. 'Services for helping acute stroke patients avoid hospital admission. (Cochrane Review)', *in The Cochrane Library,* Issue 4. Chichester, UK: John Wiley & Sons, Ltd..

Lanter, P., Kulkarni, A., Palivos, L., Miller, S., Roberts, R. and Rydman, R. 2001a. 'Efficacy of follow-up appointments in decreasing subsequent ED visits and hospital admissions', *Academic Emergency Medicine* 8:579.

Lanter, P., Kulkarni, A., Palivos, L., Miller, S., Roberts, R. and Rydman, R. 2001b. 'The impact of primary care follow-up after an acute exacerbation of asthma on subsequent emergency department utilization and hospitalization', *Academic Emergency Medicine* 9:394-b.

Larklin, G. and Lesko, S. 1999. 'What's an emergency department (ED) visit worth? Willingness to pay out-of-pocket costs for minor injury varies for physician and non-physician clinicians (NPCs)', *Academic Emergency Medicine* 6:403-a.

Lateef, F. and Anantharaman, V. 2000. 'The short-stay emergency observation ward is here to stay', *American Journal of Emergency Medicine* 18: 629-34.

Lattimer, V.A., George, S., Thompson, F., Thomas, E., Mullee, M., Turnbull, J., Smith, H., Moore, M., Bond, H. and Glasper, A. 1998. 'Safety and effectiveness of nurse telephone consultation in out of hours primary care: randomised controlled trial', *British Medical Journal* 317:1054-1059.

Lau, F.L. and Leung, K.P. 1997. 'Waiting time in an urban accident and emergency department - a way to improve it', *Journal of Accident and Emergency Medicine* 302-3:299-301.

Lau, S., Walkley, T. and Harding, J. 2000. 'Don't accept ED's claim it's too busy to benchmark emergency department', *Healthcare Benchmarks* 7:37-40.

Law, H. and Sloan, J. 1999. 'Doctor's assistants - do we need them?', *Journal of Accident and Emergency Medicine* 16:114-116.

Lawrence, L.M. and Wright, S.W. 1998. 'Sedation of pediatric patients for minor laceration repair: effect on length of emergency department stay and patient charges', *Pediatric Emergency Care* 14:393-395.

Leaman, A. 2001. 'The management of minor injuries-a personal view', *Emergency Medicine Journal* Suppl:2 pp. 2-3.

Leaman, A.M. 2003. 'See and treat: a management driven method of achieving targets or a tool for better patient care? One size does not fit all', *Emergency Medicine Journal* 20:118.

Lee, K.M., Wong, T.W., Chan, R., Lau, C.C., Fu, Y.K. and Fung, K.H. 1996. 'Accuracy and efficiency of x-ray requests initiated by triage nurses in an accident and emergency department', *Accident and Emergency Nursing* 4:179-181.

Lee-Lewandrowski, E., Corboy, D., Lewandrowski, K., Sinclair, J., McDermot, S. and Benzer, T.I. 2003. 'Implementation of a point-of-care satellite laboratory in the emergency department of an academic medical center. Impact on test turnaround time and patient emergency department length of stay', *Archives of Pathology and Laboratory Medicine* 127:456-460.

Lewis, B.A., McNabb, W.A., Rahman, S.U. and Rahmas, S.U. 1994. 'The role of the social worker in the accident and emergency department of a district general hospital', *Journal of Accident and Emergency Medicine* 11:21-24.

Lewis, P. 1999. 'The role of paramedics in the ED', *Emergency Medical Services* 28:53-58.

Lindley-Jones, M. and Finlayson, B.J. 2000. 'Triage nurse requested x-rays - are they worthwhile?' *Journal of Accident and Emergency Medicine* 17:103-7.

Lipley, N. 2000. 'Managers "hid" patients from snapshot survey' *Nursing Standard* 14:4.

Liu, S., Hobgood, C. and Brice, J.H. 2003. 'Impact of critical bed status on emergency department patient flow and overcrowding', *Academic Emergency Medicine* 10:382-385.

London Ambulance Service NHS Trust. 2002. *Evaluation of the cost-effectiveness of direct triage and transportation to minor injuries units by ambulance crews*. London: London Ambulance Service NHS Trust. [Online]. Available (March 2005) at http://www.londonambulance.nhs.uk/aboutus/publication_scheme/media/MIU%20report.pdf

Loveman, E., Royle, P. and Waugh, N. 2004. 'Specialist nurses in diabetes mellitus. (Cochrane Review)', in *The Cochrane Library*, Issue 3. . Chichester, UK: John Wiley & Sons, Ltd.

Lowe, R.A. and Bindman, A.B. 1997. 'Judging who needs emergency department care: a prerequisite for policy-making', *American Journal of Emergency Medicine* 15:133-136.

Lowe, R.A., Bindman, A.B. and Ulrich, S.K. 1994. 'Refusing care to emergency department patients: evaluation of published triage guidelines', *Annals of Emergency Medicine* 23:286-293.

Lowy, A., Kohler, B. and Nicholl, J. 1994. 'Attendance at accident and emergency departments: unnecessary or inappropriate?', *Journal of Public Health Medicine* 16:134-140.

Lucas, R. and Sanford, S. 1998. 'An analysis of frequent users of emergency care at an urban university hospital', *Annals of Emergency Medicine* 32:563-568.

Mabrook, A.F. and Dale, B. 1998. 'Can nurse practitioners offer a quality service? An evaluation of a year's work of a nurse led minor injury unit', *Journal of Accident and Emergency Medicine* 15:266-268.

Macgregor, D.M. 2003. 'Effect of weather on attendance with injury at a paediatric emergency department', *Emergency Medicine Journal* 20:204-205.

Macleod, A.J. and Freeland, P. 1992. 'Should nurses be allowed to request x-rays in an accident and emergency department?', *Archives of Emergency Medicine* 9:19-22.

Magalski, A.E., Benenson, R.S., Cavanaugh, S.H. and Williams, E.D. 1999. 'A pneumonia clinical pathway decreases time to antibiotic treatment, length of stay and mortality', *Academic Emergency Medicine* 6:438-b.

Magid, D.J., Koepsell, T.D., Every, N.R., Martin, J.S., Siscovick, D.S., Wagner, E.H. and Weaver, W.D. 1997. 'Absence of association between insurance copayments and delays in seeking emergency care among patients with myocardial infarction*', New England Journal of Medicine* 336:1722-1729.

Mahon, M. 2003. 'ED triage: Is a five-level triage system best?', *American Journal of Nursing* 103:61-63.

Maister, D.A. 1985. 'The psychology of waiting lines', in Czepiel, J.A., Soloman, M.R. and Surprenant, C.F. (eds.) *The Service Encounter* 113-123.

Mallett, J. and Woolwich, C. 1990. 'Triage in accident and emergency departments', *Journal of Advanced Nursing* 15: 1443-1451.

Mandelberg, J.H., Kuhn, R.E. and Kohn, M.A. 2000. 'Epidemiologic analysis of an urban, public emergency department's frequent users', *Academic Emergency Medicine* 7:637-646.

Marill, K.A., Gauharou, E.S., Nelson, B.K., Peterson, M.A., Curtis, R.L. and Gonzalez, M.R. 1999. 'Prospective, randomized trial of template-assisted versus undirected written recording of physician records in the emergency department', *Annals of Emergency Medicine* 33: 500-509.

Marinakis, H.A. and Zwemer, F.L.Jr. 2003. 'An inexpensive modification of the laboratory computer display changes emergency physicians'

work habits and perceptions', *Annals of Emergency Medicine* 41:186-190.

Marks, G.B., Colquhoun, J.R., Girgis, S.T., Hjelmroos, K., Treloar, A.B.A., Hansen, P., Downs, S.H. and Car, N.G. 2001. 'Thunderstorm outflows preceding epidemics of asthma during spring and summer', *Thorax* 56:468-471.

Marks, P.J., Daniel, T.D., Afolabi, O., Spiers, G., Nguyen-Van-Tam, J.S. 2002. 'Emergency (999) calls to the ambulance service that do not result in patient being transported to hospital: an epidemiological study', *Journal of Accident and Emergency Medicine* 19:449-452.

Marsh, G. and Dawes, M. 1995. 'Establishing a minor illness nurse in a busy general practice', *British Medical Journal* 310:778-780.

Mason, S., Wardrope, J. and Perrin, J. 2003. 'Developing a community paramedic practitioner intermediate care support scheme for older people with minor conditions', *Emergency Medicine Journal* 20:196-198.

Maynard, E.J. and Dodge, J.S. 1983. 'Introducing a community health center at Mosgiel, New Zealand: Effects on use of the hospital accident and emergency (A & E) department', *Medical Care* 21:379-388.

McDermott, M.F., Murphy, D.G., Zalenski, R.J., Rydman, R.J., McCarren, M., Marder, D., Jovanovic, B., Kaur, K., Roberts, R.R., Isola, M., Mensah, E., Rajendran, R. and Kampe, L. 1997. 'A comparison between emergency diagnostic and treatment unit and inpatient care in the management of acute asthma', *Archives of Internal Medicine* 157:2055-2062.

McDonagh, M.S., Smith, D.H. and Goddard, M. 2000. 'Measuring appropriate use of acute beds. A systematic review of methods and results', *Health Policy* 53:157-184.

McGillis, H. 1996. 'Comprehensive program to improve care leads to reduced ED use by patients with asthma: One hospital's experience', *Journal of Emergency Nursing* 22: 18-23.

McGinty, B. and Ghiz, J. 1993. 'Developing a nursing managed central transportation service', *Nursing Management* 24:62-65.

McGuire, F. 1997. 'Using simulation to reduce length of stay in emergency departments', *Journal of the Society for Health Systems* 5:81-90.

McKee, M., Gleadhill, D.N.S. and Watson, D. 1990. 'Accident and emergency attendance rates: variation among patients from different general practices', *British Journal of General Practice* 40:150-153.

McKinley, R.K., Cragg, D.K., Hastings, A.M., French, D.P., Manku-Scott, T.K., Campbell, S.M., Roland, M.O. and Roberts, C. 1997. 'Comparison of out of hours care provided by patients' own general practitioners and by commercial deputising services: A randomised

controlled trial: the outcome of care', *British Medical Journal* 314:190-193.

McLauchlan, C.A.J. and Harris, A. 1998. 'Providing primary care in accident and emergency departments', *British Medical Journal* 317:207.

McLeod, E. and Olsson, M. 2004. *Older frequent emergency department attenders' appraisal of emergency department social work. A comparative UK and Swedish study* [Online]. Available at www2.warwick.ac.uk/fac/soc/shss/mrc/olderpeople/mcleod.doc .

McManus, M. 2001. *Emergency department overcrowding in Massachusetts: making room in our hospitals*. Waltham, MA: The Massachussetts Health Policy Forum.

McNally, E., de Lacey, G., Lovell, P. and Welch, T. 1995. 'Posters for accident departments: simple methods of sustaining reduction in x ray examinations', *British Medical Journal* 310:640-642.

Meek, S., Kendall, J., Porter, J. and Freij, R. 1998. 'Can accident and emergency nurse practitioners interpret radiographs? A multicentre study', *Emergency Medicine Journal* 15:105-107.

Meldon, S.W., Mion, L.C., Palmer, R.M., Drew, B.L., Connor, J.T., Lewicki, L.J., Bass, D.M. and Emerman, C.L. 2003. 'A brief risk-stratification tool to predict repeat emergency department visits and hospitalizations in older patients discharged from the emergency department', *Academic Emergency Medicine* 10:224-232.

Menec, V.H., Black, C., MacWilliam, L. and Aoki, F.Y. 2003. 'The impact of influenza-associated respiratory illnesses on hospitalizations, physician visits, emergency room visits, and mortality', *Canadian Journal of Public Health. Revue Canadienne de Sante Publique*. 94:59-63.

Meredith, L., Kilgore, S. and Steindel Smith, J.A. 1998. 'Evaluating stat testing options in an academic health center: therapeutic turnaround time and staff satisfaction', *Clinical Chemistry* 44:1597-1603.

Merritt, B., Naamon, E. and Morris, S.A. 2000. 'The influence of an urgent care center on the frequency of ED visits in an urban hospital setting', *American Journal of Emergency Medicine* 18:123-125.

Met Office. 2002. *Forecasting the nation's health*. London: Met Office.

Miller, D.K., Lewis, L.M., Nork, M.J. and Morley, J.E. 1996. 'Controlled trial of a geriatric case-finding and liaison service in an emergency department', *Journal of the American Geriatric Society* 44:513-520.

Millward, L.M., Morgan, A. and Kelly, M.P. 2003. *Prevention and reduction of accidental injury in children and older people - evidence briefing*. London: Department of Health. Available online

(March 2005) at http://www.hda-online.org.uk/documents/prev_accidental_injury.pdf

Milner, P.C., Nicholl, J.P. and Williams, B.T. 1988. 'Variation in demand for accident and emergency departments in England from 1974', *Journal of Epidemiology and Community Health* 42:274-278.

Miro, O., Antonio, M.J., Jimenez, S., De Dios, A., Sanchez, M., Borras, A. and Milla, J. 1999. 'Decreased health care quality associated with emergency department overcrowding', *European Journal of Emergency Medicine* 6:105-107.

Miro, O., Sanchez, M., Espinosa, G., Coll-Vinent, B., Bragulat, E., Milla, J. and Wardrope, J. 2003. 'Analysis of patient flow in the emergency department and the effect of an extensive reorganisation', *Emergency Medicine Journal* 20:143-148.

Monninkhof, E.M., van der Valk, P.D.L.P.M., van der Palen, J., van Herwaarden, C.L.A., Partidge, M.R., Walters, E.H. and Zielhuis, G.A. 2004. 'Self-management education for chronic obstructive pulmonary disease. (Cochrane Review)', in *The Cochrane Library*, Issue 3.. Chichester, UK: John Wiley & Sons, Ltd.

Monsuez, J.J., Fergelot, H., Papon, B.J. and LeGall, J.R. 1993. 'Early social work intervention in the emergency department', *European Journal of Emergency Medicine* 2:489-492.

Morgan, G. and Cooke, M.W. 2001. *Shared Learning Opportunities Project*. [Online]. Available (March 2005) at http://www2.warwick.ac.uk/fac/med/healthcom/emergencycare/research/sharedlearning/

Morrison, W.G., Pennycook, A.G., Makower, R.M. and Swann, I.J. 1990. 'The general practitioner's use and expectations of an accident and emergency department'. *Journal of the Royal Society of Medicine*, 83(4):237-240.

Morrison, L.J., Verbeek, P.R., McDonald, A.C., Sawadsky, B.V. and Cook, D.J. 2000. 'Mortality and prehospital thrombolysis for acute myocardial infarction: A meta-analysis', *Journal of the American Medical Association* 283:2686-2692.

Munro, J., Nicholl, J.P., O'Cathain, A. and Knowles, E. 2000. 'Impact of NHS Direct on demand for immediate care: observational study', *British Medical Journal* 321:150-153.

Murphy, A.W. 1998. '"Inappropriate" attenders at accident and emergency departments I: Definition, incidence and reasons for attendance', *Family Practice* 15:23-32.

Murphy, A.W., Bury, G., Plunkett, P.K., Gilbney, D., Smith, M. and Mullan, E. 1996. 'A comparison of general practitioner and usual medical care in an urban accident and emergency deaprtment in terms of process, health status and comparative costs', *British Medical Journal* 312:1135-1142.

Murphy, A.W., Leonard, C., Plunkett, P.K., Bury, G., Lynham, F., Smith, M. and Gibney, D. 1997. 'Effect of the introduction of a financial incentive for fee paying A&E attenders to consult their general practitioner before attending the A&E department', *Family Practitioner* 14: 407-410.

Murphy, A.W., Plunkett, P.K., Bury, G., Leonard, C., Walsh, J., Lynham, F. and Johnson, S. 2000. 'Effect of patients seeing a general practitioner in accident and emergency on their subsequent reattendance: Cohort study', *British Medical Journal* 320:903-904.

Murphy, R., Eckersley, C., Driscoll, P. [n.d.]. *A comparison of medical admissions by an accident and emergency clinician and an on-call medical team*. Trafford Healthcare NHS Trust (unpublished).

Murray, R.P., Leroux, M., Sabga, E., Palatnick, W., Ludwig, L. 1999. 'Effect of point of care testing on length of stay in an adult emergency department', *Journal of Emergency Medicine* 17:811-814.

Nathanson, L. 2003. 'Tracking the ED electronically', *Emergency Medical Services* 32:52.

National Association of EMS Physicians. 2001. 'Patient nontransport' (position paper), *Prehospital Emergency Care* 5:288.

Natsch, S., Kullberg, B.J., Meis, J.F.G.M., van der Meer J,W,M. 2000. 'Earlier initiation of antibiotic treatment for severe infections after interventions to improve the organization and specific guidelines in the emergency department', *Archives of Internal Medicine* 160:1317-1320.

Naumann, S. and Miles, J.A. 2001. 'Managing waiting patients' perceptions: The role of process control', *Journal of Management in Medicine* 15:376-386.

Nazarko, L. 1998. 'Improving discharge: the role of the discharge co-ordinator', *Nursing Standard* 12 (49):35-37.

Neades, B.L. 1997. 'Expanding the role of the nurse in the accident and emergency department', *Postgraduate Medical Journal* 73:17-22.

Nelson, D., Coleman, K. and Walker, J. 1997. 'Why are you waiting? Formulating an information pamphlet for use in an accident and emergency department', *Accident and Emergency Nursing* 5:39-41.

Nelson, D.S., Hoagland, J.R. and Kunkel, N.C. 2000. Costs of sedation using oral midazolam: Money, time, and parental attitudes', *Pediatric Emergency Care* 16:80-84.

New Jersey Hospital Association. 2001. *A Full House: Updated hospital diversion guidelines*. [Online]. Available at http://www.njha.com/publications/pubCatalog/DiversionGuidelines.pdf (accessed 29 March 2005).

New, T.D. 2000. 'Clinical decision support tools in A&E nursing: A preliminary study', *Nursing Standard* 14:32-39.

NHS Modernisation Agency. 2001*. Improving the flow of emergency admissions*. [Online]. Available (March 2005) at http://www.modern.nhs.uk/1164/Improving_the_flow.pdf

NHS Modernisation Agency.2002. *An Improvement Leader's Guide to Matching Capacity and demand.* Ipswich: NHS Modernisation Agency.

NHS Modernisation Agency. 2002. *See and Treat*. London: NHS Modernisation Agency. Available (April 2005) at http://www.modern.nhs.uk/esc/8237/See%20&Treat.pdf

NHS Modernisation Agency. [n.d.]. *Improvements in Emergency Care: Case Studies – Emergency Services Collaborative Volume II*. [Online]. Available (March 2005) at http://www.modern.nhs.uk/esc/7902/Emer_case_study.pdf

NHS Modernisation Agency. 2003a. *Emergency Services Collaborative*. [Online]. Available (March 2005) at www.modern.nhs.uk/emergency

NHS Modernisation Agency. 2003b. *Changing Workforce Programme: New ways of working in healthcare*. [Online]. Available (March 2005) at http://www.modern.nhs.uk/scripts/default.asp?site_id=65

Nicholl, J., Turner, J., Pickin, M. 1998. *A review of evidence and recommendations for the provision and organisation of emergency services*. Sheffield: University of Sheffield.

Nicholl, J.P., Gilhooley, K., Parry, P., Turner, J. and Dixon, S. 1996. *The Safety and Reliability of Priority Dispatch Systems*. Sheffield: University of Sheffield Medical Care Research Unit.

Nikolaus, T., Specht-Leible, N., Bach, M., Oster, P. and Schlierf, G. 1999. 'A randomized trial of comprehensive geriatric assessment and home intervention in the care of hospitalized patients', *Age and Ageing* 28:543-550.

Nolan, T.W., Schall, M.W., Berwick, D.M. and Roessner, I. 1996. *Reducing Delays and Waiting Times Throughout the Healthcare System*. Boston: Institute for Healthcare Improvement.

Norris, G., Young Pong, S.N., Koenig, J.Q., Larson, T.V., Sheppard, L. and Stout, J.W. 1999. 'An association between fine particles and asthma emergency department visits for children in Seattle', *Environmental Health Perspectives*. 107:489-493.

Novak, T. and Pross, H. 1983. 'The role of deputising agencies in the delivery of primary health care services', *Canadian Medical Association Journal* 128:1079-1082.

O'Brien, R.A., Shapiro, M.J., Woolard, R.W., O'Sullivan, P.S. and Stein, M.D. 1996. 'Inappropriate emergency department use: a comparison of three methodologies for identification', *Academic Emergency Medicine* 3:252-257.

O'Connor, P.M., Dowey, K.E., Bell, P.M., Irwin, S.T. and Dearden, C.H. 1995. 'Unnecessary delays in accident and emergency

departments: Do medical and surgical senior house officers need to vet admissions?', *Emergency Medicine Journal* 12(4):251-254.

O'Grady, K., Manning, W.G., Newhouse, J.P. and Brook, R.H. 1985. 'The impact of cost sharing on emergency department use', *New England Journal of Medicine* 313:484-490.

O'Meara, P. 2003. 'Would a prehospital practitioner model improve patient care in rural Australia?', *Emergency Medicine Journal* 20:199-203.

O'Shea, J.S., Collins, E.W. and Pezzullo, J.C. 1984. 'An attempt to influence health care visits of frequent hospital emergency facility users', *Clinical Paediatrics* 23:559-562.

Okin, R.L., Boccellari, A., Azocar, F., Shumway, M., O'Brien, K., Gelb, A., Kohn, M., Harding, P. and Wachsmuth, C. 2000. 'The effects of clinical case management of hospital service use among ED frequent users', *American Journal of Emergency Medicine* 18:603-608.

Oliver, D., Hopper, A. and Seed, P. 2000. 'Do hospital fall prevention programs work? A systematic review', *Journal of the American Geriatrics Society* 48: 1679-1689.

Olshaker, J.S., Barish, R.A., Naradzay, J.F., Jerrard, D.A., Safir, E. and Campbell, L. 1999. 'Prescription noncompliance: contribution to emergency department visits and cost', *Journal of Emergency Medicine* 17:909-912.

Olsson, M., Edhag, O. and Rosenquist, U. 1986. 'Emergency care. Identification of psychosocial problems', *Scandinavian Journal of Social Medicine* 14:87-91.

Olsson, M. and Hansagi, H. 2001. 'Repeated use of the emergency department: qualitative study of the patient's perspective', *Emergency Medicine Journal* 18:430-434.

Ornato, J.P. 1990. 'Role of the emergency department in decreasing the time to thrombolytic therapy in acute myocardial infarction', *American Journal of Hospital Pharmacy* 47:S11-S14.

Owens, C.W., Ben-Shlomo, Y. and Moore, F.P. 1993. 'Accident and emergency in London. Better primary care won't affect self referrals', *British Medical Journal* 306:1751.

Parfey, P.S., Gardner, E., Vasasour, H. Harnett, J.D., McManamon, C., McDonald, J. and Dawe, J. The feasibility and efficacy of early discharge planning initiated by the admitting department into acute care hospitals. *Clinical and Investigative Medicine* 1994;17: 88-96.

Parris, W., McCarthy, S., Kelly, A.M. and Richardson, S. 1997. 'Do triage nurse-initiated X-rays for limb injuries reduce patient transit time?' *Accident and Emergency Nursing*. 5:14-15.

Parsons, P.L. and McMurtry, C.T. 1997. 'Short communications. In response: NP care/discharge planning saves money', *Nurse Practitioner* 22:238-240.

Partovi, S.N., Nelson, B.K., Bryan, E.D. and Walsh, M.J. 2001. 'Faculty triage shortens emergency department length of stay', *Academic Emergency Medicine* 8:990-995.

Parvin, C., Lo, S., Deuser, S., Weaver, L., Lewis, L., Scott, M. 1996. 'Impact of point of care testing on patients' length of stay in a large emergency department', *Clinical Chemistry* 42:711-717.

Patterson, C.J. and Mulley, G.P. 1999. 'The effectiveness of predischarge home assessment visits: a systematic review', *Clinical Rehabilitation* 13:101-104.

Pearce, L. 2002. 'Complete turnaround. Tears, long trolley waits and a hostile local press characterised A&E in Bath', *Nursing Standard* 16:16-17.

Pell, A.C., Miller, H.C., Robertson, C.E. and Fox, K.A. 1991. 'Effect of a 'fast track' admission for acute myocardial infarction on delay of thrombolysis', *British Medical Journal* 304:83-87.

Pencheon, D., Lambert, M. and Hadridge, P. 1998. 'So many unanswered questions: the emergency care system of the future', *Journal of Accident and Emergency Medicine* 15: 49-53.

Petersen, C. 1985. 'Cut your paperwork with this 4-minute E.D. admission form', *Nursing* 15:56-57.

Petersen, L.A., Burstin, H.R., O'Neil, A.C., Orav, E.J. and Brennan, T.A. 1998. 'Nonurgent emergency department visits: the effect of having a regular doctor', *Medical Care* 36:1249-1255.

Petrie, P.J., Sadiq, Z., Clague, J.E. and Horan, M.A. 1999. 'Readmission of patient discharged from emergency departments', *Age and Ageing* 28:499-500.

Phadke, M.S. (n.d.) 'Introduction to robust design: Taguchi Method'. [Online]. Available (March 2005) at http://www.isixsigma.com/library/content/c020311a.asp

Piehl, M.D., Clemens, C.J. and Joines, J.D. 2000. 'Narrowing the gap. Decreasing emergency department use by children enrolled in the Medicaid program by improving access to primary care', *Archives of Pediatrics and Adolescent Medicine* 154:791-795.

Pierce, J. and Kellerman, A. 1990. 'Bounces: An analysis of short-term return visits to a public hospital emergency department', *Annals of Emergency Medicine* 19:752-757.

Plorde, M.L., Peiguss, K. and Murray, J. 2001. *Appropriate destination and patient treatment (ADAPT) pilot project*. Seattle: Kent and Maple Valley Fire and Life Safety; Public Health-Seattle and King County; Health South; Multi Care and Maple Valley Urgent Care Clinics; Premera; Group Health; DSHS.

Pointer, J.E., Levitt, M.A., Young, J.C., Promes, S.B., Messana, B.J. and Ader, M.E.J. 2001. 'Can paramedics using guidelines accurately triage patients?' *Annals of Emergency Medicine* 38:268-277.

Poncia, H.D.M., Ryan, J. and Carver, M. 2000. 'Next day telephone follow up of the elderly: A needs assesment and critical incident monitoring tool for the accident and emergency department', *Emergency Medicine Journal* 17:337-340

Pope, D., Fernandes, C., Bouthillette, F. and Etherington, J. 2000. 'Frequent users of the emergency department: A program to improve care and reduce visits', *Canadian Medical Association Journal* 162:1017-1020.

Pourriat, J.L., Prudhomme, C., Laborie, J.M., Nemorin, M. and Cupa, M. 1989. Emergency department: Effect of structure on care delay', *Annales Francaises d'Anesthesie et de Reanimation* 8:Suppl:R73.

Powell, D. and Peile, E. 2000. 'Joint working. It's a stitch up', *Health Service Journal* 110:24-25.

Prasad, N., Wright, A., Hogg, K.J. and Dunn, F.G. 1997. 'Direct admission to the coronary care unit by the ambulance service for patients with suspected myocardial infarction', *Heart* 78:462-464.

Preater, J. 2002. 'Queues in health', *Health Care Management Science* 5:283.

Priestley, S., Kelly, A.M., Chow, L., Powell, C. and Williams, A. 2003. 'Application of topical anesthetic at triage reduces treatement time for children with lacerations. A randomized controlled trial', *Annals of Emergency Medicine* 41:34-40.

Proudlove, N.C., Gordon, K. and Boaden, R. 2003. 'Can good bed management solve the overcrowding in accident and emergency departments?' *Emergency Medicine Journal* 20:149-155.

Quinn, T., Allan, T.F., Thompson, D.R., Pawelec, J., Boyle, R.M. 1999. 'Identification of patients suitable for direct admission to a coronary care unit by ambulance paramedics: An observational study', *Pre-Hospital Immediate Care*. 3:126-130.

Rajmohan, B. 2000. 'Audit of the effect of a fast tracking protocol on transfer time from A&E to ward for patients with hip fractures', *Injury* 31:585-589.

Rajpar, S.F., Smith, M.A. and Cooke, M.W. 2000. 'Study of choice between accident and emergency departments and general practice centres for out of hours primary care problems', *Emergency Medicine Journal* 17:18-21.

Ranjadayalan, K., Umachandran, V. and Timmis, A.D. 1992. 'Fast track admission for acute myocardial infarction', *British Medical Journal* 304:83-87.

Rasmussen, S.W., Svendsen, R.N. and Gringer, K. 1997. 'Attendance pattern at an open casualty ward in Greater Copenhagen', *Ugeskrift for Laeger*. 159:6831-6834.

Raw, M., McNeill, A. and West, R. 1999. 'Smoking cessation: evidence based recommendations for the healthcare system', *British Medical Journal* 318:182-185.

Read, S., Broadbent, J. and George, S. 1994. 'Do formal controls always achieve control? The case of triage in accident and emergency departments', *Health Services Management* 7:31-42.

Rector, T.S., Venus, P.J. and Laine, A.J. 1999. 'Impact of mailing information about nonurgent care on emergency department visits by Medicaid beneficiaries enrolled in managed care', *American Journal of Managed Care*. 5:1505-1512.

Redelmeier, D.A., Blair, P.J. and Collins, W.E. 1994. 'No place to unload: A preliminary analysis of the prevalence, risk factors, and consequences of ambulance diversion', *Annals of Emergency Medicine* 23:43-47.

Redelmeier, D.A., Molin, J. and Tibshirani, R.J. 1995. 'A randomised trial of compassionate care for the homeless in an emergency department', *The Lancet* 345:1131-1134.

Redfern, R.O., Langlotz, C.P., Abbuhl, S.B., Polansky, M., Horii, S.C. and Kundel, H.L. 2002. 'The effect of PACS on the time required for technologists to produce radiographic images in the emergency department radiology suite', *Journal of Digital Imaging* 15:153-160.

Redmond, A.D. and Buxton, N. 1993. 'Consultant triage of minor cases in an accident and emergency department', *Archives of Emergency Medicine* 10:328-330.

Reeder, T.J., Garrison, H.G. 2001. 'Real-time assessment of the overcrowded emergency department' *Academic Emergency Medicine* 8:1070-1074.

Reeder, T.J., Burleson, D.L. and Garrison, H.G. 2003. 'The overcrowded emergency department: perception vs reality', *Academic Emergency Medicine* 10:1059-1064.

Regan, G. 2000. 'Making a difference to A&E: analysis of the operational inefficencies in A&E departments in / major acute hospitals in Dublin', *Accident and Emergency Nursing* 8; 54-61.

Rhee, K. and Dermyer, A. 1995. 'Patient satisfaction with a nurse practitioner in a university emergency service', *Annals of Emergency Medicine* 26- 130.

Rhee, K.J. and Bird, J. 1996. 'Perceptions and satisfaction with emergency department care', *Journal of Emergency Medicine* 14: 679-683.

Rich, M.W., Beckham, V., Wittenberg, C., Leven, C.L., Freedland, K.E. and Carney, R.M. 1995. 'A multidisciplinary intervention to prevent the readmission of elderly patients with congestive heart failure', *New England Journal of Medicine* 333: 1190-1195.

Richards, D.A., Meakins, J., Tawfik, J., Godfrey, L., Dutton, E., Richardson, G. and Russell, D. 2002. Nurse telephone triage for same day appointments in general practice: multiple interrupted time series trial of effect on workload and costs. *British Medical Journal* 325:1214.

Richardson, D.B. 2001. 'Association of access block with decreased ED performance', *Academic Emergency Medicine* 8:575-a-576-a.

Richardson, D.B. 2002. 'The access-block effect: relationship between delay to reaching an inpatient bed and inpatient length of stay', *Medical Journal of Australia* 177:492-495.

Richardson, D.B. 2003a. 'Prospective confirmation that total daily patient care time can measure emergency department overcrowding', *Academic Emergency Medicine* 10:526-b-527-b.

Richardson, D.B. 2003b. 'Relationship between total daily patient care time and performance as a measure of emergency department efficiency', *Academic Emergency Medicine* 10:527.

Richardson, D.B. 2003c. 'Prospective confirmation total daily patient time as a measure of emergency department overcrowding', *Academic Emergency Medicine* 10:526-a.

Rieffe, C., Oosterveld, P., Wijkel, D. and Wiefferink, C. 1999. 'Reasons why patients bypass their GP to visit a hospital emergency department', *Accident and Emergency Nursing* 7:217-225.

Riley, J. 2001. *Creating a Generic Model of Accident and Emergency departments* Glasgow: Glasgow Caledonian.

Rinderer, Z.M. 1996. 'A study of factors influencing emergency department patients' length of stay at one community hospital', *Journal of Emergency Nursing* 22:105-110.

Rivara, F.P., Wall, H.P., Worley, P. and James, K.D. 1986. 'Pediatric nurse triage. Its efficacy, safety, and implications for care', *American Journal of Diseases of Children* 140:205-210.

Roberts, E. and Mays, N. 1997. *Accident and emergency care at the primary-secondary interface: a systematic review of the evidence on substitution*. London: King's Fund Commission.

Robertson, M.C., Devlin, N., Schuffham, P., Gardner, M.M., Buchner, D.M. and Campbell, A.J. 2001. 'Economic evaluation of a community based exercise programme to prevent falls', *Journal of Epidemiology and Community Health* 55:600-606.

Rodriguez, G.C., Romera ,Garcia M.T., Menendez, R.J.J., Losa Campillo, J., Mendieta, L.J.M., Montabes, M.E., Arriola, B.P., Paniagua, C.E. and Alvarez, M.I. 1992. 'Length of stay in the hospital emergency department', *Gaceta Sanitaria* 6:113-116.

Roland, M. and Morris, R. 1988. Are referrals by general practitioners influenced by the availability of consultants?', *British Medical Journal* 297:599.

Rosen, M.P., Slewert, B., Sands, D.Z., Bromberg, R., Edlow, J., Raptopoulos, V. 2003. 'Value of abdominal CT in the emergency department for patients with abdominal pain', *European Radiology* 13:418-424.

Rosenberg, E.E. and Pless, I.B. 1993. 'Can effective parent education occur during emergency room visits?' *Family Medicine* 25:598-601.

Rosenblatt, R.A., Wright, G.E., Baldwin, L., Chan, L., Clitherow, P., Chen, F.M. and Hart, L.G. 2000. 'The effect of the doctor-patient relationship on emergency department use among the elderly', *American Journal of Public Health* 90:97-102.

Rosenstein, A.H., Hanel, J.B. and Martin, C. 2000. 'Timing is everything: Impact of emergency department care on hospital length of stay', *Journal of Clinical Outcomes Management* 7:31-36.

Rosow, E., Adams, J., Coulombe, K., Race, K., Anderson, R. 2003. Virtual instrumentation and real-time executive dashboards. Solutions for health care systems', *Nursing Administration Quarterly* 27:58-76.

Ross, M.A., Wilson, A.G. and McPherson, M. 2001. 'The impact of an ED observation unit bed on inpatient bed availability', *Academic Emergency Medicine* 8:576.

Rotstein, Z., Barabash, G., Noy, S., Wilf-Miron, R. and Shani, M. 1996. 'Allocation of emergency ward patients to medicine departments: Increasing physicians' incentive to shorten length of stay', *Public Health Reviews* 24:37-48.

Rotstein, Z., Wilf-Miron, R., Lavi, B. 1997. 'The dynamics of patient visits to a public hospital ED: A statistical model', *American Journal of Emergency Medicine* 15: 596-599.

Rotstein, Z., Wilf-Miron, R., Lavi, B., Seidman, D.S., Shahaf, P., Shahar, A., Gabay, U. and Noy, S. 2002. 'Management by constraints: Considering patient volume when adding medical staff to the emergency department', *Israel Medical Association Journal* 4:170-173.

Rowe, B.H., Spooner, C., Ducharme, F.M., Bretzlaff, J.A. and Bota, G.W. 2004. 'Early emergency department treatment of acute asthma with systemic corticosteroids. (Cochrane Review)', in *The Cochrane Library*, Issue 3. Chichester, UK: John Wiley & Sons, Ltd.

Rowland, K., Maitra, A.K., Richardson, D.A., Hudson, K. and Woodhouse, K.W. 1990. 'The discharge of elderly patients from an accident and emergency department: functional changes and risk of readmission', *Age & Ageing* 19:415-418.

Rucker, D.W., Setnik, G., Brennan, T.A., Burstin, H.R. and Richardson, D.B. 1999. 'Willingness to wait for an appointment rather than going to the ED', *Academic Emergency Medicine* 6:538-a.

Rutherford, W.H., Illingworth, R.N., Marsden, Nelson, Redmond and Wilson. 1989. *Accident and Emergency Medicine*. Edinburgh: Churchill Livingstone.

Ryan, B. 1995. 'Effects of formal triage on A&E waiting times', *Nursing Times* 91:14.

Ryan, J., Ghani, M., Stainforth, P., Bryant, G. and Edwards, S. 1996. 'Fast tracking' patients with a proximal femoral fracture', *Journal of Accident and Emergency Medicine* 13:108-110.

Ryan, J.M., Sing, S., Bryant, G., Edwards, S. and Staniforth, P. 2000. 'Fast tracking patients with a proximal femoral fracture - more than a broken bone', *Emergency Medicine Journal* 17:76.

Sahnd, S. 1991. 'Making the ED waiting game a little easier to play', *RN* 54:19-20.

Sakr, M. 2000. 'Randomised controlled study comparing the care and clinical outcome of patients with minor injuries treated by nurse practitioners versus senior house officers (BL)', Sheffield: Sheffield University.

Sakr, M. 2003. *Emergency Nurse Practitioners*. [Online] Available (March 2005) at http://libraries.nelh.nhs.uk/emergency/ (search for 'emergency nurse practitioners').

Sakr, M., Angus, J., Perrin, J., Nixon, C., Nicholl, J., Wardrope, J. 1999. 'Care of minor injuries by emergency nurse practitioners or junior doctors: A randomised controlled trial.' *The Lancet* 354:1321-1326.

Salisbury, C. 1997a. 'Observational study of a general practice out of hours cooperative: measures of activity', *British Medical Journal* 314:182-186.

Salisbury, C. 1997b. 'Postal survey of patients' satisfaction with a general practice out of hours co-operative', *British Medical Journal* 314:1594-1598.

Salisbury, C., Chalder, M., Manku-Scott, T., Nicholas, R., Deave, T., Noble, S., Pope, C., Moore, L., Coast, J., Anderson, E., Weiss, M., Grant, C. and Sharp, D. 2002. *National Evaluation of NHS Walk-in Centres*. Bristol: University of Bristol.

Sanders, J. 2000. 'A review of health professional attitudes and patient perceptions on 'innapropriate' accident and emergency attendances. The implications for current minor injury service provision in England and Wales', *Journal of Advanced Nursing* 31:1097-1105.

Sandler, D.A. 1999. 'Call to needle times after acute myocardial infarction. Paramedics in Derbyshire can admit direct to coronary care unit when they diagnose myocardial infarction*', British Medical Journal* 318:1553-1554.

Sands, V.M., Auerbach, P.S., Birnbaum, J. and Green, M. 1995. 'Evaluation of a portable clinical blood analyzer in the emergency department', *Academic Emergency Medicine*. 2:172-178.

Santos Martin, M.D., Bascunana Morejon de Giron, J., Lumbreras Garcia, G., Alvarez, M. E., Martinez Pascual, B., Correcher, P., Hernando, de Larramendi, C. and Mancebo, A. L. 2000. 'Evaluation of the functional component underlying the frequent attendance to a hospital emergency service and its economic consequences', *Anales de Medicina Interna*. 17:410-415.

Sarkozi, L., Simson, E. and Ramanathan, L. 2003. 'The effects of total laboratory automation on the management of a clinical chemistry

laboratory. Retrospective analysis of 36 years', *Clinica Chimica Acta*. 329:89-94.

Sarver, J.H., Cydulka, R.K. and Baker, D.W. 2002. 'Usual source of care and nonurgent emergency department use', *Academic Emergency Medicine* 9: 916-923.

Saunders, C.E. and Gentile, D.A. 1988. 'Treatment of mild exacerbations of recurrent alcoholic pancreatitis in an emergency department observation unit', *Southern Medical Journal* 81:317-320.

Saunders, C.E., Makens, P.K. and Leblanc, L.J. 1989. 'Modeling emergency department operations using advanced computer simulation systems', *Annals of Emergency Medicine* 18:134-140.

Saxena, S. and Wong, E.T. 1993. 'Does the emergency department need a dedicated stat laboratory? Continuous quality improvement as a management tool for the clinical laboratory', *American Journal of Clinical Pathology* 100:606-610.

Saywell, R.M., Cordell, W.H., Nyhuis, A.W., Giles, B.K., Culler, S.D., Woods, J.R., Chu, D.K., McKinzie, J.P. and Rodman, G.H. 'The use of a break-even analysis: financial analysis of a fast-track program', *Academic Emergency Medicine* 2:739-745.

Schafermeyer, R.W. and Brent, R.A. 2003. 'Hospital and emergency department crowding in the United States', *Emergency Medicine* 15:22-27.

Scherer, Y.K. and Bruce, S. 2001. 'Knowledge, attitudes, and self-efficacy and compliance with medical regimen, number of emergency department visits, and hospitalizations in adults with asthma', *Heart and Lung: Journal of Acute and Critical Care* 30:250-257.

Schmidt, T., Atcheson, R., Feduriuk, C., Mann, C., Pinney, T., Fuller, D. and Colbry, K. 2000. 'Evaluation of protocols allowing emergency medical technicians to determine need for treatment and transport', *Academic Emergency Medicine* 7:663-9.

Schmidt, T., Neely, K.W., Adams, A.L., Newgard, C.D., Wittwer, L., Muhr, M. and Norton, R. 2003. 'Is it possible to safely triage callers to EMS dispatch centers to alternative resources?' *Prehospital Emergency Care* 7:368-374.

Schmidt, T.A., Iserson, K.V., Freas, G.C., Adams, J.G., Burke, T.F., Derse, A.R., Goldfrank, L., Kalbfleisch, N.D., Keim, S.M., Krimm, J.R. and Larkn, G.L. 1995. 'Ethics of emergency department triage: SAEM position statement', *Academic Emergency Medicine* 2:990-995.

Schneider, S., Zwemer, F., Doniger, A., Dick, R., Czapranski, T. and Davis, E. 2001. 'Rochester, New York: A decade of emergency department overcrowding', *Academic Emergency Medicine* 8:1044-1050.

Schraibman, I.G., Milne, A.A. and Royle, E.M. 2001. 'Home versus in-patient treatment for deep vein thrombosis', *Cochrane Database of Systematic Reviews*. (2), CD003076.

Schull, M.J. and Mamdani, M. 2001a. 'How influenza outbreaks affect emergency department overcrowding and ambulance diversion', *Academic Emergency Medicine* 8.574.

Schull, M.J. and Mamdani, M. 2001b. 'Influenza virus as a determinant of emergency department overcrowding', *Canadian Journal of Emergency Medicine* 3:126-127.

Schull, M.J., Morrison, L.J., Vermeulen, M. and Redelmeier, D.A. 2003. 'Emergency department overcrowding and ambulance transport delays for patients with chest pain', *Canadian Medical Association Journal* 168:277-283.

Schull, M.J., Slaughter, P.M. and Redelmeier, D.A. 2001a. 'Urban emergency department overcrowding: Defining the problem and eliminating misconceptions', *Canadian Journal of Emergency Medicine* 4:76-83.

Schull, M.J., Szalai, J.P., Schwartz, B. and Redelmeier, D.A. 2001b. 'Emergency department overcrowding following systematic hospital restructuring: trends at twenty hospitals over ten years', *Academic Emergency Medicine* 8:1037-1043.

Scrivens, E., Cropper, S. and Beech, R. 1998. *Making Winter Monies Work: A Review of localy used methods for selecting and evaluating supply-side interventions*. Keele: Keele University.

Seaberg, D.C. and Macleod, B.A. 1998. 'Correlation between triage nurse and physician ordering of ED tests', *American Journal of Emergency Medicine* 16:8-11.

Selby, J.Y., Firman, B.H. and Swain, B.E. 1996. 'Effect of a copayment on use of the emergency department in a health maintenance organisation', *New England Journal of Medicine* 334:635-641.

Selden, B.S., Schnitzer, P.G., Nolan, F.X. and Veronesi, J.F. 1991. 'The "no-patient" run: 2698 patients evaluated but not transported by paramedics', *Prehospital and Disaster Medicine* 6:135-142.

Semke, J., VanDerWeele, T. and Weatherley, R. 1989. 'Delayed discharges for medical and surgical patients in an acute care hospital', *Social Work in Health Care* 14:15-31.

Shah, N.M., Shah, M.A., Behbehani, J. 1996. 'Predictors of non-urgent utilization of hospital emergency services in Kuwait', *Social Science and Medicine* 42:1313-1323.

Sharieff, G.Q., Hoecker, C. and Silva, P.D. 2001. 'Effects of a pediatric emergency department febrile infant protocol on time to antibiotic therapy', *Journal of Emergency Medicine* 21:1-6.

Shaw, K.N. and Lavelle, J.M. 1998. 'VESAS: A solution to seasonal fluctuations in emergency department census', *Annals of Emergency Medicine* 32:698-702.

Shepperd, S. and Iliffe, S. 2004. 2004. 'Hospital at home versus in-patient hospital care (Cochrane Review)', in *The Cochrane Library*, Issue 3. Chichester, UK: John Wiley & Sons, Ltd.

Shesser, R., Kirsch, T., Smith, J. and Hirsch, R. 1991. 'An analysis of emergency department use by patients with minor illness', *Annals of Internal Medicine* 20:743-748.

Shih, C.H. 1997. 'Effect of emergency physician-performed pelvic sonography on length of stay in the emergency department', *Annals of Emergency Medicine* 29:348-351.

Shih, F.Y., Ma, M.H., Chen, S.C., Wang, H.P., Fang, C.C., Shyu, R.S., Huang, G.T. and Wang, S.M. 1999. 'ED overcrowding in Taiwan: facts and strategies', *American Journal of Emergency Medicine* 17:198-202.

Shrimpling, M. 2002. 'Redesigning triage to reduce waiting times', *Emergency Nurse* 10:34-37.

Shum, C., Humphreys, A., Wheeler, D., Cochrane, M., Skoda, S. and Clement, S. 2000. 'Nurse management of patients with minor illnesses in general practice: Multicentre, randomised control trial', *British Medical Journal* 320:1038-1043.

Siddharthan, K., Jones, W.J. and Johnson, J.A. 1996. 'A priority queuing model to reduce waiting times in emergency care', *International Journal of Health Care Quality Assurance* 9:10-16.

Silberstein, S.D., Winner, P.K. and Chmiel, J.J. 2003. 'Migraine preventive medicine reduces resource utilisation', *Headache* 43:171-178.

Silvestri, S., Rothrock, S.G., Kennedy, D., Ladde, J., Bryant, M. and Pagane, J. 2002. 'Can paramedics accurately identify patients who do not require emergency department care?', *Prehospital Emergency Care* 6:387-390.

Simon, H.K., McLario, D., Daily, R., Lanese, C., Castillo, J. and Wright, J. 1996. 'Fast tracking patients in an urban pediatric emergency department', *American Journal of Emergency Medicine* 14:242-244.

Simpson, A.N., Wardrope, J. and Burke, D. 2001. 'The Sheffield experiment: The effects of centralising accident and emergency services in a large urban setting', *Emergency Medicine Journal* 18:193-197.

Sin, D.D. and Man, S.F. 2002. 'Low-dose inhaled corticosteroid therapy and risk of emergency department visits for asthma', *Archives of Internal Medicine*. 162:1591-1595.

Sinclair, D. and Ackroyd-Stolarz, S. 2000. 'Home care and emergency medicine: A pilot project to discharge patients safely from the emergency department', *Academic Emergency Medicine* 7:951-954.

Sinclair, D. and Green, R. 1998. 'Emergency department observation unit: can it be funded through reduced inpatient admission?' *Annals of Emergency Medicine* 32: 670-675.

Singer, A.J., Chretien, J., Viccellio, A.W., Schiavone, F. and Thode, H.C. 2002. 'Insertion of IVs by residents: Does it save time?' *American Journal of Emergency Medicine* 20:385-387.

Singh, P. 1995. 'Managing chronic congestive heart failure in the home', *Home Healthcare Nurse* 13:11-13.

Singh, S. 1988. 'Self-referral to accident and emergency department: Patients' perceptions', *British Medical Journal* 297:1179-1180.

Sjönell, G. 1986. 'Effect of establishing a primary care health centre on the utilisation of primary health care and other outpatient care in a Swedish urban area', *Family Practice* 3:148-54.

Sklar, D.P., Herring, M., Roth, P.B. and Besante, R. 1989. 'Emergency department technicians in a university-county hospital: A 15-year experience', *Annals of Emergency Medicine*. 18: 401-405.

Small, K.G. and Seime, R.J. 1986. 'The use of education to reduce utilization of emergency health care services: a case illustration', *Journal of Behavior Therapy and Experimental Psychiatry*. 17:43-46.

Smart, D., Pollard, C. and Walpole, B. 1999. Mental health triage in emergency medicine*', Australian & New Zealand Journal of Psychiatry* 33:57-66.

Smeltzer, C.H. and Curtis, L. 1987. 'An analysis of emergency department time: laying the groundwork for efficiency standards', *Quality Review Bulletin*. 13:240-242.

Smith, B., Appleton, S., Adams, R., Southcott, A. and Ruffin, R. 2001. 'Home care by outreach nursing for chronic obstructive pulmonary disease. (Cochrane Review)' in *The Cochrane Library*, Issue 4. Chichester, UK: John Wiley & Sons, Ltd.

Smith, S.R., Woodard, R. and Strunk, R.C. 2001a. 'Follow-up after an ED visit for asthma', *Academic Emergency Medicine* 8:418.

Smith, W.R., Culley, L., Plorde, M., Murray, J.A., Hearne, T., Goldberg, P. and Eisenberg, M. 2001b. 'Emergency medical services telephone referral programme', *Prehospital Emergency Care* 5:174-180.

Snooks, H., Dale, J., Kearsley, N., Halter, M. and Redhead, J. 2001. '*Development and impact of emergency ambulance '"treat and 'refer" protocols for non-serious 999 patients',* London: London Ambulance Service.

Snooks, H., Kearsley, N., Dale, J. and Halter, M. 2000. 'New models of care for 999 callers with conditions that are neither life threatening nor serious: results of a national survey', *Pre Hospital Immediate Care* 4:180-182.

Snooks, H., Williams, S. and Crouch, R. 2002. 'NHS emergency response to 999 calls: Alternatives for cases that are neither life threatening nor serious', *British Medical Journal* 325:330-333.

Snooks, H., Wrigley, H., George, S., Thomas, E., Smith, H. and Glasper, A. 1998. 'Appropriateness of use of emergency ambulances', *Journal of Accident and Emergency Medicine* 15:212-215.

Solomon, D.D. and Johnson, R.W. 1999. 'ED pledge: See doc in 30 minutes or visit is free', *Healthcare Benchmarks* 6:18-19.

Sommers, L.S., Marton, K.I., Barbaccia, J.C. and Randolph, J. 2000. 'Physician, nurse, and social worker collaboration in primary care for chronically ill seniors', *Archives of Internal Medicine* 160:1825-1833.

Soskoline, V. and Auslander, G.K. 1993. 'Follow up evaluation of discharge planning by social workers in an acute care centre in Israel', *Social Work in Health Care* 18:23-48.

Sowney, R. 1999. 'Older people in A&E: A position statement', *Emergency Nurse* 7:6-7.

Spaite, D.W., Bartholomeaux, F., Guisto, J., Lindberg, E., Hull, B., Eyherabide, A., Lanyon, S., Criss, E.A., Valenzuela, T.D. and Conroy, C. 2002. 'Rapid process redesign in a university-based emergency department: Decreasing waiting time intervals and improving patient satisfaction', *Annals of Emergency Medicine* 39:168-177.

Spillane, L., Lumb, E. and Cobaugh, E. 1997. 'Frequent users of the emergency department: Can we intervene?', *Academic Emergency Medicine* 4:574-580.

Staffordshire Ambulance Service NHS Trust. 2001. *The deployment of community paramedic officers within urban areas of Staffordshire*. Staffordshire: Staffordshire Ambulance Service.

Steindel, S.J. and Howanitz, P.J. 2001. 'Physician satisfaction and emergency department laboratory test turnaround time', *Archives of Pathology and Laboratory Medicine* 125: 863-871.

Stewart, S., Pearson, S., Luke, C.G., Horowitz, J.D., Bazarian, J.J., Schneider, S.M., Newman, V.J. and Chodosh, J. 1998. 'Effects of home-based interventions on unplanned re-admissions and out-of-hospital deaths', *Journal of the American Geriatrics Society* 46:174-180.

Steyn, R. [n.d.] *Improving Patient Flow*. [Online]. Available (March 2005) at http://www.steyn.org.uk

Stiell, I.G., McKnight, R.D., Greenberg, G.H., McDowell, I., Nair, R.C., Wells, G.A., Johns, C. and Worthington, J.R. 1994. 'Implementation of the Ottawa ankle rules', *Journal of the American Medical Association* 271:827-832.

Stiell, I.G., Wells, G.A., Hoag, R.H., Sivilotti, M.L., Cacciotti, T.F., Verbeek, P.R., Greenway, K.T., McDowell, I., Cwinn, A.A.,

Greenberg, G.H., Nichol, G. and Michael, J.A. 1997. 'Implementation of the Ottawa knee rule for the use of radiography in acute knee injuries', *Journal of the American Medical Association* 278: 2075-2079.

Stirling, G., Higgins, J. and Cooke, M.W. 2001. 'Violence in A&E departments: A systematic review of the literature', *Accident and Emergency Nursing* 9:77-85.

Stoddart, D., Ireland, A.J., Crawford, R., Kelly, B. 1999. 'Impact on an accident and emergency department of Glasgow's new primary care emergency service', *Health Bulletin* 57:186-191.

Strachan, H., Forster, A. and Stillie, G. 2001. 'The impact of a decision support system on the role of the nurse in a primary care emergency centre', *ITIN* (the official journal of the British Computer Society Nursing Specialist Group) 13:3-7.

Straus, J.H., Orr, S.T. and Charney, E. 1983. 'Referrals from an emergency room to primary care practices at an urban hospital', *American Journal of Public Health* 73:57-61.

Sun, B.C., Burstin, H.R. and Brennan, T.A. 2003. 'Predictors and Outcomes of Frequent Emergency Department Users', *Emergency Medicine Journal* 10:320-328.

Sunyer, J., Saez, M., Murillo, C., Castellsague, J., Martinez, F. and Anto, J.M. 1993. 'Air pollution and emergency room admissions for chronic obstructive pulmonary disease: A 5-year study', *American Journal of Epidemiology* 137:701-705.

Szabo, P. 2003. 'Bed-der than ever', *Health Management Technology* 24:58-59.

Tachakra, S., Uko Uche, C. and Stinson, A. 2002. 'Four years' experience of telemedicine support of a minor accident and treatment service', *Journal of Telemedicine and Telecare* 8 Suppl 2:87-89.

Takakuwa, K.M., Shofer, F.S., Boedec, C. and Reyes, I.M. 2003. 'The effect of bedside registration on patient encounter times in an urban academic emergency department', *Academic Emergency Medicine* 10:525-a.

Taylor, C., Forrest-Hay, A., Meek, S. 2002. 'ROMEO: A rapid rule out strategy for low risk chest pain. Does it work in a UK emergency department?', *Emergency Medicine Journal* 19:395-399.

Taylor, C.J., Bull, F., Burdis, C. and Ferguson, D.G. 1997. 'Workload management in A&E: Counting the uncountable and predicting the unpredictable', *Journal of Accident and Emergency Medicine* 14:88-91.

Thakker, Y., Sheldon, T.A., Long, R. and MacFaul, R. 1994. 'Paediatric inpatient utilisation in a district general hospital', *Archives of Disease in Childhood* 70:488-492.

National Institute of Clinical Studies (NICS). 2005. *NICS Projects: Emergency Care Community of Practice*. [Online]. Available (March 2005) at www.nicsl.com.au/projects_projects_detail.aspx?view=6&type=Normal

The Schumacher Group. 2002. *Emergency department overcrowding: causes and effects*. QI/RM newsletter. [Online]. Available (March 2005) at www.tsged.com/Newsletters/Emergency_Department_Overcrowding.htm

Theodoro, D.L., Blaivas, M., Duggal, S., Snyder, G. and Lucas, M. 2002. 'Emergency physician-performed lower extremity doppler results in significant time savings', *Academic Emergency Medicine* 9: 541-a.

Thompson, D.A. and Adams, S.L. 1996. 'The full moon and ED patient volumes: Unearthing a myth', *American Journal of Emergency Medicine*. 14:161-164.

Thompson, D.A. and Yarnold, P.R. 1995. 'Relating patient satisfaction to waiting time perceptions and expectations: The disconfirmation paradigm', *Academic Emergency Medicine* 2:1057-1062.

Thompson, D.A., Yarnold, P.R., Adams, S.L. and Spacone, A.B. 1996. 'How accurate are waiting time perceptions of patients in the emergency department?', *Annals of Emergency Medicine*. 28:652-656.

Thompson, J. 1999. 'Coroners and lack of emergency resources', *Journal of Emergency Medicine* 17:541-542.

Thomson, H., Kohli, H.S. and Brookes, M. 1995. 'Non-emergency attenders at a district general hospital accident and emergency department', *Emergency Medicine Journal* 12:279-281.

Thurston, J. and Field, S. 1996. 'Should accident and emergency nurses request radiographs? Results of a multicentre evaluation', *Emergency Medicine Journal* 13:86-89.

Timerding, B.L., Barsan, W.G., Hedges, J.R., Brott, T.G., VanLigten, P.F., Spilker, J.A. and Olinger, C.P.1989. 'Stroke patient evaluation in the emergency department before pharmacologic therapy', *American Journal of Emergency Medicine* 7:11-15.

Tinkoff, G.H., O'Connor, R.E. and Fulda, G.J. 1996. 'Impact of a two-tiered trauma response in the emergency department: Promoting efficient resource utilization', *Journal of Trauma - Injury, Infection and Critical Care*. 41:735-740.

Townsend, J., Piper, M., Frank, A.O., Dyer, S., North, W.R.S. and Meade, T.W. 1988. 'Reduction in hospital readmission stay of elderly patients by a community based hospital discharge scheme: A randomised controlled trial', *British Medical Journal* 297:544-547.

Tran, T.P., Schutte, W.P., Muelleman, R.L., Wadman, M.C. 2002. 'Provision of clinically based information improves patients'

perceived length of stay and satisfaction with EP*', American Journal of Emergency Medicine* 20:506-509.

Trossman, S. 2000. 'Waiting for care: Too many patients, too little staff', *American Nurse* 32:1-2.

Trout, A., Magnusson, A.R. and Hedges, J.R. 2000. 'Patient satisfaction investigations and the emergency department', *Academic Emergency Medicine* 7:695-709.

Trudeau, S., Ladue, M. 1996. 'Wireless bedside registration in the emergency department', *Journal of Emergency Nursing* 22: 57-60.

Turner, V.F., Bentley, P.J., Hodgson, S.A., Collard, P.J., Drimatis, R., Rabune, C. and Wilson, A.J. 2002. 'Telephone triage in Western Australia', *Medical Journal of Australia* 176:100-103.

Tye, C.C. 1997. 'The emergency nurse practitioner role in major accident and emergency departments: Professional issues and the research agenda', *Journal of Advanced Nursing* 26:364-370.

Van Haastregt, J.C.M., Diederiks, J.P.M., van Rossum, E., de Witte, L.P. and Crebolder, H.F.J.M. 2000. 'Effects of preventative home visits to elderly people living in the community: Systematic review', *British Medical Journal* 320:754-758.

Van Heyningen, C., Watson, I.D. and Morrice, A.E. 1999. 'Point-of-care testing outcomes in an emergency department', *Clinical Chemistry* 45:437-438.

Van Looy, B., Gemmel, P. and Van Dierdonck, R. 2003. *Services Management*. Harlow: Prentice Hall.

Velsted, P. and Christensen, M.B. 2001. 'The effect of an out of hours reform on attendance at casualty wards. The Danish example', *Scandinavian Journal of Primary Health Care* 19:95-98.

Vetter, N. 2003. 'Inappropriately delayed discharge from hospital: What do we know?' *British Medical Journal* 326:927.

Walley, P. 2003a. 'Designing the accident and emergency system: Lessons from manufacturing', *Emergency Medicine Journal* 20:126-130.

Walley, P. 2003b. *A Report into the Implementation of the Modernisation Agency's 'Ideal Design of Emergency Access' (IDEA) Project.* Warwick: Warwick University. [Online]. Available (March 2005) at www.modern.nhs.uk/esc/8237/Final%20Review%20Report%20Sept03.doc

Walls, C.A., Rhodes, K.V. and Kennedy, J.J. 2002. 'The emergency department as usual source of medical care: Estimated from the 1998 National Health Interview survey', *Academic Emergency Medicine* 9:1140-1145.

Walsh, M. and Little, S. 2001. 'Study of a nurse practitioner working in a paramedic role', *Emergency Nurse* 9:11-14.

Wanklyn, P., Hosker, H. and Pearson, S. 1997. 'Slowing the rate of acute medical admissions', *Journal of the Royal College of Physicians* 31:173-176.

Ward, P., Huddy, J., Hargreaves, S., Touquet, R., Hurley, J. and Fothergill, J. 1996. 'Primary care in London: An evaluation of general practitioners working in an inner city accident and emergency department', *Journal of Accident and Emergency Medicine* 13:11-15.

Washington, D.L., Stevens, C.D., Shekelle, P.G., Baker, D.W., Fink, A. and Brook, R.H. 2000. 'Safely directing patients to appropriate levels of care: Guideline-driven triage in the emergency service', *Annals of Emergency Medicine* 36:15-22.

Washington, D.L., Stevens, C.D., Shekelle, P.G., Henneman, P.L. and Brook, R.H. 2002. 'Next-day care for emergency department users with nonacute conditions. A randomized, controlled trial', *Annals of Internal Medicine* 137:707-714.

Wasson, J., Gaudette, C., Whaley, F., Sauvigne, A., Baribeau, P. and Welch, H.G. 1992. 'Telephone care as a substitute for routine clinic follow-up', *Journal of the American Medical Association* 267:1788-1793.

Weigland, J. and Gerson, L. 1995. 'Preventive care in the emergency department: Should emergency departments institute a falls prevention program for elder patients? A systematic review', *Academic Emergency Medicine* 8:823-826.

Weigland, J.V. and Gerson, L. 2001. 'Preventative care in the emergency department: Should emergency departments institute a falls prevention programme for elder Patients? A systematic review', *Academic Emergency Medicine* 8:823-826.

Weinberger, M., Oddone, E.Z. and Henderson, W.G. 1996. 'The Veterans Cooperative study group on primary care and hospital readmissions. Does increased access to primary care reduce hospital readmissions?' *New England Journal of Medicine* 334: 1441-1447.

Whiting, P., Joseph, C.A., Zambon, M., Nunn, M., Fleming, D. and Watson, J.M. 1999. 'Influenza activity in England and Wales: October 1998 to June 1999', *Communicable Disease and Public Health* 2:273-279.

Willert, C., Davis, A.T., Herman, J.J., Holson, B.B. and Zieserl, E. 1985. 'Short-term holding room treatment of asthmatic children', *Journal of Pediatrics* 106:707-711.

Williams, A.G., Jelinek, G.A., Rogers, I.R., Wenban, J.A. and Jacobs, I.G. 2000. 'The effect on hospital admission profiles of establishing an emergency department observation ward', *Medical Journal of Australia* 173:411-414.

Williams, B.T., Dixon, R.A. and Knowelden, J. 1973. 'Emergency admission to hospital from a deputizing service. A controlled study of duration of stay and outcome', *British Journal of Preventive and Social Medicine* 27:126-128.

Williams, J.L. 1998. 'Guidelines to reducing delays in administration of thrombolytic therapy in acute myocardial infarction', *Drugs* 55:689-698.

Wilmshurst, P., Purchase, A., Webb, C., Jowett, C. and Quinn, T. 2000. 'Improving door to needle times with nurse initiated thrombolysis', *Heart* 84:262-266.

Wilson, S., Cooke, M.W., Morrell, R., Bridge, P. and Allan, T. 2002. 'A systematic review of the evidence supporting the use of priority dispatch of emergency ambulances', *Prehospital Emergency Care* 6:42-49.

Windle, J., Mackway-Jones, K. 2003. 'Don't throw triage out with the bathwater', *Emergency Medicine Journal* 20:119-120.

Wisecup, J.W. 1992. 'Paramedics in the emergency department', *Journal of Emergency Nursing* 18: 372-373.

Witt, D.J. 1995. 'Transcription services in the ED', *American Journal of Emergency Medicine* 13: 34-36.

Woo, J., McCabe, J.B., Chauncey, D., Schug, T. and Henry, J.B. 1993. 'The evaluation of a portable clinical analyzer in the emergency department', *American Journal of Clinical Pathology* 100:599-605.

Wrenn, K. and Rice, N. 1994. 'Social work services in an emergency department: An integral part of the health care safety net', *Academic Emergency Medicine* 1:247-253.

Xu, X., Li, B. and Huang, H. 1995. 'Air pollution and unscheduled hospital outpatient and emergency room visits', *Environmental Health Perspectives* 103:286-289.

Yoon, P. 2003. *Emergency department fast-track system*. Canada: Alberta Heritage Foundation for Medical Research.

Yoon, P., Steiner, I. and Reinhardt, G. 2003. 'Analysis of factors influencing length of stay in the emergency department', *Canadian Journal of Emergency Medicine* 5:155-161.

Young, G.P. and Lowe, R.A. 1997. 'Adverse outcomes of managed care gatekeeping', *Academic Emergency Medicine* 4:1129-1136.

Young, G.P., Wagner, M.B., Kellermann, A.L., Ellis, J. and Bouley, D. 1996. 'Ambulatory visits to hospital emergency departments. Patterns and reasons for use. 24 hours in the ED study group', *Journal of the American Medical Association* 276: 460-465.

Zick, R.G. and Olsen, J. 2001. 'Voice recognition software versus a traditional transcription service for physician charting in the ED', *American Journal of Emergency Medicine* 19:295-298.

Appendices

Appendix 1 Search strategy

The sources searched for this review are listed below.

Database searches

BIDS (Bath Information and Data Services)

BIND (British Nursing Index)

BIOME Database

CINAHL (Cumulative Index to Nursing and Allied Health Literature)

COCHRANE Database

COIN (Department of Health circulars)

DARE (Database of Abstracts of Reviews of Effects)

MEDLINE (Ovid)

NHS ED (NHS Economic Evaluation Database)

HTA (Health Technology Assessment)

EMBASE Database

LIBCAT (Department of Health)

NRR (National Research Register)

POINT (Department of Health publications)

PsycINFO

SIGLE (System for Information on Grey Literature in Europe)

THESIS Database

TRIP+ Database

The search strategy overleaf was developed to search the MEDLINE database. Subsequent database searches utilised the same format modified only to accommodate differences in search capabilities.

Copies of search strategies for these databases are available from the authors.

MEDLINE (Ovid): 1985-2003

1	exp Emergency Service, Hospital/ or A&E.mp.
2	exp Emergency Medicine/ or "Accident and Emergency".mp.
3	exp Emergency Medical Services/ or "Emergency Department".mp.
4	Casualty.mp.
5	exp Emergency Medical Services/ or Emergicenters.mp.
6	“Minor Injur$ Unit$ .mp. [mp=title, abstract, cas registry/ec number word, mesh subject heading]
7	exp Primary Health Care/ or "Primary Health Care".mp.
8	exp Emergency Medical Services/ or “Pre-hospital Care” .mp.
9	exp Emergency Medical Services/ or “Prehospital Care” .mp.
10	exp Social Work/ or "Social Work$".mp.
11	"Social Care".mp.
12	exp Emergency Medicine/
13	1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12
14	exp Waiting Lists/ or Wait$.mp.
15	"Wait$ List$".mp.
16	exp Time Factors/ or "Waiting Time$".mp.
17	"Trolley Wait$".mp. or exp Emergency Service, Hospital/
18	exp Emergency Service, Hospital/ or Overcrowding.mp.
19	exp Emergency Service, Hospital/ or Attendance$.mp.
20	exp Health Services Misuse/ or “Inappropriate Attend$.mp.”
21	“Unscheduled Attend$.mp.”
22	exp Time Factors/ or Delay$.mp.
23	14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22
24	13 and 23
25	limit 24 to human
26	limit 25 to yr=1985-2003

Journal search

Electronic search

Academic Emergency Medicine

American Journal of Emergency Medicine

Annals of Emergency Medicine

Applied Nursing Research

Clinical Excellence

EMS Insider

EMS Manager and Supervisor

International Journal of Operations and Production Management

International Journal of Trauma Nursing

JEMS

Journal of Accident and Emergency Medicine

Journal of Emergency Nursing

Journal of Management in Medicine

Journal of Professional Nursing

Nurse Practitioners

Nursing Outlook

Prehospital Emergency Care

RCN Publishing

Hand search

Academic Emergency Medicine

Accident and Emergency Nursing

Ambulance UK

Annals of Emergency Medicine

British Medical Journal

Emergency Medical Journal

Emergency Nurse

Journal of A&E Medicine

Journal of Emergency Medicine

Journal of Emergency Nursing

Nurse Practitioner

Nursing Times

Pre-Hospital Immediate Care

Royal Nurse

Today's Emergency

Internet searches were also undertaken using the biomedical search engine BIOME (http://biome.ac.uk), the meta-search engine Search.com (www.search.com) and the Google search engine (www.google.com).

Key researchers were contacted and adverts placed in key journals, the Emergency Care Network and on internet mailing lists.

Appendix 2 Sources for case studies and other information

Case studies

A range of useful case studies can be found at:
www.warwick.ac.uk/go/emergencycare

Information on issues in emergency care

A variety of sources have been collated and can be accessed at:

www.warwick.ac.uk/go/edwaits

The documents available include key publications from the Department of Health, NHS Modernisation Agency and National Service Frameworks as well as journal and review articles.

Appendix 3 Related research at Warwick University

Service delivery, organisation and informatics

- International emergency department overcrowding project (MA).
- Emergency care facilitator study (MA).
- Modernising through team building, 2002-2003.
- Open access unplanned health care in Coventry (completed).
- Evaluation of Modernisation Agency ideal design of emergency access (IDEA) project (completed).

Emergency department systems

- Contribution of A&E in Coventry to crime reduction initiatives.
- Development of emergency department assistant role.
- A study of discharging patients from triage (completed).
- Fast track systems in A&E (completed).
- Can A&E nurses predict admission (completed).

Out of hospital emergency care

- Evaluation of the NHS Changing Workforce Programme's emergency care practitioner pilot study 2003.
- Emergency care practitioner study.
- UK ambulance services national clinical guidelines development project.
- Innovations in UK ambulance services.
- Safety and effectiveness of criteria based dispatch (completed).
- Shared learning project (completed).
- 'Treat and refer' protocols (completed).

Informatics

- Surrey emergency care project phase 1
- National electronic library and national A&E guidelines project

Social care

- Social work and older people in A&E, Anglo-Scandinavian study (Nuffield Foundation).
- Social workers in A&E (completed).

Further details are available at **www.emergencycare.org.uk**

This document was published by the National Coordinating Centre for the Service Delivery and Organisation (NCCSDO) research programme, managed by the London School of Hygiene & Tropical Medicine.

The management of the Service Delivery and Organisation (SDO) programme has now transferred to the National Institute for Health Research Evaluations, Trials and Studies Coordinating Centre (NETSCC) based at the University of Southampton. Prior to April 2009, NETSCC had no involvement in the commissioning or production of this document and therefore we may not be able to comment on the background or technical detail of this document. Should you have any queries please contact sdo@southampton.ac.uk.

Disclaimer:

This report presents independent research commissioned by the National Institute for Health Research (NIHR). The views and opinions expressed therein are those of the authors and do not necessarily reflect those of the NHS, the NIHR, the SDO programme or the Department of Health.