Acute medical admissions

A critical appraisal of the literature
1998 New Zealand Health Technology Assessment Clearing House (NZHTA)

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ACUTE MEDICAL ADMISSIONS
EXECUTIVE SUMMARY

Aims
This report aims to answer the following questions in relation to both adults and children:

- Are acute medical admissions rising?
- Why are acute medical admissions increasing?
- Are acute medical admissions appropriate?
- What interventions reduce acute medical admission rates?

Data sources
A structured literature search was conducted using the following databases: Medline, Healthstar, Cinahl, Current Contents, Index New Zealand, New Zealand Bibliographic Network, DARE (Database of Abstracts of Reviews of Effectiveness), Cochrane Library, INAHTA (International Network of Agencies for Health Technology Assessment), NHS Economic Evaluation Database. In addition, references were obtained from the Kings Fund catalogue, HMSO catalogue, New Zealand university and medical library catalogues. Others were selected from the bibliographies of retrieved articles and searches of the Internet that used common search engines (e.g. Altavista and Lycos).

The search was limited to English language material and primarily included articles that were published after 1992.

Study selection
Studies were selected if they examined acute medical admissions. A broad range of study designs was eligible for appraisal including meta-analyses, randomised controlled trials, quasi-experimental studies, cohort studies, case-control studies, descriptive studies, economic evaluations and some expert opinion articles.

Criteria for exclusion from appraisal were: participation rate of less than 50%, sample size below 25 people, studies with discrepancies in their methods/results, studies that failed to describe their methods/results, letters and non-English language studies.

A single reviewer applied these criteria. Over 1500 abstracts were subjected to these criteria and 632 articles were selected for formal appraisal.

Data extraction
Critical appraisal forms standardised by study design were used to extract and appraise the literature. These forms were designed for use by the Group Health Co-operative of Puget Sound and were adopted by the New Zealand Guidelines Group (New Zealand Guidelines Group, 1997). A single reviewer conducted the appraisal of studies.

The level of evidence was evaluated using a modified version of the US Preventive Services Task Force protocol (US Preventive Services Task Force, 1989).

Data synthesis and conclusions
The general limitations associated with the literature that has assessed acute medical admissions and the specific limitations of this report should be borne in mind when considering the following conclusions:
A significant unresolved issue in the literature is that no satisfactory definition exists of what constitutes an emergency admission. Although most studies have used an administrative definition (namely a patient spending a defined period of time in a hospital), this definition should also require some consideration of the patient’s clinical state (that is, they should have an emergency condition that requires urgent care) or else the potential will always exist for classification bias in the research literature (Hobbs, 1995).

Any focus on reducing hospital admissions largely considers the effectiveness of interventions to prevent exacerbations of chronic disease and does not consider the potential importance of preventing the development of these diseases.

Acute medical admissions for children have significant differences to adults: children are usually admitted on the initiative of a care-giver for a single, acute condition.

General practitioners (GPs), followed by the emergency department (ED), are the most important gatekeepers in the admission pathway for both adults and children in New Zealand. Therefore, interventions aimed at either GPs or EDs may have the largest potential to reduce the number of acute medical admissions.

A large number of steps, involving a wide range of health professionals, are involved in hospital admission. The presence of a range of steps and health professionals in the process indicates there is a wide range of possible interventions that could impact on the rising number of acute medical admissions.

The consequences of increased numbers of acute admissions include: a fiscal challenge to the budgets of the purchasers and the providers of secondary care services, a reduced ability to undertake non-urgent work, increased pressure on staff and difficulties with planning staffing levels. Finally, an increased workload for hospital staff may lead to changes in professional roles and have implications for professional education.

No published review has yet examined the rise in admissions with regard to its implications for the health of a population. For example, more admissions may represent an improvement in health outcomes associated with better access to secondary care services for some groups. Conversely, it may represent a deterioration in population health, reflecting lost opportunities to utilise other health interventions.

Are acute medical admissions rising?

Acute admissions comprise an important percentage of all medical admissions. Acute medical admissions constitute approximately one third of all hospital admissions in New Zealand.

A number of studies have confirmed that there has been a steady increase in the absolute number, as well as the rate, of acute medical admissions over the last decade (Wass and Zoltie, 1996).

The increase in the number, and rate, of admissions is particularly pronounced for acute medical admissions and is less apparent with acute surgical admissions or arranged/waiting list admissions.

The increase in emergency medical admissions has been found consistently in studies based in a number of countries (UK, Australia and New Zealand) as well as reviews undertaken at regional and local hospital levels (Mallender, 1997). Increased acute admissions are part of a general increase in emergency care that includes rising numbers of ED attendances.

Although the complexity of acute medical admissions may be increasing, their average length of stay is reducing. A reduced length of stay has facilitated a higher number of admissions to be made with either a fixed or reduced stock of available hospital beds.

The rise in admission rates is less apparent among children, although fewer studies have examined trends in paediatric admissions. Gastroenteritis and respiratory conditions remain the most important causes of acute medical admission for children.
Most of the increase in acute admissions is primarily related to an increase in medical admissions among the elderly, and primarily for cardiac or respiratory conditions. In addition, most of the increased number of admissions is probably due to an increase in the number of people admitted rather than the more frequent admission of a small number of very sick individuals, although this has not been firmly established in the research literature.

**Why are acute medical admissions increasing?**

Probable reasons for the increase in acute admissions include: demographic changes, increased numbers in ethnic minority groups, reduced socio-economic status of the population, increased smoking and alcohol consumption, changing societal patterns of care, economic incentives for health care organisations, iatrogenic causes and artefactual explanations.

Possible causes of the increase in acute medical admissions include: more available hospital beds, increased numbers of readmissions, increasing distance for patients to the nearest hospital associated with the closure of some hospitals, changes in the prevalence of illness, increased expectations of patients, and an increased number of deputising services for after hours GP care.

Unlikely causes of the increase in acute admissions include increasing waiting lists and changes in the number or behaviour of GPs.

**Are acute medical admissions appropriate?**

Tension exists between ensuring that all admissions are appropriate while also maximising the safety of patients in the frequent situations where clinical uncertainty exists about the seriousness of a patient’s illness.

Defining the appropriateness of admissions is highly problematic. Numerous criteria are available to define appropriateness but no ‘gold standard’ exists to determine the sensitivity and specificity of these instruments.

A crucial issue is who decides on the criteria for determining the appropriateness of hospital admission. Although most reviews have used medical or administrative definitions of appropriateness, it is likely that consumers would employ different criteria.

Most reviews of the appropriateness of admission have employed a retrospective analysis. Although a retrospective analysis is able to determine the appropriateness for the entire episode of care (because it allows for any deterioration or recovery in a patient’s condition during the course of their inpatient stay), these instruments do not assist clinicians with their need to prospectively determine whether hospitalisation is necessary. This limitation suggests most commonly used instruments may be more effective at discriminating which episodes of care were appropriate or which days of inpatient care were necessary rather than elucidating on whether the decision to admit a patient was appropriate.

All the instruments that have been used to assess the appropriateness of an admission have a number of significant limitations including: a limited ability to consider social (or non-medical) issues, difficulties with accommodating new technologies, and a focus on symptoms without relevance to diseases.

A large body of literature has applied utilisation review (UR) instruments, in a number of settings, to both adult and paediatric admissions.

UR attempts to overcome the vagaries of subjective evaluations of the appropriateness of hospitalisation by applying standardised, explicit criteria that try to define a patient’s need to receive treatment in an acute hospital.

A wide range of results has been obtained in studies that have undertaken UR. Between 0.7%-50.5% of adult admissions and 16%-28% of paediatric admissions have been labelled inappropriate.
The validity of UR has been criticised particularly when applied outside the United States, because it ignores the heterogeneity of patients and the ability of a patient to actually benefit from hospital admission.

UR instruments are best applied as a screening tool and cannot operate as definite arbiters of the appropriateness of individual hospital admissions.

**What interventions reduce acute medical admission rates?**

Good evidence exists (from randomised controlled trials) that the following interventions are effective at reducing admissions: hospital at home schemes, comprehensive geriatric care, and the placement of GPs in the ED. It also appears that the introduction of various guidelines, certain new technologies and the provision of prospective funding have been proven to reduce admissions.

Some evidence exists that several other interventions are probably effective at reducing admissions. These initiatives include various public health interventions, home alarms, increased options for long-term care for the elderly, drug education for patients and practitioners, and hospital outreach services. The provision of senior staff in the ED and the development of ED-based observation units and chest pain units are also probably effective at reducing admissions.

Some interventions appear to be unsuccessful at reducing admissions although it should be noted that these interventions may still be able to improve other health outcomes. These ineffective interventions include: outpatient based education for individuals or groups, increased outpatient services, and utilisation review and case management.

**Additional research**

An urgent need exists for additional research in relation to health outcomes (including hospital admissions) associated with the provision of alternatives to inpatient care. Ideally this research should be New Zealand-based and undertaken with a robust methodology (especially a randomised controlled trial study design).

**Mesh headings**

Patient admission, acute disease, hospitals - utilisation, bed occupancy, admitting department, hospital, delivery of healthcare.
## LIST OF ABBREVIATIONS

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<td>95% CI</td>
<td>95% confidence interval</td>
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<tr>
<td>ARR</td>
<td>absolute risk reduction</td>
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<tr>
<td>DRG</td>
<td>diagnostic related grouping</td>
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<tr>
<td>ED</td>
<td>emergency department</td>
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<tr>
<td>GP</td>
<td>general practitioner</td>
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<tr>
<td>NHS</td>
<td>National Health Service (UK)</td>
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<td>NZ</td>
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<tr>
<td>OECD</td>
<td>Organisation for Economic Co-operation and Development</td>
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<tr>
<td>OP</td>
<td>outpatient</td>
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<tr>
<td>OR</td>
<td>odds ratio</td>
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<tr>
<td>RHA</td>
<td>Regional Health Authority</td>
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<tr>
<td>RR</td>
<td>relative risk</td>
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<tr>
<td>SD</td>
<td>standard deviation</td>
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<tr>
<td>UK</td>
<td>United Kingdom</td>
</tr>
<tr>
<td>UR</td>
<td>utilisation review</td>
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<td>US</td>
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GLOSSARY

Absolute risk reduction  ~  The difference between adverse outcomes in the treated and placebo groups in a clinical trial.

Acute services  ~  Services for urgent conditions that need immediate treatment.

Age adjusted rates  ~  Mortality or morbidity rates in which there has been adjustment for differences in age distribution of the populations being compared.

Ambulatory care  ~  Health care provided in other than an inpatient setting.

Before and after study  ~  A situation in which the investigator compares outcomes before and after the introduction of a new intervention.

Benchmarking  ~  The process of comparing the prices, quality or scope of services against those of other similar services or against common reference points or standards.

Bias  ~  Deviation of results or inferences from the truth, or processes leading to such deviation.

Budget-holding  ~  A system where managers have a fixed budget for a defined population and must meet the costs of an agreed set of services used by that population.

Capitation  ~  A system of paying providers a defined price for each consumer who is registered with a provider.

Case control study  ~  The observational epidemiologic study of persons with the disease (or other outcome variable) of interest and a suitable control group of persons without the disease. The relationship of an attribute to the disease is examined by the diseased and the non-diseased with regard to how frequently the attribute is present.

Casemix  ~  The distribution and different types of patients cared for in a health care facility.

Cohort study  ~  The analytic method of epidemiologic study in which subsets of a defined population can be identified who are, have been, or in the future may be exposed or not exposed, or exposed in different degrees, to a factor or factors hypothesised to influence the probability of occurrence of a given disease or outcome.

Community care  ~  Corresponds to ambulatory and domiciliary services provided other than through hospitals to patients who are resident at their home, hotel, prison, barrack etc.

Confounder  ~  A third variable that indirectly distorts the relationship between two other variables.

Cross-sectional study  ~  A study that examines the relationship between diseases (or other health related characteristics) and other variables of interest as they exist in a defined population at one particular time.

Day patient  ~  A person who is admitted and discharged from hospital on the same day.

Demand driven services  ~  Services purchased for an unlimited fee-for-service basis according to demand.
Descriptive study ~ A study concerned with and designed only to describe the existing distribution of variables, without regard to causal or other hypotheses.

Diagnostic related group ~ A grouping of cases on the basis of similar cost within broader groupings relating to the same or similar organ or system of the body.

Elective services ~ Non-urgent services for conditions which do not need immediate treatment. This includes services for patients with semi-urgent or non-life-threatening chronic conditions that tend to be stable or slowly deteriorate over time.

Evidence based ~ Based on valid empirical information.

Generalisability ~ Applicability of the results to other populations.

Hospitalisations ~ A term used as an indicator of morbidity of diseases in a community. A hospitalisation in New Zealand health statistics includes inpatients who leave hospital to return home, transfer to another hospital or institution, or die in hospital after formal admission. That is a count of episodes of care rather than individuals.

Incidence ~ The number of new cases that occur in a given period in populations at risk.

Indicator ~ An item of quantitative or qualitative information reported to enable the monitoring of a condition or the performance of an organisation.

Inpatient ~ A person admitted to hospital for medical, surgical or psychiatric treatment, observation or care, which spends at least one night in the hospital. A healthy person accompanying a sick person is included if formally admitted as a boarder.

Intention to treat ~ A method for data analysis in a randomised controlled trial in which individual outcomes are analysed according to the group to which they were randomised even if they never received the treatment to which they were assigned.

Managed care organisation ~ An organisation or service provider which is given responsibility for ensuring that a defined population receives a defined set of services in a co-ordinated way.

Meta-analysis ~ Any systematic method that uses statistical analysis to integrate the data from a number of independent studies.

Misclassification ~ The erroneous classification of an individual, a value, or an attribute into a category other than that to which it should be assigned.

Morbidity ~ Illness

Multiple regression ~ Any analysis of data that takes into account a number of variables simultaneously.

National Minimum Dataset ~ Data on specific procedures required from service providers by the Ministry of Health.

Number needed to treat ~ The number of patients similar to the study patients who need to be treated to obtain one fewer bad outcome or one more good outcome.
Odds ratio  ~  A measure of the degree or strength of an association. In a case control or a cross-sectional study it is measured as the ratio of the odds of exposure among the cases to that among the controls.

OECD  ~  Organisation for Economic Co-operation and Development. There are 24 countries in the OECD.

Outpatient  ~  A person who goes to a health care facility for a consultation, and who leaves the facility within three hours of the start of the consultation. An outpatient is not formally admitted to the facility.

Prevalence  ~  The number of events in a given population at a designated time.

Providers  ~  Organisations and health professionals providing health services.

Purchasers  ~  The four divisions of the Health Funding Authority.

Randomised controlled trial (RCT)  ~  An epidemiologic experiment in which subjects in a population are randomly allocated into groups to receive or not receive an experimental preventive or therapeutic procedure, manoeuvre or intervention. RCTs are generally regarded as the most scientifically rigorous method of hypothesis testing available in epidemiology.

Recall bias  ~  Systematic bias due to differences in accuracy or completeness of recall or memory of past events or experiences.

Relative risk  ~  The ratio of the risk of disease or death among the exposed to the risk among the unexposed. It is a measure of the strength or degree of association applicable to cohort studies and RCTs.

Secondary care services  ~  Surgical and medical services, which are generally provided in a hospital setting.

Selection bias  ~  Error due to systematic differences in characteristics between those who are selected for a study and those who are not.

Sensitivity analysis  ~  A method to determine the robustness of an assessment by examining the extent to which results are affected by changes in methods, values of variables, or assumptions.

Utilisation review  ~  Systematic review of particular procedures to ensure the right thing was done to the right person, in the right places, at the right time and in the right way.
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Introduction

AIMS

This review aims to identify and appraise the literature in relation to an examination of the following questions in relation to both adults and children:

- Are acute medical admissions rising?
- Why are acute admissions increasing?
- Are acute admissions appropriate?
- What interventions reduce acute medical admission rates?

The report is structured into sections that specifically address each of these aims. The first section examines the literature evidence for a rise in acute medical admissions. The second section considers the reasons that have been presented in the literature to explain this trend. The third section considers the appropriateness of acute medical admissions. The fourth and final section appraises the literature that has evaluated the effectiveness of an intervention at reducing acute medical admissions. Every section is presented in relation to both adult and paediatric populations. Figures and tables are presented at the end of the relevant section.

PUBLIC HEALTH IMPORTANCE

An increasing number of acute medical hospital admissions presents a critical challenge to a health care system.

The underlying reason(s) for the increase in admissions could represent a significant challenge to the effective functioning of the health system. For example, it may be the result of a significant change in the health status of the population. Alternatively, an escalating number of admissions could be due to a breakdown in the ability of primary care services to manage some conditions within the community.

The effects of an increasing number of admissions are of considerable public health importance. Medical admissions are expensive. Approximately $700 million per year is spent on acute medical admissions (Ministry of Health Performance Monitoring and Review Unit, 1994). A rising number threatens the fixed budgets of health care organisation at all levels, including local hospitals as well as both regional and national health funding or policy-making organisations.
Methodology

LITERATURE SEARCH

A structured literature search was undertaken on the following bibliographic databases:

- Medline
- HealthStar
- Cinahl
- Current Contents

Searches were limited to English language material from 1993 onwards and were run between mid-December 1997 and mid-January 1998.

A number of other electronic databases and bibliographic sources were also searched. These included the following:

- New Zealand university and medical library catalogues
- New Zealand Bibliographic Network
- Index New Zealand
- HMSO publications catalogues
- International Network of Agencies for Health Technology Assessment (INAHTA) documents
- Database of Abstracts of Reviews of Effectiveness (DARE)
- NHS Economic Evaluation Database
- King's Fund catalogue of publications
- Cochrane Library
- Material referenced in publications obtained in the course of research on the topic
- Internet sites and personal contacts

Details of the major search strategies are included in Appendix 1. During the course of this project, other small searches were done to examine specific interventions in more detail. The original intention to divide the report into separate sections for adults and children was reflected in the design of the search strategy that looked separately at paediatric material. The final report, however, was not organised in this way.

As the topic was very broad, no attempt was made to limit the results of the search to evidence-based material. This was done in the later stages by scanning abstracts and the articles themselves.

Because of limited financial resources, material that was available within New Zealand was preferentially selected. Abstracts of articles from journals which were not available nationally were scrutinized more closely before making the decision to obtain them from overseas.

This report does not contain detailed reviews of the following topics:

- The appropriate use of the emergency department (especially in relation to minor problems) and interventions to reduce inappropriate ED attendance.
- Integrated care.
- Can outpatient admissions interventions reduce acute respiratory admissions?

These subjects are reviewed in separate NZHTA reports.

APPRAISAL METHODOLOGY

This review adopted broad inclusion criteria with regard to the literature that was included. The review attempted to provide a comprehensive overview of the literature and as such it has included (with appropriate identification) opinion articles and descriptive studies. Study designs evaluated therefore were: meta-analyses, randomised controlled trials, quasi-experimental studies, cohort studies, case control studies, descriptive studies, review articles and opinion articles.

Exclusions

The following criteria were used to exclude articles from appraisal:

- participation rate below 50%
- studies with discrepancies in their description of methods/results
- studies that did not clearly describe the methods/results
- limited generalisability to the New Zealand population
- letters
- non-English language studies.

Articles were formally appraised using the schedule developed by the Group Health Co-operative of Puget Sound and adapted by the New Zealand Guidelines Group of the National Health Committee (New Zealand Guidelines Group, 1997). Summaries of appraisal results have usually been shown in table form and conclusions have been drawn that were dependent on the study design and the specific problems associated with the individual studies.
The level of evidence was graded using an adapted version of the US Preventive Services Task Force protocol (US Preventive Services Task Force, 1989). Thus, levels of evidence were:

I evidence obtained from at least one properly designed randomised controlled trial

II-1 evidence obtained from well-designed controlled trials without randomisation

II-2 evidence obtained from well-designed cohort or case control analytic studies preferably from more than one centre or research group

II-3 evidence obtained from well-designed time series studies

III evidence obtained from descriptive studies (cross sectional, ecological)

IV opinions of respected authorities based on consensus or clinical experience.

Evidence grades have been applied to all of the literature based upon the study design of each article. The formal critical appraisal process systematically reviewed the methods and analyses of the studies in each of the three grades.

**LIMITATIONS OF THIS REVIEW**

This study has used a structured approach to review the literature. However, there are some potential limitations inherent in this process.

Although, in general, grade one evidence (randomised controlled trials and meta analyses) is usually best able to reduce the effects of bias and confounding (through the use of randomisation), the most important determinant of the validity of a study is the rigour applied to its design and subsequent analysis and not necessarily the type of study design that has been used. In addition, certain types of study are more appropriate for particular issues. For example, a cohort study can usually best describe the prognosis of a group of patients with a particular illness and a randomised controlled trial is well suited to evaluate the effects of a treatment. The reader is referred to the original study for full clarification of the methods and results used in any particular study.

This review has been limited by the need to restrict the analysis to English language studies and references presented in the databases cited above. All web sites on the Internet could not be assessed.

Although this review has greatly benefited from advice provided by consultants, it has not been exposed to wide peer review. In addition, the work has been based only upon the published academic literature and has not reviewed unpublished work. The bulk of the studies included in the review were conducted outside New Zealand, therefore it is uncertain whether their conclusions can be generalised to a New Zealand population and context.

While most of the articles cited in the databases were obtained (>90%), a small proportion were not available from overseas in sufficient time to be included in this review.

This review was conducted over a limited period of time (January–May 1998).

**Methodological issues**

This review has identified few randomised controlled trials that have assessed the effectiveness of substitutes for inpatient-based treatment. At least in part this is not surprising given there is clinical uncertainty as to which patients benefit most from inpatient care and the instruments available to decide on which patients should be admitted to hospital.

Given this significant clinical uncertainty, it is ethically difficult to randomise patients to inpatient/outpatient care. For the patients who are clearly very sick it is not possible to randomise them to an outpatient-based treatment centre. In addition, because randomisation must be undertaken prospectively and because ill people can deteriorate quickly, it is difficult to randomise people without significant safeguards in place to ensure people are still receiving treatment in an appropriate setting.

In the absence of randomised controlled trials, quasi-experimental studies have often been used as the preferred study design by researchers. However, without randomisation it is difficult for studies to eliminate the effects of bias. Although a cohort study could be undertaken, admission to hospital is too infrequent an event for this method to be an efficient study design for any groups apart from those with endstage disease.

Case control studies are plagued by difficulties with selection bias and confounding (see Appendix 2 for a general discussion of advantages/disadvantages of different study designs).
This review examines the admission process for people with acute medical illnesses and the effectiveness of interventions to reduce these admissions.

Most acute medical admissions for adults occur among people who develop an acute exacerbation of a chronic illness. That is, this review mainly considers interventions for people who are at a late stage in the development of a disease process. Consequently, it largely ignores a number of potential interventions that may be more effective either in avoiding the exacerbation or preventing the initial development of the disease.

However, it is generally easier to gauge the effectiveness of an intervention that was introduced as a substitute for the inpatient care of people than it may be to assess the effectiveness of preventive interventions at reducing future service utilisation.

Finally, there is an inherent tension between safety and economy when considering alternatives between inpatient and outpatient care for patients with end-stage disease. Safety usually suggests that more patients should be admitted; economy broadly argues it is cheaper to admit fewer patients. A considerable amount of the debate coalesces around what is the most acceptable resolution for this tension.

Unlike most adults, children are often acutely admitted for reversible episodes of ill health (gastroenteritis, upper respiratory tract infections) and not because of exacerbations of chronic illnesses (such as heart failure, diabetes, or ischaemic heart disease).

Children are usually admitted because of one disease process and do not have complicated presentations related to multi-system disease and multiple pathology.

Finally, unlike adults, the healthcare seeking behaviour of children (including to some extent the admission of children to hospital) is largely modulated by their caregivers.
Section One

Are acute medical admissions rising?
What is an acute medical admission?

DEFINITIONS, METHODS OF MEASUREMENT AND DIFFICULTIES

The definition of an acute medical admission is problematic. The clinical concept of an acute medical admission which is commonly employed, although not usually explicitly stated, in most of the literature regards acute admissions as patients requiring inpatient care for an emergency medical condition. The admission process to most clinicians is the structured evaluation of diagnostic and treatment possibilities in relation to patients presenting with an acute medical condition.

By contrast, most quantitative studies have used an administrative definition of the admission of a patient. The administrative definition most commonly employed in New Zealand is provided by the New Zealand Health Information Service (NZHIS) in relation to their administration of the National Minimum Dataset1 and is ‘the process of documentation that changes the status of a patient’s episode of care’ (Ministry of Health Performance Monitoring Unit, 1998). The NZHIS definition of an acute admission is ‘an unplanned admission on the day of presentation at the admitting health care facility’ (Ministry of Health Performance Monitoring Unit, 1998)2.

Information from the National Minimum Dataset is used by the Health Funding Authority and hospital based providers in New Zealand in formulating their contracts for acute hospital services. Information from the dataset is also used in health status reports and in research describing the effectiveness of interventions to reduce admissions.

However, problems exist with the use of an administrative definition of admission in relation to the different uses of this data. Comparisons of past research that has examined the number of acute medical admissions over the preceding 10 years have been hampered by the fact that admissions have been given a number of different terms over the last decade. Prior to 1992, admissions were referred to as ‘separations’ while between 1993-1994 the term ‘hospitalisations’ was used. Since 1995 ‘discharges’ has been adopted as the term to emphasise that the National Minimum Dataset mainly uses information gained after the patient left the institution.

Changes in the name used for acute admissions have been accompanied by variations in administrative policy in relation to the recording of patients who were admitted for less than one day. Prior to 1988 these patients were not recorded, but between 1989-1992 patients remaining in hospital for less than 24 hours have been erratically recorded. Since 1993, all unplanned admissions (irrespective of duration) have been included in the number of acute discharges.

These differences in the inclusion of patients admitted for short inpatient stays have caused problems in relation to contracting for acute medical volumes. Contracts based on historical levels of admission may have underestimated the number of short-stay acute admissions simply because they were not previously included in the information contained in the National Minimum Dataset.

Another problem with the administrative definitions of acute, arranged and waiting list admissions is that for some conditions some arranged admissions will be patients with episodes of acute illness that may be better regarded as acute admissions. That is, although these patients have an urgent medical condition it is not immediately life-threatening and an admission can be scheduled over the following week (e.g. cardioversion for some types of cardiac arrhythmias).

In recognition of this dilemma some health purchasers have included arranged admissions as acute admissions in their policy documents (Jackson, 1996). Patients transferred for care to an acute medical facility from another department within the same institution will also be counted as an additional admission (discharge). Some of these patients may be transferred because of an acute deterioration in their condition while others may be moved because of other reasons.

Finally, all short stay (less than 24 hours) inpatients or people receiving care in an observation unit are

1 The National Minimum Dataset is maintained by the New Zealand Health Information Service within the Ministry of Health and receives standardised discharge information about hospital based episodes of care from Crown Health Enterprises.

2 Arranged admissions are defined as ‘planned admissions occurring less than 7 days after the clinical decision that hospital admission was necessary’ and waiting list admissions are defined as an admission occurring after 7 days from when the clinical decision was made that admission was necessary (Ministry of Health Performance Monitoring Unit, 1998).

Readmissions are defined by the Ministry of Health as patients who return to a hospital within 30 days of discharge. Some readmissions are avoidable if good quality inpatient and follow-up care had been available and consequently readmission rates are often used as an indicator of hospital performance (Gold et al., 1998).
also included in acute discharge volumes. Some of these patients may be more appropriately considered as arranged or waiting list presentations.

**CONCLUSIONS**

- A significant unresolved issue in the literature is that no satisfactory definition exists of what constitutes an emergency admission. Although most studies have used an administrative definition (namely a patient spending a defined period of time in a hospital), an ideal definition would also include some consideration of the patient’s clinical state (that is, they should have an emergency condition that requires urgent care) or else the potential will always exist for classification bias in relation to administrative changes in how acute admissions data has been collected. (Hobbs, 1995).

- Any focus on reducing hospital admissions largely considers the effectiveness of interventions to prevent exacerbations of chronic disease and does not consider the potential importance of preventing the development of these diseases.

- Acute medical admissions for children have significant differences to those for adults: children are usually admitted on the initiative of a caregiver for a single, self-limiting condition.
How do acute patients get admitted?

OVERVIEW OF THE ADMISSION PROCESS

A number of pathways exist that describe how acute medical patients become admitted to hospital (see Figure 1). In most of these pathways the patient requires the services of a health professional (usually a doctor) to act as the gatekeeper and to facilitate the patient’s hospitalisation.

A common pathway for admission is for the patient to be referred by their general practitioner. Alternative pathways include admission by emergency department doctors of patients who may, or may not, have already seen their GP. A variety of other pathways exist but they are less common (e.g. referral by outpatient clinic, medical specialist, or non-medical health practitioner).

THE MAIN ADMISSION PATHWAYS

Patients are usually admitted to hospital as a consequence of consultations with a variety of health professionals, principally doctors (Roland and Coulter, 1992). This process that modulates patient admissions is referred to as gatekeeping.

Gatekeeping in New Zealand, as well as in Australia and the UK, is traditionally considered to be the purview of general practitioners, and admission to hospital can be viewed as a subset of the system of referrals made by GPs to specialists who work in hospital (and other) settings. It is the main system that operates in these countries to characterise the interface between primary and secondary care (Marinker, 1988).

This system has at least two main advantages according to (Marinker, 1988) in relation to emphasizing primary care instead of more expensive high technology secondary care along with providing improved continuity of care. However, restriction of patient autonomy and access are inherent possible disadvantages of a referral-based gatekeeper system. In some other countries (such as the United States), patients have direct access to specialist care although direct access to hospital admission, particularly for a medical reason, is not common.

Recently a variation on the role of GPs as the main primary care gatekeepers has emerged with the increasing use of deputising services to provide after hours care. For substantial portions of the week, for an increasing percentage of the population in New Zealand, Australia and the UK these deputising services are now functioning as the gatekeepers to hospital-based health services.

A parallel process to either GPs or deputising services involves those hospital admissions that occur as a consequence of a patient seeking medical care at the ED. In this process ED-based doctors function as the gatekeepers. This process is particularly important in relation to emergency admissions because a significant proportion either present themselves to the ED or are brought there after an ambulance was summoned to assist with their care.

Ultimately, most patients who are admitted to hospital (including those patients who are admitted by their GP or deputising agent) will be assessed by an ED doctor. It can therefore be conceptualised that these doctors could function as the most important gatekeepers, and the ED might be considered as the essential conduit through which most medical admissions must pass. As a consequence of this, the function of the ED as a provider of ambulatory care is considered in more detail in a separate NZHTA report.

While a reasonable amount of descriptive data has been published about the number and percentage of patients who have been admitted by GPs (usually via an emergency department) less information is available about the relative proportion of patients who have been directly admitted from the ED or were referred by a deputising service or locum. In particular, there is a scarcity of information about the relative appropriateness and outcomes (after adjustments for differences in case mix) associated with ED-based admissions that either have not been referred by a GP or have been admitted by a deputising agency or locum who may have restricted access to patient case notes and only a limited knowledge of the social and medical backgrounds of their clientele.

THE RELATIVE IMPORTANCE OF GPs AND THE ED AS GATEKEEPERS

While several studies have described that typically a general practitioner admits only a small proportion (around 3%) of their total daily patient caseload (McAvoy et al., 1994; Roland and Coulter, 1992),
GPs as a group occupy the principal gatekeeper role and are responsible for referring the majority of patients who are hospitalised (around 55%) (Ministry of Health Performance Monitoring Unit, 1998; Harrison and Prentice, 1995; Roland and Coulter, 1992).

The Auckland Healthcare Utilisation Review is the largest New Zealand-based assessment of emergency medical admissions (Ministry of Health, 1997).

This research is the largest review of the appropriateness of admissions that also included a consideration of the relative importance of the alternative admission pathways (Ministry of Health, 1997). The review provided data in relation to 707 adult admissions to Auckland Hospital and 402 paediatric admissions to Auckland’s Starship Hospital in 1996. It found that GPs were the largest referral source for adult, acute medical admissions while the emergency department was the second largest source of emergency admissions (43% were arranged by the ED compared to 51% via GPs) (Ministry of Health, 1997).

The study found that children were slightly less frequently admitted after presenting to the ED compared to adults. The ED was the source of 35% of emergency medical admissions for children while 52% of admissions were arranged by GPs (Ministry of Health, 1997). A further 12% of children were admitted after arriving at the hospital by ambulance (Ministry of Health, 1997). The proportion of admissions that were arranged by the patient’s regular GP compared to a locum or deputising service was not described for either adults or children.

If these findings can be generalised to the entire country, then both GPs and the ED are important sources of emergency medical admissions for both adults and children. The corollary of this finding is that GP or ED-based interventions could potentially have a significant impact on the rising number of acute medical admissions.

The study also compared the applicability of admission by a review of the case notes that firstly used an adapted utilisation review assessment tool (see Section Three) and then the opinion of an expert panel to determine appropriateness. The study found that GPs were not only the most common method of admission but were also responsible for the lowest percentage of inappropriate referrals (13.5% of 201 admissions). By contrast, self-referred patients to emergency who had been admitted to hospital were more likely to be inappropriately hospitalised (16.3% of 142 admissions), while patients who had been referred to the hospital for admission by other non-medical health professionals (mainly ambulance officers) were the group who contributed the highest percentage of inappropriate paediatric admissions (29.4% of 51 admissions). This finding is another reason why ambulatory presentations to the ED have been reviewed in detail in a separate NZHTA report.

Unfortunately the review did not identify the proportion of adult patients admitted via the ED who had arrived by ambulance compared to the number who had walked into the department.

In contrast to the findings of overseas-based trials (Marinker et al., 1988), no relationship was found between the experience of the admitting doctor (GP or emergency department-based) and the appropriateness of admission.

Although the small size of the Auckland Healthcare study prevents any definitive conclusions, the findings suggest gatekeeping by GPs does effectively enhance the appropriate use of secondary care services. However, it should be noted that the Auckland study included among the referrals by GPs a small number of admissions that were arranged by doctors other than the patient’s usual general practitioner (i.e. locums and doctors in deputising services and a small number arranged by private medical specialists). Therefore no conclusive New Zealand-based evidence is available to describe the frequency of admission by the different pathways and help determine the appropriateness of hospitalisation by each of these different routes.

A report by the Clinical Standards Advisory Group (Clinical Standards Advisory Group, 1995) is notable as the only systematic survey of the time taken for each step in the admission process. The study examines a representative sample of health areas and hospitals in the UK and catalogues the time required from when a primary care worker is first summoned to attend an emergency through to the discharge of the patient.

The study reported that a wide range of health professionals were involved in the intermediate stages before a patient presented to either a GP and/or the ED for consideration of hospital admission.

Another notable finding was the wide variation between areas in the UK in the time taken for each step of the process. The authors concluded that for each step a number of interventions might be possible to reduce the time taken by some areas. Although the available interventions were listed, no attempt was made to correlate hospitals using each of these interventions with their relative delay in providing care at the appropriate step in the process.

Despite the limitations of this descriptive survey, it is notable because it is the only study to dissect out the
large number of interwoven steps, involving numerous professionals, that results in the admission of a patient to hospital. The authors rightly point out that although the large number of steps provide the possibility that there are a large number of potentially limiting steps in the process, it also offers the possibility that a wide range of interventions might impact on the speed and quality of the process.

**Professional boundaries and resistance to change**

The role of the general practitioner as the main gatekeeper to secondary care medical services has become firmly established in the New Zealand health system (similar to the UK and the Australian systems) (Ministry of Health, 1994).

Within the medical profession, boundaries exist between the roles of doctors based in primary or secondary care. The referral system operates to maintain these boundaries and permits the flow of a filtered number of patients to receive a consultation in the secondary care (hospital-based) system (Roland and Coulter, 1992). This referral system is relatively tightly controlled in that most specialists will not see patients without a referral from their general practitioner (Roland and Coulter, 1992). A notable exception is the emergency department, where junior medical staff function in the role of primary care doctors and control access to hospital-based consultants.

While, in part, the origin of the referral system was due to the wish of general practitioners to protect their work from hospital-based specialists (Roland and Coulter, 1992), a contemporary challenge to GP gatekeeping now comes from other health professionals, especially the expanding role of the nurse practitioner (Bond et al., 1996; Kaufman, 1996).

The development of GP-lead Independent Practitioner Organisations with large budget-holding resources presents a new challenge to the respective roles of doctors in primary and secondary care (Barnett et al., 1998). In addition, the increasing provision of community outreach services by hospital-based physicians (and nurses) also threatens the historical boundaries between primary and secondary care-based practitioners (Brown and Caplan, 1997).

Consequently, this review considers the number and behaviour of admitting doctors (which includes both GPs and emergency department doctors).

**CONCLUSIONS**

- GPs, followed by the ED, are the most important gatekeepers in the acute medical admissions pathway for both adults and children in New Zealand.

- Interventions aimed at either GPs or EDs may have the largest potential to reduce the number of admissions.

- A large number of steps involving a wide range of health professionals are involved in the process that leads to the presentation of a patient to a gatekeeper for consideration of hospital admission. The presence of a range of steps and health professionals in the process of admission indicates there is a wide range of possible interventions that could impact on the rising number of acute medical admissions.
How common are acute medical admissions and are these increasing in public hospitals?

ACUTE MEDICAL ADMISSIONS AS A PROPORTION OF HOSPITAL WORKLOAD

Acute medical admissions comprise around 60% of all medical admissions to hospitals in New Zealand. Among children the percentage is around 70% (Medical and Surgical Services, 1997; Watt and Stokes, 1995; Jackson, 1996). Among all types of admissions for adults and children (including medical, surgical, mental health and maternity admissions) in the North Health region, acute medical admissions account for nearly 38% of the daily number of new inpatients (Jackson, 1996).

TRENDS IN THE NUMBER OF ACUTE MEDICAL ADMISSIONS

A number of descriptive studies have documented the current trends in the numbers of acute medical admissions. This review examines data from New Zealand, Australia and the United Kingdom.

NEW ZEALAND-BASED REVIEWS

National

Purchasing for Your Health, a report by the Ministry of Health’s Performance Monitoring and Review Unit (Ministry of Health Performance Monitoring and Review Unit, 1994), found the absolute number of acute medical admissions (discharges) increased between 1989/1990 to 1993/1994 by 4.9%. In addition, the average complexity of these cases increased over this period. There was also a consistent reduction in the average length of stay for acute medical inpatients over the same five-year period. A related trend was the substantial increase in outpatient treat-

ments over this time. However, the findings of this review were artificially increased by the improvements in data capture and changes in coding practice that had also occurred over the study period.

The Performance Monitoring and Review Section of the Ministry of Health in a subsequent, and more detailed, analysis examined public hospital data for the financial years 1988/89 to 1994/5 to explore the nature and possible causes for the increase in acute medical admissions in New Zealand (Performance Monitoring and Review Section, 1995). The report used data from the National Minimum Dataset relating to hospital discharges coded according to diagnostic related groups (DRGs). The DRGs were defined as acute if 80% or more of cases within the DRG had an admission type listed as acute in the dataset. The study found that total inpatient discharges in New Zealand rose between 1988/89-1994/5 (see Figure 2).

By comparing the number of episodes of care with the number of different people admitted, the study concluded that more individuals being admitted accounted for the rise in medical admissions (rather than a change in the number of the individuals who had undergone more frequent (re)admissions). The study found there was a significant decrease in the average length of stay between 1988/89-1994/5 (see Figure 3).

Despite the decrease in the average length of stay, the report found there was no evidence that readmission rates had significantly increased over the study period (see Figure 4). The relatively modest readmission rate across the country (7.5% in 1996/7) (Ministry of Health Performance Monitoring Unit, 1998) and the absence of any significant increase in this rate between 1988/9 and 1994/5 (Performance Monitoring and Review Section, 1995) suggests re-admissions may not be a useful area to focus on in a review of the causes of rising acute medical admissions.

The study’s findings led the authors to conclude that the most likely explanation for the rise in admissions were two linked factors: supplier-induced demand related to the reduction in the average length of stay allowing additional capacity for admissions, combined with a reduced threshold for admission among patients, GPs and hospital-based clinicians.

However, the study had a limited ability to substantiate these conclusions. Firstly, because the report was based on the number of admissions and not the rate of admission among the population at risk, it failed to exclude significant changes in the demography of the population as an alternative explanation for the study’s findings. In addition, the study did not include an assessment of the number of available beds.
No information was provided in the report about the relative severity of illness for all the acute admissions in each year to substantiate any claim that the threshold for admission may have changed. Furthermore this finding was in marked contrast to that published in the other report by the Performance Monitoring and Review Unit (namely that case mix complexity was actually increasing).

Some more recent information is presented in two Ministry of Health publications (Ministry of Health Performance Monitoring Unit, 1998). In a comparison of the raw number of discharges from hospitals in 1996/7 with those of 1995/6, it was found that hospital discharges had increased by 2.3%. To allow for differences in case complexity (which must be taken into account when making comparisons between regions), discharges were case mix adjusted (based on the national average prices for treatment) to provide comparisons of relative throughput between regions and across years.

Using case mix adjustment, hospital throughput increased by 5.1% during the 1996/7 year. The Northern region had the highest growth in throughput (both raw and case mix adjusted) with case mix adjusted growth of 7.6%, while the increases in the Southern and Central areas were smaller (5.9% and 4.5% respectively). The Midland region experienced a small decline in the raw number of discharges although there was a 1.8% growth in casemix adjusted throughput.

Most of the increase in total throughput has been primarily due to an increase in acute medical admissions. The Northern, Central and Southern regions have experienced consistent growth in their raw number of acute medical admissions between 1992/3 and 1996/7. By contrast, in the Midland region the number of acute medical admissions increased sharply in 1994/5 (by 24.4%), while in 1995/6 and 1996/7 there were significant reductions in the number of admissions (by 7.1% and 6.9% respectively).

The report compared the annual change in admission numbers over the three previous years (1993/4 to 1996/7) with the changes noted between 1995/6 and 1996/7 and concluded that the annual increase in the number of medical admissions in New Zealand had markedly decreased from an average growth of 11.4% to 1.1%. Nationally acute medical admissions made up the same percentage of all hospitalisations in 1996/7 as 1993/4 also indicating that the number of acute medical admissions may have stabilised over the last couple of years.

Growth in the number of respiratory and circulatory conditions explained much of the increase in the number of acute medical admissions between 1993/4 and 1996/7. DRGs related to these conditions accounted for over 51% of the increase in medical discharges during this period. The report concluded that although the total number of discharges had still increased by 1.1% over the last year there had been a reduction in the number of admissions for respiratory conditions by 1.7%. In contrast to respiratory conditions, the number of admissions for circulatory conditions increased in the last year by 3.9%.

### Regional analyses

#### Regional Health Authority (RHA) reports

Three Regional Health Authorities (North, Central and Southern) have released reports examining the trends in emergency medical admissions over the last decade. Each of the reports examined crude (unadjusted) admission rates in their respective regions and all consistently found that these rates were increasing. All three reviews described the increase in admissions in relation to individual Crown Health Enterprises (hospitals). **Table 1** indicates that the increase in admissions (at least in the North Health region) was highest for acute medical conditions amongst adults (an increase of 3.6% was found for all types of adult admissions, 6.5% for acute medical and surgical adult admissions and 7.6% for acute medical admissions).

Difficulties exist, however, with the comparison and interpretation of these results. The three RHA reports have examined different time periods and have differed in the types of admissions that were included in the reviews, hence it is difficult to compare their results.

The ratio of acute to arranged (or waiting list) admissions is an important concept in a hospital’s workload. Acute admissions are, by definition, largely unpredictable and present a significant risk to an organisation’s staff and budget resources. Three RHA reports (see **Table 2**) have provided comparative data on the ratio of medical and surgical acute: medical and surgical elective admissions over the last five years (Watt and Stokes, 1995; Jackson, 1996; Medical and Surgical Services, 1997), although in only one report was the ratio actually presented (Medical and Surgical Services, 1997). The published literature has otherwise paid surprisingly little attention to this ratio.

All three reports found that acute medical and surgical admissions increased as a percentage of all (acute + waiting list + arranged) medical and surgical hospitalisations over the preceding five years. However,

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3 Different regions have generally excluded admissions for psychiatric and obstetric conditions but have differed in their inclusion of admissions for boarding relatives or specific treatments such as blood transfusion or chemotherapy.
there is some variation in the relative percentage of acute medical and surgical admissions in each region (55%-63%), which can be attributed (at least in part) to differences in the years included in each review and discrepancies in whether admissions for discrete interventions (such as blood transfusions or chemotherapy) were included in the analyses.

Additional recent RHA reports

A recent internal memo by North Health found that acute admissions continued to rise between 1995/6 and 1996/7 (Corkill, 1997). Acute medical admissions increased during the study period by 8.2% while acute surgical admissions rose by only 2.8%. The memo listed some possible explanations and recommended that a study should be undertaken into the applicability of introducing admission criteria for acute admissions.

Other regional studies

An analysis of health care contacts made by a sample of patients in six general practices in the Otago region between 1992 and 1994 was presented by the Royal College of General Practitioners (Royal New Zealand College of General Practitioners, 1995).

The study found that among the sample, the number of people admitted to hospital each year decreased while the number of readmissions increased. That is, a smaller number of patients received inpatient care more often over the study period.

The authors found that, on average, patient contact with their GP decreased over the study period, especially for those with a community services card, while their use of the emergency department increased. The authors concluded that reduced access to general practitioner services among the sample population had lead to an increase in the frequency of attendance at the emergency department. In addition, a smaller number of chronically ill patients were not receiving adequate GP support to maintain them in the community.

The study has a number of limitations that reduce the validity of its findings. For example, the small sample was unlikely to have been representative of the whole population and doubts exist about whether the authors accurately captured all the relevant hospital utilisation data. An important omission from the study was the failure to quantify the proportion of the patients who were admitted after presentation to either their GP, the emergency department or through a deputising service for different conditions.

Hospital based reviews

A small descriptive study undertaken as part of a Master of Public Health degree found that emergency medical admissions at Auckland’s Middlemore Hospital rose by 29.8% between 1995 and 1996 (Muneeb, 1997). The study examined a random 10% sample of all admissions from each year included in the study period and concluded that there had been a decrease in the average length of stay of inpatients. However, the study was small and used only a descriptive methodology. No analysis was undertaken to determine the relative importance of each of the determinants of hospital admission.

AUSTRALIA

National

The National Health Strategy report, Hospital services in Australia, utilised data from the New South Wales (NSW) Health Services Research Group at the University of Newcastle. The report examined trends in the use of acute hospital services over a preceding 12-year period and used these trends, along with demographic projections, to forecast the future requirements for inpatient services in Australia (NSW Health Services Research Group, 1998).

The report concluded that total admission numbers were projected to increase by 29.3% between 1996 and the year 2001. Most (23.8% of the 29.3%) of this increase in the number of admissions was accounted for by an increase in the country’s population, the effect of ageing contributed a further 5.1%.

The report concluded that after demographic and ageing factors were excluded, admission rates were estimated to increase by only 0.5%. By contrast, day-only admissions (admissions where the patient arrived and departed on the same day for investigations such as gastroscopy and colonoscopy or treatments such as radiotherapy and dialysis) were expected to rise by 82%. The average length of stay of patients by the year 2001 was forecast to decrease to 3.7 days, largely due to the rise in day-only admissions. Total bed days required by the year 2001 were predicted to decrease by around 9%.

Major growth specialties were those related to population ageing and included urology, cardiology, respiratory medicine, and orthopaedics. By contrast, paediatric, obstetric and gynaecology admissions were predicted to decrease by the year 2001.

UNITED KINGDOM

National

In the UK, the rate of all types of hospital admission has steadily increased by an average of 2% per an-
num for over four decades (Goldacre et al., 1988; Kings Fund, 1996). In Scotland the annual rise was higher (closer to 4%) between 1981 and 1994 (Kendrick, 1996). By 1994 emergency admissions accounted for nearly half of total bed use in the whole UK (Kendrick, 1996).

Kendrick found that in Scotland all specialties and conditions have exhibited a rise in admissions between 1981 and 1994. Numerically the most important rise was in adult medical admissions because they accounted for the largest number of emergency admissions in Scotland (Kendrick, 1996). Hobbs reported that in the early 1990s the number of medical admissions has increased by 7-13% per annum (Hobbs, 1995).

Between 1982 and 1992 available beds for acute admission fell in the UK by 25% but the number of cases treated rose from 4,709,000 to 5,986,000. That is, there was a 65% increase in cases per beds (Henderson et al., 1989).

Increased throughput despite a reduction in the number of beds has been achieved in the UK by reducing the average hospital stay (Department of Health, 1994). Some authors have argued that increased bed use represents a way to achieve cost savings and thereby improve the efficiency of hospital services (Beech and Larkinson, 1990).

A comparison of the risk of paediatric admission between a birth cohort in the UK from 1947-1951 and their first offspring in 1966-1976 found there was no increase in the risk of being admitted, although the reasons for admission had substantially changed (injury had replaced respiratory as the most common reason and infections had gone from second most common to less than seventh) (Wadsworth et al., 1993). The duration of inpatient admission had significantly decreased and the contribution from low birthweight babies to the total admitted had markedly increased. However, this result could have been biased by the closer follow-up of the original cohort which may have lead to more information about admissions being derived for that group relative to their offspring.

**Regional**

A detailed analysis by the Kings Fund/NHS Trust Federation examined the changes in the number of admissions, and the number of patients admitted, between 1981-1994 (Harrison et al., 1995). The report analysed admissions in six NHS hospital trusts in the UK and found the number of admissions was steadily increasing.

The report found the number of emergency admissions had probably been growing over a number of decades and noted that although variability in the number of daily admissions did not seem to have changed between 1981 and 1994, the capacity to deal with this variability had decreased.

The report identified a rising number of patients admitted with ill-defined chest pain and suggested that changes in GP practice might be responsible for the increase.

By comparison with acute medical admissions other workload studies in the United Kingdom have found that admission rates for emergency surgical patients have either been relatively steady or may even have declined e.g. (Whiteley et al., 1996). Workloads are typically higher in winter, and lighter in weekends (Whiteley et al., 1996).

**INTERNATIONAL**

A correlational study by Wiley (1996) found that in eight out of fourteen OECD countries, hospital acute admission rates had increased between 1980-1994. By contrast, the number of acute hospital beds per 1000 population had decreased in all countries (except Spain) and consequently the average length of inpatient stay had reduced in all countries.

A comparative study based in Israel comparing 100 admissions in 1973 with a similar number in 1987 found that although patients were sicker in the later year, their length of stay was shorter (Boehm et al., 1994).

**LIMITATIONS OF THE AVAILABLE DATA**

Generally all the descriptive studies presented in this section have not provided any analysis of the underlying factors that may have contributed to their results.

There has been little consistency in the units of measurement or the timeframes used to describe the temporal changes in the number of acute medical admissions in different countries. For example, Kendrick (1996) described the changes in age specific admission rates between 1981-1994 while Muneeb (1997) presented the absolute differences in unadjusted (crude) admission numbers between 1995 and 1996.

The studies have also varied in relation to which types of admissions they have included. In addition, the accuracy of the information may be variable. In New Zealand discharge data is filtered to ensure hospitals consistently record medical admissions such as day stay transfusions, renal dialysis or chemotherapy.
However, it is unclear whether other countries have used similar filtering procedures and whether the reports based on these countries’ data are therefore presenting comparable information.

Cognisant of these limitations some general conclusions are still possible with regard to trends in the number of acute medical admissions in New Zealand, Australian and the United Kingdom.

**ARTEFACT**

Caution must be exercised with any review of the trends in hospital admission over time and the factors that might be underlying these trends because different studies have varied in the definitions of an acute admission, the time periods that have been assessed and the methods by which admission numbers have been calculated and presented. Consequently, artefact must be considered as a possible explanation in any of the studies that have examined this issue.

Changes in coding, improved data capture and enhanced incentives to improve the recording of inpatient activity to meet the new demands of contracting have been cited as potential causes of the growth in acute admissions (Edwards and Werneke, 1994). Once again there is a relative lack of quantitative evidence to support (or refute) this claim. A study by Williams et al. (1994) is a notable exception as it clearly found that the apparent rise in diabetes-related, age standardised, admission rates in the UK was an artefact of the introduction of a new inpatient recording system in that country.

Another possible artefactual cause of a rise in acute admissions is comparison of data over small time frames, because most admissions occur in winter. If summer admission numbers were compared with winter, it would appear that their number was increasing (Houghton and Hopkins, 1996; Kendricks et al., 1997).

Although most studies have avoided such simple confounding, some have failed to consider the contribution to admission numbers from epidemics of infectious diseases. A periodicity exists for admissions due to infectious diseases (for example measles) such that over cyclical periods of time the number of susceptible people builds up to a sufficient level to sustain an outbreak of disease. Measuring admission rates for certain groups of diseases during an outbreak will present a larger number of admissions than if a similar measurement was made when an epidemic was not apparent (Chavez and Ellis, 1996; Shears and Wight, 1995). A clear example of the potential for this type of confounding was presented in the time series study by Johnston et al. (1996), where a strong association between increasing numbers of acute admissions for respiratory conditions (especially asthma) during the 1980s was confounded by seasonal patterns of upper respiratory infections.

In addition, a change in the classification of some outpatient visits to day-stay inpatient care could also provide an artefactual increase in emergency admissions. Work by Harrison and Prentice (1995) has shown that the volume of day-stay admissions has risen by over 150% during the 1980s in the United Kingdom. Although not all day-stay patients are classified as acute admissions, a number of hospitals now admit emergency patients to a day-stay unit for observation. To some extent these admissions could reflect a reclassification of work (for example, from outpatient-based care to day-stay inpatient care) or better recording of patient visits (possibly related to financial incentives associated with DRG payments that remunerate for inpatient and not outpatient-based care).

Over the last 10 years three versions of the standard International Classification of Diseases (ICD) classification system have been used by New Zealand hospitals to code the principal diagnosis for each hospital discharge (admission) (Ministry of Health, 1993).

While these systems were broadly similar it is possible that discrepancies could have been introduced in any attempt to compare the number of admissions for certain conditions between different years that have used different classification systems. Although the Ministry of Health has attempted to ensure the ICD classifications were undertaken by the coders at the individual hospitals with a high standard of accuracy, significant errors rates in these classifications have been documented (Smith, 1989). Problems associated with the need for coders to adjust to the changes in the classification system would be expected to have produced non-systematic errors. By contrast, the economic incentives present in the DRG payment system could have lead to the systematic classification of admissions in relation to the category that delivered the most funding (i.e. ‘DRG creep’) (Iezzoni, 1990; Jencks, 1992).

New Zealand work by North Health is notable because although primarily a descriptive study, it also investigated the effect of previous coding changes within the National Minimum Dataset (Jackson, 1996). These changes have markedly increased the number of diseases and procedures that can be coded.

The increase in the coding potential of the NMDS was found to have been reflected in an increase in the number of procedures that were coded for each record (up from 70 per 100 records in 1994 to 90 per 100 records in 1995). In addition, the number of
complications listed for each DRG also rose between the two years.

The report concluded that about 2% (or about half) of the annual increase in the number of cases and case weights might be due to coding changes. A further 2-3% rise was potentially explainable by the demographic changes occurring in the region and only a 1-2% rise in acute admissions was left unexplained.

CONCLUSIONS

- Acute admissions comprise an important percentage of all medical admissions and acute medical admissions constitute approximately one third of all hospital admissions in New Zealand.

- A number of studies have confirmed that there has been a steady increase in the absolute number of acute medical admissions as well as the hospital admission rate for defined populations over the last decade (Wass and Zoltie, 1996).

- The increase in the number, and rate, of admissions is particularly pronounced for acute (or emergency) medical admissions and is less apparent with acute surgical admissions or arranged/waiting list admissions.

- The increase in emergency medical admissions has been consistently found in studies based in a number of countries (UK, Australia and New Zealand) as well as reviews undertaken at both regional and local hospital levels (Mallender, 1997).

- Although the complexity of acute medical admissions may be increasing, their average length of stay is reducing. A reduced length of stay has facilitated a higher number of admissions to be made with either a fixed or reduced stock of available hospital beds.

- The rise in admission rates is less apparent among children, although fewer studies have examined trends in paediatric admissions.

- Most of the increased number of admissions is probably due to an increase in the number of people admitted rather than the more frequent admission of a small number of very sick individuals, although this has not been firmly established in the research literature.

- Artefact exists as a significant possible explanation for the increase in acute medical admissions. Although it has not been determined exactly how important this factor may be, it is probably unlikely to account for most of the rise in emergency admissions. While it is possible that regional differences in coding or changes over time have resulted in variations in hospital admission rates and an apparent increase over the last few years, it is unlikely this would explain most of the growth in acute medical admissions. It is unlikely there could have been systematic differences in coding in a number of regions working in one direction over a sustained period of time. It would be expected that most random miscodings would probably shift the primary diagnoses from one related diagnosis to another (e.g. from one respiratory illness to another) and therefore have little net effect on trends in admission rates between major categories over time.
What are the most important conditions causing an increase in acute medical admissions?

**Purchasing for your Health**, a report by the Ministry of Health’s Performance Monitoring and Review Unit (Ministry of Health Performance Monitoring and Review Unit, 1994) found that most of the rise in admissions in New Zealand between 1988/89-1994/5 was related to medical admissions, and more specifically, mainly to cardiac or respiratory DRGs (see Figures 4 and 5).

The percentage increase in admission numbers rose most steeply in relation to elderly people (>65 years), although numerically the elderly still comprise fewer admissions than people under 65 years of age (see Figure 6).

The study found that the rise in admissions was not restricted to any particular New Zealand geographic location.

A review by North Health (Jackson, 1996) consistently found that the largest rises in admission rates were among emergency medical admissions for adults, and particularly the elderly, again with respiratory and cardiac (particularly heart failure and chest pain) conditions predominating. In the North Health region most of the increase was found among the three Auckland-based CHEs.

A small study based in a single Auckland CHE (Muneeb, 1997) consistently found that most of the increase in hospitalisations were in relation to escalating numbers of admissions for elderly people with cardiac or respiratory conditions.

Another review in the North Health region (Bloomfield, 1997) found the admission rate increased with increasing age, such that people aged over 85 years in the region had an admission rate of 258 per 1000 population and an annual absolute risk of admission of nearly 1 in 4. By contrast, the admission rate for those people aged between 65-69 years was 130 per 1000 and the absolute risk of admission was only 1 in 8.

Between 1993 and 1996, Bloomfield found that the number of elderly people admitted to hospital increased at a higher rate than the increase in the size of the population for that period. In part, this increase might be explained by the increased rate of readmissions among the older age groups.

Finally, despite the higher admission and readmissions rates of the very old, these people had, on average, a longer length of stay than younger patients. Although many older people maintain good health, the elderly are more likely to suffer from a chronic condition (such as hypertension or diabetes mellitus) and a complication or an exacerbation related to a chronic illness is a frequent cause of hospital admission (Bloomfield, 1997). In addition, the elderly are at higher risk from drug side effects, falls or physiological events that can also precipitate acute medical hospital admission.

An Australian report (NSW Health Services Research Group, 1998; Department of Health Housing and Community Services, 1991) examined the trends in admissions between 1979-1989 and used demographic trends to project the admission rates for the general population along with the age specific rates. The report concluded that although the overall admission rate was expected to rise by 0.5% by the year 2001, the rise among people over 65 years of age was expected to be 19.5%. By contrast the hospital admission rate for people under 65 was projected to decrease by 0.1% for people aged 45-64 and 8.9% for people 15-44. Notably, the admission rate amongst the paediatric population (age less than 15 years) was expected to decrease by 7.5%.

In the UK, Kendrick (1996) has also identified that most of the rise in acute medical admissions is in relation to higher hospitalisation rates for elderly people with cardiac or respiratory conditions. The analysis by the Kings Fund/NHS Trust Federation examined the changes in the number of admissions in six NHS hospitals in the UK (Harrison et al., 1995). The report also concluded that an increase in hospitalisations in relation to respiratory or cardiac conditions was primarily responsible for the increase in the number of admissions in the UK.

The most common causes of emergency medical admission for children are gastroenteritis and respiratory conditions (Read et al., 1994). These conditions have consistently been the most common causes of acute paediatric medical admission over the last decade (Read et al., 1994).
CONCLUSIONS

- Most of the increase in acute admissions is primarily related to an increase in medical admissions among the elderly and primarily for cardiac or respiratory conditions.

- Admission rates among children have not exhibited such a dramatic increase, although fewer studies have examined the trends in paediatric admissions.

- Gastroenteritis and respiratory conditions remain the most important causes of acute medical admission for children.
A number of authors have commented on the rising number of acute medical admissions from the perspective that this trend represents a serious fiscal challenge to the fixed budgets of hospitals and their funding organisations (Capewell, 1996; Hobbs, 1995; Edwards and Werneke, 1994).

However, no one has undertaken a systematic review of the issues underlying this increase and examined the implications of both the rising number of admissions and interventions to reduce this trend in terms of their advantages and disadvantages to the health of a population.

Such a review would include a consideration of access to primary and secondary care and the interface between them. A descriptive study by Hiss et al. (1994) discusses these issues and concludes that a decrease in hospital admissions need not be an advantage, if the declining admission rate represents a deteriorating access to medical care for patients whose health care needs are not otherwise being addressed.

By contrast, other studies have examined other perspectives. For example, some research has suggested that although the elderly get admitted the most often they do not reap any survival advantage from their excess hospitalisations. Cross-sectional studies by Fried et al. (1995) and Fabiszewski et al. (1990) both consistently found there was no survival benefit in hospitalising long-stay elderly patients for treatment of their pneumonia or fever respectively. The authors argued that increased acute admission rates for these conditions were hard to justify for the elderly.

Regardless of the cause, an increase in the number of acute medical admissions is important because hospital admissions are an expensive part of the health system and they represent a large amount of serious morbidity in the population which may be increasing.

The rising number of acute medical admissions is part of the increased pressure on the whole spectrum of emergency care, which includes escalating numbers of attendances at emergency departments, increasing use of out of hours doctors, and more demand being placed upon ambulance services (Kings Fund, 1996).

In the United States literature in particular, the authors discuss the rising number of admissions as a crisis (e.g. crisis rhetoric used in the qualitative study by Green and Armstrong (1995)). This literature describes the cascading effects of overcrowding as wards have become filled with emergency medical admissions which in turn cannot accept patients from ED, while the ED then becomes further congested, meaning patients requiring urgent assessment often wait while those with non-urgent problems may even be turned away (Krochmal and Riley, 1994).

An important implication of the growth in emergency admissions is that these admissions are by definition unplanned, and hence the workload of the hospital is becoming inherently more variable and harder to predict (Harrison and Prentice, 1995). Increasing acute workloads prevent a hospital from providing services to patients on waiting lists. Increasing acute loads also contribute to pressure on staff who must deal with a higher proportion of patients and families in serious physical and emotional distress associated with an acute illness. Staffing levels become difficult to manage if patients are arriving at unpredictable times requiring urgent attention.

Increasing emergency admissions have financial implications for hospitals and health funders. Uncapped budgets are increased by rising numbers of admissions while those that are capped are stretched because emergency admissions are usually a more expensive case mix than waiting list admissions (Scottish Office Home and Health Department Health Policy Directorate, 1994).

Changes in the workload of the hospital are linked to alterations in the roles of staff. In-
creasingly other staff are substituting for roles that were previously occupied by doctors. Allied to this trend is the provision for improved technology that enables a number of clinical functions to be automated and undertaken by staff with less training. For example, minimal access techniques threaten the role of the specialist surgeon by enabling less trained workers to undertake a number of procedures (Wickham, 1994).

A central argument for retaining hospitals has been that they provide a training site for doctors and expose them to a substantial amount of clinical material (Audit Commission, 1995). Reviews of junior doctors' workload have found there is a significant amount of non-medical work in their roles which can be provided by other staff (McKee and Black, 1991). In addition, most hospitals in the UK are providing care to sicker patients than previously, resulting in a need for increasing roles for nurses and other staff that used to be undertaken by junior doctors. This trend has been heightened by efforts by junior doctors to limit their long hours of work, which has in turn accelerated a trend of substituting other staff for roles previously and exclusively occupied by junior doctors.

Another implication of these changes in staff roles is the likelihood that the close historical link between the hospital structure and medical training may be eroded. However, job substitution is a complex issue for which Richardson and Maynard (1995), in their detailed review of doctor-nurse substitution, conclude that the evidence base is very limited. Richardson and Maynard argue that little is known about the costs and benefits of role substitution and caution against significant skill mix changes, at least in the short term, while research is still accumulating (Richardson and Maynard, 1995).

Admission rates, length of admission and the cost of inpatient care

Although admission rates are increasing, the average length of stay in most hospitals is decreasing, resulting in a net increase in bed occupancy in the UK based on cross-sectional data (Harrison, 1997).

Although admission rates have increased for a number of conditions, reductions in length of stay have resulted in a decrease in the net inpatient costs associated with some conditions—e.g. childhood poisoning (Woolf et al., 1997). By contrast, even though the absolute numbers of some types of admissions are decreasing (for example, motor vehicle accidents), the relative number and costs associated with these types of admissions are high, and they remain a significant part of a country's hospital care budget (Phillips et al., 1993).

CONCLUSIONS

- Increased acute admissions are part of a general increase in emergency care including rising numbers of ED attendances.
- The consequences of increased numbers of acute admissions include: a fiscal challenge to the budgets of the purchasers and the providers of secondary care services, a reduced ability to undertake non-urgent work, increased pressure on staff and difficulties with planning staffing levels. An increased workload for hospital staff may lead to changes in professional roles and have implications for professional education.
- No published review has yet examined the rise in admissions with regard to its implications for the health of a population. For example, more admissions may represent an improvement in health outcomes associated with better access to secondary care services for some groups or a decrease in population health gain in relation to forgone opportunities to use the expenditure on acute admissions for other health interventions.
Figure 1  Main admission pathways
Figure 2: Number of acute medical admissions 1988/89-1994/5
(Source: Performance Monitoring and Review Section, 1955)
Figure 3: Number of inpatient days for acute medical admissions
(Source: Performance Monitoring and Review Section, 1995)
Figure 4: Number of respiratory admissions 1988/89-1994/5
Figure 5: Number of cardiac admissions 1988/89-1994/5
(Source: Performance Monitoring and Review Section, 1995)
Figure 6: Percentage change in acute medical admissions in relation to age 1989/90-1994/5
(Source: Performance Monitoring and Review Section, 1995)
### Table 1. RHA reports of the increase in all admissions, medical admissions and acute admissions

<table>
<thead>
<tr>
<th>Region</th>
<th>Time period</th>
<th>Inclusions</th>
<th>Result (percentage annual increase in admissions)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total medical and surgical admissions (acute, arranged and waiting list)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>North (Jackson, 1996)</td>
<td>July to December 1994 - July to December 1995</td>
<td>Adults</td>
<td>3.6%</td>
</tr>
<tr>
<td>North (Jackson, 1996)</td>
<td>July to December 1994 - July to December 1995</td>
<td>Children</td>
<td>0.2%</td>
</tr>
<tr>
<td>Central (Medical and Surgical Services, 1997)</td>
<td>1994/5 - 1996/7</td>
<td>Adults</td>
<td>1.3%</td>
</tr>
<tr>
<td>Southern (Watt and Stokes, 1995)</td>
<td>July 1991 to December 1994</td>
<td>Adults</td>
<td>2.5%</td>
</tr>
<tr>
<td><strong>Acute medical and surgical admissions</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>North (Jackson, 1996)</td>
<td>July to December 1994 - July to December 1995</td>
<td>Adults</td>
<td>6.5%</td>
</tr>
<tr>
<td>North (Jackson, 1996)</td>
<td>July to December 1994 - July to December 1995</td>
<td>Children</td>
<td>2.2%</td>
</tr>
<tr>
<td>Central (Medical and Surgical Services, 1997)</td>
<td>1994/5-1996/7</td>
<td>Adults</td>
<td>3.2%</td>
</tr>
<tr>
<td>Southern (Watt and Stokes, 1995)</td>
<td>July 1991 to December 1994</td>
<td>Adults</td>
<td>3.4%</td>
</tr>
<tr>
<td><strong>Acute medical admissions</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>North (Jackson, 1996)</td>
<td>July to December 1994 - July to December 1995</td>
<td>Adults</td>
<td>7.6%</td>
</tr>
<tr>
<td>North (Corkill, 1997)</td>
<td>1996/7 - 1996/7</td>
<td>Adults</td>
<td>8.2%</td>
</tr>
<tr>
<td>North (Jackson, 1996)</td>
<td>July to December 1994 - July to December 1995</td>
<td>Children</td>
<td>0.2%</td>
</tr>
</tbody>
</table>
Table 2. The ratio of acute (medical and surgical) admissions to all types of admissions

<table>
<thead>
<tr>
<th>Report</th>
<th>Subjects</th>
<th>Years</th>
<th>Increased acute medical and surgical admissions as percentage of total medical and surgical admissions per year (percentage of acute admissions at beginning and end of period)</th>
</tr>
</thead>
<tbody>
<tr>
<td>North Health</td>
<td>Adults</td>
<td>1994-1996</td>
<td>2% (63.1%-65.1%)</td>
</tr>
<tr>
<td>(Jackson, 1996)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>North Health</td>
<td>Children</td>
<td>1994-1995</td>
<td>1.4% (69.7%-71.1%)</td>
</tr>
<tr>
<td>(Jackson, 1996)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Central (Medical and Surgical Services, 1997)</td>
<td>Adults</td>
<td>1993/4-1996/7</td>
<td>1% (55%-59%)</td>
</tr>
<tr>
<td>Southern (Watt and Stokes, 1995)</td>
<td>Adults</td>
<td>1991/2-1993/4</td>
<td>0.9% (55.4%-58.1)</td>
</tr>
</tbody>
</table>

Table 3. Studies that have examined artefact as an explanation for the rise in acute admissions

<table>
<thead>
<tr>
<th>Author</th>
<th>Study design</th>
<th>Level of evidence</th>
<th>Conclusions</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Williams et al., 1994)</td>
<td>Cross sectional</td>
<td>III</td>
<td>Age standardized rise in discharges in the UK was mainly due to change in coding for the condition (no p value).</td>
</tr>
<tr>
<td>United Kingdom</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Chevze and Ellis, 1996)</td>
<td>Time series</td>
<td>II-3</td>
<td>Measles epidemic is mainly responsible for increased number of hospital admissions (no p value).</td>
</tr>
<tr>
<td>United States</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Johnston et al., 1996)</td>
<td>Time series</td>
<td>II-3</td>
<td>Respiratory admissions have mainly increased in relation to epidemics of respiratory illnesses (p&lt;0.01 adults, p&lt;0.0001 children).</td>
</tr>
<tr>
<td>United Kingdom</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Jackson, 1996)</td>
<td>Cross sectional</td>
<td>III</td>
<td>Coding changes account for up to approximately half of the increase in admissions in North Health between 1994-1996 (no p value).</td>
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<td>New Zealand</td>
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<td>(Harrison and Prentice, 1995)</td>
<td>Cross sectional</td>
<td>III</td>
<td>Substantial increase in day-stay admissions may be due to the re-classification of some previously outpatient-based episodes of care (no p value).</td>
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<td>United Kingdom</td>
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Section Two

Why are acute medical admissions increasing?
Is the rise in admissions appropriate for the needs of the community?

INTRODUCTION

There are major problems with trying to disentangle the separate influences of the many complex and interrelated factors that are associated with hospital admission. For example, increases in the supply of GPs could be increasing the number of new hospital admissions; alternatively, any third factor that is causing hospital admissions to increase may also be increasing GP numbers (such as demographic changes in the population).

The underlying problem is that much of the research in the area of rising hospital admissions is based on cross-sectional data that does not allow an accurate assessment of the direction of causation between statistically associated factors.

A large review of the causes of increased emergency admissions (Harrison and Prentice, 1995) concluded that economic, demographic and technological factors, as well as the health status of the population, clearly played a role but that it was hard to isolate their individual effects.

Another problem is that the potential causes of rising emergency admission numbers are so numerous. A large multi-disciplinary review of the causes of the rise in emergency admissions in the UK found a range of explanations that ran well into double figures (National Association of Health Authorities and Trusts, 1994). Even though explanations need to account for the generality and persistence of rising admission numbers, a large number of potential explanations working alone, or in concert, are readily available (Capewell, 1996).

A large number of studies suggest acute medical admissions may be increasing while the average length of stay for these admissions is reducing (e.g. Postma et al., 1995). Unfortunately good evidence to illuminate this issue is scarce and much of what is available is simply opinion or conjecture (Hobbs, 1995).

DEFINING THE NEED FOR ADMISSION

Problems exist with defining the need for hospital admission. A central underlying problem is that it is difficult to measure the absolute clinical need for hospital care in a population (Scottish Office Home and Health Department Health Policy Directorate, 1994). When clinical need is taken as meaning the ability of the population to benefit from a health service (Stevens and Raftery, 1997), several limitations emerge from research assessing the underlying causes for the rise in emergency hospital admissions. These limitations include uncertainty about the effectiveness of inpatient versus outpatient-based emergency treatment and difficulties in assessing the costs and benefits of interventions that are aimed at preventing a condition from developing, or deteriorating to the point where admission would even become considered.

Defining need on the basis of a community consensus indicates that because people value their access to hospital care, more is often regarded as better (Stevens and Raftery, 1997). This belief may not be related to the effectiveness of the service or the relative merit of providing it within a hospital setting.

Difficulties also arise when the need for hospital services is based on their utilisation (expressed need). These difficulties stem from the knowledge that aspects of the supply and demand for services, particularly the availability of hospital services, actually determine service utilisation (Wennberg and Cooper, 1996).

Finally, a definition of need based on a comparative analysis is also problematic when there is general agreement that admission numbers are increasing in most individual hospitals, regions and countries.

REGIONAL VARIATIONS IN ADMISSION RATES

While the number of admissions has been steadily increasing over time, there are well-documented variations in hospitalisation rates in different regions at any single point in time.

A number of studies have documented a geographic heterogeneity of hospital admission rates in the United States e.g. Morris and Munasinghe (1994); Billings et al. (1996). A wide range of admission rates have also been recorded between different regions in the UK (four-fold variation for all conditions (Roland and Coulter, 1992) and six-fold for asthma (Hyndman et al., 1994)) and in New Zealand (six fold variation for diabetes (Brown and Barnett, 1992).
and nine-fold variation for asthma and diabetes (Hider, 1997).

Some studies examining variations in the admission rates for children have documented even wider variations, including a 16-fold variation in admissions for gastroenteritis among regions in the US (Connell et al., 1981) and a 14-fold variation for regions in Canada (To et al., 1996).

Variations have been recorded between small and large geographic areas (Krakauer et al., 1995). However, a large amount of work principally exploring variations at the small area level by investigators such as Wennberg et al. (1989) has done much to illuminate the admission process. The large variation in admission rates at the small area level has been accounted for by the suggestion that many hospitalisations may actually be discretionary and relates to discrepancies in the opinions of physicians about the utility of hospital-based interventions (Chassin, 1986), based on the relative lack of clear, objective evidence for the effectiveness of a great majority of commonly used, hospital-based interventions (Eddy and Billings, 1988).

Variable hospital admission rates may also be due to differences in disease prevalence, epidemics or discrepancies in the admitting policies of individual hospitals.

An overview by Roland and Coulter (1992) of the hospital referral process, which mainly focused on outpatient referrals, is very informative. This review identified that increased referrals may result from a number of possibilities. However, reflecting changes in need (especially socio-economic status) the authors concluded that variations in social class (or any other patient characteristics) did not explain variations in referrals. The authors concluded that GPs at either end of the referring spectrum were seeing basically the same type of patients with exactly the same type of problems.

Provider variations in training, background or attitudes to uncertainty also provided inconclusive evidence. Differences related to their practices, such as list size, were also not a major influence on referral rates.

Some differences between areas in their accessibility and the availability of primary and secondary care resources were found to be significant, but the authors noted that variation in referral rates were much higher between GPs than between areas and therefore suggested these factors were not as critical.

A study of the factors underlying the variations in hospitalisation rates offers an invaluable insight into the admission process and the reasons that may be underpinning the general rise in the number of emergency admissions (Perrin, 1994).

A number of possibilities exist for the causes of variations between regions in hospital admission rates and for the increase in emergency medical admissions. These possibilities include (after Perrin (1994):

- variations in geographic and socioeconomic access to services (primary care and hospital based)
- differences in the epidemiology of illness
- differences in community resources (e.g. variations in the number of hospital beds or community care resources)
- differences in physician and patient behaviours
- artefact.
Broadly the factors underlying the rise in acute medical admissions can be grouped into three categories:

- factors related to the patient
- factors related to the gatekeepers for admission
- factors related to health care organisations.

**Figure 7** illustrates the range of possible determinants in the rise of emergency admissions. The diagram describes the spectrum of possible factors underlying the increase and also depicts the relationships between these factors. A series of circles illustrates the various levels (hospital, local community, health sector, and societal wide context) at which these factors operate.

**PATIENT-RELATED FACTORS**

**Demography**

Although all age groups and most diagnostic categories are involved in the rise in number of emergency medical admissions, the largest contribution has consistently come from older (>65 years) medical admissions, especially for cardio-respiratory causes (Capewell, 1996).

A review of the literature has consistently found that hospital admission rates for the elderly are significantly higher than any other age group and the proportion of elderly people among the number of acute medical admissions is rising.

Numerically older people have made up an increasing number of emergency department attenders and hospital admissions over the last two decades (Wass and Zoltie, 1996; Goldacre and Ferguson, 1995). Excess admission rates for the elderly remain whether episode-specific or person-based rates have been used. A review by (Harrison and Prentice, 1995) concluded that the elderly by 1995 made up half the workload of the hospital in terms of bed days in the UK.

While most of the evidence comes from the results of large cross-sectional studies which have used data from administrative databases e.g. Goldacre et al. (1993), other study designs have been used (see Table 4).

A time series study by Taylor and McConnell, 1994b) found that elderly people made up an increasing proportion of acute admissions in the UK over the last two decades. A retrospective comparison of two cohorts in a US health maintenance organisation found that hospitalisation rates were increasing among older patients between 1970-1990 (Haan et al., 1997).

At least, in part higher admission rates for the elderly relate to the increasing percentage of elderly people in society. Older people are more likely to be admitted to hospital because of their higher prevalence of serious chronic illnesses as well as the physiological factors associated with aging (Davies and Kenny, 1996). In addition, once admitted for a condition the elderly are more likely to be hospitalised for longer and then readmitted for the same condition or another related condition due to their higher presence of multi-system diseases (Gubler et al., 1996). The elderly are more likely to receive medication and in turn suffer an iatrogenic condition than younger patients are.

Furthermore, the elderly have been shown to be less likely to seek help for conditions that are amenable to primary care which could prevent admission (Bailey et al., 1992).

Other aspects of sociodemography have been found to be important determinants of hospital admission among the elderly, including an increase in the number of frail elderly people living alone or in rest homes who frequently require hospital care for acute illnesses that compromise their marginal independence (Jankowski and Mandali, 1993; Taylor and McConnell, 1994a).

Several authors have found that more people living longer in the community has significantly increased the number of people requiring hospital care (e.g. Cartwright, 1991). A number of new health technologies have also recently emerged for the health care of the elderly. These technologies (such as prostate cancer screening) may have contributed to the rise in the number of the elderly being admitted for inpatient care.

Another factor may be that ED departments are themselves receiving an increased number of elderly patients with complex problems relating to multi-system disease (Eliastam, 1989). The additional time required to diagnose and treat these patients has been noted as a major factor in increasing waiting times at ED clinics as well as contributing to rising admission numbers (Cameron et al., 1989).
Another observation on why bed occupancy by the elderly is increasing comes from a London based study by Millard (1992), who concluded that the administrative decision to use more hospital beds for acute care (reinforced by the financial incentive of higher amount of reimbursement) has increased the use of previously long-stay beds in hospitals for acute care which in turn has lead to higher numbers of acute admissions particularly among the elderly.

Despite these findings, the rising number and proportion of the elderly in the community has not consistently been found by all the research to be largely responsible for the escalating number of acute medical admissions. Some authors have estimated that population aging may account for as little as 2% of the increase in hospital admissions over the last two decades (National Association of Health Authorities and Trusts, 1994).

In Scotland between 1981 to 1994, Kendrick, (1996) found admission rates rose across all age groups and the increase was not confined to the elderly. Kendrick found that less than 25% of the rise in admissions between 1981–1994 was due to the rise in the proportion of the elderly in the community (Kendrick, 1996).

In support of the assertion that an increasing proportion of the elderly in the community need not increase the demand for hospital care, some commentators have strongly argued that longer life need not be accompanied by a longer period of ill health (e.g. Fries (1989)).

New Zealand-based evidence has, in general, consistently found that the increased proportion of elderly in the community has contributed to the rise in acute medical admissions over the last 10 years, although there is some disagreement about the size of the contribution (Jackson, 1996; Performance Monitoring and Review Section, 1995; Bloomfield, 1997).

Conclusion

- The increasing number and proportion of elderly in the community has been found by most (but not all) studies to be an important explanation for the increase in acute medical admissions in New Zealand and several other western countries over the last decade.

Ethnicity

A related demographic change is the relative increase in the size of different ethnic minority populations among many communities. Various ethnic groups have been documented to have higher rates of acute hospital admissions for many conditions. Most notable among these ethnic minority groups with higher admission rates are the excess hospitalisation rates for Maori with regard to several major medical conditions such as asthma (Lewis et al., 1997), diabetes (Simmons, 1996), congestive heart failure (Bullen and Beaglehole, 1997) and stroke (Bonita et al., 1997; cross sectional studies).

Conclusion

- An increase in the proportion of Maori (or another ethnic minority group) in a community over time might be expected to result in a relative rise in acute hospital admission rates for that region. The disadvantaged socioeconomic and cultural positions of most ethnic minority groups in society are likely to be key factors underlying their disproportionately greater use of acute hospital beds (Gracey and Gee, 1994).

Socio-economic status of the population

Economic factors have been found to be important determinants of hospital admission in most ecological studies (e.g. Morris and Munasinghe, 1994) (see Table 5). Although ecological studies have a limited ability to draw causal inferences between variables, there is strength in the consistency of their findings in relation to hospital admission rates and socio-economic status.

A number of other studies that have used a cross-sectional design have also found that socio-economic status is an important determinant of hospital admission for adults and children. A large (n= 2867) cross-sectional survey of adults in the Netherlands found a significant association between self-reported hospitalisation rates and socio-economic status (van der Meer et al., 1996). The study used educational achievement as an indicator of socio-economic status and relied upon self-reported hospitalisation information. A similar retrospective cross-sectional study based in Scotland found the most important predictor of hospital admission for adults in Edinburgh in 1996 (Duffield et al., 1997) was socio-economic status.

In New Zealand, lower socio-economic status has also been strongly associated with higher rates of hospitalisation. Cross-sectional studies based in Wellington (Crampton et al., 1997) and Auckland (Jackson et al., 1998) have both consistently found a strong relationship between low socio-economic status and higher admission rates to a public hospital.

A consistent association has been found between lower socio-economic status and increased hospital inpatient care utilisation in relation to specific diseases, most notably diabetes mellitus (Morgan et al., 1997a; Caddick et al., 1994). A similar finding has also been noted by New Zealand based research (Brown and Barnett, 1992). Although these studies
have obtained consistent results it is difficult to make any definitive conclusion because the validity of the findings are limited by their retrospective and cross sectional design.

Further evidence of a strong relationship between socio-economic status and hospitalisation comes from a prospective cohort study by (Stirling and Wadsworth, 1995). This study was based on 1946 people in the UK who were followed up over a seven year period and it examined their number of admissions to both public and private hospitals. The study by Stirling clearly found the risk of admission was highest among those people with low socio-economic status.

The research findings in relation to children are generally also consistent. Most studies have found that lower socio-economic children are more likely to be hospitalised for an acute illness. Cross-sectional studies by McConnochie et al. (1997), Perrin et al., (1989), Wissow et al. (1988), Halfon and Newacheck (1993) have found that socioeconomic status is one of the most important determinants of admission rates amongst children. Following a birth cohort in Sheffield (UK), Spencer et al. (1993b) found that children born in low socio-economic status areas exhibited higher rates of hospital admission in early childhood. Spencer separated admissions for low birth weight infants and young mothers and defined these admissions as being attributable to impaired parental coping. After these admissions were excluded from the analysis, the authors found that the remaining admissions for 'organic pathology' were still significantly associated with poverty.

In another related study that used a case control design, Spencer et al. (1996) found that children living in socio-economically deprived areas of Sheffield (UK) were 50% more likely to be admitted to hospital with bronchiolitis than children in more affluent areas.

Two New Zealand-based studies that have each followed birth cohorts for nearly 20 years have also recorded that children and young people with low socio-economic status are considerably more likely to be hospitalised than their more affluent peers (Fergusson et al., 1990; Stanton et al., 1991).

Although a number of studies have shown that children (Wyke et al., 1991; Weitzman et al., 1990) and adults (Higgins et al., 1977; Caird and Akhtar, 1972) in low socio-economic classes have more symptoms of respiratory illness, the relationship between low socio-economic status and hospital admission could be confounded by a number of factors. It is known that people with low socio-economic status have a diminished nutritional status (LaCroix et al., 1989), unsanitary and overcrowded living conditions (Call et al., 1992), higher smoking rates (Higgins et al., 1977), less compliance with medical advice (Mitchell et al., 1989) and difficulties with transport to a doctor or getting time off work or finding childcare to visit a health care professional (Billings et al., 1996). Any of these factors could be modulating the effect of socio-economic status on hospital admission.

People with specific chronic illnesses (such as asthma or diabetes) have especially been found to be correlated to higher admission rates in association with lower socio-economic status in overseas studies (Morgan et al., 1997a; Kovacs et al., 1995; Currie et al., 1997), as well as New Zealand-based research (Crampton et al., 1997; Brown and Barnett, 1992). These cross-sectional studies have found there is a linear relationship between decreasing socio-economic status and increasing rates of hospital admission.

A problem, however, is that the association is confounded by other related issues such as an increasing prevalence of chronic illness among low socio-economic classes (Marshall et al., 1993; Kelly et al., 1993; Meadows, 1995; Chaturevdi et al., 1996; Barker et al., 1982; Connolly et al., 1995), reduced access to medical care (Barnett and Coyle, 1998; Davis, 1995; Kelly et al., 1994; Leese and Bosanquet, 1995), increased smoking and other risk factors for chronic illness (Beaglehole and Bonita, 1998; Jackson et al., 1990; Unwin et al., 1995; Kelly et al., 1994; Pocock et al., 1987).

In addition, uptake of population based health promotion issues are also lower (Mullins and Borland, 1996; Waller et al., 1990). Ethnic groups with high hospital admission rates also disproportionately occupy low socio-economic classes (Pomare et al., 1995, Mitchell, 1988).

Finally, most studies have used an aggregate description such as a postal code to define the socio-economic status of their study populations. The use of collective proxies for socio-economic status is of questionable validity for the individuals in a study. The use of these proxy indicators of socio-economic status may explain the small number of studies that have failed to find a relationship between socio-economic status and hospital admission for children (e.g. To et al., 1996). The negative findings of these studies may be explained by an ecological fallacy - that is, population-based data might sometimes be too coarse to illustrate the importance of low socio-economic status in the admission of individual patients.

Conclusion

- Generally consistent evidence (among both adults and children) exists that socio-economic
status is inversely related to hospital admission rates. Therefore it is possible that changes in socioeconomic status over the last two decades may have been a significant cause of increased rates of acute medical admissions.

**Changing societal patterns of care**

Clear evidence exists from a number of studies that people living alone are at higher risk of being admitted to hospital (see Table 6). A prospective cohort study found that being without social support (that is being single and living alone) was an important predictor of admission for elderly people attending two London ED departments (Jankowski and Mandal, 1993). Langman (1995) found that people living alone were 30% more likely to be admitted to hospital than matched controls who lived with another family member.

A number of authors have reported that hospital admissions may be increasing as a consequence of the breakdown in social care within the community and the consequent rise in the number of people living alone (Perneger et al., 1997).

An inadequate number of residential beds for the elderly and the need for more elderly people to stay with relatives who have an inadequate ability to cope with their care was considered to be a primary reason why London’s emergency admission rate has increased so dramatically (Jarman, 1993). This trend also reflects the increased number of the elderly in the community along with changes in societal structure, where more families do not have the resources to care for their grandparents (Kendrick, 1995).

In some articles (e.g. Coast et al., 1996b), inappropriate admissions are referred to as social admissions.

In this rhetoric, the factors underlying inappropriate admissions are associated with the provision of social care and not medical care for patients. That is, the medical services are seen as acting as a proxy for inadequate or overwhelmed social services or family caregivers.

A number of studies have examined the appropriateness of medical admissions, particularly in relation to the elderly (see Section Three). One survey of admitting GPs responsible for 200 consecutive admissions of elderly patients to Wellington Hospital in 1987 found that in over half the admissions to an acute medical bed it was not the preferred option and was used as a default option because it was the only placement option available (Durham and Durham, 1990).

Another study based in the United Kingdom concluded that 15% of admissions could have been more appropriately managed in a different setting to an acute medical hospital (Coast et al., 1995).

However, there is no clear divide between health care and social care and often a sudden family crisis can become an emergency medical crisis.

A cross-sectional study of patients attending a children’s hospital found that more attenders used the hospital appropriately when they had previously sought advice from a family member or if they had prior child care experience (Oberlander et al., 1993). The authors speculated that a social trend for increasing numbers of single parent families (also possibly without grandparent support) might be contributing to an increasing reliance on hospital-based facilities and an increased number of hospital admissions. However, because the study was conducted with limited methodological rigour (the authors did not survey a random sample, the response rate was only 50% and the authors made no effort to gather information on non-responders and non-attenders) it is difficult to make any firm conclusions from its findings.

**Conclusion**

- In conclusion, there is clear evidence from the consistent results obtained from a number of study designs that patients without social supports are more likely to be admitted to hospital. However, it is unclear as to what the relative contribution to the increased number of admissions over the last two decades may have been from changes in societal support structures. In addition, there is some debate about how appropriate it is to admit people to hospital for predominantly social reasons, and what the best facility might be to manage these types of admissions.

**Distance from a hospital**

The distance a person must travel to attend either a GP or a hospital’s emergency department dictates from which venue they will seek medical care (McKee et al., 1990) (see Table 7). In addition, the acceptance that at least some admissions are discretionary allows for the possibility that there will be some elasticity in the decision to admit patients for patients and doctors in relation to increasing distance from a hospital. It is possible that increasing distance results in reduced access for patients to hospital care. Alternatively, patients and doctors may lower their threshold for admission in relation to the need for patients to travel further to receive hospital-based care.
In a logistic regression by Chishaty and Packer (1995) the relative distance to the nearest hospital was an important explanation for increased admissions which along with socio-economic status and age, have accounted for over half of the rise in admissions in their study of North Worcestershire (Chishaty and Packer, 1995).

An increased distance to the nearest hospital resultant from the closure of local rural hospitals during the 1980s has been cited as a reason for increased admission rates in provincial parts of Australia (Gracey and Gee, 1994). Gracey suggested that concern about the distance that must be travelled caused people and their doctors to admit sooner a less severely ill patient, because of the possibility that serious complications might otherwise occur before hospital care could be reached.

By contrast, increasing distance was found to be associated with a reduction in the admission rate for children in New Hampshire (Goodman et al., 1994). In the UK, surveys of urban and rural people clearly found that proximity to a hospital was associated with significantly higher attendance rates as both outpatients and inpatients (Haynes and Bentham, 1982).

Finally, a cross sectional study by McFaul failed to find any significant relationship between increased distance from hospital and admission rates (McFaul et al., 1994).

Conclusion

- An increased distance to the nearest hospital appears to be inconsistently associated with changes in hospital admission rates.

**Increased morbidity: Higher prevalence of ill health or more detection of illnesses?**

Among adults, and especially the elderly, admission rates for cardiac conditions (especially congestive heart failure and cardiac chest pain) and respiratory illnesses have exhibited the largest increases in most countries (Kendrick, 1996; Edwards and Wenneke, 1994) (see Table 8). A review by the Council of International Hospitals found that chest pain admissions in Scotland had increased by 329% between 1981-1995.

Applying age specific rates of heart failure to the New Zealand population implies that there are over 25,000 patients with this condition in this country (Doughty et al., 1997). Hospitalisation is common for people with this condition. On average nearly one in three sufferers will be hospitalised each year resulting in about 8000 annual admissions of 5000 patients with heart failure in this country, 75% of whom are over 65 years of age (Doughty et al., 1995).

The estimated costs associated with their inpatient care now accounts for over 1% of the total health budget.

A similar increase in the number of admissions for people with heart failure was noted by Reitsma et al. (1996) in a time series correlational study in the Netherlands. Reitsma found there had been a significant rise in age adjusted rates of admissions for heart failure in the Netherlands between 1980-1993. Aside from the increasing number of elderly people in the community, other factors could be contributing to an increased prevalence of this disease and an associated rise in hospitalisation rates, including better diagnostic techniques (such as doppler echocardiography) or iatrogenic causes associated with the medication commonly used to treat the condition, such as diuretic induced hypokolaemia (Cody, 1993) or digoxin toxicity (Gosselink et al., 1997).

Finally, a cross-sectional study found that poor compliance with medications was associated with higher rates of hospitalisation for patients with congestive heart failure (Chin and Goldman, 1997).

An increased cautiousness about admitting people presenting with chest pain which may be due to a myocardial infarction, coupled with a realisation about the poor sensitivity, specificity and predictive value of available outpatient diagnostic tests (Zalenski et al., 1997) have all been cited as reasons for the rise in chest pain admissions.

The increase in both heart failure and chest pain admissions could also be due to higher survival rates among patients with an acute myocardial infarction (perhaps related to thrombolysis or medications such as beta-blockers) who are subsequently able to represent with other cardiac problem (Reitsma et al., 1996).

A study by Currie et al. (1997) is also notable because it suggested the prevalence of diabetes may be increasing in the UK. The study used a cross-sectional descriptive design in conjunction with a population modelling exercise to estimate the current, and future, hospital costs for diabetes in a population of 400,000 people in the United Kingdom. The study found that diabetics, although making up only 1.36% of the population, annually occupied over 10% of hospital beds in the area and were responsible for over 9% of inpatient spending. The authors concluded that the prevalence of diabetes was increasing in the region in relation to demographic changes and estimated that the admission rate and costs attributable to the disease would markedly rise over the next 15 years.
Despite the findings in relation to congestive heart failure and diabetes, some doubts exist about the relationship between the prevalence rate of illness in a community and admission rates for the corresponding conditions. Areas that have been found in cross-sectional studies to have the same prevalence rates of various illnesses (Billings et al., 1993) have been noted to exhibit substantial variations in their respective hospital admission rates.

The work of Payne et al. (1994) is particularly important in questioning the relationship between the prevalence of ill health in a community and the hospital admission rates of that region. Payne found that the prevalence rates of diseases estimated by specific surveys in small areas correlated poorly with admission rates for the same diseases. Payne suggested that admission rates did not accurately reflect the prevalence of illness in a community and hospitalisation rates were therefore a poor proxy indicator for morbidity in a community. Changes in the rate of hospital admission for a condition was therefore an unreliable marker of any underlying alteration in the prevalence of a condition in an area.

For children, gastroenteritis and respiratory conditions are common reasons for emergency medical admission (Read et al., 1994). An increasing number of paediatric acute medical admissions may be related to the development of more severe forms of pathological gastroenteritis infections in children (Shears and Wight, 1995).

Increasing evidence is now accumulating that the prevalence of childhood asthma may be increasing (Stevens and Raftery, 1994). An increase in the prevalence of asthma could explain the rising number of admissions for this condition that was recorded in a time series analysis over the last decade by (Johnston et al., 1996).

Although the prevalence of asthma and the pathogenicity of certain gastrointestinal infections may have increased, there is little other evidence of a genuine rise in disease incidence and prevalence amongst children (Kun et al., 1993; National Association of Health Authorities and Trusts, 1994).

(Hobbs, 1995) has suggested that more available diagnostic facilities and more sensitive tests have increased the ability to diagnose conditions that ultimately increase the demand for hospital care.

Capewell (1996) has also described the presence of “icebergs of disease” in the community where closer or more detailed diagnostic interventions will reveal more cases needing care often involving acute inpatient services. This is particularly true for patients presenting with chest pain where improved investigations and more effective interventions have markedly lead to an increase in the number of admissions for myocardial infarction (Edlavitch et al., 1991; Weston et al., 1994). A related view is that admissions may be increasing because of improved emergency services. That is, more patients have survived to be admitted than was previously possible (Roberts et al., 1996).

Allied to these changes has been the increasing availability of more specialised units for the care of chronic illness e.g. the development of Specialised Stroke Units; (Langhorne, 1997) and new interventions for patients with chronic illness (such as laser treatment for patients with diabetic eye emergencies; (Capewell, 1996)). Better investigations and more specialised care for people with vascular problems have been shown to have lead to a rapid upsurge in the number of people admitted to hospital with vascular problems in the United Kingdom. Many of these people would previously have been managed conservatively within the community (Whiteley et al., 1996).

Finally, the appearance of some new diseases, especially AIDS, has substantially escalated hospital admission rates in some countries (Beck et al., 1994; Dijkgraaf et al., 1994) although recent years have shown some reversal of this trend (Peyron et al., 1997). By contrast, AIDS has had a limited impact on rising admission numbers in New Zealand (Hyland et al., 1997).

Conclusions

- Increased acute medical admissions may be related to a rise in the underlying prevalence of various medical conditions, particularly congestive heart failure and diabetes. Alternatively increases in the prevalence of these medical conditions may be due to demographic changes, improvements in survival or even more frequent iatrogenic problems related to an increase in the number of people receiving pharmaceutical treatments. More admissions may be the result of the increased availability of diagnostic facilities to identify previously hidden ‘icebergs of disease’ in populations. Unfortunately no clear evidence is available to confirm or refute these causal relationships. The limitations associated with the mainly descriptive study designs used in the literature (see Table 8) prevent any causal inferences from being made.

- There is significant doubt in the literature about the efficacy of using hospitalisation data as an indicator of the prevalence of disease in a community. Some resolution of the issue of whether rates of hospital admission can serve as a proxy for the prevalence rates of various diseases might be found in a closer consideration of dis-
ease-specific hospital admission rates. It is possible that conditions with a high prevalence but low mortality (such as arthritis) may not correlate as well with medical admission rates as those conditions that are characterised by both high prevalence and high mortality (for example, ischaemic heart disease or various forms of cancer).

**Increased risk factors for ill-health**

Aside from socio-economic status, other health status determinants have been linked to admission rates by means of ecological studies (see Table 9). Time series studies which can allow for more exploration of causal issues within an essentially ecological framework have also shown that an increase in population levels of alcohol or tobacco consumption are related to increases in hospital admission rates (Muller, 1996). Regression analysis incorporating a number of the likely determinants of hospital admission found alcohol consumption was an important determinant in 10-30% of hospital admissions in the US in the early 1990s (Muller, 1996).

A number of cross-sectional studies have found that smoking (Vogt and Schweitzer, 1985; Tsai et al., 1990) or a high intake of alcohol (Rivara et al., 1993) were each associated with a significant excess risk of hospital admission. The additional risk for smokers was found to be particularly high and in the order of an annual increased risk of hospitalisation by 40-60%. Similarly, a case control trial by Wagner et al. (1995b) found that persistent smokers had a 30-45% increase in hospital admissions over five years. This result is consistent with a New Zealand cross-sectional study that found that, after ethnicity and educational achievement had been controlled for, maternal smoking lead to a 50% increase in hospital admission in the first year of life (Robertson et al., 1993).

**Conclusion**

- Although the study designs that have been used are subject to significant methodological deficiencies, there is some consistent evidence that an increased rate of hospital admissions in a population could be related to increases in the population’s average consumption of alcohol or tobacco.

**Increased expectations of patients**

Some of the rise in acute admissions may be due to changes in the perceptions of people with regard to what an emergency is, what they can do for themselves, or what others can and should do to assist them.

Some people inappropriately delay seeking help for medical emergencies which then substantially contributes to the seriousness of their condition and leads to the need for hospitalisation when earlier treatment might have allowed for effective outpatient based care (Petch, 1991) (see Table 10). Some people do not use primary care services because they may not be well integrated into society. These people include some ethnic groups and members of lower socio-economic groups (Malone, 1995).

People may not use a service because they are unaware of its existence, or if they do use the service, they may not adhere to the advice they have received. Kovacs et al. (1995) has described the strong association between hospital admission and the poor compliance with treatment among a group young diabetics. A small cohort study in Christchurch (O’Hagan et al., 1996) found that the 31 patients interviewed in the study generally had a poor understanding of their illness and its community-based treatment options. A significant reason for these patients with chronic obstructive pulmonary disease being admitted to hospital with an infective exacerbation was their lack of appreciation that any further treatment was available for them in the community (O’Hagan et al., 1996). Allied to the patient’s low expectation from primary care was their lack of awareness about community-based outreach, rehabilitation and support services. However, the report’s conclusions must be judged in the light of its small sample size and its lack of a control group.

An ecological pointer to the role of consumer demand in the rising number of emergency admissions comes from a comparison of admissions in countries regarded to have a higher or lower consumer-oriented health system (Fleming, 1992). Emergency admissions as a percentage of all admissions have been found to be very high in systems defined as being consumer-oriented (such as Germany), compared with more professionally dominated systems (such as the UK) where emergency admissions have always comprised a lower percentage of all hospital discharges. Although in parallel with the rise of the Patient’s Charter and other consumer-based legislation in the UK, this percentage has been noted to be increasing (Hobbs, 1995).

A number of clinicians have suggested there has been a rise in patient expectations that emergency care should be accessible and a greater willingness by them to use this care (Capewell, 1996).

**Conclusion**

- It is plausible that changes in patient expectations along with their health care seeking behaviour may have contributed to an increase in medical admissions. However, little robust evi-
dence is available to prove (or refute) this possibility.

**FACTORs RELATED TO THE GATEKEEPERS**

**Behaviour of GPs and hospital admitting staff**

The influence of the number and behaviour of GPs (and other health professionals) on the admissions process is complex and requires some description before the importance of these variables can be assessed in relation to their potential influence on rising admission numbers.

Hospital admission rates amongst GPs have been found to vary by at least three to fourfold (Roland and Coulter, 1992; Wilkins and Mao, 1993). Most of this variation cannot be accounted for by differences in the demographic composition of the patient populations (Roland and Coulter, 1992; Wennberg et al., 1989; Wenerke and MacFaul, 1996). This discrepancy implies GP behaviour may have an important influence on admission rates. Consequently, a change in the behaviour of GPs has been cited as an important determinant of rising medical admission numbers (Capewell, 1996; Hobbs, 1995).

Several small area studies have concluded that the most significant underlying cause for variations in admitting doctor behaviour are professional uncertainty about the effectiveness of either inpatient or outpatient treatments, allied with strong economic incentives to admit patients (Wennberg et al., 1982) (see Table 11).

More recently, other authors have stated that the role of any single doctor (especially the GP) in admitting patients may be overestimated. Two cross-sectional studies based in the United Kingdom have found that the GP was involved in only half of the emergency medical admissions at two separate hospitals (Hobbs, 1995; Jankowski and Mandal, 1993). Instead of relatively experienced GPs, it is possible that rising admissions are more closely related to increasing difficulties in requiring relatively young and inexperienced junior doctors to act as gatekeepers (either in EDs or in deputising services). Perhaps not surprisingly, these young doctors often practice defensively and admit patients who might equally have been able to receive appropriate outpatient-based care (Houghton and Hopkins, 1996).

Some commentators have suggested the discretion of junior doctors to admit patients has been aided by broadened admitting criteria in many emergency departments (Longley and Warner, 1995).

The audit by Houghton et al. (1996) also provided an interesting insight into the admitting behaviour of hospital-based specialists. The report concluded that an increasing number of medical admissions might be due to the increasing specialisation of the medical teams who were required to undertake on-call duties. That is, more specialisation by medical teams doing on call work led them to be less experienced with many of the acute problems that were referred to them, hence they were increasingly required to admit the patient to arrange the relevant specialist input (Houghton and Hopkins, 1996). Related to this was the increasing inability of many specialist teams to offer telephone support to GPs as an alternative to admission out of hours (Houghton and Hopkins, 1996).

Several commentators have suggested that increased fears of litigation among GPs was also more likely to lead them to practise defensive medicine and admit patients for whom they may have previously accepted some risk and managed in the community (Longley and Warner, 1995; McGlennon and Noble-Partridge, 1995). A recent small and non-random survey found that over 70% of GPs reported that the risk of litigation was an increasing factor for them in deciding whether they admitted patients (Hensher and Edwards, 1996).

Chambers (1996) points to another reason for the increase in admissions with her hypothesis that low morale among primary care doctors has resulted in their reluctance to accept a more demanding management option and maintain a patient under their care in the community when that patient suffers some serious lapse in their health.

In contrast with these findings, two recent studies have found there is no relationship between physician behaviour and admission rates. These studies, although based in different countries (and each having different study designs), both concluded that practitioner behaviour is relatively unimportant compared to the influence of the socio-economic status of the patient in determining the likelihood of admission. The studies by Komaromy et al. (1996) and Lissauer et al. (1993) are important because they imply that physicians are primarily responsive (either consciously or unconsciously) to patient disadvantage in their decisions about hospital admission.

A corollary of this conclusion is that attempts to alter physician admitting behaviour (e.g. by guidelines or utilisation review) may be counter productive because they may further limit access to care for the disadvantaged. If physicians alter their threshold to admission on the basis of socio-economic status, reducing hospitalisation rates by changing physician admitting behaviour may undermine access to healthcare for the poor.
However, both studies have significant limitations. In the case of Komaromy, the data was derived from doctors' responses to clinical vignettes and therefore might not accurately represent their behaviour in relation to actual cases. The study by Lissauer was small and the findings might have been influenced by measurement bias.

Another viewpoint on the relationship between patient socio-economic status and GP admitting behaviour comes from a retrospective cohort study by Rosenthal et al. (1997). Rosenthal found that more admissions for patients with low severity conditions occurred among poor and homeless people and suggested that physicians adjusted their threshold for admitting disadvantaged people.

**The number of GPs**

A closely related issue to the admitting behaviour of GPs is their relative number in a region. A correlational study by Parchman and Culler (1994), which examined the admission rates of ambulatory care sensitive conditions and the number of primary care physicians in areas of Pennsylvania, found that the regions with less primary care physicians had significantly higher admission rates for conditions that could supposedly be prevented with appropriate ambulatory care. The implication from this work is that a relative decrease in the number of GPs in a region could be a possible explanation for a rise in admissions in that area.

By contrast, Krakauer et al. (1996) using a cross-sectional design, found that primary care physician supply had no significant association with hospital admission rates for all conditions and especially those conditions that were assumed to be sensitive to ambulatory care (Krakauer et al., 1996). This result was also noted by Hider (1997) in a small study based in the South Island of New Zealand. Both Krakauer and Hider found that socio-economic status was a more important determinant of hospital admission than physician supply.

The inference is that altering levels of providers (or access to them) may not have any influence on hospital admission levels. Given that most countries have ample evidence of a relative increase in practitioner supply over the last two decades (Barnett, 1991; Hider, 1997) it would seem that the relationship between GPs and hospital admission rates must be more subtle than quantitative changes between the two variables.

Further information comes from a qualitative study using the Delphi technique and focus group interviews which identified a number of issues about GP behaviour that may be important in increasing admission rates (McColl et al., 1994). Limited GP knowledge and information, relationships with consultants, and their perceptions of the significant benefits of secondary care might be important factors underlying the increasing rate of admissions.

Overall there is a lack of information, particularly quantitative information, about the provider characteristics that might explain the variation in admitting rates between doctors at any one time and certainly over a period of time (Roland and Coulter, 1992). A significant difficulty has been the need for research to be able to distinguish between random variation and systematic differences - that is, to have sufficient statistical power to find any significant difference when they truly exist (Hobbs, 1995). The few studies that have examined the admitting behaviour of practitioners are primarily focused on referral to outpatient clinics (Roland and Coulter, 1992). Most acute admissions bypass this route and are referred directly to hospital or via the ED department, and very little analysis has been undertaken on these circumstances (Harrison and Prentice, 1995).

Other health professionals apart from GPs and hospital-based junior doctors are also important in maintaining chronically ill patients in the community or facilitating the admission of acutely ill patients. While data about the acute admitting behaviour of GPs is limited, information about the admitting behaviour of either community, or hospital-based, specialist doctors and nurses is almost non-existent. An exception is the cross-sectional study by Baumer et al. (1997) which examined the admitting rates of children with diabetes who primarily received their medical care from a variety of community or hospital based practitioners. Baumer found that admission rates were higher for patients who received their medical care at a hospital-based outpatient centre, primarily from a nurse specialist (especially nurses with case loads of less than 40 patients) or a non-specialist paediatrician while medical specialists admitting rates were lower. In general, however, practitioners with higher caseloads and those who provided care based in a specialist unit were associated with the lowest admission rates.

Although there are problems with confounding in this study by differences in case mix between the different types of practitioner, it is difficult to conclude from the study that an increase in the type of practitioners who were associated with higher rates of admission may be a contributing factor in the trend for rising medical emergency admissions.

**Conclusion**

- It appears that the characteristics (their number or behaviour) of the admitting doctor are a relatively unimportant determinant of acute medical admission rates and hence strategies aimed at
Some commentators have attempted to relate the increased amount of out-of-hours work which has been provided in an expanding range of novel settings causally to the rise in acute medical admissions (Pancheon et al., 1995). It has been suggested that the threshold for hospital admission may have fallen for all GPs, but more specifically for deputising doctors in relation to an increase in litigation or limited information about the patient (National Association of Health Authorities and Trusts, 1994).

A review of the literature discussing after-hours clinics by Pancheon et al. (1995) found that although some opinion suggested they were likely to make primary care more complicated and unco-ordinated, a number of positive features have anecdotally emerged from these centres including:

- Reliable availability – there is always a doctor in a set location.
- More comprehensive care, – out-of-hours clinics often have X-ray facilities and a pharmacy on-site.
- Better workload – allowing the doctor to be more alert and less stressed, along with their GP colleagues.
- Professional support – having a number of doctors working together improves professional support and peer review while working.
- Working preferences – many GPs prefer shorter but more intensive working periods (Pancheon et al., 1995). Many GPs may prefer to work in a purpose-built out-of-hours facility with its additional services e.g. X-Ray (Pancheon et al., 1995).

Other commentators have warned that good quality primary care may be undermined by the presence of these clinics because there is a risk they might be used as the main primary care provider by people who find it more convenient to attend a doctor in the evening. Some have argued that these centres actually fragment and destabilise health care (Luke, 1994).

It is possible that patient expectations, a lack of local caregivers or transport may be responsible for this rise in out-of-hours calls, or it could be related to lower socio-economic status and the unavailability of a car among patients.

A variety of centres exist to provide different types of emergency care (Virji, 1992). More GPs now belong to IPAs and have coordinated out-of-hours rosters at clinics that may even employ full-time doctors thereby relieving the usual GPs even further of the necessity of providing care outside normal working hours.

A tension exists between ensuring job satisfaction for GPs with reasonable hours of work and providing patients with appropriate continuity of care. This tension may be especially important in relation to rising rates of hospital admission for (usually) elderly patients with serious co-morbidities. These patients may be especially prone to inappropriate admission as a consequence of having their primary care managed by possibly less experienced doctors who will be unfamiliar with the patient’s past medical history and may also be unable to access their case notes.

Poole using a retrospective case control study design found that admissions increased by 13% when patients were seen by a locum or deputising service (Poole et al., 1996) (see Table 12). It was postulated that doctors in deputising services might cautiously admit patients for whom no past history was available, or doctors in deputising services might be less experienced than general practitioners and have a lower threshold for hospital admission.

The only located randomised controlled trial of after-hours care provided by either practice doctors or deputising doctors found there was no difference between the practitioners in their hospital admission rates, although the two groups did exhibit significant variations in other aspects of their processes of care (Cragg et al., 1997). Practice doctors were more likely to give telephone advice, took less time to visit at home and had more discriminating prescribing habits. Patients were also more satisfied with the care provided by practice doctors, although subsequent practice visits did not vary between the two groups (McKinlay et al., 1997). However, both studies did not describe the baseline characteristics of their respective populations and their follow-up.

A small non-random survey found that most GPs would be unlikely to alter their admitting behaviour in relation to whether they were working in a deputising agency or their own practice - 37% of GPs working in deputising services stated that they would...
be more likely to admit a patient than if the same person was seen with the same clinical problem in their own practice (Hensher and Edwards, 1996). However, the study was based on the responses of a group of GPs to a questionnaire, which may not accurately reflect their actual clinical practice. It would seem plausible that GPs who were required to make decisions about whether to admit a patient with a complex medical condition(s) about which they were provided only limited historical detail, and in the absence of any access to a patient’s case notes, would invariably opt for the relative safety of inpatient care. Another possibility that was not explored by Hensher is that the doctors who work in deputising services may be less experienced than those GPs who have their own practice.

Patient satisfaction surveys offer mixed results. Some patients appear to be equally satisfied with GP care as that offered by deputising services (Dixon and Williams, 1988) while other patients value the convenience of visiting a surgery that requires no appointment and which has longer opening hours (Rizos et al., 1990). Another survey found most patients appreciated the continuous relationship they had established with their usual practice GP and were less satisfied with the provision of episodic care provided by deputising services (Maxwell and Toby, 1993).

The results of patient satisfaction surveys mirror the debate between patient demands for consistent advice from a primary provider of care versus the convenience of receiving care when social, rather than medical factors dictate (Maxwell and Toby, 1993).

Conclusions

- There is considerable uncertainty as to whether new co-operative clinics providing out-of-hours GP care increase admissions as doctors working in them refer patients they do not know to hospital more frequently in order to be medicolegally safe or if they have no net effect, or even reduce admission rates. No cost-effectiveness studies have been undertaken on the different types of after-hours care (Pancheon et al., 1995). In particular, no analyses have been undertaken to deduce the optimal out-of-hours arrangements for the elderly, or other patients, with serious chronic medical conditions.

- Even if doctors in after-hours clinics do admit a higher proportion of patients, it may still be preferable to have these centres to enable the GP to concentrate on delivering quality care during the day and prevent them from developing feelings of omni-availability which may be a liability to their own health and that of their family’s (Hurwitz, 1994).

Iatrogenic causes

A number of studies have collectively identified an excess number of admissions among patients receiving various types of medications in comparison with population-based controls (see Table 13). For example, Gutthann et al. (1996) found that patients receiving non-steroidal inflammatories had a greater than 400% increased risk of hospital admission for acute renal failure compared to matched controls. In light of these findings, some commentators have suggested that the increased number of acute admissions may be associated with an increase in the frequency of iatrogenic problems (Capewell, 1996).

Several studies have examined the frequency of drug-related admissions to hospital using a retrospective cross-sectional design and assuming causation if a typical reaction occurred in a patient receiving a particular drug. A sample of these studies was described by Jankel and Fitterman (1993) and is shown at the end of this section.

Although these studies probably overstate the incidence of iatrogenic admissions (because they report potential rather than actual reactions) they do illustrate the important potential contribution of iatrogenic illness to the total number of admissions, and the possibility that an increase in these admissions may be an important factor in the increased number of hospital admissions. Several studies, principally based on elderly rest home residents, have directly explored this possibility (for example, Fried and Mor 1997). Fried reported a strong association between the prescription of a new medication and a markedly increased risk of hospitalisation and an increasing number of medication-related admissions. Although Fried concluded that iatrogenic causes were increasingly precipitating the need for hospital care, the finding could also be due to the possibility that the new illness, for which the medication was provided, was the actual cause of the admission.

Several studies of drug-related illnesses (DRIs) have found that DRIs account for around 5% of hospital admissions (Denneyh, 1996; Ives et al., 1987) - although the figure is higher when drug abuse has also been included in the study (Prince et al., 1992). Factors contributing to these drug-related illnesses (in relatively even proportions) include inappropriate prescribing, poor compliance and drug interactions (Denneyh, 1996). Although up to 10% of admissions may be drug-related, it has been estimated by peer review that as few as 3% of these admissions may be avoidable iatrogenic admissions (Hallas et al., 1993).
Drug-related admissions are especially common with certain medications, specifically anticoagulants and insulin (Dennehy, 1996). In New Zealand, rising numbers of prescriptions for (mainly) insulin and anticoagulants (Pharmac, Annual Report, 1997) may be contributing to an increasing number of iatrogenic admissions.

A related issue is the problem of iatrogenic illnesses that are associated with inpatient care and which result in either a prolonged hospital stay or readmission for a problem in addition to that for which the patient was originally admitted (Brooks et al., 1994).

**Conclusion**

- Iatrogenic illness appears to be a likely factor underlying the rise in acute medical admissions although its relative importance and preventability remains uncertain.

**Relationship between rising ED attendance and acute admissions**

The rise in acute admissions parallels a similar increase in the attendance rates at emergency departments (Kings Fund, 1996). Allied to the increased number of patients, overcrowding has also been fostered by changes in medical practice that have seen increased amounts of patient intervention in the ED, especially of seriously ill patients (National Health Strategy, 1992).

Liggins has reviewed the literature surrounding the rise in emergency department use and has found that similar underlying factors to those influencing the increase in acute admissions were also important in the escalating number of ED consultations. In particular, these factors included alterations in the socioeconomic status and demography of the local population, differences in the perceptions of doctors and patients, and changes in the organisation of care including the increasing variety of developments in after-hours GP care (Liggins, 1993). Not surprisingly, therefore, those groups that are at high risk for admission are also high users of emergency department services.

Numerous cross-sectional studies have also documented the excess hospital admission rate and ED attendance rate of groups that may be increasing in the population such as the elderly (Parboosingh, 1987) and the less affluent (Grumbach et al., 1993; Hurley et al., 1989).

Therefore it appears there are similar and related causes for the rise in ED utilisation along with the increased number of medical admissions. What is unclear is whether a larger proportion of the population is now obtaining their medical care from the ED in lieu of other primary care practitioners, and whether this increase could then be another explanatory factor in the increased number of medical admissions.

**FACTORS RELATED TO HEALTH CARE ORGANISATIONS**

**More available beds and Roemer’s Law**

Supply side factors are also important in the increase in urgent medical admissions (see Table 14). A large number of studies have conclusively found that having more available hospital beds for acute medical admissions in an area will increase the utilisation of these beds (Capewell, 1996, Kirkup and Forster, 1990). This association between supply and utilisation (known as Roemer’s Law) has been found in a large number of studies based in a variety of regions in a number of countries, and the association has been found consistently using either adults or children as the study population (Evans, 1984).

An important study undertaken by Wennberg found that in relation to Roemer’s Law, areas in the US with a higher proportion of hospital beds also had higher rates of hospital admission for patients with a wide range of illness severity (Wennberg and Cooper, 1996). Wennberg (1996) has argued that the key to understanding the general increase in bed usage by patients with all degrees of severity of illness is the effect of excess capacity upon clinical judgement. That is, the main effect of increasing the number of hospital beds in an area is to reduce the threshold for admission at all levels of patient illness severity i.e. very sick are admitted more often as well as the less sick. According to Wennberg, there is a general lack of studies indicating whether the benefits of hospital care exceed the risks for a number of specific medical conditions and levels of illness studies. In particular, ecological studies have not shown that increased hospitalisations improve life expectancy (Wennberg and Cooper, 1996).

The net result of this general clinical uncertainty is that patients at all levels of illness severity will be more likely to be admitted if a bed is available. Closely allied to this are the strong incentives to admit patients, including the likelihood that an inappropriate admission will receive much less criticism than the inappropriate sending home of a patient (Edwards, 1997).

Small area analysis is the methodology commonly employed by these studies. The major strength of this methodology, according to Wennberg, is its capacity to examine the issue of variations in rates at the aggregate supply level rather than at the level of the appropriateness of individual admissions, which can
be more complex, and sometimes less rewarding. These studies use benchmarking rather than a group consensus approach or randomised controlled trial evidence or appropriateness criteria to derive the optimum admission level (Wennberg, 1996). However, caution must be exercised with their conclusions because the study design does not permit any definitive conclusions about cause and effect and the findings can only be applied to a population and not individuals. Furthermore, the studies may not have included other factors that may be important in determining admissions (for example, socio-economic status) or the variables used in the study may actually be surrogates for other more important determinants of hospitalisation.

Although consistent evidence is available that an increased supply of hospital beds is associated with their higher utilisation, two important issues related to changes in the number of available beds have not been adequately addressed in the literature. These issues are the effect of large and rapid reductions in the total bed supply upon utilisation and the importance of changes in the ratio of acute beds to rehabilitation/long-stay beds on hospital admission rates.

The lack of information on these issues is of particular significance in relation to current changes in bed supply in many western countries. In the UK, total bed supply has rapidly decreased over the last decade in conjunction with a decrease in the proportion of beds available for acute care (Department of Health, 1994).

Over the last two decades, the number of public hospitals has decreased in New Zealand (from 189 in 1980 to 117 in 1997). In relation to this decrease, the number of hospital beds has also declined since 1970 (see Figure 3). Unfortunately there is a conspicuous lack of published information on any changes in the number of medical beds in public hospitals in New Zealand over the last two decades. However, despite this lack of long-term data some limited information is available for the period 1990-1997 to describe the actual number of licensed medical beds and changes in the ratio of acute medical beds to other types of inpatient beds (see Table 15). This data suggests that both the number of medical beds and the ratio have decreased between 1990 and 1997 (medical beds reduced from 3537 in 1990 to 2753 in 1997, and the ratio has declined from 0.29 in 1990 to 0.22 in 1997). These reductions in both the number of medical beds and their ratio to the number of other types of hospital beds appears to be most apparent between 1990-1992 and subsequently both numbers have remained stable over the last five years (1993-1997).

It must be recognised, though, that a significant limitation with this data is that it is based on the number of hospital beds licensed by the Ministry of Health for medical care and does not necessarily represent the actual number of beds used for acute medical admissions. Rural hospitals, in particular, may have their beds licensed for several different types of admissions (e.g. Waikari Hospital in North Canterbury has 11 beds that have been licensed for medical, maternity or geriatric care).

The dearth of available long-term information on the number of acute medical beds as well as the ratio of these beds to the total number of hospital beds in New Zealand prevents any detailed investigation of the theoretical possibility suggested by Roemer's Law that an increase in the rate of acute medical admissions may be related to an escalating number of available hospital beds. The limited information available from the last eight years suggests bed supply has been decreasing. This reduction in bed supply does not appear to be compatible with an explanation based on Roemer's Law.

Another possibility is that the reduction in the average length of stay of acute medical inpatients in New Zealand over the last decade could be associated with a rise in the number of available medical beds (given that bedstock appears to have been relatively stable between 1993-1997). The increase in available beds resultant from a higher turnover of patients is compatible with an explanation based on Roemer's Law.

It is also possible that a previous availability of more designated acute beds (or more long-stay beds that could be seconded for acute care) may have accommodated past increases in the demand for care while a recent reduction in acute bed stock has now exposed escalating rates of utilisation. Some support for this theory comes from the decline in the ratio of the number of licensed medical beds to the number of beds licensed for other types of inpatient care over the period 1990-1997 (in 1990 ratio = 0.29, 1997 ratio=0.22).

**The related concept of bed-blocking**

A related concept to inappropriate admission is the inappropriate utilisation of a hospital bed by a patient who has already stayed more than 28 days. Factors associated with prolonged stay have been identified in previous studies and closely correlate to predictors of hospital admission. They include dementia or confusion (Beech et al., 1987), immobility (Farag and Tinker, 1985), increasing age (Anderson et al., 1988) or living alone (Anderson et al., 1988). Most studies have examined these factors in isolation and not adjusted for confounding between them, although Anderson et al. (1988) and Beech et al. (1987) are notable exceptions. The most important predictors of long-term stay in these two studies that used logistic regression to separate out the influence of each predictor of admission were: age, living alone on dis-
charge, and impaired mental state (Beech et al., 1987; Anderson et al., 1988).

Despite the close relationship between the determinants of hospital admission and prolonged length of stay, interventions to reduce the effect of either would likely increase the other. A small audit by Roberts and Houghton (1996) found that the inappropriate use of beds by patients waiting for placement in elderly residential homes was a major problem in restricting the number of available acute beds and reducing the admission rate. Reducing bed-blocking was found to increase acute admissions although it was not clear that more appropriate admissions resulted from the intervention.

Conclusions

- Unfortunately there is insufficient high-quality data to make any definite conclusions about the availability of hospital beds for medical admissions as a clear explanation for the rising number of admissions in New Zealand.

- The elimination of patients who are inappropriately occupying a medical hospital bed may increase the capacity of acute hospitals to meet the rise in demand. Alternatively, an increase in the supply of beds might also increase hospital utilisation.

Longer elective waiting lists

The literature offers a few (mainly anecdotal) examples of patients being admitted acutely whilst on a waiting list for a procedure either because of genuine deterioration or simply in order to bypass the queue (McGlennon and Noble-Partridge, 1995) (see Table 16). Generally it appears there is little evidence that patients on waiting lists could explain the rise in acute medical admissions. Most of the available studies report cases in relation to surgical (not medical) conditions. In addition, an audit of emergency admissions in the United Kingdom found that the rising number of acute admissions could not be accounted for by patients already on a waiting list, nor was there any evidence of large-scale abuse of the emergency admission category by clinicians admitting patients acutely in order to circumvent a waiting list (Edwards and Weneke, 1994).

Conclusion

- The limited available evidence suggests an increase in acute medical admissions cannot be related to longer waiting lists for elective procedures.

Increasing readmissions

A number of authors have proposed that a significant proportion of the rise in acute medical admissions might be due to readmissions (Hobbs, 1995; National Association of Health Authorities and Trusts, 1994; Longley and Warner, 1995). Recently a number of studies have provided some evidence for this assertion (see Table 17). A notable example is the Oxford Record Linkage series of studies which found that a large contribution (nearly one third) to the increased number of hospital admissions between 1968 and 1987 was an increase in the number of readmissions (Henderson et al., 1989; Goldacre et al., 1993; Goldacre and Ferguson, 1995).

In Scotland, Kendrick (1996) found readmissions accounted for 14% of the rise in admissions between 1981 and 1994. Similarly Blatchford and Capewell, (1997) noted that the number of people readmitted in the entire UK had doubled between 1981-1994 whereas the proportion of the population who had been admitted to hospital in any year remained constant.

The rise in readmissions in these studies was closely aligned with a reduction in the length of stay for each admission. In Australia, MacIntyre et al. (1997) has also shown that a reduced length of stay is correlated to an increased rate of readmissions. In light of these findings, several authors have discussed ‘revolving door’ admissions as a consequence of the trend to discharge patients “sicker and quicker” (Capewell, 1996; Hobbs, 1995).

Using data linkage and a cross-sectional design Newton and Goldacre (1993) found that increasing age was strongly associated with an increasing number of hospital readmissions in the UK. Newton noted that a significant number of admissions were elderly patients with chronic conditions oscillating between community care and a public hospital.

Another prominent group of patients who have been found to be more likely to be readmitted a number of times in a year are the young low birthweight babies who required neonatal intensive care at birth (Hill, 1989; Mutch et al., 1992). A case control study at Sheffield found that these babies made up the largest proportion of children who were readmitted to hospital during one year (Spencer et al., 1993a). Low birth weight contributed to a higher rate of readmissions than the any other predictor variable. Young mothers and low socio-economic status were the next two most common variables).

Hospital readmission rates among all age groups of children have substantially increased (by up to 30%) over the last decade (Spencer and Lewis, 1991; Hill, 1989). Interestingly, Hill attributed this rise to the
reduction in the average length of inpatient stay that has been frequently associated with the increasing readmission rate. Hill suggested that a lower admission threshold among primary care doctors might be associated with the increased availability of beds that had resulted from the diminishing average lengths of stay of inpatients.

New Zealand-based studies have found mixed results. The Performance Monitoring and Review Section of the Ministry of Health examined readmissions rates in the years 1988/89 to 1994/5 (Performance Monitoring and Review Section, 1995). By comparing the number of episodes of care with the number of different people admitted, the study concluded that more individuals being admitted over the study period had accounted for the rise in medical admissions (rather than a change in the number of the individuals who had undergone more frequent (re)admissions). The report found there was no evidence that readmission rates had increased over the study period.

The relatively modest readmission rate across the country (7.5% in 1996/7) (Ministry of Health Performance Monitoring Unit, 1998) and the absence of any significant increase in this rate between 1988/9 and 1994/5 (Performance Monitoring and Review Section, 1995) suggest readmissions may not be a useful area to focus on in any review of the causes of rising acute medical admissions.

By contrast, an analysis of health care contacts made by a sample of patients from six general practices in the Otago region between 1992 and 1994 (Royal New Zealand College of General Practitioners, 1995) found that among the small, non-random sample of patients the annual number of readmissions had increased.

Some commentators have argued that readmission (especially within 30 days of discharge) represents a sign of poor quality inpatient care. The number of readmissions has been used by a number of monitoring groups as a proxy measure of the outcome of inpatient care (Gold et al., 1998).

There is some debate about the validity of readmission rates as a proxy indicator of the quality of inpatient care. While Ashton et al. (1995) found that readmission was a sensitive indicator, Hayward et al. (1993) concluded the opposite. At least in part, the different findings from these two studies may be due to the different conditions included in the reviews and the partly subjective nature of what constitutes good quality care.

Conclusions

- Uncertainty exists in the literature about what proportion of the increase in admissions could be accounted for by a rise in readmissions. Although overseas studies have generally found that readmissions comprise a significant proportion of the increase in admissions the largest New Zealand-based review failed to record any significant role from readmissions to the increase in hospitalisations during the period 1988/9 to 1994/5 (Performance Monitoring and Review Section, 1995). The findings from the Performance and Monitoring Review Section of the Ministry of Health are surprising because overseas work has clearly associated a rise in the number of admissions for the elderly and a reduced length of inpatient stay with an increase in hospital readmission rates. There is ample evidence in New Zealand of both an increase in elderly admissions and a reduction in the duration of stay (see Section One). A possible resolution for this apparent discrepancy may be found in the precept that the total number of re-admissions may be too coarse a grouping to provide useful information. At least three main groups of readmissions can be identified: patients with endstage disease requiring frequent admissions as part of their terminal illness, patients with exacerbations of episodic illness for whom readmission may be an indicator of the inadequate quality of their outpatient care (see Section Two) and patients undergoing hospital procedures (or operations) for whom readmission may more accurately represent poor quality inpatient care. Different studies may have included different proportions of each of these three groups and therefore may have been subject to confounding by differences in the quality of the outpatient care or inpatient care that was received. Studies examining readmission rates might be more useful if they defined which of these groups of patients they had included in their research.

**Economic incentives**

Diagnosis Related Group (DRG) volume contracts, where each admission attracts a payment, provide a significant economic incentive for hospitals to increase admission rates. Furthermore, the additional incentive is for hospitals to reduce the length of stay for patients in order to receive money when services were not given. Several studies have found that the introduction of DRG volume payments are associated with increased admission rates (e.g. Alonso et al., 1996; Fitzgerald et al., 1988) (see Table 18). It should be noted that other time-related factors could also explain the results obtained in these quasi-experimental studies.

Two further economic factors related to rising acute admissions are proposed in a Swiss study by Perneger et al. (1997) - hospital co-payments and fee
for service GPs. Perneger using a cross-sectional study design, found that co-payments existed for outpatient care but not for hospital care, creating a financial incentive for patients or their agents to hospitalise rather than treat as an outpatient. In addition, Perneger suggested that fee-for-service practitioners may find it harder to regulate the demand for hospitalisation of patients and thereby function less efficiently as gatekeepers because their incentive is to do what the patient pays them to do.

The financial incentives that exist in primary care might also be an important determinant of the increasing number of emergency hospital admissions. Financial incentives exist for rest home owners and attending physicians to admit patients rather than provide intensive, medical therapy to residents on-site. A cross-sectional study by Brooks et al. (1994) found that hospital admission for rest home residents was common and often for relatively minor illnesses. Furthermore, physicians in nearly two-thirds of cases did not actually visit and examine rest home patients prior to sending them to hospital. Brooks suggested that many admissions were due to there being insufficient reimbursement for doctors to visit acutely ill patients combined with inadequate resources being available to rest homes to care for the acutely sick.

Finally, important possible influences on the admitting behaviour of GPs are the economic incentives present in their new funding arrangements. Fundholding (where GPs are prospectively allocated a budget for the provision of nominated services) has been in widespread use in the UK for about seven years (Wilton and Smith, 1998). A small longitudinal study by Boersma in the United Kingdom found that admission rates for fundholding GPs increased only slightly (8%) over a two-year period while emergency admission rates for non-fundholding GPs increased by over 47% (Boersma, 1996). Boersma compared the hospital admission rates in 1994 and 1995 between patients in 30 fundholding practices (145,000 patients) with patients in 16 practices that were non-fundholders (165,000). The study by Boersma, although small and lacking in methodological rigour, is important as a rare example of an evaluation of the hypothesis that fundholding practices would respond to the economic incentive to control costs by admitting fewer patients who did not need hospitalisation.

Although Boersma concluded that the economic incentives in fundholding practices were important in curtailing any increase in the number of admissions, other explanations are also possible. Hospital admission is a relatively rare event and the study was conducted over a short period such that relatively few admissions could be expected to have occurred. It is therefore possible that the study had insufficient power to find any difference in the number of admissions. The study was also not based on representative samples of patients and it is possible the result was due to other differences in the patient populations.

Two larger and more methodologically rigorous studies than Boersma’s both found that fundholding practices were not associated with lower emergency admission rates in comparison with non-fundholding practices. A retrospective cross-sectional study by Duffield et al. (1997) found that both fundholding practices and non-fundholding practices in Edinburgh had identical hospital admitting rates for emergency medical conditions. This study also had some limitations. It did not assess the case mix or severity of the admissions and 10% of the admissions could not be accurately allocated to practices.

Finally, a prospective study, based in Oxford between 1990-1994, found a consistent result to that of Duffield - that is, referral practices between fundholding and non-fundholding practices did not differ (Surender et al., 1995). Although this study had a prospective design it was also subject to some significant limitations. It was based on referrals to consultants and not admissions (and therefore included a significant proportion of non-urgent referrals) and the study was undertaken over a relatively short period.
Conclusions

- Despite the probable importance of economic incentives in relation to hospital admission rates, relatively little research has closely examined this relationship. In particular, there is an absence of research in the New Zealand setting on the effect of DRG based purchasing and various types of cost and volume contracts despite their widespread use in this country. Of particular interest would be the effect on acute admissions of the use of contracts that include a tapering price for DRG volumes over a preset limit.

- Despite the widespread introduction of budget-holding in the UK over the last decade, there is a lack of rigorous research to enable any firm conclusions to be made about its effect on acute medical admissions.
The relative importance of the different causes of increased acute medical admissions described in Section Two are summarised in Tables 19-21. The importance of the causes has been grouped into probable, possible and unlikely explanations of the increase in acute medical admissions. These groupings have been undertaken with regard to the limitations associated with the respective studies and their methodologies and should be interpreted in relation to the text.

**Probable causes of the increase in acute medical admissions**

- Factors with generally consistent research evidence indicating that they are likely to be important determinants of the increased number of acute medical admissions in a country are illustrated in Table 19. These factors include: demographic changes, a reduction in socio-economic status, increased population-based consumption of alcohol and/or tobacco, changing societal patterns of care, economic incentives, iatrogenic causes and artefact.

**Possible causes of the increase in acute medical admissions**

- Factors with inconsistent research findings (or where the research findings are very inconclusive), indicating that the factor may possibly be a determinant of the increased number of acute hospital admissions, are set out in Table 20. These factors include: more available hospital beds, increased number of readmissions, increasing distance to the nearest hospital, changes in the prevalence of ill-health, increased expectations of patients, increased number of depu-tising services for GP care.

**Unlikely causes of the increase in acute medical admissions**

- Factors that appear to be unimportant in determining the increase in acute medical admissions are described in Table 21. These factors include: increased waiting lists and changes in the characteristics of GPs.
Figure 7. Possible determinants in the rise of emergency admissions
(Adapted with permission from the NHS Confederation 1997)
Figure 8: Number of public hospital beds in New Zealand 1979-1997
(Source: Ministry of Health, Licensing Section, 1998)
Table 4. Selected studies that have examined the importance of demographic changes on admission rates

<table>
<thead>
<tr>
<th>Author</th>
<th>Study design</th>
<th>Level of evidence</th>
<th>Conclusions</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Haan et al., 1997) United States</td>
<td>Cohort</td>
<td>II-2</td>
<td>Hospitalisation rates increased among elderly members of an HMO between 1970-1990 (P&lt;0.0001).</td>
</tr>
<tr>
<td>(Kendrick, 1996) United Kingdom</td>
<td>Time series</td>
<td>II-3</td>
<td>Less than 25% of the increase in admissions is due to the increase in the number of elderly in the community (no p value).</td>
</tr>
<tr>
<td>(Taylor and McConnell, 1994b) Northern Ireland</td>
<td>Time series</td>
<td>II-3</td>
<td>Elderly people have made up an increasing proportion of admissions over the last two decades</td>
</tr>
<tr>
<td>(Goldacre and Ferguson, 1995) United Kingdom</td>
<td>Cross-sectional</td>
<td>III</td>
<td>Elderly people have made up an increasing proportion of admissions over the last two decades (no p value).</td>
</tr>
<tr>
<td>(Cartwright, 1991) United Kingdom</td>
<td>Cross-sectional</td>
<td>III</td>
<td>Increased admission rates are associated with increased numbers of elderly people living alone.</td>
</tr>
<tr>
<td>(National Association of Health Authorities and Trusts, 1994) United Kingdom</td>
<td>Opinion</td>
<td>IV</td>
<td>As little as 2% of the increase in admissions may be due to a rise in the elderly (no p value).</td>
</tr>
</tbody>
</table>

Unless otherwise stated conclusions are significant at p≤0.05
Table 5. Studies that have examined the relationship between socioeconomic status and hospital admission

<table>
<thead>
<tr>
<th>Author Country</th>
<th>Study population</th>
<th>Study design</th>
<th>Level of evidence</th>
<th>Relationship between socioeconomic status (SES) and admissions</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Lissauer et al., 1998) United Kingdom</td>
<td>Children</td>
<td>Case control</td>
<td>II-2</td>
<td>Increased admissions with lower SES (no p value)</td>
</tr>
<tr>
<td>(Spencer et al., 1996) United Kingdom</td>
<td>Children</td>
<td>Case control</td>
<td>II-2</td>
<td>Increased admissions with lower SES (p &lt; 0.00001)</td>
</tr>
<tr>
<td>(Stanton et al., 1991) New Zealand</td>
<td>Children</td>
<td>Cohort</td>
<td>II-2</td>
<td>Increased admissions with lower SES</td>
</tr>
<tr>
<td>(Ferguson et al., 1990) New Zealand</td>
<td>Children</td>
<td>Cohort</td>
<td>II-2</td>
<td>Increased admissions with lower SES</td>
</tr>
<tr>
<td>(To et al., 1996) Canada</td>
<td>Children</td>
<td>Cross sectional</td>
<td>III</td>
<td>No significant relationship</td>
</tr>
<tr>
<td>(Perin et al., 1989) United States</td>
<td>Children</td>
<td>Cross sectional</td>
<td>III</td>
<td>Increased admissions with lower SES</td>
</tr>
<tr>
<td>(McConnochie et al., 1997) United States</td>
<td>Children</td>
<td>Cross sectional</td>
<td>III</td>
<td>Increased admissions with lower SES (p &lt; 0.001)</td>
</tr>
<tr>
<td>(Stirling and Wadsworth, 1998) United Kingdom</td>
<td>Adults</td>
<td>Cohort</td>
<td>II-2</td>
<td>Increased admissions with lower SES</td>
</tr>
<tr>
<td>(Morris and Mumasinghe, 1994) United States</td>
<td>Elderly</td>
<td>Ecological</td>
<td>III</td>
<td>Increased admissions with lower SES (p &lt; 0.0001)</td>
</tr>
<tr>
<td>(van der Meer et al., 1996) Holland</td>
<td>Adults</td>
<td>Cross sectional</td>
<td>III</td>
<td>Increased admissions with lower SES (no p value)</td>
</tr>
<tr>
<td>(Morgan et al., 1997a) United Kingdom</td>
<td>Adults</td>
<td>Cross sectional</td>
<td>III</td>
<td>Increased admissions with lower SES (p &lt; 0.001)</td>
</tr>
<tr>
<td>(Crampton et al., 1997) New Zealand</td>
<td>Adults</td>
<td>Cross sectional</td>
<td>III</td>
<td>Increased admissions with lower SES</td>
</tr>
<tr>
<td>(Jackson et al., 1998) New Zealand</td>
<td>Adults</td>
<td>Cross sectional</td>
<td>III</td>
<td>Increased admissions with lower SES</td>
</tr>
<tr>
<td>(Brown and Barnett, 1992) New Zealand</td>
<td>Adult</td>
<td>Cross sectional</td>
<td>III</td>
<td>Increased diabetes admissions with lower SES</td>
</tr>
<tr>
<td>(Duffield et al., 1997) Scotland</td>
<td>Adults</td>
<td>Cross sectional</td>
<td>III</td>
<td>Increased admissions with lower SES</td>
</tr>
</tbody>
</table>

Unless otherwise indicated relationships significant at p <= 0.05
Table 6. Studies that have examined the relationship between changing societal patterns of care and admissions.

<table>
<thead>
<tr>
<th>Author Country</th>
<th>Study design</th>
<th>Level of evidence</th>
<th>Conclusions</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Jankowski and Mandle, 1993), United Kingdom</td>
<td>Cohort</td>
<td>II-2</td>
<td>A lack of support was associated with increased admissions (no p value).</td>
</tr>
<tr>
<td>(Langman, 1995) United Kingdom</td>
<td>Case control</td>
<td>II-2</td>
<td>People living alone are at higher risk of admission.</td>
</tr>
<tr>
<td>(Perseger et al., 1997) Switzerland</td>
<td>Cross sectional</td>
<td>III</td>
<td>Increased number of people living alone is related to an increased number of admissions.</td>
</tr>
<tr>
<td>(Jarman, 1993), United Kingdom</td>
<td>Cross sectional</td>
<td>III</td>
<td>Increased admissions relates to an increased number of elderly forced to live in fragile domestic situations due to a reduction in long stay care (no p value).</td>
</tr>
<tr>
<td>(Durham and Durham, 1990) New Zealand</td>
<td>Cross sectional</td>
<td>III</td>
<td>Half of acute admissions are because no other alternative exists (no p value).</td>
</tr>
<tr>
<td>(Otfiander et al., 1993) Canada</td>
<td>Cross sectional</td>
<td>III</td>
<td>Advice of a family member reduces inappropriate hospital attendance by parents for their children.</td>
</tr>
</tbody>
</table>

Unless otherwise indicated conclusions significant at p<0.05

Table 7. Studies that have examined the relationship between distance to the hospital and hospital admission rates

<table>
<thead>
<tr>
<th>Author Country</th>
<th>Study design</th>
<th>Level of evidence</th>
<th>Conclusions</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Geczy and Gee, 1994) Australia</td>
<td>Descriptive</td>
<td>III</td>
<td>Increased distance to hospital is important in rising admissions (no p value).</td>
</tr>
<tr>
<td>(Chishty and Packer, 1995) United Kingdom</td>
<td>Cross sectional</td>
<td>III</td>
<td>Increased distance to the nearest hospital was an important determinant in the increased number of admissions.</td>
</tr>
<tr>
<td>(McFaul et al., 1994) United Kingdom</td>
<td>Cross sectional</td>
<td>III</td>
<td>No relationship between distance and admission rates (no p value).</td>
</tr>
<tr>
<td>(Haynes and Benthem, 1982) United Kingdom</td>
<td>Correlational</td>
<td>III</td>
<td>Urban people have higher admission rates than rural people.</td>
</tr>
<tr>
<td>(Goodman et al., 1994) United States</td>
<td>Cross sectional</td>
<td>III</td>
<td>Increased distance strongly associated with reduced admission rates (p=0.0001).</td>
</tr>
</tbody>
</table>

Unless otherwise indicated conclusions significant at p<0.05
Table 8. Studies that have examined the effect of changes in morbidity on hospitalisation rates

<table>
<thead>
<tr>
<th>Author Country</th>
<th>Study design</th>
<th>Level of evidence</th>
<th>Conclusions</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Read et al., 1994) Australia</td>
<td>Time series</td>
<td>II-3</td>
<td>Increase in the prevalence of asthma amongst children has lead to an increased number of asthma admissions (no p value).</td>
</tr>
<tr>
<td>(Reitsma et al., 1996) Netherlands</td>
<td>Time series</td>
<td>II-3</td>
<td>Admissions for the elderly due to congestive heart failure have increased.</td>
</tr>
<tr>
<td>(Beck et al., 1994) United Kingdom</td>
<td>Ecological</td>
<td>III</td>
<td>An increased number of admissions has been attributable to AIDS in several countries (no p value).</td>
</tr>
<tr>
<td>(Currie et al., 1997) United Kingdom</td>
<td>Cross sectional</td>
<td>III</td>
<td>Admission rates for diabetes are increasing in relation to demographic changes (no p value).</td>
</tr>
<tr>
<td>(Payne et al., 1994) United Kingdom</td>
<td>Cross sectional</td>
<td>III</td>
<td>Admission rates are not associated with the prevalence of disease in a community.</td>
</tr>
<tr>
<td>(Capewell, 1996) (Whiteley et al., 1996) United Kingdom</td>
<td>Opinion</td>
<td>IV</td>
<td>Admission rates are increasing in relation to better diagnostic facilities (no p value).</td>
</tr>
<tr>
<td>(Roberts et al., 1996) United Kingdom</td>
<td>Opinion</td>
<td>IV</td>
<td>Admissions are increasing due to improved emergency services ensuring improved patient survival to reach hospital (no p value).</td>
</tr>
</tbody>
</table>

Unless otherwise indicated conclusions significant at p<0.05

Table 9. Studies that have examined the relationship between risk factors for ill-health and increased acute medical admissions.

<table>
<thead>
<tr>
<th>Author Country</th>
<th>Study design</th>
<th>Level of evidence</th>
<th>Conclusions</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Wagner et al., 1995b) United States</td>
<td>Case control</td>
<td>II-2</td>
<td>Smokers are at higher risk of admission.</td>
</tr>
<tr>
<td>(Robertson et al., 1993) New Zealand</td>
<td>Case control</td>
<td>II-2</td>
<td>Smokers are at higher risk of admission (p&lt;0.002).</td>
</tr>
<tr>
<td>(Muller, 1996) United States</td>
<td>Time series</td>
<td>II-3</td>
<td>Increased population consumption of alcohol or tobacco is associated with increased admission rates.</td>
</tr>
<tr>
<td>(Tsai et al., 1990) United States</td>
<td>Cross sectional</td>
<td>III</td>
<td>Smoking is associated with increased admissions.</td>
</tr>
<tr>
<td>(Rivara et al., 1993) United States</td>
<td>Cross sectional</td>
<td>III</td>
<td>Alcohol consumption is associated with increased admissions (no p value).</td>
</tr>
</tbody>
</table>

Unless otherwise indicated conclusions significant at p<0.05
Table 10. Studies that have examined the effect of changes in patient expectations on acute admission rates

<table>
<thead>
<tr>
<th>Author Country</th>
<th>Study design</th>
<th>Level of evidence</th>
<th>Conclusions</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Kovacs et al., 1995) United States</td>
<td>Cohort</td>
<td>II-2</td>
<td>Poor compliance is associated with increased admissions amongst diabetics.</td>
</tr>
<tr>
<td>(O'Hagan et al., 1996) New Zealand</td>
<td>Cohort</td>
<td>II-2</td>
<td>Low patient expectations inhibit patients with COAD from seeking medical care (no p value).</td>
</tr>
<tr>
<td>(Freming, 1992) Various European</td>
<td>Ecological</td>
<td>III</td>
<td>More consumer oriented countries have higher admission rates.</td>
</tr>
<tr>
<td>(Petch, 1991) United Kingdom</td>
<td>Opinion</td>
<td>IV</td>
<td>Delaying seeking care can lead to a deterioration in the condition which can then result in admission (no p value).</td>
</tr>
<tr>
<td>(Carewell, 1996) United Kingdom</td>
<td>Opinion</td>
<td>IV</td>
<td>A rise in patient expectations has lead to an increase in admissions (no p value).</td>
</tr>
</tbody>
</table>

Unless otherwise indicated conclusions significant at p<0.05
Table 11. Studies that have evaluated the effects of changes in the number or behaviour of GPs on acute admission rates

<table>
<thead>
<tr>
<th>Author</th>
<th>Study design</th>
<th>Level of evidence</th>
<th>Conclusions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lissauer, 1993 #282</td>
<td>Case control</td>
<td>II-2</td>
<td>Characteristics of the admitting doctor are less important than the SES of the patient (no p value).</td>
</tr>
<tr>
<td>United Kingdom</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Komunyak, 1996 #183</td>
<td>Cross sectional</td>
<td>III</td>
<td>Characteristics of the admitting doctor are less important than the SES of the patient (p&gt;0.05).</td>
</tr>
<tr>
<td>United States</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wennberg, 1982 #48</td>
<td>Cross sectional study using small</td>
<td>III</td>
<td>Clinical uncertainty amongst physicians is an important determinant of hospital admission (no p value).</td>
</tr>
<tr>
<td>United States</td>
<td>Area analysis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jankowski, 1993 #480</td>
<td>Cross sectional</td>
<td>III</td>
<td>GPs are not involved in half of admissions (no p value).</td>
</tr>
<tr>
<td>United Kingdom</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 12. Studies examining the effect of GP deputising services on hospital admission rates

<table>
<thead>
<tr>
<th>Author</th>
<th>Study design</th>
<th>Level of evidence</th>
<th>Conclusions</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Cmigge et al., 1997)*</td>
<td>Randomized controlled trial</td>
<td>I</td>
<td>Significant differences in processes of care (e.g. fewer house visits made by deputising services). However, no differences were found in the admission rates between different practice types. Patient satisfaction was higher with care provided by practice doctors (p&lt;0.05).</td>
</tr>
<tr>
<td>United Kingdom</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(McKinlay et al., 1997)*</td>
<td></td>
<td>I</td>
<td></td>
</tr>
<tr>
<td>(Poole et al., 1996)</td>
<td>Case control</td>
<td>II-2</td>
<td>Deputising services increase admissions (no p value).</td>
</tr>
<tr>
<td>United States</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Dixon and Williams, 1988)</td>
<td>Satisfaction survey</td>
<td>III</td>
<td>No difference in patient satisfaction between practices (no p value).</td>
</tr>
<tr>
<td>United Kingdom</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Ríos et al., 1990)</td>
<td>Patient satisfaction Survey</td>
<td>III</td>
<td>Patients appreciate convenience of deputising services (no p value).</td>
</tr>
<tr>
<td>Canada</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Henscher and Edwards, 1996)</td>
<td>GP questionnaire</td>
<td>III</td>
<td>A minority (37%) of GPs would change their admitting behaviour when working in a deputising service (no p value).</td>
</tr>
<tr>
<td>United Kingdom</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Both studies were based on data from the same trial.

Table 13. Studies that have described the percentage of admissions considered to be due to an iatrogenic cause

<table>
<thead>
<tr>
<th>Author</th>
<th>Percentage of admissions considered to be drug related</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Colt and Shapiro, 1989)</td>
<td>9.4% (23/244)</td>
</tr>
<tr>
<td>(Hallas et al., 1992)</td>
<td>7.9% (157/1999)</td>
</tr>
<tr>
<td>(Dutten et al., 1996)</td>
<td>5.7% (55/965)</td>
</tr>
<tr>
<td>(Hallas et al., 1990)</td>
<td>10.8%</td>
</tr>
<tr>
<td>(Trunet et al., 1980)</td>
<td>7.1% (23/325)</td>
</tr>
</tbody>
</table>
Table 14. Selected studies that have assessed the relationship between the increased supply of beds and increased admission rates

<table>
<thead>
<tr>
<th>Author</th>
<th>Study design</th>
<th>Sample</th>
<th>Conclusions</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Wennberg et al., 1989)</td>
<td>Cross sectional III</td>
<td>Adults Boston, New Haven United States</td>
<td>Increased bed supply is significantly correlated to increased utilisation</td>
</tr>
<tr>
<td>(Carr Hill, 1994)</td>
<td>Cross sectional III</td>
<td>Adults Multiple regions in United Kingdom</td>
<td>Increased supply of available hospital beds was significantly associated with increased hospital admission rates</td>
</tr>
<tr>
<td>(Brown and Barnett, 1992)</td>
<td>Cross sectional III</td>
<td>Adults South Island, New Zealand</td>
<td>Supply of hospital beds was the most important significant variable associated with admission rates for diabetes.</td>
</tr>
<tr>
<td>(Goodman et al., 1994)</td>
<td>Cross sectional III</td>
<td>Children New Hampshire, United States</td>
<td>Significant association between areas with higher number of available hospital beds and admission rates</td>
</tr>
</tbody>
</table>

All conclusions significant at p<0.05

Table 15. The number of hospital medical beds in New Zealand 1990-1997

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of public hospitals</th>
<th>Total number of beds in public hospitals</th>
<th>Number of Licensed Medical Beds</th>
<th>No of medical beds per 10,000 population</th>
<th>Ratio of medical beds to other bed categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>152</td>
<td>15,849</td>
<td>3537</td>
<td>10.3</td>
<td>0.29</td>
</tr>
<tr>
<td>1991</td>
<td>146</td>
<td>15,821</td>
<td>3149</td>
<td>9.1</td>
<td>0.25</td>
</tr>
<tr>
<td>1992</td>
<td>No data</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1993</td>
<td>109</td>
<td>15,897</td>
<td>2894</td>
<td>8.1</td>
<td>0.22</td>
</tr>
<tr>
<td>1994</td>
<td>131</td>
<td>16,295</td>
<td>2451</td>
<td>6.8</td>
<td>0.18</td>
</tr>
<tr>
<td>1995</td>
<td>138</td>
<td>15,555</td>
<td>2820</td>
<td>7.6</td>
<td>0.22</td>
</tr>
<tr>
<td>1996</td>
<td>119</td>
<td>15,270</td>
<td>2001</td>
<td>6.9</td>
<td>0.20</td>
</tr>
<tr>
<td>1997</td>
<td>116</td>
<td>14,930</td>
<td>2753</td>
<td>7.3</td>
<td>0.22</td>
</tr>
</tbody>
</table>

Data derived from information provided in: (Statistics New Zealand, 1998) (Anonymous, 1998)

Table 16. Studies that have examined the relationship between hospital waiting lists and acute admissions

<table>
<thead>
<tr>
<th>Author</th>
<th>Study design</th>
<th>Level of evidence</th>
<th>Conclusions</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Edwards and Beresne, 1994) United Kingdom</td>
<td>Cross sectional III</td>
<td></td>
<td>The rising number of admissions cannot be accounted for by patients already on waiting lists (no p value).</td>
</tr>
<tr>
<td>(McEwen and Noble-Partridge, 1995) United Kingdom</td>
<td>Opinion IV</td>
<td></td>
<td>An increasing number of patients are acutely admitted from lengthening waiting lists either because of genuine deterioration or to circumvent the queue (no p value).</td>
</tr>
</tbody>
</table>

*Acute Medical Admissions*
### Table 17. Studies that have examined the relationship between the rise in admissions and changes in the number of readmissions

<table>
<thead>
<tr>
<th>Author Country</th>
<th>Design</th>
<th>Level of evidence</th>
<th>Conclusions</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Spencer et al., 1998) United Kingdom</td>
<td>Case control</td>
<td>II-2</td>
<td>Low birthweight babies had significantly increased admissions.</td>
</tr>
<tr>
<td>(Kendrick, 1996) Scotland</td>
<td>Time series</td>
<td>II-3</td>
<td>Readmissions account for 14% of the increase in admissions (no p value).</td>
</tr>
<tr>
<td>(Performance Monitoring and Review Section, 1995) New Zealand</td>
<td>Time series</td>
<td>II-3</td>
<td>Increased rate of admissions not related to an increase in readmissions (no p value).</td>
</tr>
<tr>
<td>(MacIntyre et al., 1997) Australia</td>
<td>Cross sectional</td>
<td>III</td>
<td>Increased readmissions are significantly correlated to decreased length of stay.</td>
</tr>
<tr>
<td>(Newton and Goldacre, 1993) United Kingdom</td>
<td>Cross sectional</td>
<td>III</td>
<td>Increased numbers of elderly admissions are significantly associated with increased readmissions.</td>
</tr>
<tr>
<td>(Spencer and Lewis, 1991) United Kingdom</td>
<td>Cross sectional</td>
<td>III</td>
<td>Readmission rates have increased over the last decade among children of all age groups (no p value).</td>
</tr>
<tr>
<td>(Goldacre and Ferguson, 1995) United Kingdom</td>
<td>Cross sectional (Record linkage)</td>
<td>III</td>
<td>Readmissions accounted for about one third of the increase in admission rates between 1968-1987 (no p value).</td>
</tr>
<tr>
<td>(Hobbs, 1995) United Kingdom</td>
<td>Opinion</td>
<td>IV</td>
<td>Readmissions account for a large amount of the increase in admissions (no p value).</td>
</tr>
</tbody>
</table>

Unless otherwise indicated conclusions significant at p<0.05

### Table 18. Studies that have examined the relationship between economic incentives and acute hospital admission rates

<table>
<thead>
<tr>
<th>Author Country</th>
<th>Study design</th>
<th>Level of evidence</th>
<th>Conclusions</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Alonso et al., 1996) Spain</td>
<td>Quasi experimental</td>
<td>II-1</td>
<td>Introduction of DRG payment contracts were significantly associated with increased acute admissions (p&lt;0.001).</td>
</tr>
<tr>
<td>(Surender et al., 1995) United Kingdom</td>
<td>Cohort</td>
<td>II-2</td>
<td>Referral practices between fundholding and non-fundholding GPs did not significantly differ in Oxford (UK) between 1990-94 (p&gt;0.05).</td>
</tr>
<tr>
<td>(Perneger et al., 1997) Switzerland</td>
<td>Cross sectional</td>
<td>III</td>
<td>Increased admissions may be related to copayments or fee for service GPs.</td>
</tr>
<tr>
<td>(Boersma, 1996) United Kingdom</td>
<td>Cross sectional</td>
<td>III</td>
<td>Fundholding GPs had a smaller increase in emergency admissions between 1994-5 than non-fundholding GPs (no p value).</td>
</tr>
<tr>
<td>(Duffield et al., 1997) United Kingdom</td>
<td>Cross sectional</td>
<td>III</td>
<td>Fundholding and non-fundholding practices had identical emergency admission rates (p&gt;0.05).</td>
</tr>
<tr>
<td>(Brooks et al., 1994) United States</td>
<td>Cross sectional</td>
<td>III</td>
<td>Financial incentives favour admission of rest home residents when acutely unwell (no p value).</td>
</tr>
</tbody>
</table>

Unless otherwise indicated conclusions significant at p<0.05
Table 19. Probable causes of the increase in acute medical admissions

<table>
<thead>
<tr>
<th>General factor</th>
<th>Specific factor</th>
<th>Levels of evidence of key studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient Related Factors</td>
<td>Demographic changes</td>
<td>II-2 - IV</td>
</tr>
<tr>
<td></td>
<td>More varied ethnic composition of society</td>
<td>III</td>
</tr>
<tr>
<td></td>
<td>Reduction in socio-economic status of the population</td>
<td>II-2 - III</td>
</tr>
<tr>
<td></td>
<td>Increased population-based consumption of tobacco and/or alcohol</td>
<td>II-2 - III</td>
</tr>
<tr>
<td></td>
<td>Changing societal patterns of care (increased number of people living alone especially elderly)</td>
<td>II-2 - III</td>
</tr>
<tr>
<td>Factors related To health care organisations</td>
<td>Economic incentives – e.g. DRG payments</td>
<td>II-1 - III</td>
</tr>
<tr>
<td></td>
<td>Artifactual</td>
<td>II-3 - III</td>
</tr>
<tr>
<td>Gatekeeper-related factor</td>
<td>Iatrogenic causes</td>
<td>III</td>
</tr>
</tbody>
</table>

Table 20. Possible causes of the increase in acute medical admissions

<table>
<thead>
<tr>
<th>General factor</th>
<th>Specific factor</th>
<th>Levels of evidence of key studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factors related to healthcare organisations</td>
<td>More available beds</td>
<td>III</td>
</tr>
<tr>
<td></td>
<td>Increased number of readmissions</td>
<td>II-2 - IV</td>
</tr>
<tr>
<td>Patient Related Factors</td>
<td>Increasing distance to nearest hospital</td>
<td>III</td>
</tr>
<tr>
<td></td>
<td>Changes in prevalence of ill health or improvements in the diagnosis of disease</td>
<td>II-3 - III</td>
</tr>
<tr>
<td></td>
<td>Increased expectations of patients</td>
<td>II-1 - IV</td>
</tr>
<tr>
<td>Gatekeeper-related factor</td>
<td>Increased number of deputising services for GP care</td>
<td>I - III</td>
</tr>
</tbody>
</table>

Table 21. Unlikely causes of the increase in acute medical admissions

<table>
<thead>
<tr>
<th>General factor</th>
<th>Specific factor</th>
<th>Levels of evidence of key studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor related to healthcare Organisations</td>
<td>Increased waiting lists may have lead to increases in admissions</td>
<td>III - IV</td>
</tr>
<tr>
<td>Gatekeeper-related Factor</td>
<td>Changes in characteristics of the admitting GP</td>
<td>II-2 - III</td>
</tr>
</tbody>
</table>
Section three

Are acute medical admissions inappropriate?
Avoidable and inappropriate admissions

An important question related to the rise in acute medical admissions is whether there has been an increase in the number of appropriate admissions, or if there has been a rise in the number of patients for whom hospitalisation could have been avoided and who could have been more appropriately treated in other clinical settings.

The concept of avoidable admissions is therefore closely related to that of inappropriate admissions. A large number of studies have used the terms interchangeably to represent any unnecessary admission. Although a large body of literature has examined the concept(s), few studies have actually attempted to define them. Some notable exceptions have defined the terms while an even smaller number of reports have actually distinguished between them.

The clearest example of this is the definition provided by Coast et al. (1996b) who defined avoidable admissions as "those patients for whom there may potentially be a lower technology alternative to admission to the acute hospital". Coast also described the difference between an inappropriate admission and an avoidable hospitalisation: "An avoidable hospitalisation does not mean that the patient has no requirement for care in the acute hospital at the present time". That is, an inappropriate admission is therefore the hospitalisation of a patient when a better alternative actually exists, and while avoidable admissions are not currently inappropriate they may become so if the health care system were to be reorganised in some way.

ADMISSIONS AVOIDABLE BY IMPROVED PRIMARY CARE

Particularly in the US literature, the admission rates of certain conditions have been designated as markers of the access to, and the quality of, primary care. A number of studies have suggested that the rate of admission for certain hospital conditions can be used as a measure of access to primary care (Weissman et al., 1991b). The assumption is that these conditions could be treated by the provision of competent primary care, thereby preventing the need for admission (e.g. good management of diabetes to prevent admission of diabetic ketoacidosis). This concept emphasises the role of primary care doctors as gatekeepers to secondary care.

An example of hospitalisation for an ambulatory sensitive condition comes from the descriptive study by O'Loughlin et al. (1995) who found that most children admitted to hospital in New South Wales (Australia) with gastroenteritis were not seriously unwell and required only oral rehydration therapy. In most cases this treatment could have been implemented at home under the oversight of a primary care worker.

Ambulatory sensitive hospitalisations usually include the admission rates for the following conditions: asthma, diabetes (especially diabetic ketoacidosis), cellulitis, pneumonia, vaccine preventable infections, gangrene, perforated gastric ulcer and malignant hypertension.

A related marker of insufficient primary care is the use of low immunisation rates. Under-immunised children have been shown to be more likely to have significant morbidity and higher health care utilisation, including higher rates of hospitalisation, than children who have received their full complement of vaccines even after socio-economic status and other confounders have been controlled for (Rodewald et al., 1995).

A review in the North Health region of New Zealand between 1992-1996 (Jackson et al., 1998) showed that about 15% of public hospital admissions for people under 65 years of age could be considered as preventable, or at least controllable, through the appropriate provision of quality primary care. Cardiac and respiratory conditions predominated among the conditions defined as avoidable in the review and the report found that the rates of avoidable admissions were highest among people in the lowest socio-economic groups. There is also some limited evidence (time series descriptive studies) that the hospitalisation rates for avoidable admissions has been increasing in New Zealand over the last two decades (e.g Thomson and Blake, 1996).

Another aspect of access is financial access. Several studies have found that uninsured patients are more likely to be admitted to hospital for ambulatory care-
sensitive conditions than people who have insurance (e.g. Billings et al. 1993). Large variations between areas in their rates of inappropriate admissions have been noted in countries with universal insurance (e.g. Billings et al., 1996). The presence of this variation in countries with free primary health care for patients implies that merely providing free care is not sufficient to prevent all unnecessary admissions.

In addition, small area studies have also shown that over the last two decades even high income areas have increased their rates of avoidable admissions, implying that financial access to primary care is not a sufficient condition to reduce inappropriate admissions (Billings et al., 1996).

Although a large body of literature (for example, Solberg et al., 1990; Wissow et al., 1988; Woolhandler et al., 1985; Charlton et al., 1983) has investigated the concept of admissions that are avoidable or controllable if appropriate primary care was obtained in an effective and timely manner, these studies have encountered a number of methodological problems that undermine the validity of their findings. These studies have typically used small area analysis and a cross-sectional design to estimate the number of admissions that could have been avoided with access to good quality ambulatory care.

Although the association between inadequate primary care and various avoidable admissions have been shown in a number of settings, it is important to realise that a number of confounders could also explain these relationships, for example the number and quality of other providers, differences in the prevalence of illness and differences in socio-economic status between areas, etc.

The influence of these large number of confounders may explain some of the conflicting results that have been found by other studies that have attempted to assess the relationship between avoidable admissions and access to quality primary care. Some studies, for example, have concluded that low socio-economic status (e.g. Weissman et al., 1991a; Krakauer et al., 1996) or patient age (e.g. Casanova et al., 1996; Hider, 1997) may be the most important determinants of admission for ambulatory sensitive conditions. Other studies have found that the number of hospital beds was the most important determinant of hospitalisation for ambulatory care sensitive conditions (e.g. Shain and Roemer, 1959; Brown and Barnett, 1992).

The variation in results from these studies calls into question the validity of using sentinel conditions as an indicator of the effectiveness of primary care in an area. The problem is that too many important variables influence the outcome of these studies and the result obtained by any study depends on the complex interplay of these variables in a particular area.

Conclusion

- Ambulatory sensitive conditions have been used in numerous cross-sectional studies as a marker of poor access, or poor quality, primary care. However, other research (that has used the same study design) has found contrasting results, probably in relation to the inherent inability of their cross-sectional study design to adequately deal with the many confounders that are involved in what is a highly complex relationship. Methodological deficiency therefore limits the validity of these markers as an accurate indicator of the adequacy of primary care.

DEFINING AN INAPPROPRIATE ADMISSION

Given the inadequacy of the concept of avoidable admissions to analyse hospitalisations, attention should be given to the literature that has examined the issue of inappropriate admissions. Houghton and Hopkins (1996) provides a clear, operative definition of an inappropriate admission as “a referral for admission to acute care of a patient who could be equally well or better managed at home, or in a less costly bed such as a nursing home”. A large body of literature has examined the concept of (in)appropriate admissions to an acute medical hospital.

Roland and Coulter (1992) provides a taxonomy of methods that have been used in the literature to describe the appropriateness of an admission to hospital (see Table 22).

Although the identification of regions with high rates of hospitalisation is the simplest method of determining areas that may have significant rates of inappropriate admission, the method is seriously flawed by its inability to determine the actual quality of the admissions in these regions. It is therefore equally possible that this method could be identifying regions with high rates of appropriate admissions.

By contrast, while an assessment of the outcome of hospital admission in a region could provide a considerable amount of information about the quality of the process, the methodology has been infrequently used because it is more technically demanding to undertake.

As a result, Roland notes that the most common method used in the literature for determining the appropriateness of hospital admissions has been the comparison of admissions with some form of expert
generated guidelines. While it is possible that these guidelines could be formulated by expert groups composed of either professionals, lay people or a mixture of both, the guidelines that have been presented in the literature have almost always represented the viewpoint of professionals (especially doctors) and they have usually been consensus based rather than evidence based.

Although professionals might be well placed to advise on the appropriateness of admission to hospital, several problems have been noted with the use of professionally generated guidelines. These problems have included difficulties when the experts do not agree amongst themselves. Some primary care practitioners have reported that guidelines about the appropriateness of admission which were based on the opinions of hospital-based doctors do not always generalise well to the clinical situations confronting community-based practitioners.

In addition, expert groups have varied in the degree that they have employed literature-based evidence in their guidelines to assess the appropriateness of hospital admission. Most guidelines have used professional, rather than consumer, perspectives on the appropriateness of hospital admission.

**STUDIES REVIEWING APPROPRIATENESS OF ADMISSIONS**

Two distinctive methods for the assessment of the appropriateness of admission have been used in the literature. The first method involves the use of subjective, expert (usually) medical opinion, while the other has employed the relatively more objective application of utilisation review tools.

Table 23 describes the study designs, settings and results obtained in major studies that have evaluated the appropriateness of hospital admissions by means of expert opinion.

Significant limitations exist with each of these studies. The study by Rosenthal et al. (1997) defined inappropriateness on the basis of the retrospective estimation of a low risk of death for specific groups of patients. However, this study exhibited selection bias and excluded a number of patient groups from its calculations. In addition, the studies by Rosenthal et al. (1997) and Young et al. (1996) were based in US urban areas and it is difficult to reliably generalise their findings to the New Zealand setting.

Two New Zealand-based studies are included in the table. The first was a review of the optimal management of admissions, assuming other alternatives existed, and was undertaken by interviewing the admitting GPs (Durham and Durham, 1990). The study found that hospital admission to an acute medical bed was only favoured in 48% of a series of 200 admissions. Instead, the provision of alternatives, such as augmented home care or GP community hospital bed use, were considered to have been more appropriate for many admissions. In particular, the admitting GPs stated that in 16.5% of their acute medical admissions the doctors would have preferably admitted the patient to a GP-based hospital bed if these facilities existed. The admitting GPs stated that a further 9.5% of their admissions could have been better accommodated in rehabilitation beds for the elderly, and 9% could have remained at home if augmented domestic services were available.

Another New Zealand-based study, a case note review by Beveridge (1986), found that 16% of 119 elderly inpatients were admitted for what were explicitly stated social reasons. That is, they had been primarily referred to hospital because there was no other place where they could be accommodated and not because they needed hospital-based medical investigation and treatment.

An enduring problem with the estimations of the appropriateness of a series of admissions (no matter which country they have been conducted in) is that they are value-laden. No objective and definitive method exists to assess the appropriateness of an acute medical admission.

Given the absence of any gold standard method to determine the appropriateness of admission, an important explanation for the variation in the estimates of appropriateness are the differences in the opinions of the individuals (and their professional backgrounds) making the assessments of what are appropriate admissions. This variation might account for why the three studies that have used primarily subjective assessments of appropriateness have produced such discrepant results (Durham and Durham, 1990; Beveridge, 1986; Beech et al., 1987).

In a number of studies, patients and doctors have been found to substantially differ in what each regards as an appropriate admission, and similar differences have also been noted between administrators and doctors, and even between members of the same profession (such as hospital-based consultants and GPs) (Hobbs, 1995; Pancheon et al., 1995).

Without a recognised gold standard no information can be presented on the sensitivity or specificity of the remaining two studies which used either an assessment of inappropriateness on the basis of the patients’ calculated risk of death or comparison of the need for admission with patients who were classified at triage in the emergency department as only
mildly unwell (Young et al., 1996; Rosenthal et al., 1997). All the studies have implied that the ‘inappropriate’ admissions would have received better (and possibly cheaper) care elsewhere, but this was not actually proven in any of these studies.

Another important issue is that in all the studies the assessment of the appropriateness of the admissions was undertaken retrospectively. That is, the assessment was conducted after the patient had been discharged by means of a review of the case notes. For the practising clinician, however, a validated prospective tool would be considerably more useful than a retrospective chart review to assist the practitioner with their decision-making in relation to hospital admission. A prospective instrument could be useful for doctors to help them manage the clinical uncertainty surrounding their decision. However such an instrument would be difficult to provide as it would have to recognise that some patients who appear to be inappropriate at the time of admission can subsequently prove to be highly appropriate recipients of inpatient care.

Conclusions

- Tension exists between ensuring that all admissions are appropriate while also maximising the safety of patients in the frequent situations where clinical uncertainty exists about the seriousness of a patient’s illness.

- Defining the appropriateness of admissions is highly problematic. Numerous criteria are available to define appropriateness but no ‘gold standard’ exists to determine the sensitivity and specificity of these instruments.

- A crucial issue is who decides on the criteria for determining the appropriateness of hospital admission. Although most reviews have used medical or administrative definitions of appropriateness, it is likely that consumers would employ different criteria.

- Most reviews of the appropriateness of admission have employed a retrospective analysis. Although a retrospective analysis is able to determine the appropriateness for the entire episode of care (because it allows for any deterioration or recovery in a patient’s condition during the course of their inpatient stay), these instruments do not assist clinicians with their need to prospectively determine whether hospitalisation is necessary. This limitation suggests that most commonly used instruments may be more effective at discriminating which episodes of care were appropriate or which days of inpatient care were necessary rather than elucidating on whether the decision to admit a patient was appropriate.
**Utilisation review**

In the United States, the practice of examining a series of admissions for their appropriateness by retrospectively comparing the admissions against the opinion of the admitting doctor or a panel of doctors has spawned an industry known as utilisation review. Over the last decade utilisation review has increasingly attempted to avoid the problem of relying on the subjective opinion of the assessor, by more frequently employing structured assessments that involve standardised evaluation tools.

A recent definition of utilisation review clearly illustrates the central role of these tools: "Utilisation review is the application of objectively defined, explicit criteria to the hospital episode using information derived from the case records or interviews with staff." (Werneke and MacFaul, 1996).

Essentially utilisation review attempts to ask two questions, namely, was the patient severely ill, and was the treatment required to be given in an acute hospital? It is also notable that utilisation review has usually included a review of the appropriateness of all the components of the episode of care and has not just been restricted to an evaluation of the relative merits of the decision to hospitalise the patient.

Utilisation review has been extensively applied to the assessment of the appropriateness of the decision to admit a patient and the subsequent daily need for inpatient care. Despite the relatively even use of utilisation review to achieve each of these two objectives, it is likely that the tool might be more effective at the less demanding task of determining if an additional day(s) of hospital care was needed rather than assessing whether any inpatient care was actually required.

Utilisation review has rapidly taken off in the US, and it has now been adopted by over 90% of that country’s Health Maintenance Organisations (Coast et al., 1996b).

**TOOLS FOR UTILISATION REVIEW**

Most recent examples of utilisation review have used standardised protocols for the assessment of the appropriateness of admission. The most commonly used and hence the best known of these protocols is the Adult Appropriateness Evaluation Protocol (AEP) along with its paediatric derivative, the Paediatric Appropriateness Evaluation Protocol (PAEP) (Gertman and Restuccia, 1981). These protocols rely upon criteria that are independent of the patient’s diagnosis and are based on the levels of care that have been provided to the inpatient. To enhance their objectivity they are usually applied by trained staff, who have taken no part in providing clinical care to the patient.

Two sets of criteria are used. The first set consists of 18 criteria that attempt to define the patient’s suitability for admission (Strumwasser et al., 1990). The 18 criteria describe parameters of the patient’s illness severity (e.g. pulse rate below 50 beats per minute (bpm) or above 140 bpm) or their need for hospital-based investigations/therapy (e.g. the need for parenteral medication or bedside cardiac monitoring). The appropriateness of each subsequent day of inpatient care is assessed in relation to a second set of criteria. These 27 additional criteria describe the patient’s clinical condition and their ongoing need for medical and nursing services. Meeting any one of these criteria is sufficient to justify an admission or a continued day of inpatient care (Strumwasser et al., 1990).

The Intensity-Severity-Discharge (ISD) review system is another, alternative protocol that uses information on the intensity of the therapeutic services that were given to patients and categorises appropriateness criteria according to organ systems (Jacobs and Lamprey, 1992). The same criteria are used for evaluating admissions and for subsequent days of care.

The ISD includes subsets of generic criteria, applicable to all patients (e.g. blood pH below 7.3) as well as organ specific criteria (e.g. endocrine test results). Each subset includes diagnosis-independent, objective criteria divided into severity of illness and intensity of service sections (Strumwasser et al., 1990). In addition, discharge criteria are used to determine the need for continued inpatient care and the timing of discharge.

For an admission to be considered appropriate, at least one ISD severity of illness or one intensity of service criterion must be met at the time of admission and at least one severity of illness and one intensity of service criterion must be met within 24 hours after admission. For subsequent days of stay to be considered to be appropriate, at least one intensity of service criterion consistent with the patient’s condition must be met. Once the severity of illness/intensity of service criteria no longer are met, the discharge screens are applied. If the discharge screens are satisfied then continued inpatient care is not considered to be appropriate (Strumwasser et al., 1990).
It is important to note that neither protocol includes any social issues in its criteria and neither takes into account whether or not alternatives to hospital-based care were actually available in the region.

AIMS OF UTILISATION REVIEW

Utilisation review has been used in the literature for two purposes:

1. To describe the proportion of acute admissions to a hospital/region that were inappropriate.
2. As a tool to reduce the proportion of inappropriate acute admissions to a hospital/region (these studies are reviewed in Section four).

Table 24 presents the literature in relation to descriptive studies that have assessed the proportion of inappropriate adult acute admissions to a hospital or region.

UTILISATION REVIEW AS A DESCRIPTIVE TOOL

Wide variation exists (0.7%-50.5%) in the proportion of inappropriate admissions that have been found by different studies that have all used UR. These studies have been based in a variety of settings and have used several different instruments. Generally, however, studies that have used a specific form of utilisation review have broadly found a similar percentage of inappropriate admissions regardless of the setting of the study. For example, recent (post 1992) studies adopting AEP have found that approximately 12% of admissions were inappropriate (based in studies set in New Zealand, Italian, United States or Spanish hospital settings). However, because there is no “gold standard” by which to measure the sensitivity and specificity of the test, it is difficult to know if this uniformity represents either a consistent percentage of inappropriate admissions in a number of settings, or the general inability of the test to discriminate appropriateness in a variety of settings.

The study by DeCoster et al. (1997) used the ISD-A criteria for its assessment and nurses undertook the assessments retrospectively. Although inter-rater reliability was satisfactory, measurement bias cannot be excluded as an explanation for at least part of the study’s result.

Similarly Inglis et al. (1995) used the ISD-A criteria to determine the percentage of inappropriate admissions and then examined the validity and reliability of the ISD criteria in the UK health system by comparing the results of UR with those obtained by the AEP method as well as the assessments of expert panels composed of hospital-based consultants and GPs. This study was the first major evaluation of the ISD system outside the US and involved 700 adults in a UK hospital. Inglis found that the ISD criteria exhibited good reliability compared to the results from the AEP or the panels. The authors reported a Cohen’s kappa agreement of 0.65 (with a 95% confidence interval of 0.46-0.84) indicating there was significant agreement between the results obtained from the AEP review and the ISD-A instrument. However, the study noted that the ISD-A instrument lacked validity when compared to the opinions of expert panels or the AEP tool, as it over-estimated the number of inappropriate admissions.

The study concluded that the ISD was not valid in the UK largely because there was a lack of alternative forms of care to hospital utilisation. The main limitation associated with these conclusions is that because no gold standard exists to define the appropriateness of admission, no absolute measure of the validity of the tools is possible.

Several commentators have described the variable ways in which utilisation review has been applied and have concluded that the validity of UR has been reduced by the differences in the way the studies have been undertaken (Ash, 1995; Restuccia, 1995).

Aside from its investigation of UR, the study by Smith et al. (1996a) is notable because it also attempted to describe the reasons why non-urgent admissions occurred. The most common reason according to the study’s authors was that there was a lack of an alternative setting for patient care outside of the acute hospital. Other less important factors cited in the study were conservative physician practices, and social factors such as homelessness, or long distances for the patient to travel in order to return home after attending an ED department with an acute but not serious problem.

GENERAL DIFFICULTIES ASSOCIATED WITH UTILISATION REVIEW

Several general problems have been identified with the use of utilisation review tools. Firstly, all the UR instruments retrospectively define need on the basis of severity of illness rather than on the patient’s ability to benefit. Thus, even if a treatment does not improve a patient’s survival or quality of life UR could still find that inpatient care was appropriate (Coast, 1996). According to Coast, no evidence exists that UR helps to improve the efficiency of care largely because it fails to look at the outcome of care.
Another concern is that UR ignores patient heterogeneity. While UR describes the appropriateness of care for designated groups of patients, it cannot accurately specify for each individual whether the hospital-based care was appurtenant (Coast et al., 1996a). A related criticism is that UR does not examine the relative efficiency of providing care in other settings. That is, utilisation review focuses upon the place of the intervention rather than on the need for the intervention regardless of setting.

A broader criticism of utilisation review comes from Black (1995) who suggests that a major limitation of UR is that it defines appropriateness in terms of only the overuse of care and not the underuse of care. Black makes the point that UR is unable to assess the appropriateness of care given to patients receiving treatment in an ambulatory setting. A valid tool to evaluate inpatient care should be able to define not only when the provision of hospital admission was inappropriate but also when its omission was inappropriate.

Several authors have commented that UR represents an overly mechanistic process that ignores much of the complexity that is present in the everyday clinical dilemmas facing clinicians (Werneke and MacFaul, 1996; Coast et al., 1996b). In particular critics point out some of the difficulties in distinguishing between mild and more serious illness and suggest there is an overwhelming need to err on the side of caution and admit a patient on the frequent occasions when clinical uncertainty exists (Werneke and MacFaul, 1996). Coast (1996) has also warned about some significant difficulties associated with the adoption of UR in health systems outside the US, and particularly in using UR to advocate for providing more health care outside hospital settings. Coast suggests the difficulties include the possibility that the relative cost of treating patients in outpatient settings in different countries may be higher than those of treating them in acute hospitals, because in some countries there is a concentration of secondary care in the acute sector, a poor provision of alternatives, and high fixed costs associated with acute hospitals that would restrict any efficiency in providing care in lower technology settings. In relation to this, Coast warns of the political difficulties associated with any attempts to close hospitals and resite care into community settings (Coast, 1996).

Finally, even with a number of adaptations some of the utilisation review methods have been difficult to transfer to other health care settings or even employ in different hospitals in the same geographical setting (O’Neil and Pearson, 1995). The two reviews undertaken in New Zealand (Ministry of Health, 1997) (Berry et al., 1995) are notable in this regard. Although both found a similar percentage of inappropriate admissions (around 7%) both reviews concluded that further modification of the AEP criteria was needed before it could be adopted for widespread use in New Zealand. Significantly, the Auckland-based review included social issues in its adapted AEP criteria but still did not allow for whether alternatives to hospital-based care actually existed in the region.

Both reviews noted that the appropriateness of hospital admission as defined by the instrument was largely dependent on the availability of viable alternatives to inpatient care and the provision of these varied considerably around the country.

The comparison by Coast et al. (1996a) was also particularly aposite. Coast reviewed the application of ISD-A criteria in two different studies which were both based in the same part of South-west England and found that each study concluded that there were markedly different proportions of inappropriate admissions in the region. The authors concluded that the ISD-A tool (and any other utilisation review instrument) could always produce markedly variable results whenever it was applied due to the complex interplay that exists between the characteristics of patients, referrers, alternative forms of care and the acute hospital in both different locations and the same region at different times (Cartwright and Windsor, 1994). Summarising these variables by means of a single instrument, Coast concluded, was flawed because it was attempting to make a too simplistic assessment of a highly complex issue.

**UTILISATION REVIEW OF PAEDIATRIC ADMISSIONS**

All of the protocols that have been developed for the review of the appropriateness of adult admissions have been adapted and used with paediatric admissions (e.g. AEP and ISD). In common with adult admissions, paediatric utilisation review of the appropriateness of inpatient care has three major functions (after Werneke and MacFaul, 1996):

- To justify the provision of resources (financial, facilities, and personnel) and identify the inefficient use of these resources.
- To identify the need for, and the type of, alternative configurations of service provision.
- To identify those patients, who should, but do not, access a service.

In common with adult UR there is no gold standard to judge definitively which admissions are appropriate. Paediatric AEP (P-AEP) is a commonly used method of utilisation review which has 20 criteria for the assessment of admissions. Meeting one of these criteria enables the rater to decide that the admission was appropriate. The criteria were derived by con-
sensus groups of clinicians and are based on the patient either needing services that are only available in an hospital or being so severely unwell that hospital care is essential.

A number of studies have applied UR to paediatric admissions. Most have used P-AEP and have been based in the United States (although a few studies have modified UR and subsequently used it in another country) (see Table 25).

Studies examining the appropriateness of hospital admission among children have (in common with studies using similar instruments applied to adult populations) found a wide range of estimates for the percentage of inappropriate admissions (13%-28%). At least part of this variation could be because some of the studies presented in Table 25 have included both arranged as well as emergency admissions, while others have included surgical as well as medical conditions. The relatively high number of inappropriate paediatric admissions found by Soulen (1994) is notable because it was based solely on acute medical admissions. It is therefore possible that the results obtained by the other studies might have been higher if only urgent admissions were assessed.

The New Zealand-based review (Ministry of Health, 1997) found that 16% of the 401 paediatric admissions were inappropriate. This percentage is significant and relatively high, particularly considering that the study was undertaken in a specialist tertiary paediatric hospital.

The research failed to identify any single factor that was responsible for the inappropriate admissions identified by the study. However, the results suggested the threshold for admission appeared to be lower at night and (significantly when this study was undertaken) no observation unit was available at the hospital for short-term, inpatient care. Only moderate agreement was recorded between reviewers and it was noted that the results depended on the local availability of alternatives to inpatient care. Consequently, the study concluded that in their current form P-AEP was more useful for internal audit at a single hospital rather than for comparative benchmarking.

A general criticism of UR when it has been applied to paediatric admissions is that it lacks a consideration of the needs of caregivers to receive hospital care for their child either because they were worried, or because the nursing assistance required for the child has exceeded their ability to cope (Werneke and MacFaul, 1996). Varying parental abilities have been found to be an important determinant of admission in a number of descriptive studies (e.g. Conway and Newport, 1994). The question of whether these admissions are inappropriate is a matter of debate.

Finally, the New Zealand-based review (Ministry of Health, 1997) (in common with a number of other reviews (e.g. Soulen et al., 1994), found there was a significantly higher percentage of inappropriate admissions when UR was applied to paediatric rather than adult populations (7% in adults compared to 16% among children).

A number of possible explanations exist for why paediatric admissions may be more likely to be inappropriate. It may be that both the diagnosis and the severity of a child’s illness may be harder to determine than for an adult and consequently, because the prognosis is more difficult to predict, the need for hospitalisation is harder to determine. Safety demands that when there is increased clinical uncertainty, more admissions would occur for episodes of illness that subsequently may be found to have not needed inpatient care.

Clinician behaviour may be different when they are treating children compared to adults - they may be less tolerant of risk and more frequently opt for admission rather than outpatient-based observation for an evolving episode of illness. Also, the decision to admit children may be more sensitive to social factors (such as the amount and quality of family support) compared to adults.

**REVIEWS OF THE APPROPRIATENESS OF PAEDIATRIC ADMISSIONS NOT USING UR**

Several other reviews of the appropriateness of paediatric admission have been undertaken which have not employed UR instruments, including a UK-based audit which involved two paediatric consultants who made subjective reviews of the appropriateness of pediatric admissions to a Cardiff hospital (Rajaratnam, 1991). The two reviewers found that 15% and 20% respectively of admissions were inappropriate but the agreement between them was poor.

Finally, McFaul et al. (1994) offers a hybrid assessment which used both subjective and P-AEP criteria. Of the 267 admissions in the review, 19.5% were judged to have been inappropriate. Although McFaul’s study is interesting because it has attempted to overcome some of the criticism of UR associated with its lack of consideration of the complexities of the clinical situation, this study also had a number of serious limitations. It had inadequate statistical power, and was undertaken in only one hospital without the use of a random sample.
CONCLUSIONS ABOUT UTILISATION REVIEW

- A large body of literature has applied utilisation review instruments, in a number of settings, to both adult and paediatric admissions.

- UR attempts to overcome the vagaries of subjective evaluations of the appropriateness of hospitalisation by applying standardised, explicit criteria that attempt to define a patient’s need to receive treatment in an acute hospital.

- A wide range of results has been obtained in studies that have undertaken UR. Between 0.7%-50.5% of adult admissions and 16%-28% of paediatric admissions have been labelled as inappropriate.

- The UR instruments that have commonly been used to assess the appropriateness of an admission all have a number of significant limitations, including:
  - a limited ability to consider social (or non-medical) issues
  - difficulties with accommodating new technologies
  - a focus on symptoms without relevance to diseases.

- The validity of UR has been criticised, particularly when applied outside the United States, and because it ignores the heterogeneity of patients while it focuses on the severity of illness in the patient population rather than on the ability of a patient to benefit from hospital admission.

- UR instruments are best applied as a screening tool and cannot operate as definite arbiters of the appropriateness of individual hospital admissions.
Table 22. A taxonomy for the appropriateness of an admission

<table>
<thead>
<tr>
<th>Method of description of appropriateness</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identification of outliers amongst admission rates for different areas or groups of admitting doctors</td>
<td>Conformity to a numeric norm is not a sufficient basis for deciding the appropriateness of an admission. Difficulties include: who should decide on the norm, and by what criteria?</td>
</tr>
<tr>
<td>Conformity with a protocol/guidelines developed by expert panel</td>
<td>Issues include who should develop guidelines and how are they best developed and implemented. How can the guidelines include a more considered view of both professional and consumer perspectives?</td>
</tr>
<tr>
<td>Assessment of outcome</td>
<td>Usually studies have focused on process (and not outcome) issues such as the number of admissions that have followed hospital-based guidelines for investigations or procedures. Most reviews have been conducted using a retrospective case review methodology.</td>
</tr>
<tr>
<td>Retrospective identification of missed opportunities when admission was not undertaken</td>
<td>A novel but rarely used method. An example is the proportion of children with renal scars. This proportion is used to represent the number of missed opportunities for the hospital-based treatment of serious urinary tract infections (South Bedfordshire Practitioners Group, 1990).</td>
</tr>
</tbody>
</table>

Table 23. Studies describing the appropriateness of admission using expert opinion

<table>
<thead>
<tr>
<th>Author</th>
<th>Study design Level of evidence</th>
<th>Sample</th>
<th>Setting</th>
<th>Result (Percentage of admissions that were inappropriate)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Durham and Durham, 1990)</td>
<td>Retrospective review of case notes and interview with admitting GP III</td>
<td>200 elderly patients</td>
<td>Wellington Hospital (New Zealand)</td>
<td>52% of acute medical admissions could have been avoided if GP had an alternative (e.g. GP hospital beds)</td>
</tr>
<tr>
<td>(Rosenthal et al., 1997)</td>
<td>Retrospective cohort review of admissions with low risk of death based on multivariate study results II-2</td>
<td>43,209 admissions over 1 year with heart failure or pneumonia</td>
<td>30 urban United States hospitals</td>
<td>15% of admissions were low severity and therefore inappropriate</td>
</tr>
<tr>
<td>(Young et al., 1996)</td>
<td>Admissions despite ED triage classification of non-urgent III</td>
<td>3045 admissions of all ages</td>
<td>Ambulatory patients at United States urban ED</td>
<td>5.5%</td>
</tr>
<tr>
<td>(Beech et al., 1987)</td>
<td>Subjective review III</td>
<td>403 admissions (202 medical, 201 surgical)</td>
<td>West Lambeth District Authority hospitals (United Kingdom)</td>
<td>24%</td>
</tr>
<tr>
<td>(Beveridge, 1986)</td>
<td>Subjective review identifying ‘social admissions’ III</td>
<td>119 elderly</td>
<td>Wellington (New Zealand)</td>
<td>16%</td>
</tr>
</tbody>
</table>
Table 24. Utilisation review to describe the percentage of inappropriate adult acute hospital admissions

<table>
<thead>
<tr>
<th>Author</th>
<th>Study design</th>
<th>Study population</th>
<th>Result (% of inappropriate admissions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Berry et al., 1995</td>
<td>Retrospective case review applying AEP III</td>
<td>300 admissions to Dunedin Hospital (NZ)</td>
<td>6.9% inappropriate admission rate per specialty</td>
</tr>
<tr>
<td>Ministry of Health, 1997</td>
<td>Retrospective application of modified AEP protocol III</td>
<td>1529 acute medical admissions to Auckland Hospital (NZ)</td>
<td>7.4%</td>
</tr>
<tr>
<td>Coast et al., 1995</td>
<td>Cross-sectional audit using ISD-A and panels of GPs III</td>
<td>677 admissions to a UK urban hospital</td>
<td>24% and 62% of days of stay were inappropriate</td>
</tr>
<tr>
<td>Coast et al., 1996b</td>
<td>Cross-sectional medical record review using ISD-A III</td>
<td>700 admissions to 2 hospitals- 1 urban and 1 rural in UK</td>
<td>20%</td>
</tr>
<tr>
<td>Coast et al., 1996a</td>
<td>Cross-sectional audit using ISD-A and panels of GPs III</td>
<td>651 admissions to UK rural hospital</td>
<td>23% and 54% of days of stay were inappropriate</td>
</tr>
<tr>
<td>DeCoster et al., 1997</td>
<td>Retrospective chart review using ISD-A III</td>
<td>3901 adults at 26 Canadian hospitals</td>
<td>50.5%</td>
</tr>
<tr>
<td>Fried et al., 1994</td>
<td>Cross-sectional using AEP III</td>
<td>889 charts from US hospitals</td>
<td>10%</td>
</tr>
<tr>
<td>Inglis et al., 1995</td>
<td>Retrospective chart review using ISD and AEP instruments in addition to expert reviews by panels of hospital based doctors or GPs III</td>
<td>700 admissions to a UK general hospital</td>
<td>24%</td>
</tr>
<tr>
<td>Manitoba Centre for Health Policy and Evaluation, 1998</td>
<td>Retrospective chart review using ISD-A III</td>
<td>8 hospitals in Manitoba (Canada)</td>
<td>25%</td>
</tr>
<tr>
<td>Perneger et al., 1997</td>
<td>Cross-sectional medical record review using AEP III</td>
<td>Random sample of 500 admissions to an urban Swiss hospital</td>
<td>15.2%</td>
</tr>
<tr>
<td>Smith et al., 1996a</td>
<td>Retrospective chart review using ISD-A and expert panel review III</td>
<td>2432 admissions to US veterans affairs hospitals</td>
<td>38%</td>
</tr>
<tr>
<td>Victor and Chica, 1994</td>
<td>Cross-sectional review using Oxford Bed Study Instrument III</td>
<td>689 admissions to inner London hospital (UK)</td>
<td>0.7%</td>
</tr>
</tbody>
</table>
### Table 25. Descriptive studies of the appropriateness of paediatric admission

<table>
<thead>
<tr>
<th>Author</th>
<th>Country</th>
<th>Age range (yrs), mean age (yrs)</th>
<th>Rater(s)</th>
<th>Percentage of inappropriate admissions</th>
<th>Inter rater reliability (κ coefficient)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Ministry of Health, 1997)</td>
<td>New Zealand</td>
<td>&lt;15, 4</td>
<td>Physician</td>
<td>16.1</td>
<td>0.44-0.63</td>
</tr>
<tr>
<td>(Kemper, 1988a)</td>
<td>USA</td>
<td>0-18, 7.8</td>
<td>Physician, nurse</td>
<td>21.4</td>
<td>0.74</td>
</tr>
<tr>
<td>(Kreger and Restuccia, 1989)</td>
<td>USA</td>
<td>2-15, 7.5</td>
<td>Nurses</td>
<td>13.3</td>
<td>0.68</td>
</tr>
<tr>
<td>(Goor et al., 1993)</td>
<td>Canada</td>
<td>0-19, ---</td>
<td>Physicians</td>
<td>23.9</td>
<td>0.74</td>
</tr>
<tr>
<td>(Formby et al., 1991)</td>
<td>Australia</td>
<td>0-13, ---</td>
<td>Professional coder, physician</td>
<td>19.4</td>
<td>0.75</td>
</tr>
<tr>
<td>(Smith et al., 1993)</td>
<td>Canada</td>
<td>0.5-18, 6.8</td>
<td>Physician, nurse</td>
<td>22.1</td>
<td>0.89</td>
</tr>
<tr>
<td>(Manitoba Centre for Health Policy and Evaluation, 1998)</td>
<td>Canada</td>
<td>Not stated</td>
<td>Nurses</td>
<td>17</td>
<td>---</td>
</tr>
<tr>
<td>(Souten et al., 1994)</td>
<td>US</td>
<td>Not stated</td>
<td>Physicians</td>
<td>28</td>
<td>---</td>
</tr>
<tr>
<td>(Henley et al., 1991)</td>
<td>Sth Africa</td>
<td>---, mean=4.</td>
<td>---</td>
<td>20.5</td>
<td>0.7</td>
</tr>
<tr>
<td>Kasian (Kasian et al., 1992)</td>
<td>Canada</td>
<td>0-18, 5.3</td>
<td>Medical student, coder</td>
<td>16.2</td>
<td>---</td>
</tr>
</tbody>
</table>

\(\kappa\) = agreement beyond chance between raters where 0.75 or above is excellent, 0.4-0.75 is fair and <0.4 is poor.
Section Four

What interventions reduce acute medical admission rates?
Section Four reviews the evidence for the effectiveness of interventions that have attempted to reduce admissions and also attempts to signal which areas have received inadequate research attention. A large number of possible interventions have not been evaluated, or the research has not been published.

**THE RELATIONSHIP BETWEEN THE VOLUME AND QUALITY OF HOSPITAL CARE AND ACUTE ADMISSIONS**

A full review of the benefits and costs associated with increasing admission rates must take into account a close consideration of the relationship between the volume of hospital care and the quality of that care. This relationship is especially important in relation to the closure of small hospitals.

Correlational studies by the Rand Corporation in the US have indicated that inappropriate use is common in all areas irrespective of their volume. However, the scale of inappropriate use is greater in the higher use areas, simply because the volume is bigger even though the proportion of admissions that are inappropriate is not necessarily increased (Brook, 1994).

A systematic review by Black and Johnston (1990) concluded that for certain conditions and operations (such as cardiac catheterisation), as well as most aspects associated with the care of the severely injured, there was persuasive evidence that hospitals with larger volumes provided a higher standard of care. However, Black did note that most of the evidence came from multiple regression analyses undertaken in studies that had used a cross-sectional design. Black recognised that this type of study design was inherently unable to adjust for all the possible confounders in a trial or adequately exclude the role of bias in a study’s results.

A closer examination of the most important individual studies offers an insight into the issues surrounding the relationship between the volume and quality of hospital care. A large cross-sectional study of 550,000 admissions in the US found there was a significant association between increased volume of admissions and various indicators of the quality of hospital care (e.g. mortality and readmission rates) (Flood et al., 1984a). The study found there was only weak and mixed evidence for any association between outcome and the volume of medical admissions. However, the study used relatively coarse methods to describe the volume and outcome of inpatient care.

In subsequent research the authors included a number of other variables related to both volume and outcome including hospital size, teaching status, and expenditure information. In this study Flood et al. (1984b) found that for both medical and surgical conditions increased hospital size was consistently correlated with outcome (Flood et al., 1984b).

Although the limitations associated with the study design prevents any definitive conclusion about causal linkage, the study did have a number of strengths that enhanced the validity of its findings (in particular, the study involved a large sample size that included most of the hospitals in the United States).

Consistent evidence that there is an association between increasing volume and improved patient outcomes has also come from other studies that have used different research methodologies. A large longitudinal study which followed a sample of 500 hospitals in the United States for over eight years (Farley and Ozminkowski, 1992) concluded that hospitals with higher patient volumes had better health outcomes for certain groups of patients. The authors noted that the effects of volume appeared to be more pronounced for a selected group of medical patients when assessed longitudinally instead of cross-sectionally. That is, evaluating the health outcomes associated with a number of hospitals measured over a period of time and not at the same time. Further work by Maerki et al. (1986) indicates that the relationship between volume and outcome may actually be disease specific- namely, improved quality of inpatient care and increased volume may be closely related to only certain diagnoses.

Although there are likely to be multifactorial reasons behind any association between increased volume and improved patient outcomes, the findings of major studies examining this issue question the belief that only poor outcomes come from increasing admission rates. In light of this research several authors have commented that rising admissions rates may be a positive trend that will lead to an improvement in health outcomes for the population. Spencer and Lewis (1991) and Durojaiye et al. (1989) provide specific examples where they suggest that GPs acting more cautiously to exclude serious disease by admitting more children with non-specific symptoms may
prevent poor outcomes from occurring for these children when their symptoms were actually the harbinger of serious illness.

An over-riding problem is the difficulty in ascribing causation from these studies. That is, rather than higher volumes leading to better outcomes it may be that patients with better outcome are selectively referred to hospitals with higher volumes. As Freeland et al. (1987) describes, there is a complex relationship between volume, quality and price which is hard to distill from an examination of administrative databases across a number of institutions and for a variety of conditions over a period of time. Although the results of some studies suggest that increased volume may improve quality (or practice makes perfect), and a larger unit can deal better with any variability in demand than a small one, the volume-outcome relationship is not universal. It is also possible that some diseconomies of scale may result with a larger organisation, because the larger the hospital the harder it might be to manage the institution (Harrison and Prentice, 1995).

It is also possible that volume and the quality of care are linked through a number of intermediary variables (Flood and Scott, 1987). For example, larger hospitals may have better trained staff or a different case mix through which better outcomes are mediated. The results of a prospective cohort study by Munoz et al. (1990) lends some support to this notion. Munoz found that orthopaedic surgeons who had a high volume of admissions had better patient outcomes than their low volume colleagues.

Closely allied to the issue of the relationship between volume and quality is the issue of the distance a population must travel to an emergency hospital i.e. large centralised specialised facilities versus more numerous general facilities that act as district hospitals.

Two related questions are of central importance to this issue. Firstly, is the threshold for admission higher at larger, urban hospitals and does this elevated threshold have any bearing on the quality of secondary care available in a region? Secondly, what is the relationship between the size of a hospital (and the number of procedures that are undertaken in the organisation) and the quality of care provided by that institution?

Although a number of studies have found that larger, urban hospitals with higher patient volumes are associated with higher quality of care, these studies are almost all observational and liable to confounding (Snowden et al., 1995). While centralised services may (possibly) be more effective, local hospital services might be more equitable, appropriate and highly valued by their local population.

Most of the work examining this issue has focused on the treatment of major trauma and not emergency medical care. However, at least some of the principles may be transferable, such as the tension between the provision of devoted multi-disciplinary teams and the need for a hospital to have sufficient size to enable these teams to be an economical proposition. Evidence from the US and Holland suggests that larger hospitals are able to offer better standards of trauma care (American College of Surgeons, 1979), (Draaisma et al., 1989). That is, special technical teams and large multi-disciplinary teams provide better outcomes for patient care (Anonymous, 1995). This improved care may operate through a number of mechanisms, for example, large hospitals have been shown to be less likely to have emergency procedures performed at night by junior doctors supervised by a consultant (Anonymous, 1992).

Any emergency hospital, irrespective of its size, needs a good operational management system with which to function, i.e. there needs to be a clear process where appropriate staff are available to function as an integrated team at any time of the day. A large hospital provides economies of scale and a larger pool of resources to facilitate the efficient functioning of such a system (Bazzoli et al., 1995; Redmond et al., 1993; McNicholl, 1992; Irving, 1988). However diseconomies of scale are also possible (Anonymous, 1995; Bazzoli et al., 1995). As major trauma occurs in less than 5 per 1000 ED attendances it is not cost effective to have a designated team available at small towns or cities on a 24-hour basis. It is notable that trauma teams have not been shown to be effective outside of the United States, although in the UK a case control study is currently underway to evaluate the effectiveness of a large trauma centre (Redmond, 1993).

Knowing how the relationship between volume and quality operates is of considerable policy importance. If it is the link between the individual clinician and volume that is important then quality is portable and the actual volume of patients in the smaller volume hospitals is irrelevant. If instead the link is with the institution as a whole then quality is not portable—what is, merely requiring the surgeons at large hospitals to work in smaller ones will not improve the quality of the care provided at the small institutions. It must still be remembered that these findings are statistical associations based on cross-sectional data. This implies there is, at best, only a general relationship between the variables and not an absolute one. In other words, while it may be possible that there is a direct relationship between the volume of admissions and their outcome, it is an ecological fallacy to expect that all large hospitals must have high-quality services.
Randomised controlled trials are considered to be the optimal method of determining the effectiveness of an intervention because of their inherent ability to minimise the effects of bias and confounding (Sackett et al., 1997). However, a number of problems are evident with any attempt to use a randomised controlled trial to evaluate the effectiveness of an intervention to substitute for inpatient care or prevent hospital admission.

**Ethical issues**

It is unethical to randomise patients who are seriously unwell to care outside of a hospital setting. In addition, any study that randomised less severely sick patients would need to closely monitor these people to ensure that if their condition deteriorated they would be promptly hospitalised. A safe margin of error would need to be kept with this process and as a result significant contamination of the randomisation process would occur.

**Logistical issues**

Conducting a randomised trial in an acute care setting is logistically demanding. Enlisting the assistance of clinicians in enrolling patients in a randomisation process may be difficult, particularly if the process allocates a different admission option to what the practitioners would prefer. It would clearly be impossible to blind all the study participants to their treatment status.

A large study with a suitable amount of statistical power would probably need to involve a number of hospitals and health provider organisations. Enlisting the co-operation of a number of organisations and subsequently ensuring all the participant institutions consistently applied the study protocol would be an onerous undertaking. In addition, it may be difficult to gain the full co-operation of a number of professional groups who may perceive that the study was attempting to challenge their traditional roles and undermine their professional boundaries.

Alternative study methodologies to randomised controlled trials (such as quasi-experimental studies) may be more suitable for evaluating the efficacy of alternatives to inpatient care. However, there is still a remarkable scarcity of evaluated alternatives to hospitalisation for many groups of patients. In particular, there is a notable shortage of New Zealand-based research. Most of the work has been conducted in the United States (usually in Health Maintenance Organisations or amongst socio-economically disadvantaged groups without any health insurance) or alternatively in the United Kingdom (among fundholding general practices who purchase integrated community services). Considerable uncertainty exists about the ability to generalise any findings from these studies to the New Zealand situation where neither Health Maintenance Organisations or full fundholding practices exist which both purchase completely integrated community services.

Finally, it is possible that any intervention that has historically been found to be effective in a previous health care system may not be applicable to any modern, reformed system. It is possible that current health care systems in most western countries may have relatively less surplus resources (funding, hospital beds or staff) to accommodate any changes to their existing arrangements. Therefore, for example, alternatives to hospital bed use may not be currently possible because community organisations are already overwhelmed with the demand for their limited services.
Interventions to reduce hospital admissions can be divided into those applied either at the organisational (macro) level or those delivered at the (micro) level and concern the management of individual patients.

Alternatively (and perhaps more logically) interventions to reduce acute medical admissions could be classified according to whether they were aimed at the hospital, the community or the interface between the hospital and the community.

Figure 9 illustrates the spectrum of interventions that have been investigated to assess whether they are alternatives to inpatient care in relation to this (hospital, interface, and community) classification system. Unfortunately this system does not facilitate a clear review of the interventions because many interventions have been applied in more than one setting (e.g. guidelines have been applied to hospital, community and interface based interventions).

MACROMANAGEMENT STRATEGIES TO REDUCE ACUTE ADMISSIONS

Hospital closure(s)

Recent articles have expressed the opinion that the most effective method to reduce unnecessary hospital usage was simply to close hospital beds e.g. (Edwards, 1997) (see Table 26).

Wennberg maintained that in a system with more capacity to admit patients, admission rates would be higher than in a system with fewer hospital beds regardless of the health status of the population. Therefore by eliminating surplus capacity and instituting the optimal hospital bed to population ratio, the best use will be made of hospital resources (Wennberg, 1996).

Wennberg suggested that benchmarking was the most appropriate method to determine the optimal hospital bed to population ratio for any given population (Wennberg, 1996). Using as a benchmark the admission rates of hospitals that had national reputations for both quality and a commitment to scientific medicine, Wennberg then estimated the appropriateness of the admission rates of other hospitals that had population catchment areas with broadly similar demographic profiles. Wennberg claimed that any reduction in an area’s hospital bed capacity could not harm patients, because research does not support any relationship between the number of hospital beds in a population and the mortality rates for that population (Wennberg et al., 1989).

The ecological approach used by Wennberg is a stark contrast to the detailed analysis of the appropriateness of each individual admission that has been conducted in studies undertaking utilisation review. Instead of individual cases, Wennberg evaluated medical admissions from an aggregate resource allocation perspective. The solution for Wennberg to reduce the increase in inappropriate hospital admissions therefore lies in a reduction in the number of hospital beds in an area and not in any micro-management strategies such as the introduction of admission guidelines or the application of appropriateness criteria to individual cases.

The crucial problem with Wennberg’s thesis is that relatively little is known about the effects of changes in an area’s hospital bed capacity and its relationship with population-based outcomes. The limited information that is available suggests the relationship is complex and multifactorial, such that changes in hospital bed capacity are likely to have different and largely unpredictable results in different locations (see Section Two). For example, any consideration of hospital bed availability would also need to include the effect of decreasing bed stay as well as the supply of bed stock.

Rosenbach and Dayhoff (1995), in a quasi-experimental study, compared hospital admission rates in areas with large numbers of rural hospital closures to others where bed numbers had remained stable. Closure areas exhibited marked reductions in admission rates but were not associated with an increase in mortality. An increased number of visits to physician services were not found to have substituted for the reduced number of hospitalisations, although there was a small increase in admissions to surrounding hospitals in some areas.

Limitations to this study included the use of a relatively small sample size combined with a short duration of follow-up. In addition, many of the hospitals (6 out of 11) in the study had occupancy rates that were relatively low (less than 50).
An economic model developed by Coffey (1983) explored the relationship between hospital supply and utilisation within a larger model that included both the public and private sectors. Coffey, not unexpectedly, found that an increase in the price of private sector hospital care or a reduction in the number of beds both resulted in a reduction in private sector utilisation and a compensatory increase in public sector admissions. Coffey also found that a reduction in the time taken before care could be obtained in the private sector or an increase in the distance to a private hospital both increased the utilisation rate of public sector hospital beds in an area.

It is notable that the study required a large number of assumptions in order to undertake its analysis. However, only a limited sensitivity analysis was undertaken to assess the impact of changes in the variables used in these assumptions.

Conclusion

- A small number of studies (that have generally employed relatively unrobust research methodologies) have found that hospital closure is associated with a reduction in the rate of inappropriate admission. Although it is possible that one effect of hospital closure may be to reduce the amount of hospital admissions in an area, the other effects on the mortality and morbidity of the local population have not been sufficiently well explored to enable any conclusions to be made about the relative merits of this intervention.

The effect of changes in hospital reimbursement on admission rates

A number of different organisational arrangements have developed (mainly in the US and the UK) over the last two decades to determine how hospitals and primary care practitioners (mainly general practitioners) are reimbursed for their services. The three most important developments are:

1. Prospective DRG payment.
2. Fundholding or budget-holding.
3. Health maintenance organisations (HMOs).

Prospective DRG payment

Increasingly, hospitals are paid by contracts that prospectively specify the number of service units (DRG) for different conditions (Wilkinson and Sainsbury, 1995).

The introduction of prospective payment systems has been credited with reducing the inappropriate expansion of demand-led services, such as unnecessary acute admissions, in health care systems (Marks, 1995). This payment system is based on estimates of the costs of treating patients by diagnosis. There are over 450 mutually exclusive, diagnosis-related groups (DRGs), and each admission is coded according to its most appropriate DRG. Payment is then made on the basis of a predetermined amount per DRG, regardless of the actual costs of providing care for the individual patient.

This system has been found by a number of studies to be effective at containing admission rates and hospital costs. The evidence for this conclusion largely comes from two types of studies: cross-sectional or quasi-experimental studies.

A number of population-based, cross-sectional studies have found that health care markets with high numbers of HMOs using prospective payment systems are associated with relatively lower hospital admission rates (e.g. Altman and Young, 1993) (see Table 27).

Other studies that have compared groups of HMOs that have adopted a prospective payment system with those that have maintained a fee for volume payment system have concluded that inpatient usage, and its associated costs, are lower in the HMOs with prospective payment (often by as much as 40%) (Manton et al., 1993; Robinson, 1996b; Miller, 1994; Robinson and Casalino, 1995). For example, a study by Rosko and Broyles (1987) compared hospitals in New Jersey which had adopted a prospective payment system with others based in Pennsylvania where reimbursement was still made on a retrospective basis and found that prospective payment was associated with less inpatient costs per day and lower costs per admission (by 9% and 14%, respectively).

Another comparison, using cross-sectional data, of US states that had a high proportion of HMOs providing medical care suggested that those areas with a substantial proportion of care provided by HMOs were associated with lower admission rates and ED visits (Weil, 1996). The author suggested that the inherent fiscal incentives in these organisations reduced unnecessary utilisation.

A before and after, quasi-experimental comparison by Powers (1997) found that emergency admissions decreased by 15% after the introduction of prospective payment in Connecticut. The introduction of prospective payment was associated with a reduction in the acute admission rate of patients enrolled in the US Blue Cross or Blue Shield plans in the US (Scheffler et al., 1994).

Another study that used a similar methodology by Muller (1993) also found that the introduction of a
prospective payment system for Medicare patients was associated with a significant reduction in the number of hospital admissions between 1970 and 1992. However, it was noted that the decrease in hospital admissions had plateaued by the end of the study.

Despite the fact that both types of study design (cross-sectional and quasi-experimental) have only a limited ability to control for the effect of all possible confounders in their assessment of the relationship between the introduction of the prospective payment system and hospital admissions, the validity of the research findings is considerably strengthened by the consistency of all the study results.

Further conclusive evidence of a causal association between the introduction of prospective payment and a reduction in hospital admission rates comes from a controlled trial undertaken by the Rand Corporation in the United States (Manning et al., 1985). The study randomly assigned 1580 people to receive free care from either a fee for service physician (431 people) or an HMO (Group Health Cooperative of Puget Sound) (1149 people). Another 733 people shared in the cost of their fee for service care but also received their care at the HMO. The trial found that both groups that had received HMO care (either free or with cost sharing) had reduced their hospital admission rates. The authors argued that more preventive visits and a different style of medicine in an HMO practice were responsible for the lower admission rates in these groups.

A final consideration is that the benefits that could accrue from the introduction of prospective payment might depend on how much excess funding was present in a country's health system. Therefore, if prospective payment was introduced into a country that already was functioning on a lean amount of funding, any benefits from the economic incentives inherent in prospective funding may be small.

In this regard, the impact of prospective payment in New Zealand, which spends considerably less per capita on its health care than the United States, could potentially be very informative (OECD, 1994). No published trials were located that have reviewed the impact of prospective payment on medical admissions in this country. In particular New Zealand's purchasing arrangements for inpatient care often involve cost and volume contracts that reduce the price paid for DRGs over a specified volume (Ministry of Health Performance Monitoring Unit, 1998). No studies were located that have assessed the impact of these contracts on the acute demand for hospital care.

A further area of research interest not apparently currently reviewed in the published literature would be to undertake an assessment of the effects of different (and presumably intermediate) amounts of prospective payment for halfway type beds such as those available in assessment or observation units.

In light of the increasing number of health funding organisations in the United States using prospective payment and the consistently negative effects of that form of payment on hospital utilisation, some authors have suggested that, at least in the US, the hospital is becoming pushed to the periphery of health care (Robinson, 1996b). In an apparent attempt to offset this decline in the role of the hospital, some large hospital–based organisations in the US have increased their involvement in primary care by taking over nursing homes, physician’s ambulatory practices or a number of outpatient services to provide larger, more vertically integrated organisations (Robinson, 1996b).

Some authors have argued that the introduction of prospective payment and the development of vertically integrated health care organisations have been detrimental to the quality of health care. For example, a cross-sectional study by Derlet and Hamilton (1996) found that a significant number of people who were subsequently admitted with serious acute medical problems had previously been denied ED treatment because they failed to receive authorisation from their HMO to attend the ED (Derlet and Young, 1997).

Conclusion

- Overwhelmingly consistent evidence exists that prospective payment is associated with a reduction in hospital admission rates. However, concerns have been expressed that this reduction may be at the expense of some quality of care. For example, Wilkinson and Sainsbury (1995) suggested that DRG payment for the inpatient care of the elderly was associated with the premature discharge of older patients who often needed prolonged rehabilitation on account of their general frailty and the frequent presence of multi-system disease. In addition, some doubt exists about the accuracy of the DRG coding. Some commentators have noted that the payment system provides an inherent incentive for hospitals to maximise their profit by coding for a more expensive DRG even when a cheaper alternative may have better described the inpatient treatment that was actually delivered (e.g. Iezzoni, 1990). At least some of the reduction in admission rates associated with DRG-based payments may therefore be an artefact that has resulted from changes in coding rather than any true changes in service delivery.
Fundholding or budget-holding

Fundholding or budget-holding involves the allocation of set budgets to (usually) general practitioners for the purchase of selected treatments for a specific group of patients. Most primary care-based budget-holding experience in New Zealand has been through Independent Practice Associations (IPAs) and other umbrella organisations acting as budget holders for largely primary care-based funds (Malcolm and Powell, 1996).

A core feature of budget-holding in the UK has been that the negotiated budget is deducted from that of the relevant health authority to enable the purchase of certain secondary care services (Harrison and Choudhry, 1996). As funds are allocated on an ex ante basis, and the primary care practitioners are responsible for how the funds are spent, the practitioners are motivated to provide the most efficient services to their patients (Wilton and Smith, 1998).

Some commentators have suggested that because emergency admissions are not a charge against fundholder’s budgets, fundholders may have less of an incentive than non-fundholders to reduce emergency admissions (Keeley, 1997). The only study that has evaluated this issue did not find any evidence that budget-holding practices in the South Western region of the UK were associated with different admission rates compared to non-fundholding practices (Toth et al., 1997) (see Table 28). The study was a before and after, quasi-experimental trial that examined the relationship between fundholding status and the frequency of emergency admission for a number of (mainly surgical) conditions. However, the study was limited by its small size and retrospective design. In addition it could not exclude the possibility that relatively high rates of admissions may have been occurring even before the introduction of fundholding in the small and unrepresentative number of practices that were included in the trial.

Nonetheless, the study’s main finding was consistent with the results obtained by two studies based in Oxford that assessed the relative referral rates to outpatient clinics for patients in either fundholding or non-fundholding practices, although it should be noted that these two studies largely excluded acute medical admissions (Coulter and Bradlow, 1993; Surender et al., 1995). By contrast, another study that evaluated the effect of budget-holding on referrals from general practices in Scotland found that these practices exhibited a large decline in their referral rates for non-urgent conditions (Howie et al., 1995).

Given the inconsistency in the findings from these four studies it is remarkable that more research, using more sophisticated methodologies and larger sample sizes, has not been conducted on patient outcomes (including the effect on acute medical admissions) associated with “one of the most fundamental changes in the structure of the NHS in recent years” (Roland, 1991).

No New Zealand-based research was located that has evaluated the effect of the introduction of IPAs on admission rates for emergency medical conditions.

Interestingly the method of reimbursement for individual physicians may also have little effect on hospital admission rates. A retrospective cohort study found no change in admission rates for practices from one year before until three years after their conversion from a fee for service to a capitated payment system (Hutchinson et al., 1996)

Conclusion

- It appears from the limited evidence available that budget-holding has a mixed effect on the admission rate of patients with acute medical conditions.

Effect of HMOs on admission rates

HMOs are largely a United States development, and represent an organised system for providing comprehensive prepaid primary and secondary health care to an enrolled population (Kuttner, 1998). HMOs usually include aspects of prospective payment and budget-holding.

Several commentators have suggested that HMOs include financial incentives that favour a reduction in discretionary uses of health care resources. In particular, a number of articles have suggested that HMOs accomplish cost savings primarily through lower overall rates of hospital admissions (Greenfield et al., 1992; Manning et al., 1985; Luft, 1978). However, other research has found a contrasting result and has concluded that HMO membership is associated with higher rates of hospital admission (see Table 29).

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5 Two studies have recently described the development of a variation of an HMO specifically targeted at the frail elderly in the United States (Kunz and Shannon, 1996) (Eng et al., 1997). This variation, known as PACE, (Programme for All-inclusive Care for the Elderly (PACE) enrolls elderly people in rest homes and provides them with comprehensive acute and long-term primary, secondary and tertiary care. The plan involves case management by a multi-disciplinary team with an emphasis on primary and preventive care. The PACE organisation receives a capitated payment from US government health funders Medicare and Medicaid. Although PACE appears promising it requires more formal evaluation to assess if it can effectively reduce the demand for acute inpatient care.
The randomised controlled trial by Manning found that membership in an HMO was associated with a reduction in admission compared to free care provided by usually fee-for-service physicians (Manning et al., 1985). By contrast, a large (n=3006), prospective cohort study by Pearson et al. (1994) assessed the patients who had presented to an emergency department with chest pain in the United States and found those patients who were members of an HMO, and who had a low risk of a myocardial infarction, were more likely to be admitted to hospital with their chest pain than non-members who had a similarly low risk of MI. The higher admission rates persisted even after other clinical differences had been controlled for in a multiple logistic model (Pearson et al., 1994).

Among the studies that have found lower admission rates for HMOs, little information is available to describe how these lower admission rates were accomplished. Ideally HMOs would reduce admission rates by eliminating inappropriate hospitalisations or by providing the appropriate substitution of adequate ambulatory, or home services, for inpatient services. Some concern has been expressed that financial restraints within HMOs could lead physicians to under treat some conditions e.g. (Rehnman, 1985) (Simon, 1993). Research has provided conflicting results as to whether HMOs have been able to selectively reduce inappropriate admissions.

Rates of complications associated with appendicitis have been suggested as an index of the quality of care in an organisation because these complications can be avoided by the provision of timely surgical intervention. A small study among children by Adolph and Falterman (1996) found the complication rates associated with appendicitis were lower in a managed care organisation than among patients receiving fee for service care.

However, another study compared inpatient utilisation among patients receiving fee-for-service health care with two other groups; either patients just prior to their enrolment in a Florida (USA) HMO or immediately after their disenrolment from the HMO (Morgan et al., 1997b). The study found the use of patient services was 66% of the rate in the fee-for-service group, whereas the rate in the HMO disenrolment group (immediately after disenrolment) was 180% of that in the fee-for-service group. The authors concluded that significant selection biases occurred with respect to who was either enrolled or disenrolled in an HMO in the United States.

Consequently, it is possible that lower admission rates associated with HMOs (compared to patients receiving Medicare services) may be due to their selective enrolment of a higher proportion of healthier people.

Conclusion

- Patients enrolled in an HMO have exhibited lower emergency admission rates. However, it is not clear if HMO membership selectively reduces unnecessary admissions and whether selection bias (that is, healthier people may be preferentially enrolled in HMOs) may account for some of this reduction.

Public health interventions to reduce admissions

A review of the ability of health promotion programmes to reduce hospital usage has been presented by Fries et al. (1993). Fries argued that public health campaigns have the largest potential ability to improve population health outcomes and specifically reduce hospital admission rates.

An ecological study by Streeton and Nolan (1997) recorded a 66% decrease in the number of burn admissions in Australia between 1970-1994 (see Table 30). The reduction was suggested to be the result of mandatory changes in sleepwear standards, alluded to a health promotion campaign that was designed to educate caregivers about the dangers of hot baths and boiling jugs in order to reduce hot water scalds to young children in Victoria. However, the ecological design of the study does not exclude the possibility that other changes, such as differences in coding or admitting practices, may also have accounted for at least some of the decline in admission rates.

Another ecological study, based in Sweden, attributed the reduction in admissions for acute pelvic inflammatory disease to more frequent condom use associated with increasingly widespread safe sex education in Sweden between 1970-1994 (Kamwendo et al., 1996). Once again, the limitations of a ecological study design prevent the exclusion of other factors, such as demographic changes or differences in the pathogenicity of microbes, that may have been important in the decreased admission rate.

The evidence for the effectiveness of immunisation campaigns to reduce hospital admission rates is more robust. A large US cohort study (25,000 people) found that the provision of influenza vaccination to elderly people markedly reduced their hospital admission rates and also realised significant fiscal savings in a US HMO (Nichol et al., 1994). The study included a considerable amount of information about possible confounding factors in its multivariate analysis.

Several studies that have used a time series cross-sectional design have consistently found there has been a marked reduction in paediatric admission rates since the introduction of haemophilus influenza
type B immunisation e.g. (Liptak et al., 1997; Gorelick and Baker, 1994). In the US, the use of the vaccine has been associated with a reduction in admission rates for epiglottitis from 10.9 per 10,000 admissions in 1990, to 1.8 per 10,000 admissions in 1992 (Gorelick and Baker, 1994). Although the time series methodology used by these studies is unable to exclude other explanations for the decrease in admission rates, both studies that have used this methodology have found consistent results. This consistency suggests there is some validity in the findings.

A large population-based, cohort study examined the outcome for motor crash victims who were categorised according to whether ambulance staff noted that seat belts were worn on the arrival of staff at the accident scene (Henry et al., 1996). The study concluded that the use of seat belts among the victims reduced the likelihood of hospital admission by 33% (95% CI: 0.46-0.98). However this result may have been subject to some measurement bias because it is possible physicians were more likely to admit patients whom they knew did not wear a seat belt at the time of their accident.

A US-based study found that a promotional campaign to increase the number of bicyclists and motorcyclists wearing helmets may have contributed to a reduction in hospital admission rates between 1986-1993 (Mock et al., 1995). The study had several limitations that prevent a definitive conclusion about the effectiveness of the campaign; it was not population-based, and confounding may have resulted from changes that occurred in the referral patterns to the trauma centre over the time period of the study. Despite these reservations, the study’s result is consistent with findings from research based in other countries that has used a similar cross-sectional design (e.g. Rivara et al., 1994) and other studies that have used different methodologies (e.g. case control study by Thompson et al. (1989)).

A recent descriptive study found that between 1979 and 1988, 238 cyclists died in New Zealand while a further 1500 cyclists were annually admitted for inpatient treatment (Collins et al., 1993). Most of the fatalities and admissions were due to head injuries. The results of this study highlight the potential to reduce admission rates from a successful campaign that increased the proportion of cyclists who used safety helmets.

An interesting series of studies was conducted in Victoria (Australia) which surveyed helmet use before and after the introduction of legislation requiring cyclists to wear helmets. Rates of helmet usage were then compared with hospital admission rates (and fatality rates from head injuries) among cyclists (Cameron et al., 1994). The study found that helmet usage markedly increased in the two years after the introduction of the legislation, and there was an associated significant reduction in both the rates of hospital admission and death amongst cyclists.

However, the limitations of the quasi-experimental design used in this trial were made apparent by the results of another study undertaken by Robinson (1996a), who found that although injuries amongst cyclists had declined following the introduction of the legislation, so had the number of people cycling. It was therefore possible that hospital admission and fatality rates among cyclists had reduced in relation to a decline in the number of cyclists rather than in response to the effects of the new legislation.

In addition, Robinson noted that the introduction of the legislation coincided with a major road safety initiative in the state directed at changing the behaviour of speeding or drinking drivers. Robinson found that hospital admission and fatality rates among car drivers had decreased by the same amount as cyclists over the study period and he suggested the reduction in severe head injury mortality and morbidity may have therefore been attributable to a change in behaviour amongst drivers and was not the result of increased helmet use among cyclists.

Another cohort study that examined the use of cycle helmets among patients presenting to an ED department in the UK, found that helmet wearers were 325% less likely to sustain a head injury in relation to cyclists without head protection (Maimaris et al., 1994). The study also had a number of significant limitations. In particular, it could not exclude the possibility that helmet wearers were generally more safety conscious than non-helmet wearers and were therefore less likely to be involved in a serious accident.

A quasi-experimental study by Ytterstad (1996) evaluated a community-based intervention to educate the public and professionals about the hazards present in the home that can cause falls in the elderly as well as methods to reduce the risks associated with these hazards. The study found that the intervention was associated with a 16.6% reduction in hospital admission rates for fracture secondary to falls among the elderly. However, the study did not consider the possibility that the result may have been confounded by differences between the study groups in their number of elderly living alone, or their number of prescribed medications.

**Conclusion**

- Population-based campaigns to reduce hospital admissions related to falls, head injuries and scalds appear to have been effective. However, firm conclusions are difficult because of the
large number of potential confounders in the trials.

*Provision of home hospital care*

Parallel reasons for rise in alternatives to hospital care

Regardless of the rise in emergency admissions a number of other reasons have fuelled the hunt for alternatives to hospital-based care. These include an increasing recognition of the problems associated with hospitalisation, including nosocomial infections, risks associated with prolonged bed rest and potential psychological problems related to institutional care. Allied to the general disquiet associated with the deleterious effects of inpatient care are the rapidly increasing costs associated with the buildings, staff and the other resources needed to maintain modern hospitals (Marks, 1995).

Overview of alternatives to hospital-based care

A number of activities undertaken in hospital are potentially separable or substitutable because the clinical links to other hospital activities are weak. A number of innovations have been explored in New Zealand and elsewhere that substitute for hospital-based care. However, most of these alternatives have grown from only local initiatives, and they have not emerged from a detailed, rational examination of each element of the workload of a hospital and close examination of the cost-effectiveness of which option presents the best health outcome for patients (Harrison and Prentice, 1995).

The closest approach to such a detailed and systematic examination was presented by Spiby at the Kings Fund (Spiby, 1995). Spiby identified the potential for transfer for each of a number of common hospital admission diagnoses. However, the author stressed that the exercise was closely based on local resources around Bromley (UK), and the findings may not be applicable to other areas.

The conclusion by Evans (1984) about the role of the hospital would still appear to aposite today: “No one has yet attempted to assemble the literature on alternatives to conventional inpatient care, to see what the aggregate impact of the substitution of other modes of care could be. A study which looked, diagnosis by diagnosis, at the savings in hospital use which have been demonstrated in some form of experimental or field trial without deterioration of patient outcome would most certainly yield very important results indeed.”

Unless such a review is undertaken it seems likely that the hospital will remain the dominant institution in the health landscape (Harrison and Prentice, 1995). Several authors have commented that hospitals over the last two centuries have continued to grow perhaps “because they are there”. They have relentlessly continued to gain additional functions as they and hospital-based consultants continue the “inexorable expansion of specialisation” (Rees, 1995).

Hospital-at-home services have received a considerable amount of recent literature attention, although opinion articles considerably outnumber clinical trials (Steel, 1991).

The provision of home hospital care contains three different assumptions (after Harrison and Prentice, 1995). That:

- Better services outside of hospital will reduce the need for hospital services.
- Some non-hospital services are more cost-effective than hospital services.
- Some hospital services can be better provided in other more familiar settings with reduced risk of acquiring an iatrogenic infection and where patient comfort and healing can be enhanced (Anonymous, 1996a).

Hospital-at-home interventions have received increasing attention, particularly in the United States where a recent cross-sectional study by (Hafkenschiel, 1990) found the introduction of prospective payment systems in that country had significantly increased the amount spent on home care. Furthermore, hospital-at-home interventions may be appropriate for a significant percentage of patients currently admitted for inpatient care. Leff et al. (1997) presented a prospective record review that found home hospital care may have been appropriate for one third of their sample of 150 elderly patients admitted to US hospitals.

A major review by Marks (1991) of home care identified four parallel streams of literature in hospital-at-home care: substitutes for hospital-based acute care, early discharge programmes, terminal illness care, and the provision of high technology care at home.

*Hospital at home for acute illness*

The review by Marks (1991) identified studies that have examined the use of hospital-at-home care as a substitute for acute inpatient care for patients with an acute stroke or myocardial infarction. The literature on hospital at home treatment for myocardial infarction is now largely redundant with the advent of thrombolytic therapy, which has ensured that inpatient care is now mandatory for this condition.

Marks found that the best example of research concerning the use of hospital-at-home care for acute stroke was a randomised controlled trial by Wade et al. (1985). Specialist home care was trialled in the
UK with the rationale that many stroke patients with minor disability would not require admission to hospital if appropriate support and rehabilitation could be provided in a domiciliary setting. Wade et al. (1985) found there was no difference in mortality or functional recovery between the two study groups but (in contrast to the study hypothesis) there was a markedly higher use of hospital bed days for the intervention group. In addition, home care was found to be the more expensive treatment option. The authors accounted for their surprising results by reference to deficiencies in the randomisation process between the two groups. A number of randomised controlled trials are now further exploring this model of care in a variety of other settings (Langhorne, 1997).

The lack of any significant benefit in functional capacity by either the provision of inpatient care or hospital at home is interesting, although an important issue is whether inpatient care in a general medical hospital is the appropriate ‘gold standard’ with which to compare an intervention.

The recent findings from another Cochrane review group report that compared the relative effectiveness of a multidisciplinary, specialist stroke unit to standard inpatient care offer an important insight (Warlow et al., 1997). The report identified 12 randomised controlled trials which again met exacting inclusion criteria for the quality of the research, and found that stroke patients managed in specialist units were more likely to be alive, and living independently, one year after their stroke. In the light of this result, it would seem the most appropriate comparison of the effectiveness of hospital-at-home care is with that provided at specialist units. No trials were identified that have attempted to undertake this analysis.

A further area where hospital-at-home treatment has been trialled as an alternative to traditional inpatient care is in the acute care of patients with a lower limb deep venous thrombosis (DVT). Two descriptive studies, both based in Australia, consistently found that hospital-at-home care was a safe and effective option for the management of a DVT (Ting et al., 1998; Montalto, 1998). These programmes have been assisted by the development of low molecular weight heparin, which can effectively be delivered subcutaneously rather than intravenously. The results from these small studies (n=100 (Montalto, 1998); n=231 (Ting et al., 1998)) both found that hospital-at-home care was associated with no major problems.

Although promising, the lack of any control group in these studies prevents any conclusions from being made about the relative efficacy of home care for DVT treatment.

**Hospital at home to assist early discharge**

A small (76 patients) case control study based in South Derbyshire (UK) examined the provision of hospital-at-home care to facilitate patients’ early discharge following a surgical repair of a fractured neck of femur (O’Cathain, 1994). The study found there was a small but not significant increase in the readmission rates of those patients who had received hospital-at-home care. However, the study had compared patients on the basis of whether they (and their consultants and GPs) had agreed to the intervention or not. This definition of study groups markedly limits the validity of the study’s findings, because it is likely that those patients who agreed to participate would differ in their prognosis compared to those patients (or their physicians) who had decided not to participate. Large prospective randomised controlled trials are necessary to conclusively find if hospital-at-home care is safe and effective.

A Cochrane review group recently reported the effectiveness of hospital-at-home interventions to assist with the early discharge of medical and surgical patients (Shepperd and Illiffe, 1997). The report identified four trials that met their tight inclusion criteria (Adler et al., 1978; Donald et al., 1995; Martin et al., 1994; Ruckley et al., 1978). Another two randomised controlled trials have been recently published (Richards et al., 1998; Shepperd et al., 1998b). Three studies were located that have addressed the relative costs associated with home-based care for early discharge (Cummings et al., 1990; Shepperd et al., 1998a; Coast et al., 1998) (see Table 31).

The studies generally found that patients discharged early to hospital-at-home care expressed greater satisfaction than those who remained in hospital, while carers expressed less satisfaction than the hospital care group. Although Adler et al. (1978), Ruckley et al. (1978) and Cummings et al. (1990) found overall costs were lower for the home care group none of these studies were able to find a statistically significant difference between the net overall health care costs.

Shepperd and Illiffe (1997) concluded in their systematic review that there was insufficient evidence to support, or discontinue, hospital-at-home schemes for early discharge. Despite the small number of studies included in their review, there was still significant heterogeneity between the trials. Furthermore no single study had sufficient power to detect a statistically significant difference between the study groups. In addition, many of the studies (for example, Cummings et al. (1990)) included a number of assumptions about the costs involved in the study but then failed to present a sensitivity analysis to allow for variations in these estimates.
The study by Cummings et al. (1990) found that patients receiving home care reported a higher satisfaction with care, and better functional status and morale. However, the trial could not exclude the possibility that these findings might have been due to the more intensive follow-up associated with the group receiving home care.

By contrast, the two recently published controlled trials (Shepperd et al., 1998b; Richards et al., 1998) were conducted more rigorously. Both trials employed a more robust randomisation procedure and detailed sensitivity analyses were undertaken in each of their associated cost-minimisation studies (Shepperd et al., 1998a; Coast et al., 1998). One of the trials was also undertaken with ample statistical power (Shepperd et al., 1998b). Both of the trials found there were no differences in health outcomes associated with the provision of hospital-at-home care for the early discharge of medical and surgical patients compared to usual inpatient care.

However, despite the consistency in these results some difficulty still exists in generalising this finding to other areas outside of the two small, English district hospitals in which the studies were undertaken. It is very likely that the health outcomes associated with these studies were closely related to both their case mix and the local arrangements of how patient care was delivered to either the hospitalised or home care groups. Consequently the question of whether hospital at home can provide similar health outcomes to home care still remains uncertain pending the completion of a large multi-centre controlled trial.

Accepting the limitations of these recent studies, their consistent finding that health outcomes were similar when care was delivered in either an inpatient or hospital-at-home setting is important because it implies cost may be the most important factor to discriminate between which type of care should be provided.

The findings from the two cost-minimisation studies associated with each of the randomised trials are therefore especially important. In contrast to the similar outcomes associated with the controlled trials, there was a marked discrepancy in the results obtained by the two cost-minimisation studies. While Shepperd et al. (1998a) found that hospital-at-home care did not reduce total healthcare costs, Coast et al. (1998) concluded that home care was less costly than treatment in an acute hospital. The different perspectives that were employed in each of the two studies might explain their contrasting findings. The study by Coast et al. (1998) was undertaken from the perspective of including all the costs borne by the health and social services as well as those costs that applied to patients and their families. By contrast, Shepperd et al. only examined the costs that were associated with the use of health services. Hospital-at-home schemes therefore appear to shift costs within the health sector from secondary to primary care organisations and from the health sector to social services and (perhaps) to the patient.

However, both studies were too small to be able to provide any fundamental answers about the value of hospital at home schemes. As discussed, the results of these studies may be too reliant on the characteristics of local services that may have influenced the recruitment to the study and the duration of inpatient care.

Another possibility is that early discharge may not reduce health care costs, perhaps because patients are discharged at a time when they need least resources. When a patient only needs nursing care it is possible that a hospital has the best economies of scale to deliver this service at the least cost.

The results of several large and ongoing controlled trials may soon provide more insight into the cost-effectiveness of home care, at least when it is applied to early discharge (Iliffe, 1998).

**Hospital at home for terminal care**

The Cochrane Review (Shepperd and Iliffe, 1997) also examined one study which met their rigorous inclusion criteria for the use of hospital at home to provide terminal care. The single study (Hughes et al., 1992) was unable to find a statistically significant difference between the study groups for a number of outcomes including patient satisfaction, length of institutional stay, functional capacity, and the utilisation or costs of health services.

Another recent systematic review has also examined the effectiveness of home care for patients with incurable cancer on their quality of life and time spent in hospital (Smeenk et al., 1998). This review identified five prospective controlled trials (including the study by Hughes) that have assessed the impact of hospital-at-home programmes on readmission time (defined as the time spent in hospital from the start of the trial till death) (see Table 32).

Four out of five of these studies were randomised controlled trials. Three of the randomised trials and one non-randomised trial all reported a lower readmission time for the (hospital-at-home) intervention group, although this difference only reached statistical significance in two studies (including only one randomised trial).

None of the studies found a negative influence of home care on the quality of life or readmission times of the terminally ill. Most actually found a significantly positive effect from home care on these out-
comes. However, despite this consistency some concerns exist about the validity of these conclusions because, as Marks (1991) has pointed out, the quality of the literature in this area is generally very poor. Most attempts to evaluate the cost-effectiveness of hospital-at-home terminal care have been marred by the non-random selection of patients to hospices, and the influence of the hospices themselves on the hospital treatment of the terminally ill.

Among the studies included in Table 32, significant shortcomings exist about the comparability of the study groups, the handling of drop-outs and the blinding procedures used in the trials. In addition, it is notable that all the trials were undertaken in the United States. The emphasis on secondary care services in the US health system may allow any primary care-based intervention to produce better results than would be expected in other healthcare systems with more established general practitioner services (such as the UK, Australia and New Zealand).

**High technology at home**

Marks (1991) identified five areas where the literature had examined the use of technology at home. These areas were:
- home enteral/parenteral nutrition
- drug delivery systems
- intravenous antibiotics
- oxygen therapies
- renal dialysis and peritoneal dialysis.

Several case series studies have described the provision of home-based intravenous antibiotic treatment and have recorded patient outcomes that were as effective as inpatient-based care e.g. (van Aalderen et al., 1995; Strandvik et al., 1992; Montalto, 1997; Montalto and Dunt, 1997). The findings from these trials are hard to interpret due to the possibility that selection bias associated with systematic recruitment of less severely ill subjects may have influenced the results. None of the studies included severely ill patients or those for whom family members were not willing to provide substantial nursing support.

Tice (1995) has provided another notable descriptive study of the use of outpatient intravenous antibiotic therapy because it included the largest sample size (538 patients). A favourable outcome was reported in 92% of patients and hospitalisation was only necessary in 8% of subjects.

Unfortunately no controlled trials have been undertaken in which patients were randomly assigned to either receive outpatient or inpatient intravenous therapy (Gilbert et al., 1997). Several reports have evaluated the cost-effectiveness of outpatient-based intravenous therapy. However, their favourable results suggesting home-based care may be less expensive must be regarded with caution because of the essentially descriptive studies from which the cost analyses were derived (Grayson et al., 1995; Williams, 1994; Hindes et al., 1995).

In general, the findings from studies that have described the home-based administration of intravenous antibiotics suggest, but have not proven, that outpatient antibiotic delivery can be clinically acceptable and resource efficient although some concerns still exist about professional liability and the reimbursement policies of health funders (Clarke, 1997; Natwhani and Davey, 1996; Marks, 1991). A significant lack of high-quality research from controlled trials exists to confirm the results from numerous descriptive studies that outpatient-based antibiotic therapy is safe, reliable and cost-effective. The need for this data is also underpinned by the apparent satisfaction of patients and carers with some outpatient-based programmes (Montalto, 1996).

Home parenteral nutrition has been shown to be cost-effective using a long-term indwelling silastic catheter (Detsky et al., 1986). Another small cost utility study based in the United Kingdom also found a favourable result for home-based parenteral nutrition in relation to the treatment of intestinal failure (Richards and Irving, 1996). Although based on small and selected patient groups, these results are encouraging. Furthermore, home enteral nutrition could possibly even be applied to a wider group of patients because it is easier to administer and less costly (Marks, 1991). Home enteral and parenteral nutrition are examples of potentially successful hospital-at-home interventions that merit further research attention (Marks, 1991).

In relation to home treatment for renal disease, Marks (1991) estimated that treatment at home by continuous ambulatory peritoneal dialysis was associated with less than half the costs of hospital. However, Marks makes the point that the use of home dialysis is intertwined with the rationing issues associated with this treatment, as only those patients with a good prognosis will be able to utilise the service. That is “the treatment for end stage renal disease illustrates that ethical dilemmas over who should receive treatment are closely linked to whether treatment is offered at home or hospital” (Marks, 1991 p20).

Several studies have addressed home ventilation. Typically these studies have involved small numbers of highly selected patients. A retrospective trial of 50 patients using mechanical ventilation at home found that domiciliary ventilation was successful in maintaining well being for many years (Sawicka et al., 1988). A study of six families by Burr et al. (1983)
found that home care costs were 50-90% lower than hospital-based care.

Conclusions

- Four systematic reviews that have examined the research describing the effectiveness of hospital at home care have all reached consistent conclusions (Hedrick and Inui, 1986; Marks, 1991; Shepperd and Iliffe, 1997; Smeenk et al., 1998). The four reviews consistently found that definitive conclusions about the effectiveness of domiciliary care were hampered by heterogeneity in the methods and outcomes used by the different researchers along with significant methodological difficulties associated with individual studies. Many studies were noted to be methodologically unsophisticated and many were classified as being only partisan descriptive reviews of services by people involved in the provision of the services that were included in the studies. In addition, many studies lacked a control group or attempted to study an inappropriately small sample size (e.g. all the studies that reviewed the effectiveness of hospital at home to facilitate early discharge). In relation to the few studies that have attempted to evaluate the cost effectiveness of domiciliary care, significant discrepancies in which costs have been assessed, and the methods by which these costs have been calculated, largely prevent any definitive conclusions about the cost-effectiveness of home-based care.

- In general, the studies that have examined the effectiveness of hospital-at-home care as a substitute for the inpatient treatment of acute medical conditions, or the provision of either high technology interventions or terminal care, have all been associated with significant methodological limitations. Although the research that has examined the efficacy of hospital-at-home care for early discharge has generally been more methodologically robust, significant deficiencies still exist in the validity of these studies.

- Finally, Marks (1991) sounds a caution that home-based care may not act as a true substitute for hospital care. Instead, new domiciliary services may expose previously unmet needs. A review by Hammond (1979) noted that when the Kaiser Health Plan (an Health Maintenance Organisation in the United States) added home health care to its benefits the cost savings achieved through a reduction in inpatient hospital services were not fully offset by the costs of providing additional benefits. Allied to the uncertainty that home hospital care will produce any savings is the consideration that considerable savings would need to be accrued before the benefits of home care exceeded the substantial fixed costs involved in hospital-based care. Despite this, most authors agree that the policy environment in the UK, the US and most western countries seems to strongly favour the development of home hospital care. One of the most potent challenges to the central position of the hospital in health services has been policy to separate the funder from the provider of health services. In the new environment where institutions can weigh the value of different services, a belief has become established that priority should be given to the provision of services in the community or primary care (Harrison and Prentice, 1995).

Community hospitals/GP beds

Any evaluation of community hospitals is significantly hampered by the lack of any generally accepted definition of these hospitals. Community hospitals include a number of functions including acute care, community-based care (e.g. through therapy and nursing care), and primary care through GP beds and social services such as respite care beds. The only single common ingredient is that they all use some form of inpatient care (Anglia and Oxford Intermediate Care Project, 1997).

The single identified systematic review examining the effectiveness of community hospitals found the quality of the evaluations was poor, most being only descriptive reviews written by partisan supporters of a particular service (see Table 33). The few cost effectiveness studies that have been undertaken were hampered by variations between hospitals in their case mix, differences in which costs had been included and variations in the method by which costs have been assessed (Anglia and Oxford Intermediate Care Project, 1997). Estimates of the cost-effectiveness of community hospitals presented in the review were highly variable. The analysis concluded that the cost per day for community hospitals was less than that at general hospitals. However, overall costs were higher in community beds because the length of stay was usually longer in community settings, and bed occupancy rates were usually lower (Anglia and Oxford Intermediate Care Project, 1997).

A number of other studies have examined the use of community hospitals as a substitute for acute hospital care. These studies have concluded that between 5–60% of patients admitted to a general hospital could be treated in a community hospital (Coast et al., 1995; Tomlinson et al., 1995; Durham and Durham, 1990; Jones, 1988; Baker et al., 1986). Much of the variation in these results relates to differences in the methods that have been used to make the assessment
and differences in the case mix that was included in the study.

These assessments have used three general methods (see Table 33):

1. Retrospective reviews of appropriateness by hospital consultants and/or GPs
2. Audits of current admissions to existing community hospitals
3. Comparisons between areas with and without local community hospitals

Appropriateness review by consultants/GPs

The resource utilisation review by Coast et al. (1995) identified that the most important alternative to admission at an emergency hospital bed was the provision of care in a community hospital under GP care. However, the study warned there was unlikely to be any marginal cost benefit from substituting community hospital care for that in an acute hospital.

Another descriptive study by Tomlinson et al. (1995) of the appropriateness of 685 admissions to a community hospital in Leicestershire (England) found only 15% of patients were transferred to an acute bed and 3.5% of the patients died during their hospitalisation. The study concluded that the facility offered appropriate and effective care. However, it is notable that relatively few patients in the study had received any community services before admission, indicating that the application of criteria demanding the exhaustion of all community-based interventions before hospitalisation were arranged may generate even more appropriate referrals.

The single study in New Zealand that examined the appropriateness of community hospital admission as an alternative to inpatient care in a general medical hospital was limited by the hypothetical context of the evaluation (that is, general practitioners commented on what they would have done if a community hospital alternative existed) (Durham and Durham, 1990). It is unclear how reliable these comments were in accurately depicting what GPs actually would have done (if alternatives actually existed) and, furthermore, it is uncertain whether improved patient outcomes would have eventuated from using these alternatives.

Audit of community hospitals

A descriptive study by Jones (1988) audited community hospitals in the UK and found that considerable variation existed in their case mix. Some hospitals, the authors noted, were undertaking a considerable amount of acute medical and surgical work. At least in part this variation was because no comprehensive definition has been established as to what is a community hospital. In his review Jones devised his own definition. He defined community hospitals as “hospitals having an objective of meeting a local community’s non-specialist health care needs. Community hospitals also took a holistic approach to health care needs and gave consideration to the social and medical needs of patients.” However, this definition better represents a description of a philosophy than a hospital service. The study also concluded that no accurate cost-effectiveness studies had been undertaken on the service, and there was a lack of reliable performance indicators that could specifically be used for community hospitals.

Comparisons between areas with and those without local community hospitals

An interesting study by Baker et al. (1986) compared the total (both community and acute hospital) hospital bed utilisation rates of patients registered to practices that had access to community beds with patients of practices that did not. The study found that those patients belonging to practices that had community bed admitting rights had significantly higher admission rates to community beds and correspondingly lower admission rates to general hospital beds. However, patients in practices with GPs who had admitting privileges to community beds had higher overall (combined community and general hospital) admission rates. Baker concluded that although community hospital admissions did substitute, to some extent, for general hospital admission the provision of community hospitals also increased the total amount of inpatient care used by a population.

A retrospective case control study by Berry (1986) compared the admissions to a general hospital before and after a community geriatric hospital was temporarily closed by an industrial dispute with the hospital admission rates of a similar control population. Berry found there was a significant increase in hospital admissions (and deaths) among the study population. Berry concluded that community hospitals were effective at substituting for general hospital admissions and improved population health outcomes.

Conclusion

- Despite the reported interest in GP beds and community hospitals as an alternative to inpatient care in a general medical hospital, limited evidence exists from well-designed trials to either confirm or refute the safety and effectiveness of these hospitals. Much of the problem in the literature relates to the lack of any agreed definition of what constitutes a community hospital and the wide variations in the case mix at-
tending the different hospitals that have been described in the literature.

**Patient hotels**

Patient hotels have been defined as separate buildings adjacent to hospitals that provide good quality hotel accommodation for mobile patients who can perform some self-cares (NHS Management Executive, 1995). They are often run by private organisations. Patients attend the hospital for almost all medical and nursing interventions although sometimes nurses are used to staff the hotels (NHS Management Executive, 1995). Patients acutely admitted for care as well as those patients awaiting discharge are both eligible for residential care in a patient hotel (NHS Management Executive, 1995).

Two descriptive studies have estimated the number of emergency admissions who may be appropriate for these hotels (see Table 34).

Harvey et al. (1993) presented a cross-sectional survey of (hospital-based) doctor and patient opinions about a proposal to provide care in patient hotels. This study has a number of serious problems that restrict the validity of its findings. The study did not include any descriptive information about the patients selected for inclusion in the study so it is difficult to know how truly representative they actually were. In addition, there was poor agreement between the assessors in their estimates of the percentage of eligible patients. Finally, the trial examined the opinions of staff and patients about a hypothetical situation and did not actually audit an existing service.

The second study was a report by the NHS Management Executive, which reviewed a number of functioning patient hotels in the UK and Scandinavia (NHS Management Executive, 1995). The report also included a review of smaller versions of patient hotels (called patient hostels) and the use of beds in private sector hotels for inpatient care. The report included an assessment by an expert panel of the percentage of all the admissions to two large acute general hospitals in England that would have been appropriate for care in a patient hotel. The study concluded that approximately 14% of all the admitted patients would have been appropriately cared for if they had been admitted to a patient hotel. The authors made favourable conclusions about the use of patient hotels, however they were less enthusiastic about the use of patient hostels or private sector beds. Once again, these findings are limited by the essentially descriptive nature of the report.

**Conclusion**

- There has been surprisingly little evaluation of patient hotels as an alternative to inpatient care in an acute hospital. The two studies that have attempted to estimate the percentage of patients appropriate to receive care in a patient hotel instead of an acute hospital both found that about 10-14% of patients were eligible for hotel care. In general, most of these patients were eligible on the basis of their appropriateness for immediate discharge to a hotel bed after a brief inpatient stay in a general hospital in order to assess their condition and begin an appropriate therapy or rehabilitation that could then be maintained in a less medically-intensive setting. The validity of the findings from these two studies was significantly limited by their essentially descriptive methodology. Both failed to provide any analysis of the clinical and financial outcomes associated with care provided in a patient hotel.
Primary care

A central concept in the literature is the assumption that a significant number of hospital admissions are due to poor access to, or inferior, primary care. The corollary of this assumption is that alterations to the way that primary care is delivered can reduce hospital utilisation. Studies evaluating the relationship between GP characteristics and hospital admission rates have reported mixed results (see Section Two).

Increased access to primary care

In particular, the effect of changing the number of primary care workers (principally GPs) in a community (with the expectation that access to primary care will be enhanced) has received a large amount of consideration in the literature (see Section Two). Studies examining the effect of increasing the number of primary care workers on acute hospital admission rates have found mixed results (see Table 35).

A correlational study by Hilditch (1980) compared admission rates between 1972 and 1975 during which time there was a five-fold increase in the number of family physicians in Toronto, Canada. Hilditch found that emergency department usage and hospital admission rates both decreased during the study period, and suggested that improved access to primary care was the most likely explanation. However, the study had several weaknesses: It relied upon patient recall to estimate the number of admissions and no information was collected about other variables that may have been important confounders (such as changes in socio-economic status) during the study period.

By contrast Durojaiye et al. (1989) undertook a cross-sectional review of the number of “preventable admissions” in Nottingham in 1985 and compared the results to a previous review in 1975. Durojaiye et al. (1989) found the introduction of more primary care workers (mainly community paediatric teams and health visitors) was associated with a dramatic increase (by over 100%) in hospital admission rates. Again the study’s findings are limited by its cross-sectional design which could not control for a number of potential confounders.

In a study that used a different methodology (a quasi-experimental, before and after study) Gill (1997) found the provision of a regular source of primary care did not reduce admission rates for either all medical conditions or those conditions considered to be sensitive to ambulatory care among a Medicaid population in the United States. This study also had significant limitations, in particular selection bias could have occurred because the study excluded patients who had made infrequent visits to primary care practitioners.

Two New Zealand-based cross-sectional studies both failed to find any significant relationship between increasing GP numbers and rising admission rates for diabetes mellitus (Brown and Barnett, 1992; Hider, 1997). Instead, the influence of socioeconomic factors and hospital bed supply were consistently more important.

Increased telephone access to primary care practitioners

Some articles have suggested that improved telephone access to primary care practitioners, especially out of hours, could reduce hospital admission rates (Bindman et al., 1995; Dale et al., 1996b) (see Table 35).

A randomised trial based in the United States failed to find any significant difference in hospital (and emergency department) utilisation between a group of patients with direct telephone access to primary care physicians out of hours and another group who did not (Darnell et al., 1985). However, it is notable that the service was infrequently used (less than 8% of eligible patients made a phone call during the 18 months of the study).

By contrast, another small US study found that the provision of telephone advice out of hours from nurse practitioners was associated with a reduction in hospitalisation rates among 27 elderly patients with serious congestive heart failure (Shah et al., 1998). However, the small sample and the before-and-after quasi-experimental design both limit the validity of any conclusions from this work.

Although patient satisfaction surveys have noted that out of hours telephone access to primary care practitioners has generally been appreciated (Greenhouse and Probst, 1995), it is unclear if the intervention has any significant effect on hospital admissions. Out of hours telephone access to nurse practitioners is now the subject of a large randomised controlled trial in the United Kingdom (Anonymous, 1997b). However, research also appears to be needed to describe the effect of telephone access to general practitioners on hospital admission (and other outcomes).

Specific interventions related to particular conditions

Although changing access to primary care appears to have an inconsistent effect on admission at the aggregated level when all conditions are included, changes in primary care have been found to success-
fully reduce admission rates for specific conditions using more closely defined interventions.

A systematic review of GP-based care for people with epilepsy found primary care was gaining an increased role in the management of the condition and was successfully able to improve a number of patient outcomes, including reducing hospital admission (Thapar, 1996) (see Table 35). While the review highlighted a series of five problems with current community-based care (namely the lack of systematic follow-up, inappropriate polypharmacy, patient non-compliance with medication, failure of GP-patient communication and low levels of patient knowledge), a number of specific initiatives were presented that were especially likely to improve the quality of community-based care and reduce hospital admissions for patients with epilepsy. These interventions included practice-based epilepsy liaison nurses, a hospital-based epilepsy liaison service for GPs, and the use of guidelines to assist GPs particularly with aspects of their prescribing.

A cross-sectional study that examined admission rates for diabetic patients and aspects of how GPs organised their practices also found that specific primary care interventions could significantly reduce admission for particular conditions (Farmer and Coulter, 1990). The study found a small, but significant, inverse association between practices that had more facilities for diabetic care and acute admission to hospital for diabetes related problems. However, it should be recognised that the study only correlated the availability of additional facilities to assist with the treatment of diabetes with admission rates, and not the actual use of these facilities. Furthermore, it is possible that the extra facilities were not the primary intervention associated with the reduction in admission rates but only an indicator of some other factor (such as the presence of more diabetics in a practice, or a more knowledgeable and interested GP in diabetic care).

In New Zealand, it has been estimated that improving the facilities to treat diabetes in primary care has a large potential to reduce the number and costs associated with diabetes-related admissions (Thompson et al., 1993a).

Several descriptive studies have indicated that GPs can reduce admission rates, especially during winter by identifying patients at risk and by having a practice nurse visit them during the winter (e.g. Saini and Flaxman, 1997). These studies do not provide any formal evaluation of this intervention but do raise an interesting possibility.

Regardless of the effect of GPs on the total number of admissions, several studies that have assessed the appropriateness of acute admissions (using standard utilisation review instruments) (see Section Three) have consistently found that primary care doctors have the lowest rate of inappropriate admissions compared to hospital-based doctors or other providers e.g. (Fried et al., 1994; Coast et al., 1996b).

Another issue is the effectiveness of primary care workers, other than GPs, to prevent hospital admission. One example is the descriptive study by Wilson-Norton and Gibson (1996) which illustrated the involvement of a pharmacist to manage the anticoagulation medication of patients in the community. The authors believed the system was effective at reducing medication-related admissions, but no analysis was undertaken to objectively evaluate this observation.

Finally, several commentators have noted that rather than just providing interventions in primary care to reduce hospital admissions, it would be more appropriate to improve the interface between primary and secondary care e.g. (Lawrenson et al., 1993; O’Hagan et al., 1996). The appropriateness and effectiveness of both hospital admission and patient discharge would be considerably enhanced if the relationship between primary and secondary care was strengthened with better use of intermediate care units, GP hospital beds and more comprehensive discharge planning (see Section Four).

Changing GP behaviour

Section Two found that GP characteristics were generally unimportant in relation to increasing acute medical admission rates. Some GP characteristics have been described in the literature in relation to their effect on admission rates. In particular, these characteristics have largely included the relative experience of the GP and their respective prescribing habits. A cross-sectional Finnish study found that less experienced doctors with more limited specialist training were associated with higher rates of hospital admission (Vehviläinen et al., 1996) (see Table 35). A similar finding was obtained in a New Zealand-based study that used a similar cross-sectional methodology (Barnett and Brown, 1993).

The literature that has examined the relationship between the prescribing behaviour of GPs and their admission rates has primarily focused on asthma. Good evidence exists to suggest that the appropriate prescription of preventive medication can prevent emergency hospital admission for asthma (Stevens and Raftery, 1994). Two studies have examined the ratio of the number of GP prescriptions for preventer medication compared to reliever drugs and compared this ratio with admission rates for asthma. Unfortunately these cross-sectional studies have found mixed results, with one noting that admission rates were higher when the ratio was lower (that is, less preven-
tive medication compared to reliever) (Griffiths et al., 1996) while the other failed to find any relationship between the variables (Shelley et al., 1996).

Providing feedback to GPs

Comparative information can be a spur to action, but hopes that the provision of feedback to GPs on their outpatient referral rates have not been proven to be realised (de Marco et al., 1993). GPs failed to accept that aggregate rates can provide useful information about the quality of their patient care. It is likely that the provision of aggregate admission rates for emergency medical conditions would be as equally unhelpful. Average rates hide important information about which admissions were appropriate and when admission was (inappropriately) not provided. This information cannot be easily appreciated from any comparison of average admissions between practices that may substantially differ in their case mix and access to hospital services. In addition, it seems that high referring doctors may not necessarily have the highest rate of inappropriate admissions (Knottnerus et al., 1990).

Practice organisation

Aspects of the practice organisation have also attracted some research interest in relation to admission rates. In the UK the average number of patients enrolled with a particular practice has risen in parallel with the number of acute admissions over the last two decades (Royal College of General Practitioners, 1995). In support of a link between the two variables Butler has suggested that practices with large patient populations may be more likely to admit more patients in order to cope with their heavier patient workload (Butler, 1980). Little evidence is available to confirm (or refute) this claim. A large UK-based cross-sectional study found there was no systematic variation between practice size and a GPs rate of admission (Wilkin and Smith, 1987) (see Table 35). Therefore, there is no clear research-based evidence to suggest that a reduction in the average size of a GP’s practice population could significantly reduce acute admission rates.

Primary care-based public health interventions

Rapidly increasing admission rates for pediatric patients with scalds indicate the potential importance for public health interventions to reduce rising hospitalisation rates (Eadie et al., 1995). A related problem is the marked rise in the number of burn cases that require intensive care treatment (Jerwood and Dickson, 1995). In the UK the number of admissions due to scald injury has risen by over 50% in 35 years to 1991. Many of these injuries could potentially be avoided, and several public health campaigns operated through GPs surgeries have been suggested to be potentially effective at reducing injury rates (Eadie et al., 1995).

Short interventions based in general practice to identify and counsel patients with harmful levels of alcohol consumption have been shown in a semi-systematic review to be effective in reducing consumption by 25-35% (at follow-up one year later), and hospital admission rates for alcohol-related problems (Anderson, 1993). Typically the interventions have consisted of 5-10 minutes of simple advice plus a leaflet, brief condensed cognitive behaviurol therapy and the use of self-help manuals combined with follow-up visits.

Primary care conclusion

- A common assumption in the literature is that effective primary care can reduce hospital admissions. While studies that have examined the effect of changes in access to primary care have produced mixed results, specific interventions based in primary care have been found to reduce hospital admission rates, especially for defined conditions.

Hospital outpatient-based interventions to reduce admissions

A number of studies have assessed the ability of services provided (usually) by multi-disciplinary teams in hospital-based outpatient (OP) departments to reduce the demand for inpatient care. These studies have focused around five broad types of intervention (see Table 36):

- Outpatient-based education delivered to individual patients.
- Outpatient-based education delivered to groups of patients.
- Increased outpatient facilities or enhanced patient access to these facilities via their GP.
- Outreach services provided by hospital outpatient departments.
- The provision of an urgent referral service for GPs to hospital consultants.

OP education to individual patients

A cohort study by Pieber et al. (1995) (see Table 36) found that outpatient-based intensive education among diabetic patients significantly reduced hospital admissions for poor glycaemic control amongst the group over a three-year period. However, the study finding must be regarded with caution because the trial lacked a control group and the assessment was not blinded.

A considerable amount of research has assessed the effectiveness of outpatient-based education to pro-
mote patient self-management and to prevent hospital admission amongst asthmatics.

On the basis of the studies presented in Table 36 there appears to be no evidence that hospital outpatient-delivered patient education to promote patient self-management can reduce the rate of hospital admission, at least in relation to asthma.

**Group OP education**

Despite the claim by Terry (1997) that the provision of group outpatient care was able to reduce the demand for inpatient care, a small randomised controlled trial, based in a US HMO, failed to find any reduction in admissions (although emergency outpatient visits were reduced) (Beck et al., 1997) (see Table 36). The study was undertaken on a random sample of chronically ill, elderly patients who were provided with group-based outpatient consultations and then compared to another group who had received traditional individual doctor–patient consultations.

Another group-based, patient education programme was evaluated in a case control study by (Boulet et al., 1995). The study was based in Canada and consisted of three sessions of group education in an outpatient setting. There was no significant reduction in hospital admission associated with the intervention, although it should be noted that nearly 50% of patients refused to participate in the programme. Selection bias might therefore explain the study’s negative result.

**More OP services and easier referral**

Several opinion articles have claimed there is a significant group of patients for whom a GP needs a non-urgent consultant opinion without necessarily requiring that the patient should be admitted to hospital (e.g. Bulger, 1995). In addition, new technologies have revolutionised the potential to make a number of common procedures outpatient-based e.g. laparoscopic investigations and treatments (Voitk, 1995). Ensuring that GPs have direct referral to these routine outpatient-based procedures can reduce admissions (Pancheon et al., 1995).

A number of regular treatments can also be provided on an outpatient basis. For example, a small cohort study by Marius-Nunez et al. (1996) (see Table 36) found that outpatient based intermittent inotropic infusions halved the hospital admission rate for patients with severe cardiac failure (NYHA class III and IV). However, it should be noted that there was only a short length of follow-up made upon a relatively small number of patients in this study.

By contrast another small, randomised controlled trial with a 12-month follow-up found that providing greater access to outpatient consultations for primary care physicians did not significantly change admission rates for older patients compared to conventional primary care (Silverman et al., 1995). However, a significant dropout rate among patients randomised to receive outpatient-based care limited the validity of the results from this small study.

A retrospective cohort study by Swift et al. (1993) found that newly-diagnosed diabetic children could be safely managed in an outpatient setting with better outcomes than those who had received their care in a hospital (in particular, the outpatient-based group was associated with fewer hospital admissions and improved glycaemic control). Swift et al. (1993) identified the need for ready access to outpatient services and close co-ordination between GPs and hospital-based specialists as important prerequisites for this model of care to be effective. Outpatient-based team management of young, newly diagnosed, insulin-dependent diabetics was also found to be a superior alternative to admission in a study by Hirasing et al. (1996). This study also emphasised the need for good communication between the practitioners responsible for patient care in order to prevent unnecessary hospital admissions.

A single study was found that investigated the effect of providing a nurse-run outpatient clinic for the management of asthma (Charlton et al., 1994). The intervention was assessed by means of a randomised controlled trial. However, the sample size for the study was relatively small (95 patients). The study failed to find any significant reduction in hospital admission rates among young asthmatics in relation to the provision of a nurse-led asthma management clinic in an outpatient setting.

It therefore seems that improved access to outpatient care for non-urgent problems is associated with mixed results in relation to its impact on the frequency of hospital admission. Although the overall quality of the research is relatively poor, it appears that the best results are obtained when access to outpatient care is enhanced in the context of improved general communication between GPs and hospital consultants.

**Urgent referral services**

Several clinicians have suggested that from their experience there is a significant group of people for whom the GP would value a rapid consultant opinion either on the telephone or by arranging an urgent outpatient appointment (Bulger, 1995; Pancheon et al., 1995). A study of 247 admissions in the UK reported that a panel of GPs and hospital specialists considered that 5% of the admissions could have
been more appropriately treated by an outpatient appointment than by inpatient care (Coast et al., 1995). The study, however, was based on the retrospective opinion of the experts and is hard to generalise to the actual decisions GPs must make about the most appropriate management of a patient’s clinical problem to prospectively enhance their wellbeing.

Despite the apparent potential for reducing hospital admissions by providing GPs with access to an urgent opinion from hospital outpatient consultants, remarkably little evaluation has been undertaken of such a service. Only one study was identified that has specifically assessed this intervention. The UK-based study was a quasi-experimental, before and after trial that evaluated the effect of the provision of 24-hour direct access for GPs to consultant physicians in relation to any urgent problems with their management of patients with HIV/AIDS (Smith et al., 1996b). The study found there was a significant reduction in the frequency of hospital admission, although it should be noted that the intervention also included other improvements in communication between GPs and consultants. For example, summaries of all outpatient visits were rapidly faxed to GPs and regular meetings were arranged between consultants and GPs. Although it is difficult to generalise the findings from this trial to other conditions aside from HIV/AIDS, the study does provide an interesting model of care that merits further research.

Outreach services

Few studies have evaluated the effectiveness (measured in terms of the effect on inpatient usage) of an outreach service from a hospital outpatient department. One example of this type of service which involved the provision of nurses to visit patients at home and provide them with ongoing education and assessment was evaluated in a quasi-experimental study. The US-based study found that an outreach service was associated with a statistically significant reduction in the frequency of hospital admission among the 52 young people included in the trial (Greinader et al., 1995) (see Table 36). However, the validity of this result was limited by the quasi-experimental methodology used in the study which could not adequately control for the possibility that other changes in the delivery of health services (or other time-related factors) over the duration of the study may have confounded the study’s findings.

Outpatient conclusion

- Outpatient-based patient services have expanded in recent years in most western countries (Pancheon et al., 1995). Unfortunately research to examine the effect of these augmented services on the demand for inpatient care has not kept pace. There was no evidence from the assessed literature that education delivered to either individual or groups of patients in an outpatient setting reduced acute medical admissions. By contrast, the provision of more outpatient-based treatments or an enhanced ability for GPs to refer patients directly to either a routine or an urgent outpatient appointment appeared to have some potential to reduce admissions, particularly when it was associated with other measures to improve communication between consultants and GPs.

Emergency department interventions

A small number of studies have examined the effect of an ED-based intervention to reduce hospital admissions as their main endpoint (see Table 37).

Increased services

Bur et al. (1997) used a retrospective study design and assessed whether providing more extensive outpatient services in an ED setting in the US was associated with a reduction in hospital admission rates. Bur found that both general medical inpatient and intensive care admissions were significantly decreased. However, the retrospective design prevented the author from making any definitive conclusions about the effectiveness of the intervention.

Use of GPs

Randomised controlled trials by Dale et al. (1996a), Dale et al. (1995), Murphy et al. (1996) have found that GPs working in ED departments were less expensive than hospital registrars and senior house officers without any difference in outcome. The GPs largely achieved their savings by admitting a smaller proportion of their patients and by ordering relatively fewer tests. On the basis of these studies Dale (1996) and others have suggested that the provision of GPs in the ED would be an appropriate intervention, to meet the demand of some patients to receive their primary care in the ED and to reduce the number of unnecessary admissions. However, conclusions about the effectiveness of GPs in the ED are premature because the studies had two significant limitations. Firstly, senior GPs were compared to relatively junior hospital staff, and secondly, admitting practices may have been affected by the fact that when the GPs were working at the ED there were relatively more staff on duty.

Senior staff

A quasi-experimental study that used cross-sectional data compared two selected trauma centres in the US and found that the EDs with more senior staff were associated with reduced hospital admission rates (Richardson et al., 1997). The limitations associated with the cross-sectional data and the before-and-after study design prevent any conclusions from being
made about any causative relationship between the two variables.

A retrospective study was undertaken to assess if having a senior registrar rather than more junior house surgeons to assess all GP referrals for admission would reduce the number of admissions in a London hospital (Wanklyn et al., 1997). Although the study found that the senior registrars did admit significantly fewer patients (instead arranging more outpatient appointments), the validity of the study is compromised by its small sample size, retrospective design and lack of blinding among the investigators.

Education about the appropriate use of the ED

Some expert opinion articles have discussed the need for more public education about the appropriate use of the ED (e.g. Bolton and Storrie, 1991). However, there is no conclusive evidence that education reduces ED attendance. A small randomised controlled trial in the US failed to find any reduction in ED attendance from the provision of a single education session on the appropriate use the ED (Chande et al., 1996). However, the study had several methodological deficiencies including a short follow-up period, incomplete follow-up of a significant number of participants, and the analysis being undertaken without blinding. It is also likely that one education session may have been insufficient to change behaviour.

By contrast, a mass media campaign that presented repeated messages about the appropriate use of the ED in New York City was successfully able to reduce the hospital’s ED usage by nearly 14% over two years. However, it is difficult to conclude that the reduction in attendance was due to the campaign because of the quasi-experimental nature of the study and its inherent inability to control for other time-related factors that may have influenced attendance.

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

Telemedicine

A number of outpatient-based alternatives to hospital treatment have used telemedicine technology. In general these interventions have usually been applied in geographically remote areas for the diagnosis, or treatment, of patients with non-urgent conditions (Wooton, 1996; Yellowlees and Kennedy, 1997).

Most of the published literature concerning the applications of telemedicine, either in acute or non-urgent settings, has been restricted to simple descriptions of new services. A New Zealand-based example is the diagnostic dermatology service provided at Waikato Hospital (Oakley et al., 1997).

Other applications of telemedicine have been described, such as electrocardiograph (ECG) interpretation by ED-based practitioners for patients either in transit to the ED or for whom GPs or paramedics are seeking assistance at the patient’s home (Yellowlees and Kennedy, 1997). In addition, telemedicine has been used to enhance the interpretation of ECGs by junior doctors in the ED by providing a rapid, second opinion from a consultant cardiologist in a remote location (Srikanthan et al., 1997).

Other audits have described the use of telemedicine to enable specialists in large centres to provide advice, or interpret X-rays for healthcare workers in remote areas (Turner, 1995).

A small number of studies have attempted to consider the effect of ED-based, telemedicine applications in relation to their effect on health outcomes, including patient morbidity as measured by ED attendance and (rarely) hospital admission. These studies have obtained conflicting results. For example, ED-based telephone advice lines were shown in a cross-sectional study by the National Audit Office (1992) to reduce patient attendance at the ED whilst also maintaining a high level of patient satisfaction. Unfortunately, no other health outcomes were measured so it is impossible to assess the quality of the service and its full impact.

Another study, that used ecological data and a before-and-after methodology, found a contrasting result in relation to the impact of a US-wide, telephone advice service on ED attendance (Perednia, 1995). The study found that the introduction of the service was associated with an increased demand for health care at EDs in the US.

Limitations associated with the study designs used in both of these trials prevent any conclusions from being made about the effect of these telemedicine applications on service utilisation.

The area of telemedicine is a new and rapidly evolving technology. Current research has largely consisted of studies that have described new services. Relatively little evaluation of the effects of these services on health outcomes has been undertaken. In particular, it is unclear as to how much telemedicine will either substitute for conventional services, or alternatively increase their use (and hence costs) (Halvorsen and Kristiansen, 1996).
A related issue to the provision of centralised regional services is the development of an air ambulance service. Two studies by the Medical Care Research Unit have reviewed the outcomes associated with the provision of a dedicated air ambulance service based in either London (Nicholl et al., 1994) or Sussex (Brazier et al., 1994). Neither review found there was any statistically significant benefit in health outcomes associated with the provision of air transport compared to ground-based services. Even though both evaluations were plagued by small numbers (e.g. 300 patients in the London study) which limited their ability to find any association, the studies presented several reasons to suspect that air helicopters may bestow only limited benefits on patients who need to be transported urgently to regional hospitals. Helicopters can only operate in a narrow range of weather conditions, and it is often difficult to administer care in transit so the patient must be fully stabilised before a helicopter can be used.

Other questions remain about the most appropriate configuration of pre-hospital emergency care, such as whether paramedics (or specialist doctors including anaesthetists) are better than GPs at providing emergency care.

Emergency department conclusions

- Most ED-based interventions to reduce acute admissions have not been evaluated by randomised controlled trials. Therefore, the effectiveness of increasing ED-based services, increased patient education, or the provision of either more senior staff or social workers remains uncertain. By contrast, the use of GPs in the ED appears to be effective at reducing admissions.

Emergency Observation Units

An observation unit has been defined as a “designated area within and under the direction of the ED for patients who require further treatment or evaluation” (Brillman et al., 1995). These units are distinct from holding units (in which patients are held pending transfer or admission). Observation units included in, or attached to, ED departments have become increasingly common in the UK (Pancheon et al., 1995)(descriptive study). Observation units have also become common in Australia (Jelinek and Galvin, 1989), although there is some variation in the way they have been used in different hospitals (Jelinek and Galvin, 1989) (descriptive study).

The function of these units is “to be an active filter into the hospital: an investigation and urgent treatment centre with near patient testing and imaging facilities” (Pancheon et al., 1995 p37). Consequently, the provision of an observation unit enables the admission procedure to become a two-stage process. In
this process the unit offers an intermediate stage with services that cater for patients who may require observation or treatments that do not obviously require the intensive services of an acute medical hospital bed. The rationale for these units is therefore that they aim to improve the quality of care for patients through extended ED-based evaluation and treatment while reducing inappropriate admissions and health care costs.

Brillman et al. (1995) summarised 10 descriptive studies that detailed the use of an observation unit in a hospital and concluded that between 2-6% of patients seen in an ED will be transferred to the unit. Brillman found that the number of beds in the units ranged from four to 20 and this number represented 10-40% of the bed capacity of the respective EDs. Brillman found that several key features were important in the successful management of these units. These conclusions were that:

- the period of observation should have a focused goal
- the unit should be located near the ED (Anonymous, 1996a).
- staffing levels are important. For example, regular rounds need to be made by senior clinicians to enable patients to be rapidly evaluated and discharged.
- experienced nurses can relieve some of the pressure on junior medical staff (Anonymous, 1996a).
- units need access to 24-hour diagnostic support services (Anonymous, 1996a).
- the intensity of service needs should be limited.
- the patient’s illness severity should be limited.
- the clinical condition should be appropriate for observation. A number of conditions were generally considered to be appropriate for observation including the diagnostic evaluation of chest pain, abdominal pain, drug overdoses (that were clinically stable) and syncope. Short-term therapy has been found to be appropriate for: allergic reactions, asthma, dehydration, blood transfusions, psychosocial support, alcohol intoxication and adjustment reactions.

The effect of observation units on admission rates

Maag et al. (1997) describes an audit of an Emergency Observation Unit in Connecticut (US) which found that the observation unit reduced the number of emergency admissions for chest pain by 12%, and also decreased from 5% to 0.1% the number of people who, although not admitted, were subsequently found to have sustained a myocardial infarction.

Similarly a short-stay ward for the elderly allowed over 70% of the 502 people to be discharged home after brief observation or treatment in an ward attached to the ED (Khan et al., 1997).

A small, descriptive study by Maimaris and Kirby (1991) found that an observation ward in the Guy’s emergency department significantly reduced the number of hospital admissions, while readmissions to the unit remained low (2%) over the year-long study period.

Another small descriptive study by Dookeran et al. (1996) found that an observation assessment unit that used middle grade staff was able to prevent a significant number of unnecessary admissions. The unit provided telephone advice alone (and no subsequent assessment) to 27.9% of calls (182 patients) during a four-month period and in a further 28.9% (189 patients) of patients, care was provided exclusively in the unit without admission.

An audit of Christchurch Hospital's paediatric day unit in 1989 concluded that the unit was successful in reducing overnight inpatient admissions (Dawson et al., 1991).

A cross-sectional review in Virginia (US) found that 1.5% of patients that attended the ED were assessed in the observation unit and 10% of patients assessed in an observation unit were subsequently admitted (Bond and Wiegand, 1997).

A cross-sectional review by Sibbritt (1994) found that the readmission rate for patients who had received care in an observation unit was no higher than patients who were admitted for longer periods of time and concluded that the quality of care provided by observation units was therefore satisfactory.

Another small cross-sectional study found that both the staff and patients were satisfied with care provided at an observation unit (McErlain-Burns, 1997).

Finally, a retrospective chart review by Israel et al. (1991) found that an observation unit was able to manage 72% of 87 adult patients who presented with pyelonephritis to a Colorado (US) hospital.

The results of these descriptive studies suggest that the provision of an observation unit can provide quality care and reduce the number of emergency admissions. However, several descriptive studies have found a contrasting result. For example, a cross-sectional study based in London found that an observation unit actually increased the number of head injury admissions (Maclaren et al., 1993). The unit was associated with a more stringent adherence to local hospital guidelines. These guidelines specified which patients who had sustained head injuries should be admitted. Before the introduction of the unit the guidelines were less well applied, and many patients who were appropriate for admission were discharged.
All of these descriptive studies have included a relatively small number of patients and were only based in a single hospital. Some studies failed to include an adequate control group. None of the studies were therefore able to reliably exclude bias or confounding as alternative explanations for their findings.

Four experimental studies have assessed the effectiveness of observation units in relation to their ability to reduce unnecessary admissions (see Table 38). All four studies have included control groups and two were conducted with relatively large patient samples (1224 and 4227 people). These studies were more methodologically rigorous and were better equipped to potentially deliver a valid conclusion about the effectiveness of observation units.

The experimental studies that have evaluated the efficacy of an ED-based observation unit have recorded mixed results (see Table 38). The two randomised controlled trials both found there was no significant difference in relapse rates between patients allocated to receive care in the unit (for up to 12 hours) compared to other adults who were treated as inpatients (Rydman et al., 1998; McDermott et al., 1997).

Despite the use of the randomised controlled trial methodology, both trials did have a number of limitations. These limitations included the relatively small sample size (222 patients and 113 respectively for McDermott and Rydman), the absence of any data on the previous use of healthcare services or preventive medication by each study group, and the lack of any information on how many patients had discharged themselves from each study group. In addition, the study by Rydman et al. (1998) did not describe the number of patients who were excluded as a result of the restrictive exclusion criteria that were employed in the trial. In particular, the study excluded patients who did not have a telephone which may have resulted in some selection bias in the study because it is likely that less affluent people may have less access to good quality medical care and may be less optimally treated in an observation unit.

Finally, the generalisability of these studies to the New Zealand setting may be questionable because high proportions of the participants in both studies were African-Americans who resided in some impoverished areas of large US cities.

Despite these limitations, the study by Rydman et al. (1998) is also notable because it assessed the relative effect of providing treatment in an observation unit in relation to patient quality of life. The research, therefore, assessed the relative impact of observation unit-based care on wider health outcomes than just hospital readmission rates. The study found that treatment in an observation unit was associated with a significant improvement in 5 out of 8 domains on a standardised quality of life measurement tool (SF-36).

The other two experimental studies both used a before-and-after, quasi-experimental design but obtained contrasting results.

The study by Brillman and Tandberg (1994) found that an observation unit in the US did not significantly reduce admissions to hospital. Instead a large number of patients from the ED that previously would have been sent home were directed to the unit for assessment. Brillman applied average costs for various services to their findings, and concluded that the introduction of the unit had produced no demonstrable savings.

The other quasi-experimental study by Gouin et al. (1997) was undertaken in Canada and included a paediatric population, in contrast to the Brillman trial that involved all age groups. Gouin found that the provision of an observation unit was associated with a significant reduction in admissions. It should be noted, however, that there was also a significant increase in the number of patients who returned to the ED within 72 hours among the observation unit group. This increase suggests the reduction in admissions may have been at the expense of not providing inpatient care to some patients who may have benefited from a more prolonged period of treatment.

The validity of both studies' findings was limited by their before-and-after study design. Neither trial was able to exclude that possibility that some time-related change in either the case mix of the study population or an aspect of practice behaviour may have contributed to the results obtained in each study. Brillman did not attempt to evaluate any clinical outcomes from the unit, and it is therefore possible that even though admissions rates were not significantly changed, patient outcome may have significantly improved after the introduction of an observation unit. Finally, neither of the studies compared the time spent in the ED before and after the introduction of the unit and therefore could not exclude the possibility that, in their respective settings, the physicians may have been using the ED as an observation unit before the actual unit was set up and the effect of the intervention was therefore unlikely to provide any consistent result.

Separate paediatric ED

Although benefits from separate emergency department services and observation units have been presented in a descriptive article (Richmond et al., 1987) and an audit of an existing service (Beattie and Moir, 1993) there is no definitive evidence that separate
facilities offer any additional benefit to general facilities (Stevens and Raftery, 1997).

Assessments of the cost of observation units

Several audits of the costs associated with the treatment of a number of conditions in observation units have reported savings in comparison to previous costs before the units were instituted. These studies are listed in Table 39.

While these studies have consistently reported that the use of observation units to investigate and treat a number of medical conditions were associated with cost advantages, these audits are not full cost-effectiveness studies. The studies have not included an assessment of all the direct and indirect costs associated with the provision of care in an observation unit and have not undertaken any formal sensitivity analyses.

In general, these trials have been unable to exclude the effects of bias, for example, associated with the provision of more intensive nursing care in the observation unit compared to the care provided in a general hospital ward.

In addition, it is possible that publication bias may account for the universally positive results noted in the literature. That is, those studies that have found a positive cost outcome associated with the provision of care in an observation unit and have not undertaken any formal sensitivity analyses.

Assessment of the cost-effectiveness of an observation unit

The only identified study that has assessed the cost effectiveness of treatment in an observation unit compared to usual inpatient care was the small trial by Rydman et al. (1998).

Rydman found that care provided in an observation unit was considerably less expensive than inpatient care for the treatment of an acute exacerbation of chronic asthma. This study compared the direct costs of care provided in either location during the seven days of follow-up for the trial. The study did not include indirect costs and the assessment was only made from the viewpoint of the hospital. Furthermore, the information on costs was abstracted from average figures and did not necessarily represent the actual costs for each patient.

Finally it was noted that no sensitivity analyses were undertaken. This study therefore completed a relatively unsophisticated cost-effectiveness analysis from which it is difficult to make firm conclusions.

Observation unit conclusions

- Many (but not all) descriptive studies have found favourable results associated with the introduction of an observation unit in an ED. Experimental studies have found mixed results in relation to the effectiveness of observation units in reducing admissions. All four experimental studies were noted to have significant methodological deficiencies. Consequently there still remains some uncertainty about whether observation units can effectively reduce hospital admissions.

- No firm conclusions can be made from an evaluation of the literature examining the effectiveness (or cost-effectiveness) of these units to improve health outcomes because of the methodological deficiencies of the available studies. In general, it appears that observation wards can offer a venue for the appropriate surveillance of patients who require a period of observation to exclude serious disease. However, these units have also been criticised for either discharging some patients too quickly or because they do not provide a clear clinical or cost-effective advantage over traditional arrangements. Further research is therefore needed to confirm the efficacy of observation units. If observation units are confirmed as effective, a considerable amount of research is then needed to describe their optimal organisation. For example, the literature has not yet evaluated the provision of observation units that were controlled by the acute medical admitting team instead of being provided under the direction of the ED. This omission appears significant, particularly in relation to the suggestion by the Council of International Hospitals that these units are best managed when medical cover is provided by the acute medical admitting team (Anonymous, 1996a).

- The use of observation units to undertake several functions (observation, investigation and treatment) has created some confusion in the literature. It is difficult to compare the effectiveness of units that are fulfilling different functions. Often the primary function(s) of an observation unit has not actually been described in a review of the efficacy of an observation unit. This plurality of functions may explain the heterogeneous findings obtained in the research that has examined the outcomes associated with the use of observation units.

- Aside from the use of observation units to reduce unnecessary admissions, the units may offer other benefits such as relieving pressure on ward-based staff, minimising disruption to patients on hospital wards and enabling hospitals
some flexibility in responding to different admission loads. In addition, a centralised admission site can improve the efficiency of admission for both the medical staff and patients by reducing their respective need to visit a number of wards or travel to several venues for investigations.

**Chest pain observation units**

The number of admissions for chest pain has increased substantially in a number of countries (Anonymous, 1996a). Increased recognition by patients and practitioners of the need for early anticoagulation has been attributed with increasing these admissions, along with a suggestion that practitioners are more aware of medico-legal risk associated with a false negative diagnosis (Anonymous, 1996a).

Chest pain is a common presenting symptom to the ED, and a frequent reason for admission because inpatient tests are needed to ascertain if a patient has sustained a heart attack. It is also important to recognise an MI early, in order to provide early treatment and reduce infarction size and associated morbidity and mortality (Appleby et al., 1994). It has long been standard practice to admit all patients with suspected myocardial infarction (MI) to hospital. The most important intended benefit from chest pain centres is that they aim to reduce the time before an acute myocardial infarction is noticed, and thereby decrease the time before thrombolysis can be employed (Mumford and Banning, 1997).

However, many patients admitted with chest pain will not have a cardiac origin for their pain. In a literature review, Wu, (1997) described the assessment of patients who had presented with chest pain to an emergency department and highlighted that nearly half of these patients had been admitted on the basis of their history after investigation results (particularly a resting ECG) yielded equivocal results. Subsequently 28% (17% of the original number) of patients were discharged without any signs of having sustained a myocardial infarction. In another review, Becker concluded that only about 1/3 of all people presenting to ED with chest pain suspicious of a cardiac origin were found to have sustained a myocardial infarction (Lee et al., 1989; Young et al., 1987).

These studies emphasise the role of an observation unit as a lower cost alternative to a coronary care unit to enable the quick and accurate determination of which patients need more intensive treatment. In parallel with the provision of an observation unit, many studies have also incorporated new diagnostic algorithms or investigations to distinguish which patients have acute cardiac pathology. A major problem with studies that have assessed the effectiveness of chest pain units is that it has therefore often been difficult to ascribe a beneficial outcome to one particular intervention (Grijsels et al., 1995).

Several authors have found that the provision of a chest pain centre (where patients who do not have overt ECG signs of infarction can be rapidly evaluated with serial ECG and blood tests and stress testing if other tests were negative) has not only reduced the need for many admissions, but also decreased the number of patientsappropriately sent home without recognition of their myocardial infarction (Gaspard et al., 1994; Rodriguez et al., 1994; Mikhail et al., 1997; Graff et al., 1997). Two centres, in particular, have extensively published the results from their chest pain observation units, these results are presented in Table 40.

The case control study by Graff et al. (1997) is another notable study because it is the only multi-site investigation of the effectiveness of chest pain observation units. Graff et al. (1997) compared the outcome of patients who had presented with chest pain at one of eight specialist chest pain centres with matched historical controls in published audits of patients at ordinary EDs. Graff found that a lower proportion of patients were either admitted, or had their myocardial infarction missed, when they had attended a chest pain centre. The study undertook a simple comparison of costs and found that chest pain clinics were associated with lower costs as well as improved quality of care.

These studies, however, have generally been associated with a number of limitations in relation to their comparison of data about cases with information about historical, literature-based controls. It is possible that there may have been a number of significant differences between the comparison groups which the study was not able to adjust for which may have influenced the results, such as differences between the studies in their case mix, the numbers and relative experience of the staff, or the availability and quality of the diagnostic procedures.

A key feature of chest pain centres in these studies was their requirement for hospital laboratories to make available urgent blood testing procedures, such that samples were analysed within one hour and results were then immediately reported to clinicians. Wu argued that the costs of this service were far outweighed by the potential savings from admitting fewer patients who did not need inpatient care (Wu, 1997).

In an expert opinion article, Becker (1995) clearly described the effectiveness of chest pain centres using CK-MB sub-form assays that were able to detect myocardial infarctions with high sensitivity and specificity. More recent attention has focused on the use of troponin T as a new biochemical marker of

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**Table 40**

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<th>Comparison</th>
<th>Chest Pain Observation Units</th>
<th>Ordinary EDs</th>
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<td>Admissions</td>
<td>Lower costs</td>
<td>Higher costs</td>
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<tr>
<td>Quality of Care</td>
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<td>Decreased</td>
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myocardial damage. Troponin is another component of cardiac muscle that is released into the blood when myocardial damage occurs. Although the optimal use of this marker in the emergency evaluations of patients with acute chest pain is not yet definitely established (Ryan et al., 1996), increasing evidence suggests that troponin may be the most sensitive marker of myocardial damage and the best indicator of patient prognosis (Hamm and Katus, 1995).

A recent small cohort study of 214 patients found that cardiac troponin T was a more specific indicator of myocardial damage and the best predictor of future major cardiac events in a direct comparison with serum creatinine kinase, CK-MB and serum myoglobin (Solymoss et al., 1997). The results of this study suggest that normal troponin levels (and normal CK-MB values) after eight hours can exclude with high probability (approximately 90%) actual myocardial infarction and high risk unstable angina (Solymoss et al., 1997).

Allied to the high specificity and sensitivity of the test is the additional advantage of the speed with which results can be obtained- quantitative tests require about 90 minutes while qualitative bed-side tests require only 25 minutes to complete (Sarko and Pollack, 1998). Consequently, several authors have suggested that troponin levels may soon become the gold standard for the biochemical determination of myocardial infarction (Sarko and Pollack, 1998).

Exercise testing is another important tool that has been used by chest pain clinics in the ED to assess whether patients have a cardiac origin for their pain. A retrospective review of 1152 patients at a US ED concluded that the application of exercise treadmill testing after six hours of observation would have reduced the number of admission by 17%. Clearly the safety and sensitivity of early exercise testing needs confirmation by a prospective trial before its adoption can be recommended.

Diagnostic protocols, designed to exclude acute cardiac ischaemia, are a key feature of chest pain clinics. A typical example is provided in a prospective cohort study by Zalenski et al. (1997). The protocol in this study included clinical criteria, serial determinations of creatine kinase isoenzyme as well as a mandatory exercise electrocardiography. Although the trial found that the protocol improved the sensitivity of the identification of cardiac pain of an ischaemic origin, the protocol had its most profound improvement on the negative predictive value of clinical decisions. That is, the protocol more reliably identified amongst the patients who were not considered to have chest pain due to a cardiac cause, patients who actually had not suffered an ischaemic episode.

Despite these encouraging findings it must be remembered that these results could have been influenced by the Hawthorn Effect. That is, the physicians participating in these protocols may have been more cautious about their decisions simply because of their awareness that their work was under close scrutiny. It is also difficult to generalise the findings of these studies to other clinical settings. Some chest pain centres have extended their protocols to assist GPs in their decisions about whether to refer a patient for assessment (e.g. Grijseels et al., 1996). Grijseels found that the use of a pre-hospital protocol markedly reduced the number of inappropriate referrals to a chest pain centre.

The conclusions in the literature evaluating the effectiveness of chest pain centres have not all been favourable. A semi-systematic review by Shesser and Smith (1994) concluded that the widespread adoption of chest pain centres was not indicated because they would increase costs and save a relatively small number of lives. Shesser concluded that the cost per life saved associated with the units in the US was between $378,000 and $3.78 million per life and this figure was relatively high compared to many other health care interventions. Shesser argued that a system of independent chest pain centres within EDs was therefore an inefficient use of resources and similar increases in the number of additional lives saved could be generated by allowing EDs to evolve towards becoming a hybrid between a chest pain centre and a traditional ED. Such a centre would improve the rigour and speed with which chest pain patients were evaluated and myocardial infarction patients were given effective treatment.

Shesser listed six interventions that had been found to be effective interventions in chest pain centres and which could be transplanted into a hybrid centre:

- Change triage protocols to ensure those patients with heart attack symptoms do not wait.
- Increase ED space and improve ED cardiac monitoring.
- Station ECG machines in the ED with trained staff available 24 hours to use them.
- Provide thrombolytic agents in the ED.
- Enable emergency physicians to administer thrombolytics.
- Monitor the effectiveness of ED treatment of heart attack patients with indicators such as time for patient triage, time before thrombolytic therapy was administered etc.

Shesser suggested that the development of chest pain centres in the United States has been an inappropriate use of resources as often each hospital with these units had developed an extensive marketing plan to increase their market share. These units had then developed a form of supplier induced demand, where
their existence had driven up hospital costs in excess of any marginal benefit.

Although Shesser has raised some important issues particularly with regard to the effective interventions that should be considered for inclusion in a chest pain observation unit, his conclusions about the potential of these units are probably overly negative and only applicable to the US setting. Shesser largely overlooked the potential for these units to prevent unnecessary admissions for a number of people who rapidly can be found not to have a cardiac origin for their chest pain and to effectively treat minor exacerbations among people with less severe coronary disease.

Chest pain conclusions

- Evidence is accumulating which suggests that the evaluation of a low-risk patient in the cardiac observation unit is a safe and cost-effective alternative to hospital admission. The proper development of these units requires close cooperation between emergency physicians and cardiologists as many current protocols require that a patient should receive a consultation with a specialist and/or specific investigations that are arranged by a consultant. It is likely that these centres will become increasingly popular in the future, albeit mainly located in major centres where a reasonable patient caseload could justify the provision of 24-hour cover by consultant cardiologists.

Maximising bed utilisation

Another view of the best method to manage the increase in medical admissions is not to increase the number of alternative beds (hospital at home or observation unit schemes) but instead improve the allocation, organisation and management of beds to maximise the efficient use of existing bedstock (Anonymous, 1996a). The number of available beds has been decreasing in a number of western countries (including New Zealand) (see Section Two). In response to this decrease in the number of available beds, two primary initiatives have been employed to improve the utilisation of existing inpatient bedstock: bed management consortia and departure lounges.

Bed management consortium

Bed management consortia involve a number of hospitals extending their bed management function to include neighbouring acute providers. These consortia aim to improve the efficient management of inpatient beds by establishing a large centralised unit that can more efficiently mobilise district-wide resources (Anonymous, 1996a).

The underlying rationale of these consortia is that larger groups of hospital beds are better able to accommodate the fluctuations inherent in the daily number of emergency admissions (Anonymous, 1994b). “The overall resources needed to cope with the unpredictability of acute emergency admissions decrease significantly the larger the admitting unit” (Anonymous, 1994b p29).

This expanded pool of co-ordinated beds is usually administered by a bed bureau that monitors the up-to-date availability of beds at participating hospitals and places patients requiring admission at the most appropriate hospital (Anonymous, 1994b). Although no research has formally evaluated the operation of these bureaux (it would also be difficult to assess their individual impact on the process of matching the supply and the demand for acute medical beds) the Council of International Hospitals has warned that there is likely to be some tension in relation to where these units might be best located. If they are placed within a participating hospital they are at risk of attracting doubts from the other collaborators about the neutrality of the placements that are made. Alternatively, if they are located in another setting there may be concerns about their ability to maintain adequate contact with the actual hospital resources that they are attempting to manage.

Departure lounge

It is not possible to manage the admission process without some consideration of how patients are discharged. Departure lounges have been developed with the rationale that more expeditious release of inpatient beds enables a more efficient turnover of inpatient care (Anonymous, 1994b). Departure lounges are centralised comfortable areas dedicated to accommodating patients awaiting discharge or transfer. These lounges ensure that patients who have been discharged or transferred do not unnecessarily occupy a bed. Ideally these lounges would be located near wards and adjacent to the hospital exit.

Discharge expeditor

The discharge expeditor role encompasses the identification of patients suitable for early transfer to lower-dependency settings (Anonymous, 1994b). This role is used in conjunction with the provision of GP community beds and hospital-at-home schemes. The discharge expeditor can also oversee the discharge process and liaise with community-based health and social services. Although the ward staff have the responsibility for discharge planning, the expeditor can offer advice, guidance and support (Anonymous, 1994b).
Bed utilisation conclusion

- More efficient use of existing bedstock may be an alternative way to accommodate the rise in acute medical admissions. Although interventions such as bed management consortia, discharge expediter and departure lounges have been described there is a scarcity of formal evaluations of the effectiveness of these interventions.

Interventions to reduce acute medical admissions in the elderly

A number of opinion articles have presented several initiatives that might reduce the number of emergency admissions among the elderly (e.g. Murphy, 1993) (see Appendix 4). Relatively few interventions have received a detailed evaluation of their effectiveness. Comprehensive geriatric assessment and five more specific interventions (case management, preventive home visiting, personal response alarms, discharge planning and more long-term care options) are five areas that have attracted the largest amount of research attention.

Comprehensive geriatric assessment

Comprehensive geriatric assessment (CGA) is a collective term for a number of interventions that are intended to identify the health and disability support needs of older people, and facilitate the provision of appropriate services to meet these needs. The interventions include inpatient-based evaluation and rehabilitation units, or an outpatient-based consultation service that may include a home assessment function.

A large meta-analysis of 28 controlled trials considered the effectiveness of these interventions (Stuck et al., 1993). The meta-analysis concluded that inpatient-based assessment services reduced readmission rates while home assessment decreased admission rates. However, the effect of these interventions on mortality was mixed.

A later review of two randomised controlled trials published after 1993 found there was only limited evidence that these interventions had any significant benefits for the health status or longevity of the elderly, although they probably did help to maintain older people in their homes for a longer time (Bloomfield, 1997).

A problem with any review of the effectiveness of comprehensive geriatric care is that it is not a single intervention but a range of treatments provided by a number of different practitioners in a variety of settings and variable groups of patients. Attempts to review the aggregated effect of these interventions are difficult and complex.

Some studies that have evaluated specific components of comprehensive geriatric assessment have also had positive results, although some limitations associated with the studies prevent any firm conclusions from being made about the effectiveness of these more specific interventions.

A small randomised controlled trial (160 patients) evaluated the effectiveness of the provision of clinic support to at-risk elderly veterans in the US by a multi-disciplinary team. Although the study found that outpatient emergency visits and admissions were reduced, there was no net cost benefit associated with team support compared to usual care (i.e. primary care provided at clinics through the Veteran Affairs Medical Centre) (Engelhardt et al., 1996). The small sample size and the relatively short follow-up do not enable any definitive conclusion to be made about the effectiveness of this intervention to reduce acute admission.

In another study, the provision of temporary rest home care for elderly Medicaid patients who had developed an acute (but mild) illness that temporarily compromised their ability to live alone, was found to have prevented hospital admission in 76% of the 112 patients in the study (Zimmer et al., 1988). While the study noted that significant cost savings resulted from the intervention, the lack of a control group prevented any definitive conclusions from this study.

Finally, the provision of inpatient care in a rehabilitation unit prior to discharge was associated with a marked (51%) reduction in the percentage of readmissions although the sample size in this study was too small for statistical significance to be achieved (Brymer et al., 1995).

Provision of a case manager

Case management has been defined as “a direct client service for individuals with complex needs which involves ongoing contact between the client and the case manager, to ensure that services are available, accessible, and co-ordinated to meet each individual’s needs.” (Challis, 1993). In relation to reducing acute medical admissions, case management has most often been applied to the elderly. The case manager may have a budget-holding role or may act merely to co-ordinate services (Richmond and Moor, 1997).

The only New Zealand research available on case management outside the psychiatric service was the non-blinded trial conducted by Richmond and Moor (1997) in Auckland (see Table 41). The study compared a cohort of 95 people who were admitted to nursing home care with another cohort of 91 elderly people who were provided with home care under case management.
Although the allocation to the two study groups was not randomised, the study found that both cohorts had no significant differences in their socio-demographic or functional characteristics (except for a higher proportion of married people in the home-care group). The study found that the case management group had a significantly higher number of acute medical admissions. The case management group was also significantly more satisfied with their living arrangements, although home carers (usually spouses) were significantly more stressed and exhibited lower morale than nursing home carers. The weekly cost of home care was markedly lower than the nursing home group even when the costs of hospital care and administrating the programme were included in the analysis.

It should be noted that the case management group exhibited a significantly higher number of people who prematurely withdrew from the study (36 compared to 24). For most of the people who withdrew the reason cited was some deterioration in their physical or mental condition. Other limitations to the study were its relatively short duration and small number of subjects.

A systematic review of UK-based studies conducted in the 1980s that had examined the effectiveness of case management was undertaken by Challis (1993). Studies, based in Kent, Gateshead and Darlington, were reviewed by Challis. All of the studies compared outcomes for matched groups of elderly people living in adjacent areas who were either provided with case management or usual care. All the groups of elderly people were relatively frail and considered marginal for requiring institutional care. Case management was provided by fieldworkers with small case loads and defined budgets.

Case management was not found by Challis to significantly reduce acute admissions and was not associated with any significant overall financial gain for health funding organisations. No significant difference was noted in mortality between the groups who received case management and those who did not, however recipients of case management did score significantly higher on some scales of subjective well-being at the end of the trial. Case management was consistently associated with a greater percentage of elderly people in each location remaining in their own homes at the end of each study.

Challis concluded that case management ensured that frail elderly received appropriate and flexible support services that enhanced their ability to remain in their own home.

In the US literature, case management has also specifically referred to limiting the access to hospital-based services for enrollees in a health maintenance organisation by requiring prior authorisation from a designated primary care physician for all inpatient and non-urgent emergency room use (Kerr, 1989).

Many managed care plans specifically employ a case manager to control inpatient use and reduce costs (Cunningham and Koen, 1996). In some HMOs detailed management programs for specific diseases that have been undertaken by case managers have also received favourable comment as a means to reduce admissions (Anonymous, 1997a).

Despite the popularity of case management in the US, few trials have actually examined its efficacy. One notable exception is the randomised controlled trial by Fitzgerald et al. (1994) that involved 668 patients aged 45 years and older in a US Veteran Affairs medical centre. After one year of follow-up the trial was unable to find any statistical difference in hospitalisation rates between the provision of case management and usual care.

Another smaller, controlled trial also found there was no significant change in hospital services after the introduction of case management (Long and Settle, 1988). Although utilisation did not significantly change, this study found the introduction of case management was associated with a 25% increase in health care costs for the funding organisation.

In addition, a small (27 patients) case control study by (Boyd et al., 1996) also failed to find any statistically significant reduction in hospital utilisation.

Home care surveillance

A component of comprehensive geriatric assessment is the use of intensive home-care surveillance. This surveillance has usually been provided to patients at high risk of hospital (re)admission such as those elderly who have been recently discharged, people living alone or individuals with serious medical conditions that restrict functional independence (such as arthritis or congestive heart failure).

Studies that have specifically examined the efficacy of preventive home visits by multi-disciplinary teams have reported mixed results (see Table 42). These programmes have involved regular or episodic home visiting by public health nurses, doctors or a number of other health workers, with the aim of improving independence and preventing admission to hospital or long-term rest home care.

A quasi-experimental study based in Israel by Kornowski et al. (1995) found that after patients received a regular weekly visit by physicians and a paramedic team, their rate of hospitalisation was significantly reduced in conjunction with increased self-rated estimates of their ability to undertake their activities of daily living.
A similar result was found in another small Danish study by Hansen et al. (1992). This study was a randomised controlled trial that compared 163 patients visited by district nurses with 181 controls. The study was initiated after patients were discharged from hospital and found a significant reduction in days spent in institutions (nursing homes and hospitals) among the experimental group.

However, contrasting results were found by Vetter et al. (1984), Clarke et al. (1992) and van Rossum et al. (1993), although it is notable that two of these studies did not use health professionals to undertake the intervention.

While there is no conclusive evidence that preventive home visits prevent hospital admission (or enhance independent functioning) it is possible that visits by health professionals may be associated with a reduction in hospital admission rates. A large, prospective, randomised controlled trial is therefore needed to determine the efficacy of this intervention. In addition, none of the studies have examined the cost-effectiveness of the intervention. This is an important omission, especially in the context of providing surveillance for recently discharged patients for whom there is clearly a close relationship between the cost-effectiveness of the service and the threshold level that exists for discharging patients from hospital.

**Personal alarms**

Several studies have examined the provision of a personal alarm system to elderly people who live alone and who have a significant disability. Most research has been of a quasi-experimental nature, involving comparisons of the rate of acute hospital admission before and after the installation of a home alarm and response system.

The alarms have usually included a tiered response system. After activation, the first response by the central monitoring agency is to phone the patient. When instructed or when contact cannot be established, a designated first responder (usually a friend or relative) is sent to assist. Finally, if further assistance is needed an ambulance is then called. Roush et al. (1995) found that the intervention was associated with a significant reduction in hospital admissions and average lengths of hospital stay (see Table 43). Similar findings were noted in separate studies by Ruchlin and Morris (1981), Redd et al. (1992), Roush and Teasdale (1997) and Koch (1984).

Ruchlin and Morris (1981) also conducted a cost benefit analysis that included calculations of the direct costs (such as those associated with the use of health care facilities or community services) as well as assessments of programme externalities and estimates of intangible costs/benefits.

Four types of facilities were included: acute hospitals, rehabilitation hospitals, nursing facilities and intermediate care facilities. Community services included physician care, mental health care, social and nutritional counseling, home health services including meals, and transportation services. Costs and benefits were compared between 139 pairs of experimental (response system users) and control subjects. The study found that over a 32-month period the control group used more long-term care than those people in the experimental group, while (not unexpectedly) the reverse was the case for community supports. Overall the cost-benefit ratio significantly favoured (by 1.87:1) the experimental group who had received the personal response devices.

Although suggestive, these studies do not provide conclusive evidence of a benefit from home alarms. The use of abstracted case-note data and a non-randomised, retrospective study design both provide a number of limitations. Although the use of paired data does overcome some potential confounders, it does not permit a measurement of the percentage of variance that might be explained by other personal characteristics (such as health status, economic factors, or the amount of in-home help) that each may have changed before or after the intervention.

The small study size and use of highly selected subjects also limit the studies' validity and generalisability. The findings therefore need confirmation by a large, prospective controlled trial to substantiate the strength of the apparent association between home monitoring with emergency response systems and reduced hospital admissions and their associated inpatient care costs.

Interestingly, some of the studies did not find any significant reduction in ED use associated with the intervention (Roush et al., 1995; (Roush and Teasdale, 1997).

**Discharge planning to prevent readmissions**

A prospective cohort study has highlighted the increased risk for elderly patients of significant functional decline after hospitalisation for a medical illness (Sager et al., 1996). Several randomised controlled trials have evaluated the effectiveness of discharge planning to prevent re-admissions among the elderly (see Table 44).

A randomised controlled trial based in the UK examined the use of support from care attendants on the first day at home and for up to 12 hours a week for two weeks compared to standard care (Townsend et al., 1988). The authors found that there was no significant difference between the two groups in physical independence, morale or death rates. However,
the experimental group had a significantly lower admission rate over the 18 months of the study.

Although the trial presents a favourable outcome for discharge planning, it is also possible that differences in the treatment groups could have lead to the study findings. The trial failed to present an adequate comparison of the study groups. In particular, the number of pre-existing medical conditions among the members of the groups and the number of recent admissions were omitted.

Finally, the study found that the number of patients who had been admitted frequently (>3 times) was significantly reduced by the intervention. This finding could equally reflect the efficacy of the intervention over the post-discharge period, or alternatively, it could reflect the greater number of patients in the control group with more serious medical conditions that required frequent re-admissions.

Another randomised controlled trial by Naylor et al. (1994) examined the use of nurse specialists to provide comprehensive, individualised, discharge planning to 276 elderly patients in Pennsylvania. The study found that the intervention significantly reduced readmissions, especially during the first six weeks after discharge. However, this benefit did not extend to patients discharged after a surgical procedure. The generalisability of the findings may be limited because only selected diagnostic conditions were included in the study. In addition, the study was based in only one hospital and involved mainly healthy, upper socio-economic status patients who were nearly all living independently in their own homes.

At least part of the explanation for the discrepancy in the results from these studies rests with the variation in the interventions that were assessed in the different studies. Weinberger assessed the effect of intensive follow-up by a physician and a nurse whereas the other studies used other groups of professionals, often involved in complicated multi-faceted interventions (for example, the study by Rich et al., 1995). The difficulty is, therefore, in concluding which component of multi-disciplinary discharge planning is actually (in)effective at reducing admissions.

Another problem with the research is the difficulty in generalising it to populations other than the seriously ill, elderly participants of these studies. In the trial by Rich et al. (1995) nearly 40% of the patients had died before the completion of the trial. It is therefore unclear if the intervention would be effective in the general (and more healthy) population.

Finally, apart from the effect of discharge planning on admission rates, the four studies found mixed results in relation to other outcomes such as the effect of discharge planning on mortality or functional independence (for example, Townsend et al. 1988) compared to Weinberger et al. (1996).

All the studies varied in their length of follow-up. In the case of Rich et al., the study was based on a relatively short duration of follow-up (average of 90 days) compared to the 18 months of Townsend et al. (1988). It is possible that the effectiveness of interventions to reduce re-admissions vary in relation to their duration.

Provision of long-term care options

A retrospective cohort study evaluated the utilisation of health services by people before and after their admission to a long-term care facility in Canada, using data from three administrative databases. The study concluded that the provision of long-term care significantly decreased acute hospital admissions. However, there was a considerable increase in GP referrals to outpatient-based services. It should be noted that limitations associated with the databases prevented any description of the quality of the care that was delivered to the patients (Ellencweig and Pagliccia, 1994).

Conclusions about the effectiveness of interventions to reduce admissions for the elderly

- Not all evaluations have found that case management is unsuccessful. Several have found that admissions can be reduced and/or costs limited with the introduction of case management (Weissert and Hedrick, 1994). Many found case management improved their quality of life even if health service utilisation was not reduced. A large quasi-experimental study by Kemper (1988b) evaluated the substitution of case management and enhanced community supports with nursing home care for a large population of frail elderly people. The study found that case management was unable to significantly reduce the need for nursing home care among the elderly and also did not reduce their frequency of acute medical admissions. The group who received case management exhibited significantly higher scores on the quality of life and well-being scales but failed to realise any significant difference in total health care costs.

- Some evidence exists (although it is not definitive) that home care surveillance by health professionals and home response alarms are efficacious at reducing hospital admissions. A small US-based study found that home response alarms also had a favourable cost benefit profile.
Utilisation review to reduce inappropriate admissions

The use of utilisation review to assess the appropriateness of admission was reviewed in Section Three. In addition to its descriptive role, the introduction of UR has also been used in an attempt to reduce inappropriate admissions.

Utilisation review (UR) was developed in the US with the aim of controlling rapidly escalating health care costs. In UR each hospital admission and day of stay is reviewed against standard criteria, and only if the criteria are met is that admission (stay) deemed appropriate. Insurers in the United States may refuse to pay the costs incurred by “inappropriate” days and thus UR provides a quasi-market incentive to reduce unnecessary admissions and costs. In the United States, several examples have been cited where UR has successfully reduced health care costs for some funding organisations (particularly Health Maintenance Organisations) by reducing both admission numbers and the length of bed stay (Wickizer et al., 1989).

The only controlled trial (Rosenberg et al., 1995) in which the effect of utilisation review was assessed on the rate of inappropriate admission found that the introduction of the intervention had no significant effect on admission rates (see Table 45). The study compared admissions before and after UR was temporarily replaced with sham review for half of the participants in a New York-based fee-for-service, health insurance plan (Rosenberg et al., 1995).

Interestingly, the two studies that have used a quasi-experimental design both found contrasting results in relation to the number of inappropriate admissions before and after the introduction of utilisation review (Cardiff et al., 1995; Wickizer et al., 1989). While Cardiff found there was no reduction in inappropriate admissions after the introduction of UR, Wickizer concluded that unnecessary admissions were reduced by 13%.

Although it may be true that utilisation review is ineffective in reducing emergency admissions, it should be noted that referrals for diagnostic and surgical procedures were reduced in the study. An explanation for the negative finding in the study by Rosenberg (1995) is that it is possible that the introduction of UR globally reduced admission levels among all study participants by means of a form of the Hawthorne Effect. That is, the introduction of UR could have reduced admissions among both the control and the intervention groups of study participants. Although health professionals were blinded as to whether their referrals were actually the subject of utilisation review, they would have known that is was possible their admissions were being scrutinised. This general knowledge may have lead to a widespread reduction in admissions among both the intervention group and those who had not been subject to review. Further research is needed to determine the importance of this effect.

In that regard, it is disappointing that other randomised controlled trials have not been undertaken to assess the effectiveness of UR. These trials could randomise either the patients, the medical teams or even the host institutions to undergo UR or not, and would generate important data about the efficacy of this tool.

Another issue is that the trials of the effectiveness of utilisation review were conducted in North American health systems (especially in the case of the study by Rosenberg et al. (1995) which was undertaken in a US Health Maintenance Organisation) and generalising the findings to the New Zealand setting may be difficult.

Conclusion

- UR has been associated with reports of cost savings in US-based Health Maintenance Organisations. The results of experimental studies, however, offer only inconsistent evidence for the effectiveness of UR in relation to its ability to reduce inappropriate hospital admissions.

Use of guidelines/protocols/critical pathways/ treatment algorithms

All of these interventions broadly seek to reduce inappropriate provider variation in patient care by removing some of the clinical uncertainty associated with the management of some conditions.

Critical pathways define and manage the timing and sequence of rate limiting steps in the provision of care. This management involves simultaneously giving feedback to providers about patient outcomes. Providers can then modify their management to prevent or modify unexpected outcomes.

Critical pathways are distinct from guidelines/protocols and algorithms. Guidelines/protocols define the appropriateness of care and algorithms define the step-by-step procedure for providing care using conditional logic (if-then statements). Unlike critical pathways, neither guidelines/protocols nor algorithms use simultaneous management of the process of care delivery to monitor practice. Protocols are more detailed and prescriptive than guidelines, but otherwise share similar features.

The published literature has largely presented the use of guidelines/critical pathways/algorithms in relation to the inpatient care process (e.g Egermayer and
Tomography (CT) was a standard part of the protocol by the protocol. However, the use of computerised regional hospital (Servadei et al., 1995). The authors found that admission rates were significantly reduced of patients presenting with head injury at a US re-

Another quasi-experimental trial compared admissions and other outcomes before and after the introduction of a protocol to guide the management of patients presenting with head injury at a US regional hospital (Servadei et al., 1995). The authors found that admission rates were significantly reduced by the protocol. However, the use of computerised tomography (CT) was a standard part of the protocol and it is therefore uncertain how cost-effective the intervention may have been.

Guidelines

A systematic review by Tannenbaum et al. (1996) concluded that evidence from large, well-designed randomised controlled trials existed to make a number of conclusions about the use of NSAID medications. They should be avoided whenever possible for patients in high risk groups such as: the elderly, those with hypertension, congestive heart failure, renal or hepatic impairment; those with certain concomitant medications; and those with a history of peptic ulcer. For those prescribed NSAIDs, the concomitant administration of misoprostol was recommended for use in those at increased risk of upper gastrointestinal complications.

Several guidelines have been developed to assist with the determination of when to admit a patient who has presented at the emergency department because of an exacerbation of asthma (Brenner and Kohn, 1998). Only one study was identified that has specifically evaluated the impact of a guideline on hospital admissions (Mcfadden et al., 1995), although several have assessed their effect on other aspects of practice such as prescribing (e.g. Thompson et al., 1993b).

The study by McFadden was a before-and-after trial based in the United States that assessed the effect of introducing asthma management guidelines into an emergency department. The study failed to find any statistically significant difference in admissions although the quasi-experimental design did prevent the study from adequately controlling for other time-related changes that may have confounded the result.

Fertig et al. (1993) found that the provision of guidelines was unlikely to make much impact on the 2.5-fold variation in referral rates that existed in the Cambridge (UK) area. Fertig examined the effect of locally produced consensus guidelines on the 15.9% of referrals that a team of hospital specialists considered to be possibly inappropriate. No statistically significant reduction in admissions was achieved by the application of the guidelines to the referrals. However, the findings from this study are difficult to generalise to emergency admissions as the authors only examined the effect of guidelines in relation to non-acute conditions and by means of the retrospective assessment of hospital case notes.

An interesting result was obtained in a prospective study that evaluated the likely effect of adopting a new guideline to determine which patients with unstable angina were most appropriate for admission (Katz et al., 1996). The study found that if the guideline was adopted then it was likely that demand for both general medical as well as intensive care hospi-
The study findings are important because of the two implications they suggest. Firstly, variation in the rate of hospital admission by practitioners need not always be in the direction of inappropriately hospitalising an excess number of unnecessary admissions. Secondly results of the study emphasise the need for all guidelines to be evaluated with respect to their effect on resource utilisation.

The effect on admissions of providing patients with decision support

Decision support for patients may be more effective than the provision of guidelines for GPs at reducing hospital admissions. Some evidence exists from the United States that better informed patients may demand less hospital-based care from family practitioners, e.g. less surgical treatment for prostate cancer (Wagner et al., 1995a) or less invasive treatment of conditions related to the female reproductive tract (Kuh and Stirling, 1995). A number of campaigns have shown that it is possible to inform patients of their treatment options and reduce their delay in receiving care (Blohm et al., 1994; Grubb et al., 1995).

Changes are also occurring in the manner that patients are now seeking help. Increasingly, electronic information resources (such as the Internet) mean patients may be as informed as their doctors about their condition and their knowledge might then be translated into a change in the way they seek help - such as by being more assertive and more questioning about the nature of the care they receive (Kasserer, 1995).

However, it is uncertain if patient aversion to hospital-based care may also extend to emergency conditions. It may instead be more likely that patient reluctance to present for assessment may inappropriately delay treatment which could have been more effectively delivered earlier in the course of an illness, perhaps even when outpatient-based care alone would have been feasible. No research has been identified to clarify this issue.

Conclusions

- A critical problem identified by Roland and Coulter (1992) with many evaluations of the effectiveness of guidelines, critical pathway and algorithms was their frequent assessment by means of a description of the number of people that had used the device, rather than any assessment of the health outcome(s) associated with (including the effects on resource utilisation) utilisation of the intervention.

- A recognised problem with the evaluation of any intervention to change practitioner behaviour (such as guidelines/critical pathways and protocols) is the Hawthorne Effect. That is, the possibility that the group receiving the intervention might improve their practice simply because they were aware that their behaviour was under scrutiny. While acknowledging these methodological issues, there is still a remarkable lack of published, well-designed, controlled trials that have evaluated the effect of the introduction of a guideline/critical pathway/protocol to determine which patients were most appropriate to be admitted to a medical hospital. This lack of evidence is surprising because several authors have maintained that guidelines need to be developed regionally in order to increase the likelihood that they will be adopted by local practitioners (Newton et al., 1996). The absence of a significant body of research does not facilitate guideline development by the large number of local groups who could potentially benefit from evidence-based information.

- An alternative to assisting providers with admission decisions is to provide decision support to patients in their choices about when (and if) they choose to see a doctor and, after they have attended, whether or not they demand admission. Limited evidence suggests that, in general, patients may be more risk averse than doctors. However, it is unclear whether a patient would perceive greater risk in remaining at home or in demanding hospital admission with the knowledge that their symptoms may be the harbinger of a serious medical illness.

Interventions to reduce medication-related admissions

An educational intervention aimed at reducing the number of drug-related hospital admissions was presented in a Danish before-and-after quasi-experimental study (Hallas et al., 1993). The intervention included a letter sent to the patient’s GP if the patient had been admitted with what hospital doctors considered to be a medication-related problem. The letter explained the drug-related problem and described how it could have been avoided. Other general information was sent to all local GPs and a number of educational symposia were held to educate GPs.

The study found that the intervention resulted in a modest (and not statistically significant) 1% decrease in drug-related admissions. However, the study found that the intervention had resulted in a significant reduction of admissions among a sub-group that the authors had defined as avoidable admissions.
Few definitive conclusions can be made from this study as the definition of avoidable admissions was debatable, the study had inadequate statistical power, and it lacked a control group.

The prevention of accidental poisoning, especially among children, is another important area where effective interventions have been found to reduce hospital admissions. Ecological data suggests that the introduction of child-proof packaging for certain pharmaceuticals has been associated with a reduction in the number of hospitalisations due to poisoning from the newly packaged medication (Anonymous, 1996b).

Poison centres that provide first aid advice by telephone to parents and professionals after a child has accidentally ingested some medication (or other chemical) have been found to have a favourable cost benefit ratio (Miller and Lestina, 1997).

Conclusion

- Although drug-related problems were identified in Section Two as a significant potential cause of increased admissions, relatively few studies have specifically examined interventions to prevent drug-related admissions either due to iatrogenic causes among adults or accidental ingestion by children.

**Studies evaluating specific medical interventions that have used hospital admission as their primary endpoint**

Several studies have assessed specific treatments or medical interventions for defined conditions in relation to their effectiveness at reducing acute admissions. These studies are presented below, although it should be noted that they are discussed in isolation and not with reference to other literature on their respective topics. Most studies are related to cardiology practice.

**New cardiology interventions that reduce admissions**

**Implantable cardiac defibrillator:**

The implantation of a cardiac defibrillator was found by Valenti et al. (1996) to reduce the rate of hospitalisation among recipients from a mean of 3.28 +/- 2.38 admissions per patient/year to 0.88 +/- 1.23 hospitalisations per patient/year. However, the findings from this study are limited by the lack of a control group and the restrictive selection of patients for the intervention in the study.

**Low dose amiodorone:**

A large, multi-centre, randomised controlled trial in Argentina (Doval et al., 1994) found that low-dose amiodorone (300 mg or less) was able to reduce hospital admissions for patients with severe heart failure. The study, however, did not closely monitor for adverse effects from the medication. For example, neither chest X-rays nor thyroid function tests were routinely measured.

**Carvedilol:**

Another randomised controlled multi-centre trial based in Australia and New Zealand found that carvedilol (a beta adrenergic blocking agent) significantly reduced hospital admission rates among the 415 participants over a 12 month period (Australia and New Zealand Heart Failure Research Collaborative Group, 1997). The trial, however, was too small and too short to provide any definitive evidence of the effectiveness of the new medication at reducing admissions or improving either the mortality or the quality of life of patient with congestive heart failure.

**Amrinone infusions:**

A retrospective review of admission rates for patients with severe heart failure (NYHA class III and IV) found that patients not amenable to coronary artery bypass grafting or angioplasty who were undergoing amrinone infusions of amrinone (a new phosphodiesterase inhibitor with inotropic and vasodilator properties) reduced (by 56%) the number of hospital admissions in the six months after starting treatment compared to the six months before the treatment (Levinoff Roth and Moe, 1993). However, the validity of this result is limited because it only included a small number of patients (41) who were followed up for a short period of time. In addition, the study could not exclude that some factor apart from the amrinone was responsible for the decreased number of hospitalisations. The trial also lacked a control group and could not therefore exclude the possibility that the regular provision of rest, proper diet and supervised medication taking was not actually responsible for the observed reduction in admissions.

**Transmyocardial laser revascularisation:**

A number of new technologies have been trialled and suggested to be effective at reducing the need for inpatient care. Horvath et al. (1997) provides a typical example of a prospective cohort study which found that patients not amenable to coronary artery bypass grafting or angioplasty who were undergoing transmyocardial laser revascularisation reduced their hospital admission rate for myocardial infarction over their average 10 +/- 3 months of follow-up. However, the validity of the results from this study is limited by the lack of a control group, and by the possibility that selection bias may have improved the outcome from the study. This intervention requires evaluation by a large prospective randomised controlled trial that includes information about the costs of care.

**Increased use of ACE inhibitors in the treatment of heart failure:**

A large meta-analysis by Linn (1996) that included 30 randomised controlled trials concluded that the
risk of hospitalisation for people with moderate to serious heart failure was reduced by 35% (95% CI 0.57-0.74) among those patients who had been prescribed ACE inhibitor medication. The results of the SOLVD trial extended this conclusion to asymptomatic (NYHA class 1) patients for whom the study found that early use of enalapril (an ACE inhibitor) significantly reduced their risk of hospitalisation by over 20% (SOLVD Investigators, 1992). There is now overwhelming evidence based on large randomised controlled trials that the use of ace inhibitor medication is effective at reducing the risk of hospital admission among patients with all classes of heart failure (Doughty et al., 1997) (Cody, 1995).

**Use of digoxin for patients with heart failure:**
The large randomised double blind trial described by Gosselink et al. (1997) recently reported on the efficacy of digoxin in people who had heart failure but remained in sinus rhythm. The study concluded that the drug had no effect on overall mortality but significantly reduced hospital admission rates among recipients (van Veldhuisen et al., 1996). It is notable that although the study found that deaths from heart failure were reduced, there was a parallel increase in mortality attributed to arrhythmias, suggesting that mortality benefits from the drug may be offset by its proarrhythmic side effects (Cohen, 1996).

**Comprehensive heart failure programme:**
A comprehensive heart failure programme that included a detailed review and then subsequent management by a multi-disciplinary team, who provided adjustments to medication and intensive patient education, found there was an 85% reduction in admissions combined with an increase in functional status for the intervention group (Fonarow et al., 1997). The authors suggested the intervention was accompanied by a net reduction in the cost of care for these patients. However, this conclusion is limited by the study’s retrospective design. The authors could not exclude a change in admission threshold as an alternative explanation for their findings.

Other interventions that may reduce hospital admissions:

**Low molecular heparin:**
A systematic review by Innes et al. (1997) concluded from an assessment of five randomised controlled trials that low molecular heparin provided more reliable and safer anticoagulation than heparin infusion, without the associated need for hospitalisation.

**The diagnosis of thromboembolic disease:**
A recent review article has examined the dilemmas associated with the diagnosis of thromboembolic disease. Although the review did not explicitly cite the impact of an accurate diagnosis on reducing unnecessary hospital admissions, the potential for this is apparent in the text (Egermayer et al., 1997). In particular the paper reported evidence to suggest that any patient who presented with clinical symptoms suggestive of thromboembolic disease should have a plasma D-dimer level measured. This test was reported to have high negative predictive value (0.96), which suggested that patients with a normal result could safely be treated as outpatients.

**A diagnostic test for appendicitis:**
The efficacy of using Tc-99m-HMPAO white blood cell scanning to exclude appendicitis and reduce unnecessary hospital admissions of patients presenting in an ED with abdominal pain was assessed in a study by Rypins et al. (1997). The study found that the test had high sensitivity (98%) and specificity (95%) and was safely able to reduce unnecessary hospital admissions when appendicitis was not present. It is difficult to generalise the study result to other areas because it was based on a small (124) number of highly selected patients at a single centre.

**Recombinant Dnase therapy:**
The use of recombinant human Dnase therapy has been documented in a randomised controlled trial to reduce admissions for respiratory tract infections among patients with cystic fibrosis (Oster et al., 1995). The 15% reduction was noted over the 24 weeks of the study. However, the result could have been due to bias, as the intervention group received closer follow-up and was more likely to receive earlier treatment for respiratory tract infection than the control group.

**Inhaled antibiotics for children with cystic fibrosis:**
Another specific intervention that is intended to reduce the need for acute inpatient care, is the provision of inhaled aerosolized antibiotics to patients with cystic fibrosis. This intervention has recently received a significant amount of research attention. Several studies have found there is a significant reduction in admission rates for patients receiving aerosolized antibiotics. The studies are presented in Tables 47 and 48.

A number of limitations are apparent with these studies. They have addressed a wide variety of treatment regimens but have all involved a small study sample with a short duration of follow-up. Longer follow up duration and larger patient samples would be needed to exclude any possible negative side effects from the medication or the possibility that bacterial resistance to the antibiotic may be encouraged by this treatment.

**Conclusion:**
- A number of specific interventions have been assessed with respect to their effect on hospital admission. Most of these interventions are concerned with particular therapies for cardiology problems. Although notable the studies do not provide any contextual information about the importance of the underlying conditions, the
relevance of the interventions in current health systems and other therapeutic modalities along with their relative costs and benefits.
A list of interventions to reduce admissions identified by this review together with the level of evidence found for their efficacy is presented in Table 49. Generally, most effective interventions to reduce admissions are macromanagement-based interventions that are often located at the interface between primary and secondary care. However, micromanagement changes within either primary care or secondary care organisations can also effectively reduce the morbidity associated with hospital admission.

Good evidence exists (from randomised controlled trials) that specific interventions are effective at reducing admissions. These interventions include hospital-at-home schemes, comprehensive geriatric care and the placement of GPs in the ED. Finally, it also appears that the introduction of various guidelines, certain new technologies and the provision of prospective funding have also been proven to reduce admissions.

Some evidence exists that several other interventions are probably effective at reducing admissions. These initiatives include: various public health interventions, home alarms, increased options for long-term care for the elderly, drug education for patients and practitioners, and hospital outreach services. The provision of senior staff in the ED and the development of ED-based observation units and chest pain units are also probably effective at reducing admissions.

Some interventions appear to be unsuccessful at reducing admissions although it should be noted that these interventions may still be able to improve other health outcomes. These ineffective interventions include: outpatient-based education for individuals or groups, increased outpatient services, and both utilisation review and case management.

Despite the significant public health importance of a rising number of acute medical admissions, there is a serious lack of well-conducted research into the possible causes and effective alternatives to increasing inpatient numbers. Although the causes and alternatives to rising acute medical admissions are inherently difficult and complex areas for study, the consistent use of terms and the appropriate presentation of data would help illuminate this area.

There is a significant need for researchers, policy makers and providers to use a standardised definition of acute medical admissions and present data as age specific, or population-based, rates in preference to simply reporting absolute numbers.

Many interventions considered in this report have not been fully evaluated in relation to their effects on hospital admissions or any other health outcomes. In addition, there is an urgent need for further research into the effects of most of these interventions in the New Zealand setting. While it may not be possible (for logistical or ethical reasons) to locally evaluate all of these interventions by means of randomised controlled trials, an alternative study design (usually a quasi-experimental study) could be employed. Table 50 provides a few selected examples of interventions that need further research in relation to determining their effectiveness to appropriately reduce acute medical admissions.

Information on rising admission rates is important but it is limited by the absence of any knowledge of what is an ideal admission rate for hospital care. Focusing on the amount of the rise, or highlighting areas with the highest increases in admissions, are useful starting points for any inquiry into what an area’s optimal admission rate might be, but they do not necessarily represent conclusions that a problem must exist.

Limited information is available about the outcomes from acute hospital admission for a large number of conditions. In particular, little is known about whether outcome would have been better if the patient had been maintained in primary care, especially when the condition is less severe.

Considerably more research on the outcomes associated with primary and secondary care, along with information on the effects of rising admission rates and their implications are essential to more fully inform this issue.
At least two challenges exist in any attempt to find a viable alternative to hospital care (Murphy, 1993). Firstly, major obstacles are present that will resist change. These obstacles exist in the professional, financial and organisational boundaries that define how care is currently provided (Moss and McNicol, 1995). For example, advocating for greater diabetes care in primary care runs up against the willingness of GPs to accept the additional workload and hospitals to relinquish it, as well as whether the additional tasks will bring more or less financial return to the respective providers. Secondly, most of the hard data required to determine the cost and clinical implications of different configurations is still essentially lacking. Evidence from well-conducted trials is urgently needed to inform decisions about which interventions should be adopted by the purchasers and providers of health care in relation to any responses to the rising number of acute medical admissions.
Figure 9. Interventions to reduce acute medical admissions
Table 26. Studies that have assessed the effect of hospital closure on regional admission rates

<table>
<thead>
<tr>
<th>Author Country</th>
<th>Study design Level of evidence</th>
<th>Sample</th>
<th>Conclusions</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Rosenbach and Dayhoff, 1995) United States</td>
<td>Quasi-experimental II-1</td>
<td>Comparison of admission rates in a area before/after closure of 12 hospitals</td>
<td>Admission rates dropped after hospitals were closed</td>
</tr>
<tr>
<td>(Wennberg et al., 1989) United States</td>
<td>Ecological III</td>
<td>Various, small area analyses</td>
<td>Benchmarking could provide the optimal bed capacity for a given size of population (no p value)</td>
</tr>
<tr>
<td>(Coffey, 1983) United States</td>
<td>Economic modeling Cross sectional data III</td>
<td>US public and private hospitals in 1970s</td>
<td>Reduced number of private beds increased admissions in public hospitals (no p value)</td>
</tr>
<tr>
<td>(Edward, 1997), United Kingdom</td>
<td>Opinion IV</td>
<td></td>
<td>Hospital closure would reduce (unnecessary) admissions (no p value)</td>
</tr>
</tbody>
</table>

Unless otherwise indicated conclusions significant at p ≤ 0.05

Table 27. Key studies that have assessed the impact of prospective DRG payment on emergency admissions

<table>
<thead>
<tr>
<th>Author Country</th>
<th>Study design Level of evidence</th>
<th>Sample</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Manning et al., 1985) United States</td>
<td>Randomised controlled trial I</td>
<td>Rand Corporation 1580 patients randomised to fee for service care or HMO-based, DRG payment system</td>
<td>Reduced emergency admission rate among patients in prospective payment system.</td>
</tr>
<tr>
<td>(Muller, 1993) United States</td>
<td>Quasi-experimental II-1</td>
<td>Before and after introduction of DRG payment to Medicare services</td>
<td>Emergency admissions decreased after the introduction of DRG payment.</td>
</tr>
<tr>
<td>(Powers, 1997) United States</td>
<td>Quasi-experimental II-1</td>
<td>Before and after comparison of the introduction of DRG payments in Connecticut</td>
<td>Emergency admissions decreased after DRG payments were introduced (no p value).</td>
</tr>
<tr>
<td>(Rosko and Broyles, 1987) United States</td>
<td>Cross sectional III</td>
<td>New Jersey compared to Pennsylvania</td>
<td>The state with higher use of DRG payment was associated with a lower rate of emergency admissions.</td>
</tr>
<tr>
<td>(Altman and Young, 1993) United States</td>
<td>Cross sectional III</td>
<td>Population based, US states</td>
<td>States with higher use of DRG payment were associated with lower rates of emergency admissions (no p value).</td>
</tr>
</tbody>
</table>

Unless otherwise indicated conclusions significant at p ≤ 0.05
### Table 28. Studies that have examined the effect of budget-holding on acute admissions

<table>
<thead>
<tr>
<th>Author</th>
<th>Country</th>
<th>Study design Level of evidence</th>
<th>Sample</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Tooth et al., 1997)</td>
<td>United Kingdom</td>
<td>Quasi-experimental II-1</td>
<td>Emergency admissions before and after fundholding</td>
<td>No change in rate of emergency admission</td>
</tr>
<tr>
<td>(Coult et al., 1993)</td>
<td>United Kingdom</td>
<td>Cross sectional III Record linkage</td>
<td>Admissions from fundholding practices compared to non-fundholders in Oxford</td>
<td>Reduced rate of emergency admissions after practices adopted budget holding (p &lt;0.05)</td>
</tr>
<tr>
<td>(Howie et al., 1995)</td>
<td>Scotland</td>
<td>Quasi experimental II-1</td>
<td>Before and after comparison of the introduction of budget holding on emergency admission rates</td>
<td>No difference in emergency admission rates</td>
</tr>
</tbody>
</table>

### Table 29. Studies that have examined the effect of HMOs on acute admission rates

<table>
<thead>
<tr>
<th>Author</th>
<th>Country</th>
<th>Study design Level of evidence</th>
<th>Sample</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Manning et al., 1985)</td>
<td>United States</td>
<td>Randomised controlled trial I</td>
<td>Rand Corporation 1580 patients randomised to fee for service care or HMO-based, DRG payment system</td>
<td>Reduced emergency admission rate among patients in prospective payment system</td>
</tr>
<tr>
<td>(Pearson et al., 1994)</td>
<td>United States</td>
<td>Cohort II-2</td>
<td>3,006 people admitted for chest pain in a US ED</td>
<td>Members of an HMO had higher admission rates for chest pain</td>
</tr>
<tr>
<td>(Morgan et al., 1997b)</td>
<td>United States</td>
<td>Case control II-2</td>
<td>Patient utilisation of services compared when enrolled or not with an HMO or fee for service health care</td>
<td>Patients with HMO enrolment used fewer services suggesting that selection bias may dictate who is enrolled (no p value)</td>
</tr>
<tr>
<td>(Adolph and Faikman, 1996)</td>
<td>United States</td>
<td>Retrospective case series III</td>
<td>102 children with complications from appendicitis</td>
<td>Children enrolled in an HMO had lower rates of complications from appendicitis (p &lt;0.01)</td>
</tr>
</tbody>
</table>

Unless otherwise indicated results significant at p ≤ 0.05
### Table 30. Studies that have examined the effect of public health interventions on hospital admission rates

<table>
<thead>
<tr>
<th>Author Country</th>
<th>Study design</th>
<th>Sample</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Cameron et al., 1994), Australia</td>
<td>Quasi-experimental</td>
<td>Before and after study on legislation change introducing mandatory helmet usage for cyclists in Victoria</td>
<td>Reduction in head injuries in relation to new legislation</td>
</tr>
<tr>
<td>(Yitverud, 1996), Norway</td>
<td>Quasi-experimental</td>
<td>Before and after study of effect of a community education campaign on falls among the elderly</td>
<td>Reduction in falls in relation to health promotion campaign</td>
</tr>
<tr>
<td>(Nichol et al., 1994), United States</td>
<td>Cohort</td>
<td>25,000 elderly people given influenza immunisation</td>
<td>Reduced admission for emergency respiratory conditions after vaccination (p &lt; 0.04)</td>
</tr>
<tr>
<td>(Henry et al., 1996), United States</td>
<td>Cohort</td>
<td>1446 car crash victims</td>
<td>Wearing a seat belt reduced the likelihood of admission by 33%</td>
</tr>
<tr>
<td>(Gorelick and Baker, 1994), United States</td>
<td>Time series cross-sectional study</td>
<td>Paediatric admissions for haemophilus influenza since introduction of vaccination programme</td>
<td>Marked reduction in emergency admissions for HIB-related disease</td>
</tr>
<tr>
<td>(Mock et al., 1995), United States</td>
<td>Time series cross-sectional study</td>
<td>Changes in admission rates between 1986-1993</td>
<td>Increased use of helmets associated with a reduction in head injuries</td>
</tr>
<tr>
<td>(Streiner and Nolan, 1997), Australia</td>
<td>Ecological</td>
<td>Number of emergency admissions for burns in Australia</td>
<td>Reduction in admissions suggested to be due to several health promotion campaigns</td>
</tr>
<tr>
<td>(Kamwendo et al., 1996), Sweden</td>
<td>Ecological</td>
<td>Admissions for PID compared to condom sales in Sweden</td>
<td>Reduced admissions in association with increased condom sales</td>
</tr>
</tbody>
</table>

Unless otherwise indicated results significant at p<0.05
<table>
<thead>
<tr>
<th>Author Country</th>
<th>Patients Sample size</th>
<th>Intervention</th>
<th>Key result</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Adler et al., 1978) United Kingdom</td>
<td>Early discharge surgical patients</td>
<td>Nursing care/home assistants but not 24 hr</td>
<td>Reduced inpatient services and costs (no p value). Reduced costs for home group (no p value)</td>
</tr>
<tr>
<td>(Donald et al., 1995) United Kingdom</td>
<td>Early discharge elderly medical patients (n = 60)</td>
<td>Nursing care/home assistants + physiotherapist + occupational therapist</td>
<td>Reduction in inpatient care by 65% (p = 0.002)</td>
</tr>
<tr>
<td>(Martin et al., 1994) United Kingdom</td>
<td>Early discharge elderly medical patients (n = 54)</td>
<td>Nursing care/home assistants but not 24 hr</td>
<td>Reduction in inpatient care by 50% (no p value)</td>
</tr>
<tr>
<td>(Ruckley et al., 1978) United Kingdom</td>
<td>Early discharge surgical patients (n = 360)</td>
<td>Nursing care/home assistants</td>
<td>Reduction in inpatient care by 165% (no p value). Reduced costs for home group (no p value)</td>
</tr>
<tr>
<td>(Sheppard et al., 1998b) United Kingdom</td>
<td>Early discharge medical and surgical patients (n = 638; medical = 96, chronic obstructive airways disease = 32)</td>
<td>Nursing care/home assistants/physiotherapist/occupational therapist</td>
<td>No differences in outcome between hospital at home care and hospital care (p &gt; 0.05)</td>
</tr>
<tr>
<td>(Richards et al., 1998) United Kingdom</td>
<td>Early discharge medical and surgical patients (n = 239)</td>
<td>Nursing care/home assistants/physiotherapist/occupational therapist</td>
<td>Early discharge was similar to routine discharge in terms of effectiveness and acceptability (p &gt; 0.05)</td>
</tr>
<tr>
<td>(Sheppard et al., 1998a) United Kingdom</td>
<td>Early discharge medical and surgical patients (n = 538; medical = 96, chronic obstructive airways disease = 32)</td>
<td>Nursing care/home assistants/physiotherapist/occupational therapist</td>
<td>Hospital at home did not reduce healthcare costs. Evidence was found of cost shifting from hospital services to primary care</td>
</tr>
<tr>
<td>(Cost et al., 1998) United Kingdom</td>
<td>Early discharge medical and surgical patients Cost minimisation study (n = 241)</td>
<td>Nursing care/home assistants/physiotherapist/occupational therapist</td>
<td>Hospital at home was less costly than care in the acute hospital</td>
</tr>
<tr>
<td>(Cummings et al., 1990) United States</td>
<td>Early discharge Veterans Administration patients Cost-effectiveness assessment (n = 419)</td>
<td>Nursing care/home assistants + social worker + dietician + physical therapist</td>
<td>Hospital at home care was more cost effective (13%) (but not statistically significant) and was associated with higher patient satisfaction</td>
</tr>
</tbody>
</table>

Unless otherwise indicated results significant at p ≤ 0.05
Table 32. Controlled trials that have examined the effect of hospital at home for terminal care on hospital utilisation rates

<table>
<thead>
<tr>
<th>Author Country</th>
<th>Patients Sample size</th>
<th>Intervention</th>
<th>Key result</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Hughes et al., 1992)</td>
<td>Early discharge for terminal care (n=171)</td>
<td>Nursing care/home assistants + physical therapist + social worker + dietician</td>
<td>Reduction in inpatient care by 38% (p = 0.030) for hospital at home group also higher satisfaction and lower costs</td>
</tr>
<tr>
<td>United States</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(McCorkle et al., 1989)</td>
<td>Patients with progressive lung cancer (n=166)</td>
<td>Oncology home care nurses or ordinary home care nurses or usual care</td>
<td>Less hospital use and less distress among both home care groups</td>
</tr>
<tr>
<td>United States</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Zimmer et al., 1985)</td>
<td>Terminally ill elderly (n=158)</td>
<td>Physician + nurse practitioner + social worker</td>
<td>Less hospitalisations among home care groups, higher satisfaction but no significant difference in costs (p &gt; 0.05)</td>
</tr>
<tr>
<td>United States</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Mor and Kidder, 1985)</td>
<td>Last year of life of terminal cancer patients</td>
<td>Home care compared to conventional care and hospice care</td>
<td>Home care lower costs than conventional care and hospice care lowest costs of the three groups</td>
</tr>
<tr>
<td>United States</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Cumminghs et al., 1990)</td>
<td>Terminally ill veterans (n=119)</td>
<td>Home care vs conventional care</td>
<td>Higher satisfaction and lower costs for home care group</td>
</tr>
</tbody>
</table>

Unless indicated results significant at p ≤ 0.05
### Table 33. The effect of community beds on acute medical admission rates

<table>
<thead>
<tr>
<th>Author Country</th>
<th>Study design</th>
<th>Sample</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Berry, 1986) United Kingdom</td>
<td>Quasi-experimental II-1</td>
<td>Admission to a general hospital compared before and after community hospital was closed</td>
<td>Community hospital significantly associated with reduced general hospital admissions</td>
</tr>
<tr>
<td>(Baker et al., 1986) United Kingdom</td>
<td>Case control II-2</td>
<td>Total hospital bed occupancy compared of patients registered to practices that had access to community hospitals compared to practices that did not</td>
<td>Community hospitals substituted for some general hospital use but overall bed stay was increased</td>
</tr>
<tr>
<td>(Jones, 1988) United Kingdom</td>
<td>Audit III</td>
<td>Review of admissions to community hospitals in the UK</td>
<td>Variation was noted in the services available at community hospitals (no p value)</td>
</tr>
<tr>
<td>(Tomlinson et al., 1995) United Kingdom</td>
<td>Cross sectional Audit III</td>
<td>Professional review of 685 admissions to community hospital in Leicestershire</td>
<td>15% of patients were transferred authors concluded that care was appropriate (no p value)</td>
</tr>
<tr>
<td>(Anglia and Oxford Intermediate Care Project, 1997) United Kingdom</td>
<td>Semi-systematic review IV</td>
<td>Review of literature examining the use of community hospitals</td>
<td>Quality of literature was noted to be poor. Although community hospital care had a cheaper bed day cost, patients stayed longer and overall costs were higher (no p value)</td>
</tr>
</tbody>
</table>

Unless otherwise stated results significant at \( p \leq 0.05 \)

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**Acute Medical Admissions**
Table 34. Descriptive studies of the use of patient hotels

<table>
<thead>
<tr>
<th>Author</th>
<th>Sample group/Setting</th>
<th>Method of assessment of number appropriate to receive care in hotel</th>
<th>Percentage of acute patients found to be suitable for care in patient hotel</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Harvey et al., 1993)</td>
<td>3972 patients at Welsh University Hospital</td>
<td>Specialist and patient assessment</td>
<td>10%</td>
</tr>
<tr>
<td>(NHS Management Executive, 1995)</td>
<td>948 patients at two English hospitals</td>
<td>Specialist assessment</td>
<td>14%</td>
</tr>
</tbody>
</table>

Table 35. Summary of key studies that have assessed the effect of primary care initiatives on reducing admissions

<table>
<thead>
<tr>
<th>Author Country</th>
<th>Study design Level of evidence</th>
<th>Sample</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Darnell et al., 1985) United States</td>
<td>Randomised controlled trial I</td>
<td>Provision of direct access to primary care doctors out of hours</td>
<td>No change in emergency medical admissions (p &gt; 0.05)</td>
</tr>
<tr>
<td>(Thapar, 1996) Various</td>
<td>Systematic review I</td>
<td>Review of primary care-based treatment of epilepsy</td>
<td>Primary care was able to significantly reduce admissions</td>
</tr>
<tr>
<td>(Gil, 1997) United States</td>
<td>Quasi-experimental II-I</td>
<td>Medicare population in the United States</td>
<td>Admissions rates did not decrease after patients were provided with a primary care doctor (p &gt; 0.1)</td>
</tr>
<tr>
<td>(Brown and Barnett, 1992) New Zealand</td>
<td>Cross-sectional III</td>
<td>The number of GPs compared to other modifiers of admission rates</td>
<td>The number of GPs had an unimportant influence on admission rates compared to socio-economic factors (p &gt; 0.05)</td>
</tr>
<tr>
<td>(Barnett and Brown, 1993) New Zealand</td>
<td>Cross-sectional III</td>
<td>Admission rates of New Zealand GPs compared to their age</td>
<td>Younger (less experienced) doctors have significantly higher emergency admission rates</td>
</tr>
<tr>
<td>(Griffiths et al., 1996) United Kingdom</td>
<td>Cross-sectional III</td>
<td>Ratio of preventer to reliever medication compared to GP admission rates for asthma</td>
<td>Increased preventer: reliever ratio was significantly associated with lower emergency admission rates for asthma</td>
</tr>
<tr>
<td>(Shelley et al., 1996) United Kingdom</td>
<td>Cross-sectional III</td>
<td>Ratio of preventer to reliever medication compared to GP admission rates for asthma</td>
<td>No relationship between ratio and admission rates for asthma (p &gt; 0.05)</td>
</tr>
<tr>
<td>(Wilkin and Smith, 1987) United Kingdom</td>
<td>Cross-sectional III</td>
<td>Size of practice population compared to admission rates</td>
<td>No relationship between practice size and emergency admissions (p &gt; 0.05)</td>
</tr>
<tr>
<td>(Hilditch, 1980) Canada</td>
<td>Ecological III</td>
<td>Changes in admissions in relation to the number of primary care doctors between 1972-1975 in Canada</td>
<td>Increased admission rates in relation to increased doctors (no p value)</td>
</tr>
<tr>
<td>(Anderson, 1993) Various</td>
<td>Non-systematic review IV</td>
<td>Studies evaluating the effect of short GP based interventions on alcohol intake and hospital admission</td>
<td>Short counseling by GPs can reduce alcohol intake and subsequent emergency admission rates (no p value)</td>
</tr>
</tbody>
</table>

Unless otherwise indicated results significant at p < 0.05
### Table 36  Outpatient-based interventions to reduce acute medical admissions

<table>
<thead>
<tr>
<th>Author Country</th>
<th>Study design</th>
<th>Level of evidence</th>
<th>Patients Sample</th>
<th>Intervention</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Outpatient-based education delivered to individuals</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Anonymous, 1994a) Scotland</td>
<td>RCT</td>
<td>I</td>
<td>Adults (n=569)</td>
<td>Education on peak flow monitoring</td>
<td>No statistically significant reduction in admissions</td>
</tr>
<tr>
<td>(Oman et al., 1994) Scotland</td>
<td>RCT</td>
<td>I</td>
<td>Adults (n=801)</td>
<td>Computer enhanced education</td>
<td>No statistically significant reduction in admissions</td>
</tr>
<tr>
<td>(Gibson et al., 1998) Various</td>
<td>Meta-analysis</td>
<td>I</td>
<td>Adults (n=906)</td>
<td>Information based education programmes</td>
<td>No statistically significant reduction in admissions</td>
</tr>
<tr>
<td><strong>Group outpatient education</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Beck et al., 1997) United States</td>
<td>RCT</td>
<td>I</td>
<td>Elderly (n=321)</td>
<td>Group outpatient education in an HMO</td>
<td>No significant reduction in admissions</td>
</tr>
<tr>
<td>(Boulet et al., 1995) Canada</td>
<td>Case control</td>
<td>II-2</td>
<td>Adult (n=84)</td>
<td>Three sessions of group education</td>
<td>No significant reduction in admissions</td>
</tr>
<tr>
<td><strong>Increased outpatient based services and improved GP referral to outpatient services</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Marius-Nunez et al., 1996) United States</td>
<td>Cohort</td>
<td>II-2</td>
<td>Adults (n=36)</td>
<td>Intermittent inotropic infusions</td>
<td>Hospital admission rate for heart failure significantly reduced by 50% (p&lt;0.01)</td>
</tr>
<tr>
<td>(Silverman et al., 1995) United States</td>
<td>RCT</td>
<td>I</td>
<td>Elderly (n=442)</td>
<td>Improved family practitioner access to outpatient services</td>
<td>No change in hospital admission rates</td>
</tr>
<tr>
<td>(Swift et al., 1993)</td>
<td>Cohort</td>
<td>II-2</td>
<td>Children (n=239)</td>
<td>Outpatient care for newly diagnosed insulin dependent diabetics</td>
<td>Significantly fewer subsequent admissions than diabetic patients initially managed in hospital (p&lt;0.05)</td>
</tr>
<tr>
<td>(Charlton et al., 1994) United Kingdom</td>
<td>RCT</td>
<td>I</td>
<td>Children (n=91)</td>
<td>Nurse run outpatient clinic for asthmatic children</td>
<td>No reduction in hospital admissions</td>
</tr>
<tr>
<td><strong>Urgent referral service for GPs with hospital consultants</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Smith et al., 1996b) United Kingdom</td>
<td>Quasi-experimental</td>
<td>II-1</td>
<td>Adults</td>
<td>24 hour direct access for GPs to consultants (other improvements in communication)</td>
<td>Hospital admissions were significantly reduced (p&lt;0.05)</td>
</tr>
<tr>
<td><strong>Outreach service provided by hospital outpatient department</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Greiner et al., 1995) United States</td>
<td>Quasi-experimental</td>
<td>II-1</td>
<td>Young adults (n=52)</td>
<td>Home visits by nurses from out-patients</td>
<td>Significant reduction in hospital admission (p&lt;0.05)</td>
</tr>
</tbody>
</table>
Table 37. Summary of key articles that have assessed the effect of ED based interventions (except observation units) on admissions

<table>
<thead>
<tr>
<th>Author</th>
<th>Study design Level of evidence</th>
<th>Sample</th>
<th>Intervention</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Increased ED services</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Bur et al., 1997)</td>
<td>Database review III</td>
<td>102,411 presentations in 2 year period</td>
<td>Increased ED services</td>
<td>Significant reduction in hospital admissions</td>
</tr>
<tr>
<td>United States</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Use of GPs in the ED</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Murphy et al., 1996)</td>
<td>RCT I</td>
<td>4684 All ages</td>
<td>GPs in ED dept compared to usual staff</td>
<td>GPs admit significantly fewer patients and have similar patient outcomes</td>
</tr>
<tr>
<td>United Kingdom</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Dale et al., 1995)</td>
<td>RCT I</td>
<td>4641 All ages</td>
<td>GPs in ED compared to other staff</td>
<td>GPs admit significantly fewer patients and are more cost effective</td>
</tr>
<tr>
<td>(Dale et al., 1996a)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Provision of senior staff in ED</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Richardson et al., 1997)</td>
<td>Quasi-experimental II-1</td>
<td>Two hospitals</td>
<td>Introduction of trauma centre</td>
<td>Significantly reduced admissions associated with more senior staff employed in a trauma centre</td>
</tr>
<tr>
<td>United States</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>The provision of a social worker in the ED</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Monsuez et al., 1993)</td>
<td>Descriptive study III</td>
<td>Adults (n=72)</td>
<td>ED-based social worker</td>
<td>Alternatives to admission were found for 82% of patients (no p value)</td>
</tr>
<tr>
<td>France</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Boyack and Backman, 1991)</td>
<td>Descriptive study III</td>
<td>Adults (n=455)</td>
<td>ED-based social worker</td>
<td>Alternatives to admission were arranged for 5% of patients (no p value)</td>
</tr>
<tr>
<td>United States</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Regional services and air ambulances</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Nicholl et al., 1994)</td>
<td>Case control study II-2</td>
<td>All ages (n=300)</td>
<td>Air ambulance for a regional trauma service</td>
<td>No significant difference in outcomes for an air ambulance service compared to ground transport</td>
</tr>
<tr>
<td>United Kingdom</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Separate paediatric emergency service</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Beatie and Moir, 1993)</td>
<td>Descriptive study III</td>
<td>Children</td>
<td>Provision of separate waiting and treatment area for children in an ED</td>
<td>Reported to have improved service and reduced admissions (no p value)</td>
</tr>
</tbody>
</table>

Unless otherwise indicated results significant at p ≤ 0.05
Table 38. The effect of observation units on acute medical admissions

<table>
<thead>
<tr>
<th>Author</th>
<th>Country</th>
<th>Patients Sample size</th>
<th>Study design (Evidence grading) Intervention</th>
<th>Results* Conclusions</th>
</tr>
</thead>
<tbody>
<tr>
<td>(McDermott et al., 1997)</td>
<td>United States</td>
<td>Adults at a hospital followed over 8 weeks (N = 222)</td>
<td>Randomised controlled trial (I) Observation unit vs inpatient care</td>
<td>No difference in admission rates between two groups</td>
</tr>
<tr>
<td>(Gouin et al., 1997)</td>
<td>Canada</td>
<td>Children at a hospital followed over 3 days (N = 4227)</td>
<td>Before and after study (II-1) of introduction of a paediatric observation unit</td>
<td>Significant reduction in admissions after the introduction of unit. However, also a significant increase in repeat visits to ED within 72 hours. (p &lt; 0.05)</td>
</tr>
<tr>
<td>(Rydman et al., 1998)</td>
<td>United States</td>
<td>Adults attending an inner city ED (n = 113)</td>
<td>Randomised controlled trial (I) Observation unit versus inpatient care of an acute exacerbation of chronic asthma</td>
<td>No significant difference in relapse survival rates. Observation unit was associated with a statistically significant reduction in 5/8 domains of the SF36 quality of life scores and a reduction in costs with similar clinical outcomes</td>
</tr>
<tr>
<td>(Brilman and Tandberg, 1994)</td>
<td>United States</td>
<td>Adults and children at a hospital (n = 1224)</td>
<td>Before and after study (II-1) of introduction of an observation unit</td>
<td>No significant decrease in admissions. Decrease in patients discharged from ED as most were diverted to the unit</td>
</tr>
</tbody>
</table>

*Significance at p ≤ 0.05

Table 39. Studies assessing before and after costs associated with the introduction of an observation unit in relation to the treatment of different conditions

<table>
<thead>
<tr>
<th>Condition</th>
<th>Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asthma</td>
<td>(Zwiche et al., 1982)</td>
</tr>
<tr>
<td>Chest pain</td>
<td>(Fineberg et al., 1984)</td>
</tr>
<tr>
<td>Exclusion of myocardial infarction</td>
<td>(Gaspoz et al., 1994)</td>
</tr>
<tr>
<td>Congestive heart failure</td>
<td>(Dunbar, 1992)</td>
</tr>
<tr>
<td>Pneumothorax</td>
<td>(Vallee et al., 1988)</td>
</tr>
<tr>
<td>Abdominal trauma</td>
<td>(Hememan, 1989)</td>
</tr>
</tbody>
</table>
### Table 40. Studies that have assessed the effectiveness of a chest pain unit to reduce acute medical admissions

<table>
<thead>
<tr>
<th>Setting Author</th>
<th>Patients Sample</th>
<th>Intervention</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart ED at the University of Cincinnati (USA) (Hoekstra et al., 1994) (Gilber et al., 1995) (Gilber et al., 1992) (Sayye et al., 1994)</td>
<td>History suggestive of MI but nondiagnostic ECG 1010 adults</td>
<td>9 hours observation serial ECG and CK-MB estimates followed by echocardiography and exercise testing under care of emergency physician and consultation with a cardiologist Discharged patients have follow up visit after 48 hours</td>
<td>828 of 1010 were discharged (82%) 2 discharged patient were found after 1 months follow-up to have sustained a MI (false negative rate 0.2%) Average cost of unit patients was $1368 compared to $2810 for admitted control group</td>
</tr>
<tr>
<td>ED at Brigham and Women’s Hospital at Boston (USA) (Gaspoz et al., 1994) (Gaspoz et al., 1991)</td>
<td>592 adults</td>
<td>24-hour surveillance with serial ECG and CKMB estimates followed by exercise testing Admission arranged by emergency physician</td>
<td>84% of the patients were discharged False negative rate was 0.8% After 6 months there was a 98% survival rate Observation unit patients were on average $857 cheaper than controls</td>
</tr>
</tbody>
</table>

### Table 41. Key studies that have assessed the effect of case management on acute admissions

<table>
<thead>
<tr>
<th>Author Country</th>
<th>Study design Level of evidence</th>
<th>Sample</th>
<th>Intervention</th>
<th>Result*</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Richmond and Moor, 1997) New Zealand</td>
<td>Cohort II-2</td>
<td>186 elderly</td>
<td>Case management at home compared to rest home care</td>
<td>Case management was associated with significantly fewer acute admissions</td>
</tr>
<tr>
<td>(Challis, 1993) United Kingdom</td>
<td>Systematic review I</td>
<td>Various</td>
<td>3 UK-based studies that have assessed the impact of case management on admissions</td>
<td>Case management was not associated with a reduction in admissions (no p value)</td>
</tr>
<tr>
<td>(Fitzgerald et al., 1994) United States</td>
<td>RCT I</td>
<td>668 adults</td>
<td>Case management in a veteran affairs medical centre</td>
<td>No significant reduction in hospitalization in relation to case management</td>
</tr>
</tbody>
</table>

*Significance at p ≤ .05

---

**Acute Medical Admissions**
Table 42. Summary of randomised controlled trials examining the efficacy of home visits to reduce admissions among the elderly

<table>
<thead>
<tr>
<th>Study author(s)</th>
<th>Study design and evidence grade</th>
<th>Intervention</th>
<th>Setting/Sample</th>
<th>Conclusions (home visits significantly increased or decreased admissions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clarke et al., 1992</td>
<td>RCT / I</td>
<td>Lay worker</td>
<td>UK 523 patients</td>
<td>No difference</td>
</tr>
<tr>
<td>Hendrickson et al., 1984</td>
<td>RCT / I</td>
<td>Nurse visits</td>
<td>Denmark 458 patients</td>
<td>Decreased</td>
</tr>
<tr>
<td>Vetter et al., 1984</td>
<td>RCT / I</td>
<td>Health visits</td>
<td>Wales</td>
<td>Increased</td>
</tr>
<tr>
<td>van Rossum et al., 1993</td>
<td>RCT / I</td>
<td>Nurse visits</td>
<td>Holland 580 patients</td>
<td>Decreased*</td>
</tr>
<tr>
<td>Hansen et al., 1992</td>
<td>RCT / I</td>
<td>Nurse visits</td>
<td>Denmark 344 patients</td>
<td>Decreased</td>
</tr>
<tr>
<td>Komowski et al., 1995</td>
<td>Quasi experimental/II-1</td>
<td>Physician/Paramedic visits</td>
<td>Israel 42 elderly patients</td>
<td>Decreased</td>
</tr>
</tbody>
</table>

RCT = Randomised controlled trial
*All conclusions significant at p ≤ 0.05 except van Rossum al. 1993

Table 43. Studies that have examined the effect of personal alarms on acute admissions

<table>
<thead>
<tr>
<th>Author</th>
<th>Study design</th>
<th>Setting/sample size</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roush et al., 1995</td>
<td>Quasi-experimental II-1</td>
<td>106 elderly subjects in Canada</td>
<td>Significant (p &lt; 0.05) decrease in admissions and inpatient stay, no difference in ED use</td>
</tr>
<tr>
<td>Ruchi and Morris, 1981</td>
<td>Cost Benefit II-1</td>
<td>139 paired elderly subjects in US</td>
<td>C.B. ratio = 1.87:1 favouring intervention</td>
</tr>
<tr>
<td>Roush and Teasdelle, 1997</td>
<td>Quasi-experimental II-1</td>
<td>106 paired US subjects compared to a matched set of 101 pairs in US</td>
<td>Both intervention groups had 40% reduction in admissions (p &lt; 0.01)</td>
</tr>
<tr>
<td>Koch, 1984</td>
<td>Quasi-experimental II-1</td>
<td>70 elderly in Boston</td>
<td>26% reduction in admission rate, 23% decrease in length of stay, 6.5% decrease in ED use (after adjustments for downward trend in hospital use) (p &lt; 0.05 for each reduction)</td>
</tr>
</tbody>
</table>
### Table 44. Summary of randomised controlled trials to prevent acute medical (re)admission amongst the elderly

<table>
<thead>
<tr>
<th>Author</th>
<th>Study population</th>
<th>Intervention</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Weinberger et al., 1996)</td>
<td>Severely ill at Veterans Affain Medical Centre.</td>
<td>Nurse, physician, follow up</td>
<td>Increased admissions p = 0.005</td>
</tr>
<tr>
<td>(Rich et al., 1995)</td>
<td>Patients with moderate congestive heart failure</td>
<td>Family education, social service and diet intervention, medications review and intensive multi disciplinary follow-up</td>
<td>Significant (44%) reduction in readmits (p&lt;0.05)</td>
</tr>
<tr>
<td>(Townsend et al., 1988)</td>
<td>903 patients in community-based trial in UK</td>
<td>Care attendants</td>
<td>Significantly reduced admissions (but no difference in independence, mortality p=0.01)</td>
</tr>
<tr>
<td>(Naylor et al., 1994)</td>
<td>276 patients in Pennsylvania (USA)</td>
<td>Nurse specialists</td>
<td>Significantly reduced readmissions only up to 6 weeks post discharge (p&lt;0.04 but p &gt; 0.05 at 12 weeks)</td>
</tr>
</tbody>
</table>

### Table 45. Studies evaluating whether utilisation review can reduce inappropriate admissions

<table>
<thead>
<tr>
<th>Author</th>
<th>Study design</th>
<th>Sample Setting</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Rosenberg et al., 1995)</td>
<td>RCT. I</td>
<td>7445 adults in New York over 8 months (USA)</td>
<td>No significant difference in admissions rates but reduced diagnostic procedures</td>
</tr>
<tr>
<td>(Cantiff et al., 1995)</td>
<td>Quasi-experimental II-1</td>
<td>1800 charts from 4 Canadian hospitals</td>
<td>No reduction in inappropriate admissions (although inappropriate length of stay was significantly reduced)</td>
</tr>
<tr>
<td>(Wickr et al., 1989)</td>
<td>Quasi-experimental II-1</td>
<td>Chart review and contigings associated with admissions to urban US hospitals</td>
<td>Significant reduction of admissions by 13% and costs decreased by 6%</td>
</tr>
<tr>
<td>(Pahor et al., 1996)</td>
<td>Cross-sectional III</td>
<td>18,790 charts based in Italian hospitals</td>
<td>Decrease from 1988 (32%), to 1993 when 15% of admissions were inappropriate (p&lt;0.001)</td>
</tr>
<tr>
<td>(Alonso et al., 1996)</td>
<td>Cross-sectional III</td>
<td>750 records in 1988 and 633 in 1990 in an urban Spanish hospital</td>
<td>12% inappropriate admissions in 1988, 18% in 1990. Significantly reduced length of stay does not reduce inappropriate admissions (p&lt;0.001)</td>
</tr>
</tbody>
</table>

Results significant at p<0.05 unless otherwise stated

---

**Acute Medical Admissions**
Table 46. Summary of key literature that has assessed the effect of guidelines/protocols/algorithms/clinical pathways on hospital admissions

<table>
<thead>
<tr>
<th>Author Country</th>
<th>Study design Level of evidence</th>
<th>Sample</th>
<th>Intervention</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Roberts et al., 1997) United States</td>
<td>RCT I</td>
<td>165 adults</td>
<td>Protocols to manage chest pain in the ED</td>
<td>Significant reduction in hospital admissions (p &lt; 0.001)</td>
</tr>
<tr>
<td>(Gomez et al., 1996) United States</td>
<td>RCT I</td>
<td>100 adults</td>
<td>Protocols to manage chest pain in the ED</td>
<td>Significant reduction in hospital admissions (p &lt; 0.0001)</td>
</tr>
<tr>
<td>(McFadden et al., 1995) United States</td>
<td>Quasi-experimental II-1</td>
<td>987 adults</td>
<td>Guidelines for asthma management in the ED</td>
<td>No significant reduction in admissions</td>
</tr>
<tr>
<td>(Katz et al., 1996) United States</td>
<td>Quasi-experimental II-1</td>
<td>457 adults</td>
<td>Application of guidelines for eligibility for admission in a trial</td>
<td>Significantly increased admission in relation to use of guideline (no p value)</td>
</tr>
<tr>
<td>(Nichol et al., 1997) United States</td>
<td>Cohort II-2</td>
<td>4585 Adults</td>
<td>Critical pathway in the ED to determine admission for people presenting with chest pain</td>
<td>Critical pathway significantly reduced admissions by 17% (no p value)</td>
</tr>
</tbody>
</table>

Unless otherwise indicated results significant at p ≤ 0.05

Table 47. Uncontrolled descriptive studies of the effect of aerosolized antibiotics on admission rates for people with cystic fibrosis

<table>
<thead>
<tr>
<th>Author</th>
<th>Sample size</th>
<th>Follow up duration</th>
<th>Active aerosol treatment</th>
<th>Significant reduction in admissions</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Wall et al., 1983)</td>
<td>9</td>
<td>5-15 months</td>
<td>Ticarcillin 1g bd and tobramycin 80 mg bd</td>
<td>Yes (p &lt; 0.05)</td>
</tr>
<tr>
<td>(Steinkamp et al., 1989)</td>
<td>14</td>
<td>3 months</td>
<td>Tobramycin 80 mg bd</td>
<td>Yes (p &gt; 0.05)</td>
</tr>
</tbody>
</table>

Table 48. Placebo controlled trials of aerosolised antibiotics in cystic fibrosis

<table>
<thead>
<tr>
<th>Author</th>
<th>Sample size</th>
<th>Follow up duration</th>
<th>Treatment</th>
<th>Significant reduction in admissions *</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Hodson et al., 1981)</td>
<td>20</td>
<td>6 months</td>
<td>Carbenicillin 1gm bd and gentamicin 80 mg bd</td>
<td>Yes</td>
</tr>
<tr>
<td>(Kun et al., 1984)</td>
<td>29</td>
<td>12 months</td>
<td>Gentamicin 20 mg bd</td>
<td>Yes</td>
</tr>
<tr>
<td>(Stead et al., 1987)</td>
<td>18</td>
<td>4 months</td>
<td>Cefazolin 1 gm bd</td>
<td>Yes</td>
</tr>
<tr>
<td>(Machatsky et al., 1989)</td>
<td>27</td>
<td>32 months</td>
<td>Tobramycin 600 mg tds</td>
<td>Yes</td>
</tr>
</tbody>
</table>

After (Touw et al., 1995)

(* significance at p ≤ 0.05)
Table 49. Summary of the effectiveness of interventions to reduce acute medical admissions

<table>
<thead>
<tr>
<th>Interventions to reduce unnecessary admissions</th>
<th>Effect on number of admissions</th>
<th>Level of evidence(^6)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Macro-management initiatives</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Closure of hospitals</td>
<td>Reduced</td>
<td>II</td>
</tr>
<tr>
<td>Public health - preventive interventions</td>
<td>Reduced</td>
<td>II</td>
</tr>
<tr>
<td>Alternative to hospital:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hospital at home for early discharge or terminal care or acute care – high tech</td>
<td>Reduced</td>
<td>I</td>
</tr>
<tr>
<td>Community hospitals - GP beds</td>
<td>Reduced</td>
<td>II</td>
</tr>
<tr>
<td>Patient hotels</td>
<td>Reduced</td>
<td>IV</td>
</tr>
<tr>
<td>Comprehensive geriatric care</td>
<td>Reduced</td>
<td>I</td>
</tr>
<tr>
<td>Home care</td>
<td>Mixed</td>
<td>I</td>
</tr>
<tr>
<td>Home alarm</td>
<td>Reduced</td>
<td>II</td>
</tr>
<tr>
<td>Increased long term care - improved nursing home care options</td>
<td>Reduced</td>
<td>II</td>
</tr>
<tr>
<td><strong>Micro-management initiatives</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary care – increased access to GPs</td>
<td>Mixed</td>
<td>I</td>
</tr>
<tr>
<td>Primary care – change behaviour of GPs</td>
<td>Mixed</td>
<td>I</td>
</tr>
<tr>
<td>Increase skill GP</td>
<td>Reduced</td>
<td>IV</td>
</tr>
<tr>
<td>GP based budget-holding</td>
<td>Mixed</td>
<td>II</td>
</tr>
<tr>
<td>Drug education to GPs/patients</td>
<td>Reduced</td>
<td>II</td>
</tr>
<tr>
<td>Outpatient based individual or group education</td>
<td>No change</td>
<td>I</td>
</tr>
<tr>
<td>Increase outpatient services</td>
<td>No change</td>
<td>I</td>
</tr>
<tr>
<td>Hospital outreach services</td>
<td>Reduced</td>
<td>II</td>
</tr>
<tr>
<td>ED based GPs</td>
<td>Reduced</td>
<td>I</td>
</tr>
<tr>
<td>ED more senior staff</td>
<td>Reduced</td>
<td>II</td>
</tr>
<tr>
<td>Provision of social worker in the ED</td>
<td>Reduced</td>
<td>IV</td>
</tr>
<tr>
<td>Regionalise ED services</td>
<td>No change</td>
<td>III</td>
</tr>
<tr>
<td>Separate paediatric ED</td>
<td>Reduced</td>
<td>IV</td>
</tr>
<tr>
<td>Observation units</td>
<td>Reduced</td>
<td>II</td>
</tr>
<tr>
<td>Chest pain units</td>
<td>Reduced</td>
<td>II</td>
</tr>
<tr>
<td>Change hospital reimbursement to prospective funding</td>
<td>Reduced</td>
<td>I</td>
</tr>
</tbody>
</table>

\(^6\) Level of evidence refers to the highest level of evidence from key studies
Table 50. Examples of interventions that need further research

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Specific areas for further research</th>
</tr>
</thead>
<tbody>
<tr>
<td>Closure of hospitals</td>
<td>The effects of hospital closure on local mortality and morbidity</td>
</tr>
<tr>
<td>DRG payment</td>
<td>Effect of DRG prospective funding or other types of contracts on health outcomes, especially in New Zealand</td>
</tr>
<tr>
<td></td>
<td>Effect of prospective funding for intermediate beds (e.g. observation units) on hospital admissions</td>
</tr>
<tr>
<td>Fundholding/budget-holding</td>
<td>Patient outcomes (including acute admission rates) in relation to primary care based budget-holding</td>
</tr>
<tr>
<td>Integrated care/managed care</td>
<td>Randomised trials of the effects of managed care on admissions and other health outcomes</td>
</tr>
<tr>
<td>Primary care</td>
<td>The admission rates of deputising services, ED-based primary care and GPs, and a comparison of the outcomes associated with each of these gatekeepers</td>
</tr>
<tr>
<td></td>
<td>Effects of improving financial or geographical access to GPs and other primary care providers</td>
</tr>
<tr>
<td>Hospital at home</td>
<td>The outcomes associated with providing certain acute medical care at home (e.g. anticoagulation for thromboembolic disease)</td>
</tr>
<tr>
<td>Observation unit</td>
<td>The effect of observation units on health outcomes and an assessment of cost-effectiveness</td>
</tr>
<tr>
<td></td>
<td>The effectiveness of a medical team led observation unit with 24-hour cover by senior medical staff including consultants</td>
</tr>
<tr>
<td>Outpatient</td>
<td>The cost-effectiveness of providing GPs with access to urgent outpatients appointments for patients within 48 hours</td>
</tr>
</tbody>
</table>
References


Department of Health, Housing and Community Services (1991) Hospital Services in Australia, Department of Health, Housing and Community Services, Canberra.


Medical and Surgical Services (1997) Acute demand, Central Regional Health Authority, Wellington.


Richmond, D. and Moor, J. (1997) *Home is where the heart is*, North Health/Waitemata Health, Auckland.


Royal New Zealand College of General Practitioners (1995) *Health care utilisation review*, University of Otago School of Medicine, Dunedin.


Appendix 1

SEARCH STRATEGIES

MEDLINE
exp hospitalization/
admitting department, hospital/
hospitals./ut
(admit: or admission:).ti.
or/1-4
acute disease/
acute.ti.
6 or 7
5 and 8
(declin: or decreas: or reduc: or slow:).tw.
(rising or rises or rose or rise or risen).tw.
(increas: or grow: or grew: or climb:).tw.
or/10-12
9 and 13
limit 14 to english
letter.pt.
15 not 16
child/
child, preschool/
paediatr:.tw.
pediatr:.tw.
or/18-21
17 and 22
17 not 22
emergency service, hospital/
patient admission/
1 or 2
td.fs.
ce.fs.
ut.fs.
or/4-6
3 and 7
(slow: adj5 (admit or admission:)).tw.
(decreas: adj5 (admit: or admission:)).tw.
(declin: adj5 (admit: or admission:)).tw.
(reduc: adj5 (admit: or admission:)).tw.
or/9-12
(rising adj5 (admit: or admission:)).tw.
(rose adj5 (admit: or admission:)).tw.
(rises adj5 (admit: or admission:)).tw.
(risen adj5 (admit: or admission:)).tw.
(rise adj5 (admit: or admission:)).tw.
(grow: adj5 (admit: or admission:)).tw.
(increas: adj5 (admit: or admission:)).tw.
or/14-20
(pattern adj5 (admit: or admission:)).tw.
13 or 21 or 22
3 and 23
7 and 23
24 or 25

Acute Medical Admissions
Appendix 1

limit 26 to english
letter.pt.
27 not 28

CINAHL
exp hospitalization/
child, hospitalized/
infant, hospitalized/
aged, hospitalized/
patient admission/
(admit: or admission:).ti.
exp hospitals/ut
or/1-7
acute care/
acute disease/
acute.ti.
or/9-11
8 and 12
(rise or rising or rose or risen).ti,sh,ab,at. or rises.tw.
(increas: or grow:).ti,sh,ab,at. or climb:tw.
(slow: or decreas: or declin:).ti,sh,ab,at. or reduc:tw.
or/14-16
13 and 17
limit 18 to (yr=1993 or yr=1994 or yr=1995 or yr=1996 or yr=1997)
limit 13 to (yr=1993 or yr=1994 or yr=1995 or yr=1996 or yr=1997)
20 or 22
bed occupancy/
8 and 24

CURRENT CONTENTS
1 acute.ab,ti,kw,kp.
2 (admit: or admission:).ab,ti,kw,kp.
3 1 and 2
4 (rise or rising).ab,ti,kw,kp.
5 3 and 4
6 (risen or rose).ab,ti,kw,kp.
7 3 and 6
8 rises.ab,ti,kw,kp.
9 3 and 8
10 5 or 7 or 9
11 from 10 keep 3,5,14-15,20,29,32-33
12 (increas: or grow: or climb:).ab,ti,kw,kp.
13 3 and 12
14 limit 13 to yr=97
15 limit 13 to yr=98
16 from 14 keep 12,22,39,58,72,79
17 (patterns and acute).ti.
18 from 17 keep 2-3,10
19 (decreas: or slow: or declin: or reduc:).ab
20 3 and 19
21 limit 20 to yr=97
22 limit 20 to yr=98

HEALTHSTAR
001 exp hospitalization/
002 admitting department, hospital/
003 (admit: or admission:).ti.
004 or/1-3
005 acute disease/
006 acute.ti.
Appendix 1

007 5 or 6
008 child/
009 child, preschool/
010 paediatr:.tw.
011 pediatr:.tw.
012 child:.tw.
013 or/8-12
014 declin:.tw.
015 slow:.tw.
016 decreas:.tw.
017 reduc:.tw.
018 or/14-17
019 4 and 7 and 13 and 18
020 (decreas: adj5 (admit: or admission:)).tw.
021 (slow: adj5 (admit: or admission:)).tw.
022 (reduc: adj5 (admit: or admission:)).tw.
023 (declin: adj5 (admit: or admission:)).tw.
024 or/20-23
025 13 and 24
026 19 or 25
027 limit 26 to english
028 limit 27 to nonmedline
029 from 28 keep 1-3
030 4 and 7 and 18
031 24 or 30
032 31 not 26
033 limit 32 to english
034 limit 33 to nonmedline
from 34 keep……
036 29 or 35
037 increas:.tw.
038 (rising or rises or rose or rise).tw.
039 grow:.tw.
040 climb:.tw.
041 or/37-40
042 (rising adj3 (admit: or admission:)).tw.
043 (rises adj3 (admit: or admission:)).tw.
044 (rise adj3 (admit: or admission:)).tw.
045 (rose adj3 (admit: or admission:)).tw.
046 (grow: adj3 (admit: or admission:)).tw.
047 (increas: adj3 (admit: or admission:)).tw.
048 or/42-47
049 4 and 7 and 13 and 41
050 13 and 48
051 49 or 50
052 limit 51 to english
053 limit 52 to nonmedline
054 4 and 7 and 41
055 54 or 48
056 limit 55 to english
057 limit 56 to nonmedline
058 57 not 35
The study designs included in this review were:

- Meta-analysis
- Randomised controlled trial
- Cohort study
- Case-control study
- Before and after studies (using a before and after comparison of an intervention)
- Descriptive studies (including cross sectional studies and ecological studies).

Before and after studies are poorly described in epidemiology textbooks. Their main advantage is that a comparison can be performed about an intervention that was introduced beyond the control of the investigators. Thus, typically this study design investigates new policies that were introduced and the investigator had no control over the policy’s implementation. Its key limiting factor is a lack of control over changes with time.

The remainder of this appendix is derived from material contained in Elwood (1988). This is presented in the table.
## A Description of Study Designs

<table>
<thead>
<tr>
<th>Study design</th>
<th>Description</th>
<th>Main role</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
</table>
| Randomised controlled trial | Random selection of intervention and control arms of the study population. | Assessment of treatment                        | • Controls who receives the intervention  
• Intervention and control groups should have similar characteristics  
• Allows minimisation of bias (through double blinding) and confounding (through randomisation)                                                                 | • Applicability limited to trials likely to be beneficial  
• Difficulties with ethics, logistics and cost                                                                                                       |
| Cohort study              | Observational study that follows exposed and unexposed participants to defined outcomes. |                                               | • Useful for prognosis  
• Primary method of studying unusual or new exposures  
• Good in rare exposures  
• Allows multiple endpoints to be assessed  
• Temporal relationship clear  
• Exposure assessed prior to outcome, avoiding bias                                                                 | • Often requires many years of follow up (if performed in a prospective manner)  
• Needs large numbers of participants if the outcome is rare  
• Susceptible to selection bias                                                                                                                   |
| Case-control study        | Observational study that starts with an outcome event and (generally) retrospectively analyse exposures. | Identification of causes of a new outcome  
• Useful in evaluations of population screening | • Efficient in terms of sample size required (particularly rare outcomes)  
• Retrospective method is rapid  
• Multiple exposures can be assessed  
• Relatively low resource use                                                                                                                      | • Unable to calculate absolute or relative risk  
• Susceptible to recall bias  
• Retrospective methods limits exposure information  
• Adequate control group may be difficult to define or obtain                                                                                     |
| Cross sectional study     | Makes observations at one point in time                                      | Measure prevalence  
• Assessment of associations | • Relatively simple so participation tends to be relatively high  
• Representative samples of a population can be drawn  
• Methods can be standardised, reliable and single blind  
• Can be repeated using similar methods                                                                                                           | • Does not allow assessment of causation due to lack of time dimension  
• Inefficient when prevalence or exposure is low                                                                                                  |
## ADVANTAGES AND DISADVANTAGES OF ADMISSION WARDS

Based on (Audit Commission, 1996).

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>They buy time to find the most suitable bed for a patient</td>
<td>Beds are sub divided</td>
</tr>
<tr>
<td>Admitting medical teams know where all their new patients are</td>
<td>At least one transfer becomes inevitable - a problem for many elderly</td>
</tr>
<tr>
<td>Reduce disturbance for existing patients</td>
<td>They are counter to primary nursing</td>
</tr>
<tr>
<td>Aid planning of work on main wards</td>
<td>Staff on main wards may feel devalued</td>
</tr>
<tr>
<td>Concentration of expertise of staff for the care of the acutely unwell</td>
<td>Optimum size is unknown</td>
</tr>
<tr>
<td>Act as a filter for inappropriate admissions</td>
<td>Can be difficult to ensure that patients are transferred promptly to wards</td>
</tr>
<tr>
<td>Stabilise staffing requirements on all wards</td>
<td></td>
</tr>
</tbody>
</table>
Measures to reduce the incidence of emergency admissions in the elderly as summarised by (Murphy, 1993).

<table>
<thead>
<tr>
<th>Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Review all patients taking night sedation</td>
</tr>
<tr>
<td>Review the necessity for all patients taking more than three drugs</td>
</tr>
<tr>
<td>Identify all elderly smokers and provide them with cessation advice</td>
</tr>
<tr>
<td>Identify all men over 80 kg or less than 55 kg and women over 70 kg and less than 45 kg to check for correctable causes of low/high weight and provide treatment</td>
</tr>
<tr>
<td>Enquire about mood with any contact with elderly</td>
</tr>
<tr>
<td>Visit all recently discharged patients to assess home plan</td>
</tr>
<tr>
<td>Screen elderly for hypertension, vision, hearing, and foot problems and treat and/or provide appropriate aids/services</td>
</tr>
<tr>
<td>Prescribe aspirin to those suspected of having a myocardial infarction/stroke</td>
</tr>
<tr>
<td>Identify those with cognitive impairment that is impinging on their safety, carry out an assessment of their needs and provide appropriate assistance</td>
</tr>
</tbody>
</table>