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## Hospital based alternatives to acute paediatric admission: a systematic review

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Note

This manuscript was prepared for electronic long, paper short (ELPS) format. The sections of text marked with vertical lines in the margins were intended for an expanded online version of the paper.

## Abstract

### Objective

To synthesise published evidence of the impacts of introducing hospital-based alternatives to acute paediatric admission.

### Design

Systematic review of studies of interventions published in English.

### Patients

Children with acute medical problems referred to hospitals.

### Interventions

Services provided in a hospital as an alternative to inpatient admission.

### Main outcome measures

Admission or discharge, unscheduled returns to hospital, satisfaction of parents and general practitioners, effects on health service activity and costs.

### Results

25 studies were included: one randomised controlled trial, 23 observational or cross-sectional studies and one qualitative study. Many studies were of uncertain quality or were open to significant potential bias. About 40% of children attending acute assessment units in paediatric departments, and over 60% of those attending acute assessment units in A&E departments, do not require inpatient admission. There is little evidence of serious clinical consequences in children discharged from these units, although up to 7% may subsequently return to hospital. There is some evidence that users are satisfied with these services and that they are associated with reductions in inpatient activity levels and certain hospital costs. Evidence about the impact of urgent outpatient clinics is very limited.

### Conclusions

Current evidence supports a view that acute paediatric assessment services are a safe, efficient and acceptable alternative to inpatient admission, but this evidence is of limited quantity and quality. Further research is required to confirm that this type of service reorganisation does not disadvantage children and their families, particularly where inpatient services are withdrawn from a hospital.

## Introduction

Children's hospital admission rates have gradually risen in recent decades, but mean lengths of stay have fallen sharply. Most acute admissions now last for fewer than two days. These trends have led many paediatric departments to consider whether some episodes of acute illness could be safely managed without admitting the child to an inpatient ward at all, using alternative models of care (including services described as ambulatory care, intermediate care or hospital at home) to provide a higher quality service for children. In some areas, ambulatory care services have also been introduced as a response to staffing difficulties in small or isolated inpatient units.<sup>1-5</sup>

In the UK, the Royal College of Paediatrics and Child Health (RCPCH) has identified two types of alternative service provided in hospitals:

- acute assessment units (also known as emergency assessment, observation, or short stay units), which provide a rapid specialist consultation for acutely ill children in support of primary care services and A&E departments, and provide in effect admission facilities for periods measured in hours rather than days
- acute assessment clinics, which provide emergency outpatient consultations.<sup>3</sup>

Acute assessment units may be on the same hospital site as a paediatric inpatient unit, or on a different site (satellite units). The substitution of inpatient units with satellite units is often politically contentious. In the early 1990s it was proposed that children's day case services could replace small-to-medium-sized inpatient units.<sup>1 6</sup> In 1996, a working party of the British Paediatric Association recommended that small units less than thirty minutes' journey from a larger inpatient unit should be closed and replaced by, for example, an emergency assessment unit, but acknowledged that this could impair access to services.<sup>2</sup> More recent reports from the RCPCH have recognised that small inpatient units may have difficulty recruiting enough doctors to provide a safe service, but it has also been acknowledged that more research is needed on the acceptability and safety of alternatives to traditional inpatient services.<sup>3 4</sup>

Most existing evidence in this area relates to services for adults.<sup>7</sup> In this paper, I report the findings of a systematic review of studies of interventions to answer the question: what is the impact of introducing hospital-based alternatives to acute admission in medical paediatrics? I sought evidence of any effect on health or on health service process, including access to services, admissions and discharges, clinical outcomes, satisfaction or experiences of children, parents or health professionals, and economic effects.

## Methods

### Literature search

I searched electronic databases, reference lists and selected journals for reports in English of evaluation or audit studies of the impacts of any service provided in a hospital as an alternative to acute medical paediatric admission. Full details of the search strategy and inclusion criteria are available in the electronic version of the paper.

### Literature search

I searched the Cochrane Database of Systematic Reviews ([www.update-software.com/cochrane/default.htm](http://www.update-software.com/cochrane/default.htm)) and the DARE, HTA and NHSEED databases of the NHS Centre for Reviews and Dissemination (CRD) ([nhscrd.york.ac.uk](http://nhscrd.york.ac.uk)) and found no existing systematic review that had addressed the review question.

I constructed a wide (sensitive) scoping search in Medline (1966-2002) using expanded medical subject headings (MeSH headings) and text words. I then refined the search iteratively, as recommended by CRD,<sup>8</sup> using various combinations of terms to define the population (children), the condition (acute illness), and the intervention (acute assessment service). I carried out identical searches using appropriate synonyms in the Cochrane Controlled Trials Register (2002/4), Embase (1980-2002) and Cinahl (1982-2002). The final search strategy is shown in the box.

## Search syntax for principal electronic databases

Cochrane Database of Systematic Reviews, DARE, HTA and NHSEED

(child\$ OR infant\$) AND (paediatric\$ OR pediatric\$) AND (emergenc\$ OR acute)  
AND hospital\$

Medline

(\*child/ OR \*infant/ OR \*pediatrics/ OR \*child health services/) AND (acute  
disease/ OR emergency service, hospital/ OR emergencies/ OR acute\$ OR  
emergenc\$ OR medical\$) AND (ambulatory care/ OR day care/ OR ambulatory  
care facilities/ OR (short ADJ stay) OR short-stay OR assessment OR satellite OR  
admit\$ OR admission\$ OR observation OR ambulatory)

Embase

(\*child/ OR \*infant/ OR \*pediatrics/ OR \*child health care/) AND (acute disease/  
OR emergency health service/ OR emergency/ OR acute\$ OR emergenc\$ OR  
medical\$)  
AND ((short ADJ stay) OR short-stay OR assessment OR satellite OR admit\$ OR  
admission\$ OR observation OR ambulatory OR ambulatory care/ OR outpatient  
department/ OR day care/)

Cinahl

(\*child/ OR \*infant/ OR \*pediatrics/ OR \*child health services/) AND (acute\$ OR  
emergenc\$ OR medical\$ OR acute disease/ OR emergency service/ OR  
emergencies/) AND ((short ADJ stay) OR short-stay OR assessment OR satellite  
OR admit\$ OR admission\$ OR observation OR ambulatory OR ambulatory care/  
OR day care/ OR ambulatory care facilities/)

Cochrane Controlled Trials Register

(child\$ OR infant\$ OR pediatric\$ OR paediatric\$) AND (hospital\$ OR acute\$ OR  
emergenc\$ OR medical\$) AND (day care or (short adj stay) or short-stay or  
assessment or satellite or admit\$ or admission\$ or observation or ambulatory)

/ subject heading

\* focus of article

\$ truncation wildcard

I also searched HSTAT and the RCPCH website ([www.rcpch.ac.uk](http://www.rcpch.ac.uk)), hand-searched the titles of articles in Archives of Disease in Childhood, Archives of Pediatrics & Adolescent Medicine and Pediatric Emergency Care (1997-2002), wrote to authors of relevant projects in the National Research Register ([www.update-software.com/national/](http://www.update-software.com/national/)), and posted queries to electronic mail lists. I screened the titles and abstracts of all identified studies and selected those that appeared to meet the inclusion criteria for full appraisal.

Some older studies described clinical practice which is now out of date. I therefore excluded studies published more than twenty years ago. I had no access to translation facilities and therefore excluded studies not written in English.

#### Inclusion and exclusion criteria

I included all available reports of evaluation or audit studies, of any design including experimental studies, observational studies, cross-sectional surveys and qualitative studies, that:

- reported on children with acute medical problems that would normally have resulted in immediate hospital admission, and
- reported on one or more alternatives to admission, provided in a hospital, and
- reported data on a relevant impact of the alternative service(s), as outlined in the introduction.

I excluded reports that:

- evaluated clinical procedures or prognostic factors rather than service organisation
- evaluated services provided outside hospital, such as a hospital at home service
- evaluated services wholly or mainly for adults
- were based on the opinions of senior staff without other supporting data.

#### Quality assessment

I first graded each article against the hierarchy of study designs specified by the NHS Centre for Reviews and Dissemination.<sup>8</sup> No single quality assessment tool was suitable for use with all the studies. I therefore adapted a checklist from the CRD's lists for observational studies and applied this to all the studies, except for the one randomised controlled trial and one qualitative study, to which I applied the appropriate separate CRD checklists.<sup>8</sup>

#### Synthesis

The interventions, study designs and impacts measured were diverse, and some studies did not report accurate numerical data. It was therefore inappropriate to attempt a formal statistical synthesis of the results. I summarised the findings using a series of tables and a narrative synthesis.

## Results

Detailed results tables are available in the electronic version of the paper.

### Studies included

25 studies met the inclusion criteria, reported in 26 documents: 18 full papers from peer-reviewed journals, five letters or commentaries in peer-reviewed journals, and three other reports.<sup>3 5 9-32</sup>

The studies reported on interventions which fell into three main groups (Table 1):

- acute assessment units based in a paediatric department (hereafter referred to as paediatric assessment units: 13 studies)
- acute assessment units based in an accident and emergency department (A&E assessment units: 9 studies)
- acute assessment clinics (3 studies).

Six main types of investigation were reported (Table 1). Apart from one randomised controlled trial and one qualitative study, all were quantitative observational studies of various types. Some studies included more than one approach.

Most studies concerned either children with acute medical problems or children attending A&E departments. A few studies restricted their analysis to children with a single diagnosis (asthma) or a few common diagnoses. A few studies reported on units which also dealt with other cases such as medical or surgical day cases.

Some reports were very brief and contained scant details of methods. It was difficult to have confidence in attributing the impacts reported in many studies to the interventions described because the authors did not make comparisons between groups, did not adequately describe their methods, or did not address the possibility of biased comparisons.

Further details of the nature of the interventions and the quality assessment of the studies are summarised in the electronic version of the paper.

### Nature of the interventions

#### Paediatric assessment units

These studies were carried out in the UK or New Zealand. The units they describe:

- were mostly in, or adjacent to, existing paediatric wards
- were mostly staffed by junior or middle-grade paediatricians, with cover from a consultant paediatrician
- tended not to be open overnight or at weekends
- accepted referrals from general practitioners (GPs) (always), A&E (mostly), and occasionally other sources, but usually not directly from parents
- saw an average of 5-15 patients per day, with an average length of stay (where stated) of 2-4.5 hours.

Three studies dealt with satellite units on hospital sites with no paediatric inpatient services. One unit was in inner London and offered a 24-hour service.<sup>5 18</sup> The other two were in rural areas, more than twenty miles from the nearest paediatric inpatient unit.<sup>5 18 26</sup>



## A&E assessment units

These studies were mostly carried out in Australia or North America. The units they describe:

- were mostly in, or adjacent to, paediatric A&E departments in tertiary referral hospitals
- were mostly staffed by A&E doctors and nurses
- were open all the time (where opening times were stated)
- were only open to patients who had been seen in the A&E department
- saw an average of 2-8 patients per day, with an average length of stay (where stated) of 5-20 hours
- saw children with injuries as well as medical problems.

## Acute assessment clinics

The studies in this section were all carried out in the UK. They describe urgent outpatient clinics:

- staffed by middle-grade or consultant paediatricians
- accepting referrals from GPs, and sometimes from other health professionals
- sometimes including a telephone hotline for discussing urgent cases
- seeing an average of four or fewer patients per day.

## Quality assessment

### Observational and cross-sectional studies

Most studies fell into this category, and most were considered to fall into grade four of the CRD hierarchy of evidence, as they could not be considered an adequately controlled study with respect to the research question posed in this review. Ten studies involved comparing groups of patients or hospital activity at different times (controlled, quasi-controlled or before-and-after studies). The others involved single cross-sectional surveys or the follow-up of a single cohort of patients (uncontrolled studies). More detailed quality assessment is summarised in table 2. In some cases, even where studies are shown in the table as having addressed certain criteria, only scant detail was provided. A higher standard of reporting was required in order to meet the validity criteria for comparative studies.

### Other studies

There was one grade one study: the randomised controlled trial by Willert et al.<sup>32</sup> This study used clear eligibility criteria, appeared to follow appropriate procedures for randomisation and allocation concealment, and confirmed that the groups were comparable at baseline. However, there was no indication that outcome assessment was blinded and no possibility of blinding clinicians or patients. Data were not shown for sixty-three eligible patients who were not randomised.

Turner's qualitative paper included an adequate description of the study's theoretical basis, context, fieldwork and analytical framework. The eleven participants were selected from among parents of children who happened to attend for acute assessment at a particular time.<sup>30</sup>

## Patient outcomes

Studies reporting patient outcomes generally involved the follow-up of a complete cohort of patients attending a service over a period of time.

### Paediatric assessment units

**Discharge:** In most studies, about 40% of children referred as emergencies were discharged without requiring inpatient admission (ten studies: Table 3). This proportion was fairly consistent between studies except for that of Bothwell et al in Ulster, whose small study excluded the most unwell children,<sup>12</sup> and the studies of two satellite units in England.<sup>5,18</sup> Doctors may have chosen not to refer very sick children to these units.

**Unscheduled returns:** Between 0.4% and 7% of discharged children returned unexpectedly to hospital (five studies: Table 4), either with a worsening of the original problem or with an unrelated condition. The proportion returning increased with the length of study follow-up.

Varying proportions of returning children then required admission. One study detailed twenty such admissions: twelve were for observation only, and four were for interventions lasting less than 24 hours.<sup>23</sup>

### A&E assessment units

**Discharge:** Most patients were discharged without requiring inpatient admission (eight studies: Table 5). The proportion ranged from 62% to 99%, largely appearing to reflect differences in case mix and definitions rather than an association with study quality. One study found that the proportion admitted was higher in a tertiary hospital (6%) than in a general hospital (4%).<sup>14</sup>

**Inappropriate cases:** Three studies reported that few (1-7%) patients accepted for the acute assessment unit were subsequently considered inappropriate (meaning, for example, that patients spent over 24 hours in the unit, or required inpatient admission).<sup>10,13,14</sup> The two Australian studies identified no critical incidents within 72 hours of attending the units.<sup>13,14</sup>

**Unscheduled returns:** The same two studies found that 0.4% and 1.7%, respectively, of patients discharged from the units returned for re-admission within 72 hours. These were all described as having minor conditions.<sup>13,14</sup>

Gouin et al compared the pattern of admission and re-attendance before and after the introduction of a unit in Toronto. Children who attended the hospital with asthma were more likely to re-attend within 72 hours after the intervention (5.0% vs 3.2%), but re-attenders were less likely to be admitted (28% vs 39%).<sup>20</sup>

In the randomised controlled trial by Willert et al, children with acute asthma were randomly assigned either to direct inpatient admission or to initial management in an acute assessment unit (holding room). Children discharged from the holding room were less likely to have a recurrence of asthma requiring further hospital treatment.<sup>32</sup>

### Acute assessment clinics

The two brief reports of patient outcomes found that 13% and 19% of attenders, respectively, were admitted to hospital.<sup>9,16,17</sup> Another study, also reported briefly, found that 82% of referrals were subsequently deemed appropriate.<sup>27</sup>

## Changes in hospital admission patterns

Studies reporting changes in hospital activity generally involved comparing activity in the year(s) before and after the new service was introduced. Most studies did not adjust for trends by making comparisons with a control hospital or population.

### Paediatric assessment units

Several studies showed increasing demand on paediatric services during the study period, as measured by total annual numbers of referrals or admissions. This constituted an attempt to adjust for the confounding effect of secular trends.

Three studies (from two units) showed downward trends in the annual number of admissions for three years after the intervention.<sup>22 23 26</sup> In Mid-Ulster, admissions from the local area fell by 47% between the pre-intervention year and the third post-intervention year.<sup>26</sup>

A further study found that the number and proportion of emergency admissions requiring an overnight stay decreased in the year after the intervention.<sup>11</sup> Another found a decrease in the number of admissions, and in the proportion of children admitted from A&E and/or the assessment unit in selected diagnostic groups, in the year after the intervention.<sup>27</sup>

### A&E assessment units

One study showed that the rise in the paediatric admission rate stopped after the intervention, while the rate of A&E attendances continued to rise.<sup>24</sup>

One study showed that a smaller proportion of children attending A&E with asthma were admitted to hospital after the intervention (24%) than before (31%).<sup>20</sup>

The Australian studies showed that annual paediatric admissions and bed days fell by 10% and 15% respectively after the intervention.<sup>13 14</sup>

## Views and experiences of parents, GPs and hospital staff

These studies comprised five cross-sectional surveys and one in-depth qualitative study.

### Paediatric assessment units

Graham et al found that parents in New Zealand were generally satisfied with their experiences. They detailed some specific problems which caused delays, including nursing and medical workload, dispensing of prescriptions, and patient transport inside the hospital.<sup>21</sup>

Macleod et al found that parents and GPs in Mid-Ulster were generally satisfied with their experiences. All but one of the parents were satisfied or very satisfied with the unit and 82% felt that their child had benefited from not being admitted. 97% of the GPs were satisfied with the ease of access to the service and the promptness of the response. However, nearly half of the GPs did not agree that opening the unit had allayed their fears about the closure of the inpatient unit.<sup>26</sup>

Bothwell et al reported high levels of parental satisfaction in 95% of parents of attenders in Ulster, and noted that the dissatisfied parents were more likely to be in the group of parents whose children had been discharged rather than admitted. The proportion of parents who were satisfied remained high three weeks after discharge (97%).<sup>12</sup>

Kibirige et al surveyed parents of children who were admitted from the acute assessment unit in Middlesborough and found that 48% would have been happy to take their child home if greater home support had been available. Of those whose children were discharged from the unit, 82% were happy for a member of unit staff to make a follow-up telephone call or visit.<sup>22</sup>

All the surveys of parents may have been subject to interviewer bias: the Mid-Ulster survey was conducted by the unit's nursing staff, and it was not clear who had carried out the interviews in the other surveys. The Mid-Ulster study may also have been biased by only surveying the parents of children who did not require admission: those whose children had to be transferred 22 miles to an inpatient unit may have had different views.

Turner's qualitative study found that parents were most satisfied when staff seemed approachable, listened, and discussed their child's care. Parents continued to need support after discharge. This included being given adequate information about their child's condition, knowing what to do if symptoms returned, and feeling able to telephone the unit for advice.<sup>30</sup>

#### A&E assessment units

Leduc et al monitored patient complaints and surveyed nursing staff after introducing dedicated nursing staffing for the assessment unit in Denver. The incidence of complaints about the unit decreased by 50%. All the nurses surveyed thought that families were more satisfied with the unit after the change. Most also thought that nurse-to-patient ratios were safer (96%) and that admissions to the unit were appropriate (71%).<sup>25</sup>

#### Economic impacts

##### Paediatric assessment units

Four of the before-and-after studies of hospital activity included some assessment of economic impacts. One study showed a decrease in ward staffing costs and sickness absence following the opening of the unit,<sup>11</sup> and two showed an associated decrease in bed days and by implication in inpatient costs.<sup>13 14</sup> Kibirige et al showed that children discharged from the unit had fewer investigations than those who were admitted, suggesting that extra investigations were not being carried out in lieu of admitting those children.<sup>22</sup>

##### A&E assessment units

The randomised controlled trial by Willert et al included a more comprehensive comparison of the direct and indirect costs of care for children managed in the acute assessment unit in Chicago with those for children admitted to the inpatient unit. They found no significant difference in indirect costs, but children who were managed initially in the acute assessment unit spent fewer days in hospital, had fewer days of intravenous therapy, and incurred lower room and therapy/ancillary charges. The comparison of room charges was biased because holding room charges were billed per hour, while inpatient charges were billed per whole day. The methods for estimating indirect costs were not stated.<sup>32</sup>

## Summary of key findings

Many of the studies identified were of uncertain quality or were open to significant potential bias. The available evidence suggests that about 40% of children attending acute assessment units in paediatric departments, and over 60% of those attending acute assessment units in A&E departments, do not require inpatient admission. There is little evidence of serious clinical consequences in children discharged from these units, although up to 7% may subsequently return to hospital. There is some evidence that users are satisfied with these services and that they are associated with reductions in inpatient activity levels and certain hospital costs. Evidence about the impact of urgent outpatient clinics is very limited.

## Discussion

This systematic review has aimed to synthesise evidence about the health impacts of one type of service reorganisation in acute paediatric care. Case studies of the processes and implications of organisational change in UK acute paediatric services have recently been reviewed in more detail elsewhere.<sup>18</sup>

In order to make comparisons between the findings of evaluation studies and draw generalisable conclusions from them, it is necessary to understand clearly the context, as well as the content, of the “black box” of apparently successful interventions.<sup>33</sup> There are several problems with the group of studies included in this review which limit the conclusions that can be drawn.

Some authors did not clearly describe key features of services which are highly likely to influence their performance, such as the criteria for acceptance, transfer and discharge of patients, the clinical practice in their unit, or the means by which critical incidents are audited. Without such information, it is not possible to draw general conclusions about how these features affect outcomes for children. However, hospitals developing similar units can draw on Turner’s qualitative findings in drawing up local clinical governance arrangements to assure the safety of children whose condition may deteriorate after initial assessment.<sup>30</sup> This is particularly important in a specialty in which a high proportion of emergency cases present in the evenings or at night and in which outcomes cannot necessarily be reliably predicted from the presenting problem.<sup>34</sup>

Few studies had attempted to make an unbiased comparison of outcomes between services offered to similar groups of children. In particular, there were no studies comparing “traditional” inpatient care with a paediatric assessment unit operating at the same time. Children’s use of emergency hospital services may be affected by sociospatial factors such as deprivation and proximity to hospital, and variables such as length of stay are dependent on the ages and case mix of children admitted.<sup>34 35 36</sup> Factors such as these are likely to underlie at least some of the differences in patient outcomes between studies, but the reports generally contained insufficient information to assess their relative importance.

In the absence of robust comparative studies, external benchmarks drawn from routine activity data might be used for comparison, but this approach is not straightforward either. For example, the overall incidence of paediatric emergency readmission within seven days of discharge in England in 2001 was 5.5%, but this performance indicator varied fivefold between the hospital trusts with the highest and lowest rates, and most of the studies in this review used different follow-up periods.<sup>37</sup>

There is little consensus about the meaning of terms used or about the collection of routine hospital activity data on acute assessment episodes. For example, the meaning of the term “admission” varies between countries;<sup>38</sup> in the studies in this review, paediatric assessment units were typically “admitting” patients for two to four hours whereas the A&E units were more likely to hold children for up to 24 hours. Even within the UK, there is still a need for clearly defined activity measures, and the potential pitfalls of misinterpreting routine paediatric inpatient statistics have been highlighted.<sup>18</sup>

Although some studies included a retrospective assessment of the appropriateness of admissions, other work has shown that measures of appropriateness are context-dependent and of only modest reliability.<sup>38 39</sup> It is also generally assumed that children discharged from an acute assessment unit would have been admitted if the unit had not been there, although it is also possible that the opening of the unit might have altered the threshold for referral. No study has adequately investigated this.

Most intervention research in this field has taken a relatively limited perspective on what outcomes should be evaluated.<sup>40</sup> I found few studies that thoroughly examined possible adverse outcomes, the perspective of service users, or economic impacts. Furthermore, many of the potential impacts of this type of service reorganisation on the population remain unknown. In particular, we lack evidence of how replacing inpatient units with satellite units affects the population's access to health care, how users' views about acute assessment services compare with those about traditional inpatient care, and whether clinical outcomes in general are affected by introducing new services.

Future studies should aim to address these gaps in the evidence. These are likely to require more rigorous methods, which may include the experimental or quasi-experimental comparison of outcomes for cohorts of children exposed to different types of acute paediatric service; sampling the experiences of parents and children in larger surveys less prone to interviewer and selection bias; and adopting a stronger population perspective on evaluation.

## Conclusion

Current evidence supports a view that acute paediatric assessment services are a safe, efficient and acceptable alternative to inpatient admission, but this evidence is of limited quantity and quality. Further research is required to confirm that this type of service reorganisation does not disadvantage children and their families, particularly where inpatient services are withdrawn from a hospital.



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Table 1  
Overview of included studies

Reference	Setting	Time period	Cases included	Study size	Study design (see footnote)					
					B	C	E	Q	R	S
Paediatric assessment units										
Dawson et al 1991 <sup>19</sup>	Christchurch, NZ	1984-90	Acute medical	1308	+	+				
Graham et al 1991 <sup>21</sup>	Christchurch, NZ	Not stated	Acute medical	60						+
Smith et al 1993 <sup>29</sup>	Newcastle	1984-91	Acute medical, some day cases and reviews	27527		+				
Beverley et al 1997 <sup>11</sup>	York	1994-96	Acute medical; head injuries, burns, some day cases, preoperative assessments and chronic illness included in parts of the analysis	3666	+	+	+			
Carter 1997 <sup>15</sup>	Leicester	1994-95	Acute medical	3855			+			
Meates 1997, 1998 <sup>3 27</sup>	London	1994-97	Acute medical, some day cases	Approx 4000 (B); 505 (C)	+	+				
Turner 1998 <sup>30</sup>	Not stated	Not stated	Acute medical	11					+	
Lal & Kibirige 1999 <sup>23</sup>	Middlesbrough	1995-97	Acute medical	7328	+	+				
Bothwell et al 2001 <sup>12</sup>	Ulster	Not stated	Acute medical	30 (C); 84 (S)		+				+
Macleod et al, 2002 <sup>26</sup>	Mid-Ulster	1995-99	Acute medical	3825 (B); 50 and 57 (S)	+					+
Cresswell 2002 <sup>5 18</sup>	London	2000-01	Acute medical	2896			+			
Cresswell 2002 <sup>5 18</sup>	Grantham	1999-2000	Acute medical	1149			+			
Kibirige et al 2003 <sup>22</sup>	Middlesbrough	1994-2001	Acute medical	43496 (B, C); 1033 (S)	+	+				+

Study designs: B: before-and-after comparison of pattern of admissions; C: follow-up of outcomes for a cohort of patients; E: assessment of the economic impact of an intervention; Q: qualitative study of parents' experiences; R: randomised controlled trial; S: survey of the views of parents, GPs or hospital staff

Table 1 continued

Reference	Setting	Time period	Cases included	Study size	Study design (see footnote)					
					B	C	E	Q	R	S
A&E assessment units										
Beattie & Moir 1993 <sup>10</sup>	Aberdeen	1990-91	A&E attenders aged >1	829		+				
Willert et al 1985 <sup>32</sup>	Chicago	1981	Children with asthma, aged >1	99			+			+
Browne & Penna 1996 <sup>13</sup>	Sydney	1990-95	A&E attenders	1300	+	+	+			
Gouin et al 1997 <sup>20</sup>	Toronto	1991-94	Children with asthma, aged 1-18	4227	+	+				
Wiley et al 1998 <sup>31</sup>	Connecticut	1996-97	A&E attenders	805	+					
Lamireau et al 2000 <sup>24</sup>	Bordeaux	1987-96	Acute medical	644	+	+				
Browne 2000 <sup>14</sup>	Sydney	1994-99	A&E attenders	6248	+	+	+			
Scribano et al 2001 <sup>28</sup>	Connecticut	1996-98	Acute medical (selected diagnoses)	5039		+				
Leduc et al 2002 <sup>25</sup>	Denver	1998-2000	A&E attenders	686		+				+
Acute assessment clinics										
Coleman & Finlay 1996, 1997 <sup>16 17</sup>	Southampton	Not stated	Acute medical	451		+				
Baildam & Ewing 1997 <sup>9</sup>	Manchester	Not stated	Acute medical	220		+				
Meates 1997, 1998 <sup>3 27</sup>	London	Not stated	Acute medical, some day cases	118		+				

Study designs: B: before-and-after comparison of pattern of admissions; C: follow-up of outcomes for a cohort of patients; E: assessment of the economic impact of an intervention; Q: qualitative study of parents' experiences; R: randomised controlled trial; S: survey of the views of parents, GPs or hospital staff

Table 2  
Quality assessment of observational and cross-sectional studies

Study	Baildam <sup>9</sup>	Beattie <sup>10</sup>	Beverley <sup>11</sup>	Bothwell <sup>12</sup>	Browne <sup>13</sup>	Browne <sup>14</sup>	Carter <sup>15</sup>	Cresswell <sup>5,18</sup>	Coleman <sup>16,17</sup>	Dawson <sup>19</sup>	Gouin <sup>20</sup>	Graham <sup>21</sup>	Kibirige <sup>22</sup>	Lal <sup>23</sup>	Lamireau <sup>24</sup>	Leduc <sup>25</sup>	Macleod <sup>26</sup>	Meates <sup>3,27</sup>	Scribano <sup>28</sup>	Smith <sup>29</sup>	Wiley <sup>31</sup>	
Description of group(s) of patients/participants	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Description of when or to whom the intervention was applied	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Appropriate sampling method, adequate response rate or sufficiently complete data (as appropriate, depending on study)	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	1	1	1	1	
Adequate and unbiased ascertainment of impacts	1	1	1	0	1	1	1	1	1	1	1	0	0	1	1	0	0	1	1	1	1	
Sufficient follow-up to detect impacts	1	1	1	1	0	0	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	
Groups being compared had similar socio-demographic characteristics	-	-	0	-	0	0	-	-	-	0	1	-	0	0	0	-	0	0	-	-	-	
Groups being compared had similar case mix	-	-	0	-	0	0	-	-	-	0	1	-	0	0	0	-	0	1	-	-	-	
Adjustment for confounders or secular trends	-	-	0	-	1	0	-	-	-	0	0	-	0	1	1	-	1	0	-	-	-	

Key: 1 addressed

0 inadequately addressed or not clear

- not applicable (study made no comparisons)

Table 3  
Discharge of patients attending paediatric assessment units

Reference	Denominator	Proportion discharged
Kibirige <sup>22</sup>	43496 attendances	34%
Beverley <sup>11</sup>	1731 emergency attendances (included some trauma)	38%
Carter <sup>15</sup>	3855 attendances	40%
Dawson <sup>19</sup>	1308 attendances	41%
Lal <sup>23</sup>	7328 attendances	43%
Smith <sup>29</sup>	12753 emergency attendances	44%
Meates <sup>3 27</sup>	121 attendances staying more than four hours	48%
Bothwell <sup>12</sup>	84 attendances, excluding the very unwell	64%
Cresswell <sup>5 18</sup>	Grantham satellite unit 1149 attendances	89%
Cresswell <sup>5 18</sup>	London satellite unit 2896 attendances	91%

Table 4  
 Unscheduled returns of patients attending paediatric assessment units

Reference	Denominator	Outcome	Frequency
Kibirige <sup>22</sup>	351 discharges	Return within 3 days	0.4%
Lal <sup>23</sup>	3131 discharges	Unscheduled returns (within unspecified period)	2%
Lal <sup>23</sup>	65 unscheduled returns	Admission	31%
Dawson <sup>19</sup>	530 discharges	Return within 7 days	6%
Bothwell <sup>12</sup>	30 discharges	Admission	4%
Beverley <sup>11</sup>	Six months' attendances, excluding those for a chronic relapsing illness	Admission within 3 weeks	7%
		Unplanned return within 28 days	11*
		Re-admission	4*

\*absolute numbers, not proportions (denominator not quantified)

Table 5  
Discharge of patients attending A&E assessment units

Reference	Denominator	Proportion discharged
Gouin <sup>20</sup>	545 attendances with asthma	62%
Leduc <sup>25</sup>	686 attendances	65-78%*
Lamireau <sup>24</sup>	644 medical attendances not already waiting for an inpatient bed	79%
Wiley <sup>31</sup>	805 attendances	88%
Scribano <sup>28</sup>	796 attendances with selected medical diagnoses	90%
Browne <sup>13</sup>	4948 attendances (46% medical)	94%
Browne <sup>14</sup>	1300 attendances (56% medical)	96%
Beattie <sup>10</sup>	829 attendances	99%

\*month-to-month variation; exact data not shown

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