

Introduction

The paradox of improving child health and increasing paediatric admissions

The 50 years of the NHS have seen an increase in diagnostic techniques available, in medical knowledge and in public health¹. As the numbers of children in the population has fallen, the numbers of medically qualified staff in paediatric jobs has increased from an estimated 23.9 thousand children per medically qualified staff member in 1957² actual ratios of 12.7 thousand children per medically qualified paediatric staff in 1967³ 5.4 thousand in 1977 and 3.5 thousand in 1987⁴.

In 1990/91, hospital and community health services (HCHS) for children accounted for £1,414m - about 10% of the total expenditure on HCHS for all ages. Hospital services are estimated to comprise about half this expenditure with community services, ambulance services and administration making up the rest.

A decline in infant mortality and deaths from infectious diseases together with evidence that children today are born healthier than ever before^{1,5} creates a paradox in which, despite these

significant advances in child health, more children are being admitted to hospital than ever before.

Over the last 15 years there has been a dramatic increase in paediatric hospital admission, both in the rate of children's admission to hospital^{6,7} and in the numbers of admissions to hospital. Comparisons of numbers of admissions of children from the same catchment area over 10 years in an English industrial city showed an increase of 100%⁸. A study of admissions before the age of five among representative national populations showed a rise from 18.5% admitted of the study population born in 1946 to 25.5% admitted of those born in⁹. Admissions of children under age 14 have also risen from 22.3 per thousand of the population in 1974 to 38.6 per thousand in 1984¹. Several other researchers have also documented an increase in paediatric admissions¹⁰⁻¹².

In a widely reported study, Hill documented a 88 per cent increase in paediatric medical admissions between 1975 and 1985⁶. Using routinely collected data from the Oxford region between 1975 to 1985, Hill showed that the reported 88% increase was due mainly to an increase in emergency admissions for acute common childhood illnesses, particularly respiratory and gastrointestinal diseases. The Audit Commission¹³ confirmed the main conclusion of Hill's work when they commissioned an analysis using the Oxford Record Linkage Study. Because data on admissions routinely collected by the NHS identifies individual episodes of care, but not patients receiving that care, it is not possible to say whether rising admission rates are due to more children being admitted to hospital or the same children being admitted

more often. The Oxford Record Linkage Study is unique because it tracks individuals rather than episodes of care by linking patients to individual episodes of admissions.

In her analysis of the Oxford Record Linkage Study, looking only at medical admissions, Hill showed that admission rates increased for all age groups between 1975-1985 (Table 1).

Table 1

Rate of admission per 1000 children aged < 14 in paediatrics by age group in the Oxford region, 1975 and 1985⁶

Age group (years)	1975	1985
0	70.5	147.8
1-	28.4	46.6
5-	8.9	17.0
10-14	4.1	9.8

Standardising for the number of admissions in 1985 which would have been expected if 1975 age specific rates were applied to the 1985 population, Hill showed that the increase in admissions were not only confined to general paediatrics but also took place in ENT, orthopaedics, dentistry and plastic surgery (Table 2).

Table 2*Admissions of children aged <14 by specialty in Oxford region, 1975 and 1985*⁶

Specialty	No in 1975	%	No in 1985	%	SAR	CI
Paediatrics	7523	27	13043	38	188	185-191
Gen Surg	4838	18	4586	13	108	105-111
ENT	4829	17	6479	19	161	157-164
Orthopaedics	4466	16	4507	13	117	113-120
Neonatology	2974	11	2532	7	82	78-85
Ophthalmology	961	3	792	2	94	88-101
Plastic surg	491	2	597	2	132	121-143
Dentistry	405	1	685	2	196	182-211
Gen Med	399	1	237	1	68	59-77
Other specs	728	3	776	2	119	110-127
Total	27614	100	34216	100	138	136-139

SAR = standardised admission rate in 1985 which would have been expected if 1975 age specific rates were applied to 1985 population.

CI = 95% confidence interval

The greatest increase occurred in general paediatrics where emergency admissions in 1975

accounted for 85% of all admissions and 91% in 1985.

In a further analysis of the same data base, the Audit Commission showed the following pattern of admission (Table 3).

Table 3

Changes in individual admission rates, annual episodes of care and length of stay. Oxford region 1975-1985¹³.

	Number of children admitted at least once in a year per 1000 population	Episodes of care per child admitted	Length of stay per episode	Total days in hospital per year
Children aged under 1 year				
1975	199.4	1.15	7.47	9.13
1985	210.2	1.26	7.93	9.40
% change (1975-1985)	+ 5%	+10%	+6%	+3%
Children aged 1-14 years				
1975	44.2	1.15	4.31	4.96
1985	55.6	1.20	2.54	3.09
% change (1975-1985)	+26%	+4%	-41%	-38%

This analysis by the Audit Commission confirmed the broad conclusions of Hills work. Table 3 shows the following:

- 1)The number of children who were admitted to hospital at least once in a year went up
- 2)The number of multiple admissions also increased but only slightly
- 3)The use of hospital beds went down by over a third in the age group 1-14 but went up slightly for children aged under 1 year.

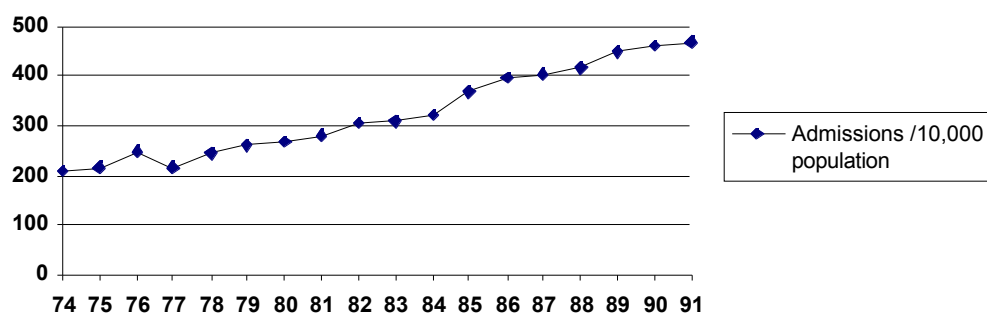
The documented rise in admissions has occurred in spite of a fall in the average length of stay which has been attributed to more day surgery, changing nursing practices and more care at home.

Reasons for the increasing admissions

There is therefore good evidence that paediatric admissions have been increasing and although this has been documented for the period 1975-1985, there are no recent studies which have attempted to assess whether these secular changes are persisting in the 1990's. However there have been no new policy initiatives or changes in medical practice in the period 1985-95 to suggest that a repeat analysis would present a different picture of rising admissions. Extrapolations of existing trends by the Audit Commission suggest that the present increase is set to continue for the foreseeable future (Figure 1).

Figure 1

In-patient admission rates (Paediatrics) for children 0-14 (1974-1990/91) (HIPE and DoH figures)¹³



The reasons for the documented rise in admissions has been attributed to an increase in early diagnoses and treatment of serious illness¹⁴ to new possibilities of treatment of previously untreatable problems such as ‘congenital heart disease, certain renal disorders and malignancies. Admission as a protective measure against possible risk of legal claims¹ has also been cited as has poor social circumstances^{8,15}. Other factors including changing morbidity, shorter lengths of stay, decreasing threshold of admission and inappropriate admissions have also been suggested as possible reasons, but the relative importance of these factors is not clear.

In the analysis of the Oxford Record Linkage Study, Hill⁶ specifically looked at the contribution of substitution of other specialties by paediatrics, changes in the source of admissions and increased readmissions of babies from special care baby units as a reason for the increase in admissions. Together these accounted for 39% of the increase in admissions, but because many of the readmissions would have occurred in the above groups, she found

that all these factors combined could not explain more than 40% of the increase in admissions.

During the period that Hill studied (1975-1985), there were no surveys of the changing occurrence of childhood illness apart from the national morbidity surveys of 1971-2 and 1981-2^{16,17}. As these were surveys of patients presenting to their general practitioners, changes over time may reflect changes in the behavior of ill people and diagnostic accuracy rather than changes in incidence and prevalence. However, it is important to exclude changes in morbidity when considering the reasons for increasing admissions.

From 1971-1981, the number of episodes of illness seen in general practice per 1000 children aged under 14 rose by 23%. Much of the increase was attributed to infectious diseases (35%), disease of the nervous system and sense organs (52%) respiratory diseases (12%) and symptoms signs and ill defined conditions (39%). Most of the rise in respiratory disease was due to the increase (by 14%) in episodes of upper respiratory tract infection. Episodes of asthma rose by 108%^{16,17}.

Large rises in admissions for asthma have been documented by several researchers^{8,18,19}.

However, there is little evidence that the prevalence of asthma is changing²⁰, and the large rise in admissions for asthma far exceeds any postulated increase in prevalence. The rises in

admissions for respiratory diseases that Hill documented far exceeded any changes occurring in primary care.

The magnitude of these changes overall did not resemble those in paediatric admissions and in the absence of any evidence of increasing morbidity to account for this increase, Hill postulated that it was changes in medical care factors - namely a lower threshold for admissions resulting in part from the increased availability of beds because of diminishing lengths of stay.

Strachan and Anderson¹⁹ have also postulated that increasing trends in hospital admissions - particularly for asthma, are due to changing patterns of provision and utilisation of health services rather than major changes in morbidity. Strachan's and Andersons work is important because they used a standard methodology to investigate time trends in childhood asthma and were able to show conclusively that morbidity for asthma did not change significantly between 1978 and 1991.

The relationship between admissions and bed availability

Logan identified the relationship between the availability of hospital beds and hospital admission in 1972²¹. The starting point for Logans study was the existence in the Liverpool region of high numbers of acute beds in relation to the population served and high

hospitalisation rates. The study sought to examine why Liverpool used more acute beds than other regions. Analysis suggested that the supply of beds and the practice style of hospital consultants in the region were key factors. Liverpool used more beds because it had more beds and doctors had a lower threshold of admission than in other parts of the country.

Logan found that these factors were more important than any other evidence about greater need in the community in accounting for higher hospitalisation rates and the slower tempo of work in Liverpool hospitals.

The findings of the Liverpool study were confirmed by an analysis of acute hospital services in London carried out by the London Health Planning Consortium in 1979²². This reported that hospitalisation rates in non-regional acute specialties were a third higher in inner London than in the home counties. The London Health Planning Consortium recognised that these variations were likely to be influenced by morbidity, differences in environmental and social conditions and the availability of other health services. However, the consortium also emphasised the importance of supply in determining utilisation and demonstrated that there was a significant positive correlation between hospitalisation rates and the supply of beds. Health service indicators for 1989/90 analysed by the Audit Commission¹³ show that the number of admissions per 'available bed' rises as the availability of beds decreases, confirming Logan's central thesis²¹. Their analysis suggested that this reflected either a lower average length of stay and or a reduction in bed emptiness as pressure on beds increases, and raised the issue of whether beds are properly matched to demand.

Increasing admissions and variations in rates of admissions

The rapid rise in admissions described by Hill and other researchers has parallels with variations in rates of referral and admission that have been noted for many conditions and in many specialties²³. The study of variations in admissions and hospital utilisation has also been extensively studied in North America²⁴⁻²⁷. Over the past 50 years geographical variations in the utilization of health services in the USA and the UK have been widely reported. One of the earliest studies published on variations described the large variation in the rate at which tonsillectomies were carried out in different parts of England²⁵. Within the UK, researchers have examined regional variations in cataract surgery, outpatient attendance's, cholecystectomy rates and hysterectomy rates^{25,28}. Variations in asthma admissions is well documented²⁹ and it is likely that variations in hospital admissions are a feature of several medical conditions. A large number of studies have now been documented which describe regional variations in the provision, utilisation and outcomes of health care²⁸.

In attempting to analyse the wide variation in utilisation, several researchers have raised the question of whether the high rate of hospitalisation in certain areas indicates unnecessary or inappropriate use of hospitals. Several additional factors have also been suggested which may explain this variation, including differences in incidence of disease, morbidity and availability of resources. However, there is little consensus on these explanations, although the importance of supply variables and clinical judgment is frequently cited^{27,30,31}.

The existence of variations between doctors has been documented both in relation to hospital care and general practice in the UK³² have reported wide differences between surgeons in the number of operations performed. Variations between GP's in terms of prescribing habits, investigation rates, home visits and referrals have also been documented^{33,34}

Researchers in the USA have had considerable experience in studying variations in hospital utilization³⁵⁻³⁸. This is partly because their insurance based health care system has resulted in increasing costs, forcing purchasers of health care to try and control these costs through the control of variation. Using this approach, the underlying assumption they have made is that inefficiency in health care systems can be identified and efforts can then be made to induce administrators and physicians to eliminate or at least reduce these inefficiencies. Brook and colleagues at the Rand Corporation have made an industry out of research into the appropriateness of medical care interventions³⁹⁻⁴¹. They have developed a methodology relying on consensus statements which define appropriate indications for health interventions. The Rand programme seeks to establish the missing clinical links between data on variations and data on appropriateness by bringing together groups of experts to list and rank indications for treatment of specific procedures. An expert consensus is then established, supported by a literature review, and in a number of cases, this has been applied retrospectively to establish levels of inappropriate use. When these criteria are applied to health care interventions, for example cholecystectomy, coronary artery bypass surgery and hysterectomy, large variations in appropriate usage have been described^{35,36,42,43}. Their results suggest that as many as one third

of certain common medical or surgical procedures are performed inappropriately in the United States⁴³.

The Rand Corporation's research has confined itself to defining appropriate criteria for medical or surgical procedures but hospitalisation per se (either as a treatment or procedure) has not been included in their list of procedures for which appropriateness criteria have been developed. The development of criteria for the appropriateness of admissions is a logical step in the understanding of factors associated with hospital admissions and their variations.

Developing a conceptual model for assessing the appropriateness of admissions

A useful conceptual model to consider the reasons for the increasing trends in admissions shown in hospital statistics is described by Anderson⁴⁴ and summarised in a modified form from the original in Fig 2.

Anderson described admission as a form of treatment with the decision to admit dependent on three interdependent factors : medical practice, the organisation of the medical care system and illness behaviour. Medical practice may result in an increase in admissions if new treatments become available which require hospitalisation - in the case of paediatric admissions, the ability to monitor sick children more intensively or the increasing use of

nebulisers in the treatment of asthma are examples of a new forms of treatment which can only be carried out in hospital.

The organisation of medical care has been described by Anderson as the structures and interrelationships of the health system, and to the way in which people working in the system relate to the system and to one another. In terms of admission it becomes apparent that the decision to admit will be influenced by the availability of resources such as beds and increased manpower. Admission decisions will also be influenced by the type of doctor making the decision - for example GP, deputising doctor or locum.

Illness behaviour (described by Anderson as ‘the way symptoms are differently perceived, evaluated and acted upon by different types of people and in different social situations’) may influence admission because of increasing lay knowledge about many disease processes resulting in patients influencing their GPs and in some cases self-referral to hospital because of the perception that family doctors may be unable to manage the problem at home.

Anderson made no attempt to quantify the contribution of these three factors to the increasing numbers of hospital admissions, but his conceptual model serves as a useful template against which to consider how these factors may be measured. As shown in the diagram, these factors are inter-related but it is worth considering each one in turn to assess how it might be measured.

In the NHS entry into hospital is controlled by the general practitioner, but patients can and do influence their GP's decision to refer for admission. Patients behaviour like that of doctors will also be affected by factors such as the organisation of care and knowledge gained from the media and lay sources. This aspect of illness behaviour is difficult to assess because it essentially requires qualitative instruments which are also capable of measuring secular trends in time. Whilst these individual factors might be difficult to study, their net effect on admissions for a particular condition will be determined by what Anderson referred to as admission criteria. According to Anderson, description of admission criteria requires a knowledge of the reasons for admission and the severity of the illness on admission.

Describing the admission state of the patient is complicated by the limitations of the ICD system which was developed to record mortality and morbidity relevant to aetiology and prevention. It is difficult for example, using the present ICD system, to describe accessory conditions and complications which may be the underlying reasons for admission. In addition, there is at present no valid and reliable mechanisms available for assessing the severity of hospital admissions. Because of these problems it is difficult to measure factors which are directly related to illness behaviour.

However medical care factors and the organisation of care can be quantified and theoretically can be measured both at a specific point in time and over a period of time. Measurement of medical care factors would require knowledge of the clinical state of the patient and some

indication of the reason for admission. Assessment of the organisation of care would require knowledge of the intensity of the service that was required in a particular admission episode.

The challenge therefore in developing a methodology which would allow researchers to study the problem of increasing admissions and specifically the necessity of hospital admissions was to either develop or find an instrument that was capable of measuring organisation of medical care and medical practice. Such an instrument could then be applied to a series of hospital admissions, initially at a specific point in time, to assess the contribution of medical care factors and the organisation of care to the treatment of hospital admission and ultimately to study trends in admissions using such an instrument.

Studying Medical Care Factors

Some of the earliest studies which attempted to measure aspects of medical care factors and the organisation of care were carried out in the United States in the early 1970's under the heading of utilisation reviews. An example of one of the earlier utilisation reviews was carried out by Lovejoy and colleagues⁴⁵. They were concerned about the rising cost of medical care in the US and particularly the problems of unnecessary hospitalisations. They developed a hypothesis that some illnesses could be better handled at home without the need for hospitalisation and reviewed a series of admissions using the judgment of unbiased observers. In what would probably now be described as an internal audit, they analysed a

random sample of admissions over a 4 month period using information obtained from the case records and interviews with staff and parents using structured questionnaires. However, they set no criteria against which to judge their admissions and not surprisingly, they found a high level of agreement between the observers on the necessity of hospitalisation. They made no mention of the problems associated with chance agreement and the significance of their work was its recognition that there was a problem with unnecessary hospitalisation. The recognition that a substantial proportion of admissions may be unnecessary also meant that measures of total utilisation (for example admissions to hospital) could not distinguish between the problem of increasing appropriateness of admissions or decreasing appropriateness of admissions. For example, increased utilisation could be due to a higher percentage of inappropriate admissions or appropriate admissions.

Duff and colleagues⁴⁶ used similar methods to assess the necessity and quality of care in hospital. To overcome the problem of subjective bias, they developed the concept of the use of guidelines to identify objective criteria against which they would judge the necessity of hospitalisation. The criteria they developed included admission for surgery, investigations such as IVP, requirement of IV fluids, repeated nursing observations and physiological disturbances such as dyspnoea and toxicity. The guidelines they developed about the need for hospitalisation were based on text book and periodical literature guidelines about respective diseases. Using these guidelines they achieved 95% agreement between the authors when these guidelines were applied to a review of hospital records. There is however no mention in their paper of chance agreement or reliability between the assessors or detail about

how the guidelines were developed. However, the guidelines they developed were comprehensive and they were able to document widespread variations between hospitals and the level of unnecessary admissions. Overall they found that nearly 25% of admissions were unnecessary using their criteria. The importance of their work was the development of the concept of objective criteria against which to measure hospital utilisation and it was probably one of the first studies which attempted to define the sorts of procedures that were an integral part of hospitalisation.

As part of their work on the development of the AEP, Gertman and Restuccia⁴⁷ carried out a review of the literature on hospital utilisation. They identified 12 studies which attempted to measure hospital utilisation in terms of appropriateness of admissions. The major methodological weakness of these studies was poor interviewer reliability, bias and lack of comprehensiveness. Particularly critical in the poor performance of these earlier instruments was the reliance on subjective, implicit criteria. As with the studies of Lovejoy and Duff^{45,46}, these studies failed to take into account the percentage agreement due to chance. However, as mentioned previously, the development of the concept of objective criteria as exemplified by the work of Duff⁴⁶, created the possibility of criteria for appropriate utilisation based on explicit objective criteria.

The development of the AEP by Gertman and Restuccia⁴⁷ was an attempt to measure the appropriateness of admissions using objective criteria. They designed the instrument with certain key decisions. The first was the requirement that the instrument should be diagnosis

independent but with the understanding that it could not apply to certain categories of patients. For example, the exclusion of obstetrics, paediatrics, psychiatry and rehabilitation medicine was made explicit. The second decision was that the instrument would focus on estimating a single day of care as opposed to estimating inappropriate use per case through the examination of all days in the stay. This avoided the problem of sampling bias - for example if inappropriate days were related to increasing length of stay - and the fact that serial judgments in a patient's stay might not be independent of each other. Finally a decision was made that reviewers could make subjective judgments in order to override the objective criteria if they felt that this was necessary. This was based on a recognition that the AEP with its short list of criteria could never claim to be comprehensive and their experience that researchers tended to fudge the data if faced with situations that did not fit in the criteria. This would allow them to keep track of how often this happened and gave a handle on the problem of false positives and false negatives. For example, if a reviewer felt that the criteria were not sufficiently comprehensive because some non criteria service or factor had occurred on the day in question, (false positive) then the reviewer was able to override the AEP criteria. Similarly, reviewers were able to override the criteria if a patient meeting one of the criteria did not need acute level hospitalisation.

Two other factors were important in the development of the AEP. The criteria had to be short so that they could be applied in a maximum time of 10 mins, allowing a large number of reviews to be carried out and the requirement that it could be used by nurse / specially trained reviewers. When it was first developed, Gertman and Restuccia⁴⁷ were also clear in its use as

a review instrument. Although many providers in the USA were keen to see the development of instruments where they could make decisions on whether to decline payments if care was found to be inappropriate, Gertman and Restuccia developed the instrument as a screening tool, best applied to aggregates of patients and not as the definitive arbiter of appropriateness.

Interestingly, Gertman's and Restuccia's service based approach to the concept of appropriateness concurred with the views of clinicians set out by North as early as 1976⁴⁸. North reviewed the most common diagnoses of children admitted to nearly 1,200 hospitals and noted that 24 diagnostic criteria accounted for 66% of the admissions. He pointed out that the time and effort required to develop standards for admissions for each diagnostic category would be prohibitive. He also made the observation that the need to hospitalise a child is dependent upon the special services which the child requires and the degree to which these services might be made in alternative settings rather than upon the diagnosis. He outlined nine criteria for admissions which have a striking similarity of the eventual criteria developed by Kreger and Restuccia⁴⁹ who modified the AEP for subsequent use in children.

In an assessment of the first trials where it was used, Kreger and Restuccia⁴⁹ established its reliability using a measure of agreement which explicitly adjusted for the amount of agreement occurring by chance (Kappa statistic)⁵⁰, its validity and the practicality of using it in large field trials.

Although the AEP was one of the first utilisation review instruments to be developed, there are in fact a total of three existing utilisation review instruments which are used widely in the USA. The AEP was chosen as the instrument for the purposes of this study because at the time that this particular study was being developed, it was the only available instrument and more importantly, it had been subjected to independent evaluation.

Studies using the AEP

Restuccia and colleagues carried out a study in Massachusetts in 1986⁵¹ covering a review of 8,000 records of patients from 41 hospitals using the AEP. They described a level of inappropriate use of 32 per cent of medical admissions.

In a large study to assess whether geographic variations in rates of hospital admission were due to different rates of inappropriate admission, Siu et al⁵² used the AEP on a sample of admissions from more than 100 hospitals. They found that 23 per cent of admissions in their study could be classified as inappropriate by AEP criteria. Siu went on to describe patient, provider and hospital characteristics associated with inappropriate hospitalisation⁵³.

Rishpon and colleagues⁵⁴ used the AEP in a study of hospital utilisation in Israel and Zwarenstein in South Africa⁵⁵ suggesting that it could be used in health care systems which were different to the one that it was developed to be used in.

Reliability and validity of AEP

Strumwasser and colleagues⁵⁶ assessed the reliability of three utilisation review instruments. In addition to the AEP they reviewed the reliability and validity of the Standardised Medreview Instrument (SMI) and the Intensity- Severity-Discharge Criteria (ISD), two other instruments widely used in the USA. They assessed reliability and validity for retrospective application of these instruments in a sample of 119 cases from 21 hospitals using nurse reviewers to assess each hospital record. Validity was tested by comparing the judgments of nurse reviewers using the instruments with a panel of physicians. They concluded that both the AEP and ISD were moderately reliable and valid and sanctioned their use in filed studies but pointed out that payment should never be denied on the basis of the instruments alone. This confirms Gertmans and Restuccias⁴⁷ directions regarding the use of the AEP as review instrument for aggregate admissions but not as a means of assessing individual admissions.

The original AEP was designed specifically to assess adult medical and surgical admissions. A Paediatric AEP (PAEP) was developed in 1988 by Kemper⁵⁷ who applied it on a sample of 1038 paediatric admissions in a Wisconsin hospital. Kemper found a rate of inappropriate use which varied from 10 per cent to 70 per cent depending on the paediatric specialty with an overall rate of 21 per cent. However, Kreger and Restuccia⁴⁹ (the latter being part of the team that developed the original AEP) criticised Kemper for her version of the AEP because she failed to consider the difference between admission criteria and day of care

criteria (this will be elaborated in the methods section.) They developed their own version of the AEP in 1989⁴⁹. The Paediatric AEP has undergone the same tests of validity and reliability as the adult AEP but has not undergone the same level of independent assessment as the adult AEP. However its development followed the same path as the AEP with assessment of validity by a independent panel of physicians and reliability assessed using the Kappa statistic to take account of chance agreement⁵⁰. It is therefore reasonable to assume that it is a valid and reliable instrument for use in assessing the appropriateness of paediatric hospital admissions.

Summary

The use of the PAEP to study the appropriateness of hospitalisation can be justified conceptually. The PAEP attempts to quantify the issue of medical care factors that Anderson⁴⁴ identifies as being important in any studies of admissions. Its reliability and validity have been assessed independently. No published studies have been carried out in the UK using the AEP for adults or children. It therefore seems appropriate that with relevant modifications accounting for cultural and organizational factors, the AEP could be a valuable instrument to measure the appropriateness of paediatric hospitalisation in the UK.

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