Methods

In order to develop the PAEP for use in the UK, several development stages needed to be carried out. Because of the organisational and cultural differences between the USA where the PAEP was developed, and the UK, it was felt that the instrument could not be transferred without important changes. There was published work which described the use of an unmodified PAEP in Israel[1] and South Africa[2], suggesting that it could be used across international boundaries. However, there was no evidence in the published or grey literature of researchers using the instrument in the UK, nor was there any information on the viability of using such an instrument in the NHS. Whether medical records were complete, the attitude of consultants and administrators together with other organisational constraints were all unknown. Several development stages were identified in order to assess specific questions.

Validity of PAEP for use in the NHS

The original American PAEP was used by me to review a random selection of case notes (n=50) in a district general hospital to determine whether the criteria were valid for use in the UK and areas were potential problems might occur. An assessment was also made as to whether there was sufficient information in the notes to make judgments about criteria for admission. This was essentially a subjective judgment to enable me to decide whether it was worth developing the PAEP for use in the UK. The original literature on the PAEP and AEP[3]

contained sufficient information for this part of the exercise to be carried out. Having satisfied myself that this was possible, I was able to proceed to the next stage of the development of the PAEP.

Recruitment of clinicians

I decided to follow closely the development stages used by Gertman, Kreger and Restuccia[3,4] in the development of the AEP and PAEP. I therefore sought consensus view of a selection of eight clinicians representing paediatricians working in teaching hospitals (n=1), district general hospitals (n=3) and in the community (n=1), and by a representative of general practitioners (n=1)..

Altogether, 8 paediatricians were approached for help with the study and six formally accepted the invitation to participate in the study. The clinicians were recommended by the Professor of Child Health and Professor of General Practice . Their recommendations were based on existing knowledge of the clinicians and their enthusiasm for undertaking research and development work in the NHS. I though it was important to get a spectrum of opinion from the paediatricians working in both teaching and district general hospitals and in the community. A general practitioner was included because in the UK setting general practitioners were important in determining the decision to admit a child to hospital. None of the clinicians had experience of working as a consensus panel prior to this research project.

The main criteria for selection of clinicians was therefore a willingness to take part in the study, and a requirement that they did not all come from the same provider unit. An attempt was made to ensure that the clinicians did not all come from one geographical part of the region. This enabled me to ensure a diversity of views and experience within the consensus panel.

The clinicians were initially contacted by letter with a brief outline of the aims of the study and asked if they were willing to participate. Any questions concerning how the results would be used and clarification of some of the methodological issues were dealt with at this stage.

Ethical approval

Ethical approval for the study was not sought because of the ruling by the Chairman of the Ethical Committee in Wandsworth that the study could be considered under the umbrella of clinical audit. However, because the study required access to the notes of all paediatricians in the Region, permission was obtained from every paediatrician working in the region during the period of the study. The Chairmen of the all District Audit Committees in the Region were also informed that the study would be taking place. Approval was also sought and obtained from the Regional Paediatric Liaison Group representing all paediatricians in the South West Thames Region.

Development of the PAEP by consensus

Each member of the panel was sent an information pack outlining the aims and objectives of the study and background information on the American PAEP. A questionnaire was developed which set out each of the criteria as used in the American PAEP (Appendix A). Space was provided for comments on the suitability of the criteria for use in the UK. If a particular criterion was not thought to be suitable, members of the panel were invited to give reasons and suggest an alternative. Responses were collated and modifications made to the PAEP based on their responses.

The process was repeated with the modified criteria and the panel were again asked to comment on whether they agreed with the modified criteria. They were offered a second opportunity to change the criteria. At the end of this second opportunity for change, there were still some members of the panel who could not agree a form of wording for some of the criteria. These individuals were contacted by telephone and told the responses of the rest of the panel. They were then asked if they would modify their responses in the light of the comments from the majority of the panel. The reasons for their differences with the rest of the panel were elaborated in greater detail and in this manner, agreement was finally reached on all the criteria. In all instances, explanation of why certain criteria were changed or the rational for the use of specific wording was sufficient to gain overall agreement.

A final postal questionnaire was sent out to the panel including all the revised criteria and they were given a final opportunity to change the criteria. Having obtained consensus by postal questionnaire, panelists were invited to a joint meeting to finally agree on the criteria.

The purpose of the meeting was twofold. Although panelists were informed at the beginning of the exercise of the names of the participants of the consensus panel, they were not given the opportunity to meet each other. I thought that it would have been more appropriate to have a discussion having obtained broad agreement by means of a postal questionnaire. Perhaps the ease which this was achieved using the postal questionnaire was a vindication of this approach. At the meeting, panelists were once again given an opportunity to consider any changes they still wanted to make. On this final occasion, no further changes were made.

The meeting also served as an opportunity for me to elaborate on the next stage of the study which involved testing the reliability of the instrument. The panelists were given a demonstration on how the PAEP was to be used and potential problems highlighted. Much of the latter was based on problems identified by Kathi Kemper following personal correspondence.

The modified PAEP (Appendix B) was the result of their deliberations.

Modification of the PAEP

The PAEP is divided into a series of admission criteria which are applied to the day of admission. A separate set of criteria are applied to dyas of stay in hospital which are greater than 48 hours - typically these criteria are applied to the day before discharge. Within the admission criteria, there is a subdivision of criteria into items related to the severity of illness of the patient and into the intensity of service required by the patient on admission. Within the day of care criteria, the subdivision is into medical services required by the patient, nursing life support services and the condition of the patient.

The following Table summarises the changes that were made from the original American based version of the PAEP. The full versions of the PAEP (both American and modified UK versions) are included in Appendix C.

Table 1

Changes made to the PAEP Admission criteria (see Appendix B)

American based PAEP admission criteria	Changes made after consultation with UK based clinicians
Severity of illness	
1. Sudden onset unconsciousness or disorientation	No change
2. Acute of progressive sensory, motor, circulatory or respiratory embarrassment	No change
3. Acute loss of sight or hearing	No change
4. Acute loss of ability to move body part	Acute loss of ability to move major body part
5. Persistent fever for more than 5 days	Persistent fever for more than 48 hr. without a diagnosis
6. Active bleeding	Active bleeding which may lead to circulatory embarrassment
7. Wound dehiscence	No change
8. Severe electrolyte / acid base abnormality	No change
9. Haematocrit	No change
10. Pulse range	No change
11. BP range	No change
12. Need for LP where not routinely done as an out-patient	No change
13. Conditions not responding to out-patient management	Encoparesis removed, vomiting and diarrhoea needing in-patient assessment added.
14. Special Paediatric problems:	
Child abuse	Criterion for child abuse expanded to explicitly state that severity of injuries necessitate admissions, or suitable safe placement not available
Non compliance	Non compliance with therapeutic regimen expanded to state that failure to comply amounts to neglect of child which puts child's immediate health at risk
Need for special observation	No change
Not included	Referred by GP because of inability of carer to cope and absence of any alternatives/social support.
Not included	Respite care
Not included	Assessment of abdominal pain

Intensity of service	
1. Surgery scheduled within 24 hr.	No change
2. Treatment in ITU	No change
3. Vital signs monitoring 2 hrly	No change
4. IV medications/ fluid replacement	No change
5. Chemotherapeutic agents requiring monitoring	No change
6. IM antibiotics	Removed
7. Intermittent respirator use 8 hrly	Intermittent nebuliser use 4 hrly

The following table summarises the changes made to the Day of Care criteria.

Table 2

Changes made to the Day of Care criteria

American based PAEP Day of Care criteria	Changes made after consultation with UK based clinicians
Medical services	
1. Operating room procedure on day	No change
2. Operating room procedure within 24 hr.	No change
3. Cardiac catheterisation	No change
4. Angiography etc. on day	No change
5. Invasive diagnostic procedures on day	No change
6. Tests requiring dietary control or times specimens	No change
7. Documented medical monitoring	No change
Nursing life support services	
1. Respiratory care	Respiratory care in hospital only allowable if carer not trained to do this at home.
2. IV therapy	Only when carer not trained to do this at home
3. Continuos monitoring of vital signs	Only when this can not be done at home
4. IM injections	IV injections only when carer not trained
5. Strict intake output monitoring	Only if cannot be done at home
6. Major wound care	No change
7. Traction	Only if cannot be done at home
8. Close medical monitoring	No change
9. Services from paramedical services	Removed. Need for respite care added.

Table 2 cont..

American based PAEP Day of Care criteria	Changes made after consultation with UK based clinicians
Patient condition	
1. Acute inability to void urine	No change
2. Transfusion	No change
3. Physician suspicion of suicide	Physician suspicion so that psychiatric opinion requested
4. Physician suspicion of child abuse	Only if suitable alternative placement not available
5. Temperature	No change
6. Coma	No change
7. Acute confusional state	No change
8. Acute haematological disorder	No change
9. Acute neurological disorder	No change

Changes to the PAEP

The majority of criteria were left unaltered when compared to the American PAEP - particularly those relating to physiological measurements. Because of the important role of general practitioners in the referral process of children to hospital, several criteria were modified with much stricter requirements being defined for admission criteria.

For example, in the Day of Care criteria staying in hospital for the administration of IV drugs was not always considered necessary especially for chronic conditions such as cystic fibrosis. This was therefore made explicit in the wording of criterion which was finally chosen.

Important changes were also made to the criteria for when a child needed to be admitted for investigation of child abuse with the explicit statement that the non availability of alternative would have to be stated if the admission was considered appropriate. This was not clearly stated in the American PAEP.

Addition was also made to make allowance for the universal feeling amongst the consensus group that there needed to be a criterion for social admissions, though the circumstances in which these could be allowed were strictly defined. (See training manual in Appendix C) . Overall, as far as the admission criteria were concerned, the important changes were related to the criterion dealing with special paediatric problems.(***Table 1***)

Most of the debate took place on criterion 14 "Special Paediatric problems". This was the section that was most different from the American PAEP. When the consensus group was first approached about developing the PAEP for use in the UK, many felt that the development of criteria for use in the UK would be impossible. They argued, for example, that because the American Health system was financed by private health insurance, admissions for social reasons would not occur because no health insurance company would pay for it. Because of the universal access available in the UK, "social admissions" were more likely to occur even though it was not medically justified. Although this was the clinical perception, there is little evidence that social factors were a significant reason for admission to paediatric wards[5] and it is unreasonable to state that they never would have occured in the

USA. Differences in admission for suspected cases of child abuse were an example where is seems the norm that they would automatically be admitted to hospital (criterion 14 in the American PAEP) in the USA whereas the paediatricians would only accept this as a reason for admission if there was no other alternative.

Consequently, it was not difficult to agree on the development of a criterion which would justify a "social" admission. The wording chosen in the UK required that there be some record by the General Practitioner that the reason for referral was that the family could not cope in the present circumstances. Addition of a criterion was also made to the legitimate need for admission for respite care.

Similarly, as far as Day of Care criteria were concerned, changes related to the physiological status of the patient remained largely unchanged. A clearer statement was required by the consensus group in several of the criteria that home care was not possible. The need to remain in hospital to be assessed by paramedical and social services was considered unacceptable in the UK setting except in the case of respite care.(***Table 2***)

Testing for validity and reliability

Implicit in the nature of the development of the modified PAEP was an understanding that the criteria had face and content validity as determined by the consensus group which as mentioned earlier was a representative group of clinicians. Having established the validity of the instrument, the next stage was assessing the reliability of the instrument.

The American developers of the PAEP had always claimed that the strength in the use of the AEP depended on its reliability compared to subjective clinical criteria and this had to be tested for the PAEP modified for use in the UK. This was carried out by means of a pilot study.

Sample selection for the pilot

In order to determine the reliability of the PAEP in assessing inappropriate admissions and days of care, 47 records were randomly selected from two district general and one teaching hospital in South West Thames. The choice of 47 records was based on statistical advice.

The 47 records were of children admitted to hospital between 1989/90 for general medical admissions. Children admitted for routine admissions, elective surgery, to burns units, intensive care cots and psychiatric admissions were excluded because it was felt that these would have been relatively easy to assess. Records were transcribed by me and typed with

results of investigations and nursing records included in the information available for a specific in-patient day. Where possible verbatim accounts from the notes were transcribed. The aim was to produce an accurate account of the in-patient episode of an individual patient which could then be assessed by the consensus panel. I was careful to include all the information from the notes that would be required in order to make an assessment of the admission using the modified PAEP.

Two groups of raters reviewed the 47 patient records. The first group (Group A) consisted of the 5 consultant paediatricians and general practitioner who developed the PAEP, giving it face and content validity. (One consultant paediatrician did not complete the exercise because of pressure of work). The group also included two researchers who would be working on the larger field study and the author.

Use of reseaerchers/reviewers

The use of researchers who were not medically qualified was an essential element in considering the future applicability and use of the PAEP which is why special attention was given to this group. If the PAEP was to be used as a general audit tool for assessing appropriateness of admissions then it would have to be used by non clinicians. Their ability

to use it and to obtain similar results to clinicians using the instrument would be crucial to gaining its acceptance as a review tool.

I recruited a health visitor who had extensive experience of working in a community setting together with paediatric experience and a 2 yr. medical student. The medical student had not done any paediatrics but understood basic clinical sciences. It had been my intention to recruit two nurses but organisational problems prevented me from doing this.

The researchers received one weeks training in the use of the PAEP and had practiced using the criteria on another randomly selected sample of notes so that they could compare their ratings with each other and clarify any misunderstandings or problems. This process with the researchers was repeated until I was satisfied that they completely understood the method of application of the PAEP including the use of overrides and that there were very high levels of overall agreement between them. The researchers were also trained how to randomly select the hospital records, inclusion and exclusion criteria and data entry for the main study.

Clinical raters

The second group of raters consisted of two doctors (one consultant paediatrician and one general practitioner) who rated the 47 records on the basis of their own subjective clinical judgment alone. They had no experience of using the PAEP but were told that their responses

would be compared to another group of people who were using objective criteria to determine the appropriateness of admissions.

The purpose of the second group of raters was to ascertain whether clinicians using subjective clinical criteria were able to do so as reliably as clinicians using objective criteria such as the PAEP.

Group A were given a detailed training manual , initially developed for use by the researchers, (see Appendix) with precise instructions on how to use the PAEP. Where a specific criteria was considered sufficiently broad or where there may be ambiguity over what was meant by a specific term, precise instructions were given as to what specific features in a case history would be required in order for a criterion to be satisfied. For example in the severity of illness criterion covering persistent fever for more than 48 hr., raters were told that there had to be a documented record of a fever in the notes (or transcribed notes in the case of the pilot study). Simple reference to the child being hot/feverish was not considered sufficient if this criterion was to be satisfied. A comment by the GP in a letter that the child had been feverish for 48 hr. was considered acceptable.

The use of overrides

Particular attention was given to the use of the overrides. The use of overrides was incorporated in the PAEP by its developers for several reasons[3,4]. Because a limit of 30 criteria had been set in the development of the AEP, so that it could be readily memorised by reviewers, Gertman and Restuccia realised that such a short list could never be sufficiently comprehensive to be applicable to all patients. They had noted that in previous studies of utilisation reviews, physicians and nurses tended to fudge data when faced with criteria that did not cover situations comprehensively. Raters were therefore allowed to override an assessment even though one or more of the criteria were fulfilled.

For example, if the criteria for temperature of 48 hr. was fulfilled but the rater still thought the admission was inappropriate, he/she was allowed to override the final assessment. Similarly, if none of the criteria were fulfilled but the rater thought that the child should have been admitted, then the final assessment although inappropriate could be overridden. The developers of the American PAEP also used the use of overrides as an internal checking procedure to ensure that the instrument was being used correctly. For example, a high use of overrides could suggest that the admission criteria were not sufficient or incomplete and may have to be redeveloped. They also felt that the use of overrides should not exceed more than 10% all cases analysed. Although this was an arbitrary cut off point it was also used in this study both to monitor the researchers in the field study and the performance of Group A.

The comparison between Group A and Group B was for admission criteria. Group A also assessed the appropriateness of the day of care of the hospital episode by using the criteria they developed for the day of care and applying it to all records where the child had been admitted for more than 48 hr. The criteria were then applied to the day before discharge.

Further modification of PAEP

Analysis of the results of the pilot and in particular attention to comments made in the override section of the PAEP proforma highlighted several areas where the developed criteria had to be modified further. For example, the use of a nebuliser was considered appropriate if used three hourly in the first version of the PAEP. However it was pointed out that normal practice was use of a nebuliser 4 hourly. There was also no mention of admission for assessment of abdominal pain in the pilot version and it was felt by most of the raters that this should be included as an appropriate reason for admission. Both these criteria were added in the final version of the PAEP which was used in the field study. The final version of the PAEP which was used in the field study is included as Appendix D.

Sample size/statistical power for field study

Several assumptions were made in order to determine the sample size required for the field study.

The American literature had suggested that the level of inappropriate admissions and days of care was between 10% and 25%. Studies on variation of hospital in the UK had shown that there was a wide variation in surgical procedures but that this variation was less than that found in the USA[8-10]. However, the variation for medical procedures was thought to be greater than that of surgical procedures[11,12]. Therefore, it seemed reasonable to assume that the level of inappropriate paediatric admissions and days of care in the United Kingdom would be at least around 10% with variation between hospital units of between 30% to 50% above this baseline figure.

Information available for South West Thames Region showed that in 1988/89 there were a total of 23072 in-patient admissions to paediatric medicine and paediatric surgery[13]. The range between districts was between 887 to 4815. In order to find a minimum variation of 30% in inappropriate admissions and days of care between any two units, (assuming a power of 90% and significance of 5%), it would be necessary to sample a minimum of 255 cases per unit. There are 13 units in South West Thames which would mean that approximately 3315 cases would need for the sampling frame. Colleagues with experience of research based on analysis of clinical records estimated that approximately 20% of case notes are usually missing so the initial sample would need to take this into account. This meant that a sampling frame of approximately 4000 cases would have to be selected from South West Thames with 306 cases to be selected from each of the 13 districts.

Sample selection

Cases were selected from the Hospital Episode Summary admission lists of all hospitals for the financial year 1990/1991. This list was provided by the Regional health Authority as a computer file of all admissions under 16 years of age to every acute provider unit in South West Thames region. This constituted the sampling frame for the study. At my request, information was also provided on the hospital record number, date of birth, date of admission, discharge diagnosis, postcode, method of admission, length of stay and specialty. The data were provided as an ASCII file which were then read into a SAS data base. A random number program was then written for use with SAS which generated a list of approximately 300 cases for each acute hospital in the region. Since the PAEP was not designed to be used on admissions to intensive care and burns units, these were excluded before the random list was generated. Experience in the pilot study also suggested that elective admissions to surgery almost always fulfilled the criteria for admission and since these were concentrated in ENT, admissions under this specialty were excluded prior to the generation of the random list. Exclusions were also made for individual hospitals - for example Queen Mary's Hospital, Roehampton, had a ward for respite care and special admissions (The Leon Gillis Unit). The intention was to keep the focus on general paediatric admissions but not only medical admissions. Children admitted to adult and psychiatric wards were also excluded.

Record review

The raters/ researchers were asked to visit the medical records departments for these hospitals and with the co-operation of medical records staff were asked to select approximately 300 of these cases. Each case was identified by its hospital number. If a particular record was not found, then the rater was asked to search out the next record on the list. In most hospitals approximately 240 cases were finally selected using this method. The rater was also given the day of admission to assess in cases where there were multiple admissions for individuals.

Notes were reviewed in the medical records department using a proforma to extract relevant details. The proforma is included in Appendix E. Raters also had a manual (see Appendix C) which gave specific instructions on what conditions needed to be met if a criteria on the PAEP was to be fulfilled. The Admission criteria were be applied to the time of admission and the Day of Care criteria to the day before discharge, if the patient had been admitted for more than 48 hr. For admissions lasting only one day, no Day of Care criteria were applicable. Data collection for each admission also include patient, demographic and illness episode characteristics.

Data entry.

Data were entered on computer using the data entry module of the EPIINFO statistical package and then transferred for analysis into the SAS statistical package. I developed the data entry screen to ensure ease and consistency of data entry. Validation checks were set up on the EPIINFO data entry screen to ensure correct data entry. Each researcher was responsible for entering their own data and were encouraged to do this after completing the data extraction from each hospital so that they were not entering more than 250 records at each sitting. I did not have the resources to ensure double entry of data to reduce error but assumed that the combination of detailed training, validation checks and restriction in the amount of data entered on each occasion would reduce this to a minimum.

Results of Pilot study

Table 3

Percentage agreement between raters using the PAEP admission criteria modified for use in the UK and clinical raters using own subjective judgement

PAEP RATERS **RATERS**											**CLINIC**
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**		**10**	**11**
1		95.74	91.49	83.36	95.74	87.23	93.62	95.74	82.92		72.3	65
2			91.49	93.62	95.74	87.23	97.87	95.74	82.98		72.3	65
3				93.62	91.49	87.23	91.49	91.49	91.49		65.9	65
4					91.49	89.36	91.49	93.62	93.62		68.0	68
5						91.49	93.62	100	87.23		70.2	68
6							89.36	91.49	95.74		68.0	65
7								95.74	89.36		65.9	68
8									87.23		68.0	68
9											65.9	68
10												59
11												

Raters 1 & 8 = trained PAEP raters (Researchers) : Raters 2,3,6,7,9, 11 = Consultant paediatricians :

Raters 4,10 = General practitioners : Rater 5 = Author

Overides and uncertainty
PAEP raters Overides 26/423 = 6.14% ; Clinical raters "can't decide" 14/94 = 14.8%

Overall agreement
Overall agreement PAEP raters = 82.9% ; Overall agreement clinical raters = 59.5%

Kappa statistic
Kappa PAEP raters = 0.848 s.e. = 0.0226 K/s.e (k) = 37.54

Kappa Clinical raters = 0.345 s.e. = 0.1145 K/s.e (k) = 3.016

Kappa Researchers = 0.9186 s.e. = 0.0507 K/s.e. (k) = 18.11

Appropriateness
Appropriate PAEP raters = 56.7% ; Inappropriate PAEP raters = 37.1%

Appropriate clinical raters = 48.9% ; Inappropriate clinical raters = 36.17%

Table 4

Percentage agreement between raters using PAEP Day of Care criteria modified for use in the UK

PAEP raters									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
1		92.3	69.2	84.6	84.6	84.6	84.6	92.3	84.6
2			76.9	76.9	76.9	92.3	76.9	84.6	76.9
3				53.8	69.2	61.5	69.2	84.6	69.2
4					76.9	69.2	84.6	76.9	84.6
5						76.9	84.6	92.3	84.6
6							69.2	76.9	69.2
7								92.3	100
8									92.3
9									

Raters 1 & 8 = trained PAEP raters ; Raters 2,3,6,7,9 = Consultant paediatricians

Raters 4 = General practitioner ; Rater 5 = Author

Appropriateness

Appropriateness PAEP raters = 47.8% ; Inappropriateness = 48.7%

Kappa statistic

Kappa PAEP raters = 0.54300 s.e. = 0.0309 K/s.e (k) = 17.56

Kappa researchers = 0.847 s.e. = 0.147 K/s.e. (k) = 5.76

Reliability testing in field work

In order to assess the consistency of the trained researchers, they were asked at two points in the study to assess a random selection of hospital records together in order to assess concordance between the raters. On the first occasion, two months after the field work started, there was 100% agreement between the reviewers. Results from the second occasion, 7 months after the start of the field work showed an overall agreement rate of 85.7%, no overrides, and a kappa of 0.828 (s.e. 0.168 C.I = 0.498 - 1.157).

Bibliography (Methods)

Ref ID : 201
1 Rishpon S, Lubacsh S, Epstein LM. Reliability of a method of determining the necessity for hospitalization days in Israel. *Med Care* 1986;**24**:279-283.

Ref ID : 286
2 Zwarenstein M, Benatar SR, Shaw LR. The pattern of care in the medical wards of a teaching hospital. *S Afr Med J* 1990;**77**:460-463.

Ref ID : 204
3 Gertman PM, Restuccia JD. The appropriateness evaluation protocol: A technique for assesing unnecessary days of hospital care. *Med Care* 1981;**19**:855-871.

Ref ID : 298
4 Kreger BE, Restuccia JD. Assessing the need to hospitalize children: pediatric appropriateness evaluation protocol. *Pediatrics* 1989;**84**:243-247.

Ref ID : 257
5 Wynne J, Hull D. Why are children admitted to hospital? *Br Med J* 1977;**2**:1140-1142.

00000000000000000199 ***** Not found in the database "ANEEZ"**

00000000000000000200 ***** Not found in the database "ANEEZ"**

Ref ID : 241
8 McPherson K, Wennberg JE, Hovind OB, Clifford P. Small-Area variations in the use of common surgical procedures: an international comparison of New England, England and Norway. *N Engl J Med* 1982;**307**:1310-1314.

Ref ID : 208
9 Bunker JP. Variations in hospital admissions and the appropriateness of care: American preoccupations. *Br Med J* 1990;**301**:531-532.

Ref ID : 234
10 Anderson HR. Trends and district variations in the hospital care of childhood asthma: results of a regional study 1970-85. *Thorax* 1990;**45**:431-437.

Ref ID : 212
11 McPherson K. Variations in hospitalisation rates: why and how to study them. In: Ham C, ed. *Variations in health care: assessing the evidence.* London: King's Fund Institute, 1988;15-20.

Ref ID : 243
12 Sanders D, Coulter A, McPherson K. *Variations in hospital admission rates: a review of the literature*. London: King Edward's Hospital Fund for London, 1989;

Ref ID : 248
13 Management Information Unit. *South West THames RHA: Hospital Statistics 1988/89*. London: South West Thames RHA, 1990;