

Results

Sample

13 hospitals in South West Thames were sampled with a total of 3324 records being assessed by the reviewers.

Table 1

Number of records sampled from paediatric admissions to hospitals in South West Thames region (Admissions for 1990-1991: Source Hospital Episode Data SWTRHA)

HOSPITAL	NO OF CASES SAMPLED	TOTAL NUMBER OF ADMISSIONS TO PAEDIATRIC WARDS*	PERCENTAGE SAMPLED
Epsom	264	1304	20.2
Kingston	229	3847	5.9
Mayday	255	2681	9.5
Queen Mary's Carsholton	256	4448	5.7
St George's	298	4013	7.4
St Richard's	255	1735	14.6
East Surrey	255	1554	16.4
Royal Surrey County	249	1898	13.1
Frimley	249	2312	10.7
Crawley	255	1983	12.8
Queen Mary's Roehampton	255	1112	22.9
St Peters	249	2294	10.8
Worthing	255	2237	11.3
TOTAL	3324	31418	10.5

*(Routine surgical admissions, admissions to burns units and rehabilitation wards have been excluded)

Table 1 shows the number of records sampled from each hospital together with the total numbers of admissions from which the sample was drawn.

We had attempted to sample about 255 cases from each district. The time it took to review records in each hospital varied considerably and poor organisation in some medical record departments meant that we were unable to reach our intended quota in all hospitals because the time required to extract the extra number of records to achieve our target was not available. Some hospitals (Queen Mary's Roehampton, Epsom and East Surrey) had what appeared to be a high sampling ratio because it was possible to use our exclusion criteria very precisely and hence exclude to burns units, rehabilitation wards and routine surgical admissions. In some hospitals (Queen Mary's Carshalton and Kingston) it proved impossible to exclude normal deliveries from the total sampling frame resulting in an apparently lower sampling fraction.

Overall we achieved a 1 in 10 sample of paediatric admissions using our inclusion and exclusion criteria (see methods section).

Age and sex distribution

Table 2

Age and sex distribution of sampled records

AGE	FREQUENCY	PERCENT
Under 1	836	25.2
1 to 4	1251	37.6
5 to 9	616	18.5
Greater than 10 yrs	621	18.7
SEX		
Male	1944	58.5
Female	1379	41.5

Table 2 shows that 64% of admissions sampled were under 5 yrs of age. Nearly 60% were males . This pattern of age and gender distribution is consistent with other studies of hospital utilisation. Despite 60% of admissions assessed being males, the proportion of males admitted inappropriately was 7% compared to 10% of females admitted inappropriately . This was statistically significant at the 1% level. (chi-square = 7 df 1 p = 0.01). This is not explained by differences between hospitals or differences in age of admissions (i.e. females do not constitute a greater proportion of younger admissions).

The gender distribution was nearly identical across all the hospitals sampled .

Table 3*Age distribution across hospitals*

Age	Under 1 (nos)	%	1 - 4 (nos)	%	5 - 9 (nos)	%	> 10 (nos)	%
Hospital								
Epsom	39	14.7	94	35.6	58	21.9	73	27.6
Kingston	74	32.3	73	31.8	49	21.4	33	14.4
Mayday	52	20.3	99	38.8	53	20.7	51	20
QMC	88	34.8	105	41	40	15.6	23	8.9
SGHMS	61	20.4	124	41.6	65	21.8	48	16.1
St Richards	45	17.6	78	30.5	67	26.2	65	25.4
East Surrey	58	22.7	89	34.9	49	19.2	59	23.1
RSCH	65	26.1	80	32.1	45	18	59	23.1
Frimley	66	26.5	72	28.9	41	16.4	70	28.1
Crawley	91	35.6	118	46.2	29	11.3	17	6.6
QMR	69	27	95	37.2	41	16	50	19.6
St Peters	60	24.1	94	37.7	49	19.6	46	18.4
Worthing	68	26.6	130	50.9	30	11.7	27	10.5

Chi-square = 190 df 36 prob < 0.0001

The age distribution of the admissions sampled varied considerably across the different hospitals . Routine statistics sometimes do not differentiate between normal babies and new admissions. This is unlikely to be a cause of the variation in admissions under 1 yr because the exclusion criteria would have excluded normal babies who had been misclassified as admissions.

Length of stay

Table 4

Frequency of length of stay of sampled records

Length of stay	Frequency	Percent
less than 24 hrs	198	6
25-48 hrs (1-2 days)	1359	40.9
49-72 hrs (2-3 days)	723	21.8
73-86 hrs (3-4 days)	387	11.6
> 87 hrs (> 4 days)	655	19.7
TOTAL	3322	

Nearly 47% of all cases assessed were admitted for less than 2 days. These figures for the LOS are consistent with nationally reported statistics.

Table 5*Frequency of length of stay by hospital*

LOS (hrs)	< 24	%	25-48 (1-2 days)	%	49-72 (2-3 days)	%	73-96 (3-4 days)	%	> 97 (> 4 days)	%
Hospital										
Epsom	0	0	111	42	32	23	35	13	56	21
Kingston	0	0	96	42	46	20	33	14	54	24
Mayday	26	10	111	43	56	22	30	12	32	12
QMC	12	5	90	35	65	25	42	16	47	18
SGHMS	33	11	107	36	55	18	30	10	71	24
St Richards	29	11	107	42	44	17	23	9	52	20
East Surrey	24	9	97	38	59	23	24	9	51	20
RSCH	2	1	128	51	64	26	23	9	32	13
Frimley	0	0	123	49	51	20	32	13	43	17
Crawley	26	10	95	37	53	21	34	13	47	18
QMR	27	11	96	37	51	20	23	9	58	23
St Peters	0	0	90	36	59	24	39	16	61	24
Worthing	19	7	108	42	58	23	19	7	51	20

Chi-square = 199 df 48 p < 0.0001

There is a large and significant variation in LOS of the sampled admissions between hospitals. The variation is consistent with other reported studies.

Distribution of time and days of week of sampled admissions

Time of admission

Table 6

Time (24 hrs) of admission of assesed records

TIME	FREQUENCY	PERCENT
1700 -0900 hrs (out of hrs)	1878	56.5
0901-1659 hrs (day time hrs)	1354	40.7
Unknown (missing data)	91	2.7

The categorisation of time into ‘out of hours’ and day time was to assess what percentage of admissions were dealt with by ‘on call staff’. Nearly 58% of the sampled admissions were admitted during ‘on call hours’ when medical staffing levels on paediatric wards are at their lowest level. Admissions during 1700 hrs and 0900 hrs are usually due to emergencies.

Table 7

Time of admission (day of week) of assesed sample

DAY OF WEEK	FREQUENCY	PERCENT
Monday - Friday	2461	74
Saturday-Sunday	863	26

About a quarter of the admissions sampled took place over the weekend.

Assessment of appropriateness

Table 8

Proportion of appropriate and inappropriate cases by hospital taking into account the assessors final decision. (admission criteria)

Assesment of admission	Appropriate (nos)	%	Inappropriate (nos)	%
HOSPITAL				
Epsom	257	97	7	3
Kingston	212	93	17	7
Mayday	241	95	14	5
QMC	220	86	36	14
SGHMS	260	87	38	13
St Richard's	237	93	18	6
East Surrey	228	90	27	10
RSCH	224	90	25	10
Frimley	236	95	13	5
Crawley	232	91	23	9
QMR	241	95	14	5
St. Peters	235	91	14	6
Worthing	222	87	33	13

Chi-square = 51 df 12 p < 0.001

Overall, 8% of the sampled admissions were classified as inappropriate by the assessors, with a range from 3% to 14%. The difference between the hospitals is highly significant.

Table 9

Proportion of appropriate and inappropriate cases by hospital taking into account the assessors final decision. (day of care criteria)

Assessment of admission	Appropriate (nos)	%	Inappropriate (nos)	%
HOSPITAL				
Epsom	54	59	37	41
Kingston	53	61	34	39
Mayday	28	45	34	55
QMC	46	51	44	49
SGHMS	43	43	58	57
St Richard's	30	41	44	59
East Surrey	31	41	45	59
RSCH	43	70	18	30
Frimley	61	82	13	18
Crawley	29	35	52	65
QMR	29	35	52	65
St. Peters	70	70	14	30
Worthing	25	36	44	64

Chi-square =

There was a much greater variation between hospitals when records were assessed on the day of care criteria. To be judged on a day of care criteria, children had to have been in hospital for more than 48 hrs. The day being assessed was the day before discharge. Overall 48% of Days of Care were assessed as inappropriate.

Use of overrides

One of the ways to monitor the validity of the PAEP was to assess the number of overrides. Reviewers were allowed to override the criteria if they felt that the admission may have been appropriate but that there were no criteria by which they could classify the admission (appropriate with override). Alternatively, they were allowed to override the criteria if they felt the admission was inappropriate, despite criteria for admission being fulfilled (inappropriate with override).

Table 10

Overrides used by the reviewers in each hospital.

Assesment of admission (nos)	Appropriate	Inappropriate	App with override	Inapprop with override
HOSPITAL				
Epsom	256	7	0	1
Kingston	217	17	0	0
Mayday	241	13	1	0
QMC	218	34	2	2
SGHMS	256	28	10	4
St Richard's	236	18	0	1
East Surrey	227	27	0	1
RSCH	219	24	1	5
Frimley	236	11	2	0
Crawley	227	21	2	5
QMR	240	14	0	1
St. Peters	235	13	1	0
Worthing	218	33	0	4

The highest number of overrides used were in St George's Hospital. The most likely reason for this was that it was the first hospital that the reviewers assessed and there may have been some uncertainty over the application of the PAEP in certain circumstances. Having assessed the records where the reviewers were having difficulty, areas of uncertainty were clarified. The overall rate of overrides was well below the 10% figure that both Kemper and Kreger^{1,2} identified as a threshold above which there may be a problem both with the reliability and validity of the PAEP.

Factors associated with inappropriate admissions

Having assessed the proportion of appropriate admissions in each hospital, I wanted to try and determine some of the factors that may be associated with inappropriate admissions. Several hypothesis were raised which can be summarised as follows:

1) More younger children would be admitted inappropriately. Clinicians are more uncertain with making a diagnosis with younger children and may tend to refer or admit children who are younger.

2) Admissions where the length of stay is longer than the average are more likely to be inappropriate

3) Admissions in ‘on call’ hours or at weekends are more likely to be inappropriate.

4) Admissions referred by the general practitioner are more likely to be inappropriate when compared to admissions admitted via the accident and emergency department.

Age and inappropriate admissions

Table 11

Variation in appropriateness of admissions by age controlling for hospital

Age Group	Under 1			1-4 years			5-9 yrs			10+ yrs		
	App (no's)	Inapp (no's)	% inapp	App (no's)	Inapp (no's)	% inapp	App (no's)	Inapp (no's)	% inapp	App (no's)	Inapp (no's)	% inapp
Hospital	App (no's)	Inapp (no's)	% inapp	App (no's)	Inapp (no's)	% inapp	App (no's)	Inapp (no's)	% inapp	App (no's)	Inapp (no's)	% inapp
Epsom	38	1	3	90	4	4	57	1	2	72	1	1
Kingston	67	7	9	65	8	11	47	2	4	33	0	0
Mayday	49	3	6	90	9	9	53	0	0	49	2	4
QMC	66	22	25	96	9	8	36	4	10	22	1	4
SGHMS	45	16	26	110	14	11	60	5	8	45	3	6
St. Richards	36	9	20	74	4	5	63	4	6	64	1	2
East Surrey	49	9	16	79	10	11	43	6	12	57	2	3
RSCH	52	13	20	71	9	11	42	3	7	59	0	0
Frimley	63	3	5	65	7	10	41	0	0	67	3	4
Crawley	82	9	10	109	9	8	25	4	14	16	1	6
QMR	65	4	6	88	7	7	39	2	5	49	1	2
St Peters	52	8	13	89	5	5	48	1	2	46	0	0
Worthing	58	10	15	112	18	14	25	5	17	27	0	0

Chi-square = 47 df 1 p<0.001

Controlling for the variation between hospitals, there is a significant relationship between age and appropriateness of admissions, confirming the hypothesis that the younger the child the more likely the admission will be inappropriate. Controlling for length of stay (to exclude the possibility that younger children are admitted more inappropriately because they are admitted for shorter lengths of stay) does not alter this finding.

Length of stay and inappropriate admissions

Assessment of admission was based on information available on the day of admission. As regards the decision to admit, no other data was assessed. The hypothesis that the longer the length of stay, the more likely the admission was going to be inappropriate was based on the assumption that because most childhood illnesses were self-limiting, children admitted for longer lengths of stay were probably inappropriately in hospital. *Table 12* shows that despite controlling for the variation in appropriateness of admissions by hospital, longer lengths of stay were associated with more appropriate hospitalisation and that this relationship was highly significant. Younger children were more likely to be admitted inappropriately for shorter lengths of stay (explain this more clearly)

Table 12*Variation in appropriateness of admissions by length of stay and hospital*

Length of stay	< 24 hrs			25-48 hrs (1 - 2 days)			49-72 hrs (2 - 3 days)			73 - 96 hrs (3 - 4 days)			> 96 hrs
	App (no's)	Inapp (no's)	% <i>inapp</i>	App (no's)	Inapp	% <i>inapp</i>	App (no's)	Inapp (no's)	% <i>inapp</i>	App	Inapp	% <i>inapp</i>	App
Hospital													
Epsom	0	0	0	105	6	5	61	1	2	35	0	0	56
Kingston	0	0	0	82	14	15	45	1	2	32	1	3	53
Mayday	21	5	20	104	7	6	54	2	4	30	0	0	32
QMC	8	4	33	65	25	28	60	5	8	40	2	5	47
SGHMS	17	16	48	91	16	15	50	5	9	30	0	0	70
St. Richards	24	5	17	96	11	10	42	2	5	23	0	0	52
East Surrey	15	9	37	85	12	13	53	6	10	24	0	0	51
RSCH	2	0	0	108	20	16	60	4	6	23	0	0	31
Frimley	0	0	0	110	13	11	51	0	0	32	0	0	43
Crawley	16	10	38	84	11	12	52	1	2	34	0	0	46
QMR	22	5	16	88	8	8	51	0	0	23	0	0	57
St Peters	0	0	0	78	12	13	57	2	3	39	0	0	61
Worthing	11	8	42	88	20	19	53	5	9	19	0	0	51

Chi sq = 198 df 1 p < 0.0001 Time and inappropriateness of admissions

Table 13*Variation in appropriateness of admission by time and hospital*

TIME	Weekday			Weekend			Daytime			'On call'		
Hospital	App (no's)	Inapp (no's)	% inapp	App (no's)	Inapp	% inapp	App	Inapp	% inapp	App	Inapp	% inapp
Epsom	189	3	2	68	4	6	127	3	2	130	4	3
Kingston	157	9	5	55	8	13	97	9	8	115	8	7
Mayday	165	9	5	76	5	6	87	4	4	149	10	6
QMC	166	31	16	54	5	8	84	17	17	130	19	13
SGHMS	203	29	13	57	9	14	90	14	13	160	23	13
St. Richards	169	9	5	68	9	12	99	7	7	134	9	6
East Surrey	177	19	10	51	8	13	83	8	9	133	12	8
RSCH	177	15	8	47	10	17	84	9	7	140	16	10
Frimley	170	11	6	66	2	3	98	5	5	138	8	5
Crawley	170	16	9	62	7	10	95	7	7	124	12	9
QMR	180	11	6	61	3	5	92	6	6	136	7	5
St Peters	175	9	5	60	5	8	105	5	5	130	9	6
Worthing	169	23	12	53	10	16	105	14	12	105	17	14

Day of week/Weekend: Chi sq = 5 df 1 p = 0.03 Test for homogeneity of odds ratio (chi-square = 14 df 12 p=0.3)

Daytime/'On call': Chi sq = 8 df 1 p = 0.05 (check this again)

Overall there did not seem to be any difference in the assessment of admission as appropriate or inappropriate based on whether the admission took place during daytime or 'on call' (chi-square = x..... get results). Nearly 8% of admissions were classified as inappropriate irrespective of the time of day that the patient was admitted.

Similarly, 8% of admissions on weekdays were classified as inappropriate compared to 10% at weekends. This difference was not significant (chi-square 3 p = 0.073).

There was also no difference between hospitals. There was also no increase in inappropriate admissions for children under 1 at weekends (inappropriate admissions under 1 at weekends = 15% at weekdays = 13%. There was no difference between appropriateness of admissions and time of admission (weekday/weekend) for differing lengths of stay. 27% of admissions at weekends who were admitted for less than 24 hrs were classified as inappropriate but the difference between appropriateness of admissions and day of week/weekend controlling for length of stay was not significant (chi-square = 2 df 1 p = 0.2)

Referrals and inappropriate admissions

Table 14

Frequency of referrals

Referral source	Frequency	Percent
General Practitioner	1513	45.5
Accident & Emergency	1446	43.5
Self referral	87	2.6
Consultant	148	4.5
Other hospital	97	2.9
Midwife/Health visitor	7	0.2

Missing data = 26.

The vast majority of admissions were referred either by their general practitioner directly or were admitted via the Accident & Emergency department. It is not clear from the data that we collected whether referrals from the Accident & Emergency department originated from the general practitioner unless it was specifically

mentioned in the notes when the admission would have been classified as originating from the general practitioner. In some hospitals, referral to the A & E department would be the method of admission for all emergency referrals, where they would initially be assessed by the paediatricians before being admitted directly to the ward. What is certain is that referral to the accident & emergency would almost certainly result in further assessment by another doctor before the decision to admit was made. It is likely that referrals classified as coming from the general practitioner would be admitted directly to the ward.

Table 15

Appropriateness of admissions by source of referral

Referral source	Appropriate	%	Inappropriate	%
General Practitioner	1387	92	126	8
Accident & Emergency	1313	91	133	9
Self	86	99	1	1
Consultant	138	93	10	7
Other hospital	93	96	4	4
Midwife/Health visitor	6	86	1	14

Within the sampled admissions, there did not appear to be any significant difference in the assessment of the admission and the source of the referral (chi-square = df p). There is no suggestion from the data that we analysed, that GP's referrals were more inappropriate than A & E departments or Consultants. The numbers for midwives and health visitors are too small for any comment to be made on the appropriateness of referral.

Analysis of source of referral by length of stay showed that admissions originating directly from the general practitioner stayed in for much longer lengths of stay (18% stayed less than 48 hrs) than admissions from accident & emergency departments (24% stayed less than 48 hrs). Proportionately more admissions via the general practitioner stayed in hospital longer than 3 days (27% of admissions) compared to 19% of admissions referred via A & E. These differences were highly significant (chi-square = 137 df 24 p < 0.001). This is surprising because more admissions involving trauma would originate in A & E and I would have expected that these admissions would result in longer lengths of stay. Controlling for length of stay did not alter this finding (i.e. takes into account the fact that admissions of shorter LOS are more likely to be inappropriate). Fewer GP admissions of LOS <24 hrs and 25-48 hrs were inappropriate compared to admissions via A & E.

One of the reasons cited for greater proportions of admissions being inappropriate in children under 1 was the increasing uncertainty of the diagnosis perhaps resulting in admissions mainly for reassurance. Analysis of appropriateness of admissions by source of referral controlling for age showed that 13 % of referrals from general practitioners of children under 1 were inappropriate compared to 24% of referrals from A & E. Across every age group, more GP admissions were categorised as appropriate compared to A&E admissions. See *Table 16*.

Table 16*Appropriateness of admissions by source of referral and age group*

Age Group	Under 1			1-4 yrs			5 - 9			10+		
Source of referral	App (no's)	Inapp (no's)	% <i>inapp</i>	App (no's)	Inapp	% <i>inapp</i>	App	Inapp	% <i>inapp</i>	App	Inapp	% <i>inapp</i>
GP	444	59	13	517	44	9	220	18	8	206	5	2
A & E	190	46	24	503	62	12	288	17	6	332	8	2
Other	82	7	6	106	6	6	68	1	1	66	2	3

Discharge diagnosis

The reviewers were asked to extract the discharge diagnosis from the notes. The assesment of discharge diagnosis is made by trained clerks who enter this information on the administrative sheet that is summarised with each admission. The completeness of medical diagnosis recording is variable throughout the region. The following table shows the range of discharge diagnosis extracted from the sampled records. Only conditions that accounted for more than 2% of the admitted sample are listed and will be analysed in greater detail.

Table 17*Frequency of selected diagnoses at discharge*

Discharge diagnosis	Frequency	percent
Gastro-intestinal infections (includes infectious and non-infectious causes) ICD....	180	6.7
Acute upper respiratory infections (acute pharyngitis, tonsillitis, laryngitis, and unspecified)	282	10.4
Lower respiratory infections (acute bronchitis and pneumonias)	141	5.2
Asthma	324	11.9
Appendicitis	96	3.5
Arthropathies, Osteopathies and related conditions	91	3.4
Conditions originating in the perinatal period	55	2
Fractures (skull, neck, upper and lower limbs)	248	9.2
Intracranial injuries	178	6.6
Open wounds and foreign bodies	68	2.5
Poisoning	64	2.4
Unspecified viral illness	53	2
Symptoms, signs and other unspecified	647	23.8
Others	469	17.2

No missing = 608

Table 18*Appropriateness of admission by selected diagnoses*

Discharge diagnosis	Appropriate (nos)	Frequency	Inappropriate (nos)	Frequency
Gastro-intestinal infections (includes infectious and non- infectious causes) ICD....	162	90	18	10
Acute upper respiratory infections (acute pharyngitis, tonsillitis, laryngitis, and unspecified)	244	87	38	13
Lower respiratory infections (acute bronchitis and pneumonias)	128	91	13	9
Asthma	315	97	9	3
Appendicitis	96	100	0	0
Arthropathies and related conditions	83	91	8	9
Conditions originating in the perinatal period	42	76	13	24
Fractures (skull, neck, upper and lower limbs)	246	99	2	1
Intracranial injuries	177	99	1	1
Open wounds and foreign bodies	61	90	7	10
Poisoning	48	75	16	25
Unspecified viral illness	48	77	16	23
Symptoms, signs and other unspecified	589	91	58	9
Others				

The greatest proportion of inappropriate admissions were confined to conditions originating in the perinatal period, unspecified viral illnesses and poisoning. It is only possible to speculate for the reasons for this and the numbers involved are too small to carry out a meaningful analysis. It is reassuring to see that fractures, appendicitis and

asthma have high rates of appropriate admissions because these can be considered as marker conditions and help to confirm the validity of the instrument (it would be surprising if these conditions were classified as inappropriate).

Criteria for selection of appropriateness

As mentioned previously, the PAEP admission criteria were divided into patient severity criteria and intensity of service criteria. Broadly speaking, one is to do with the physiological state of the patient and one is to do with the service available in hospital. An admission could take place either because the patients condition required it or a level of service was available in hospital which could not be provided in another setting. Table 19 shows the number of times that severity or intensity of service criteria were used as a sole reason for classifying the admission as appropriate.

Table 19

Classification of admissions by service and severity criteria

		Severity criteria	
		Yes	No
Intensity of service criteria	Yes	979	703
	No	1137	305

Table 19 does not take account of overrides. 29% of the cases fulfilled the patient severity criteria and 21% fulfilled the intensity of service criteria alone. 40% of cases fulfilled both criteria. Assuming that patient severity is not influenced by other factors (e.g. availability of beds, medical care factors etc) then potentially 21% of cases are admitted to hospital using our criteria for the level of service which in some cases could be provided in other settings. This is the area where providers may have scope for providing a range of alternative services to the hospital.

The Day of Care criteria were also divided into medical, nursing and patient related factors. 3% of cases were deemed appropriate to remain in hospital because of medical factors and a further 3% because of patient factors, compared to 41% of cases remaining in hospital because of nursing care factors. Many of the latter services could be provided in an alternative setting .

Bibliography (Results)

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