

# Five-Year Audit of Children Admitted to Hospital Under the Care of Paediatricians in the North East of England

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**Abstract:** *Background:* The aim of this survey was the evaluation of the case load of one hospital based paediatric team including inpatients, day care attenders and outpatients over a period of five and a half years. A further objective was the calculation of the generated income following the introduction of payment by results.

**Methods:** Data were obtained from the hospital information technology and coding departments. They included age, gender, ethnicity, home postcode, month of attendance, length of inpatient stay and diagnosis. Analysis was performed using standard computer software.

**Results:** Altogether, 9711 patients were assessed which generated an income of approximately 6 million pound sterling. Ninety percent of this amount resulted from inpatient work. The majority of patients were of white British origin, and their mean age was 4.1 years. The length of admission decreased from 1.5 days in 2005 to 0.7 days in 2010. Forty five percent of diagnoses were infections, mainly respiratory and gastrointestinal; and 55% had a non-infectious cause. The overall 'did not attend' rate was 25%. No deaths were recorded.

**Conclusion:** The reduction of inpatient stay is a national phenomenon which supports the development of children's ambulatory care units. The reasons for the relatively high non-attendance rate are multi-factorial with family vulnerability being a contributory factor.

**Keywords:** Audit, children, hospital admission, infectious diseases, length of stay, non-attendance rate, outpatients, paediatrics.

## INTRODUCTION

This project was carried out in the paediatric department of a district general hospital in the North East of England. The Trust's catchment area varies in population density which is highest in North Tyneside and the Eastern suburbs of Newcastle. The Northumberland region is more sparsely populated. The Trust is geographically one of the largest in the country, providing healthcare for over half a million people. Of this population, 17.9% comprise children under the age of 16 of which over 12,000 present annually to the A&E department [1].

The paediatric department employs 6 acute paediatric consultants, 10 middle grade doctors, 11 senior house officers, 3 sisters, 22 staff nurses, 5 health care assistants and 3 nursery staff. Approximately one third of nursing staff work part time hours, the rest being full time employees. There are 33 beds available in the department, occupied by children ranging from birth to 16 years of age. Of these 33 beds, 6 are allocated to the Children's Assessment Unit (CAU). The remaining 27 are divided up between bed bays, mother and baby rooms, isolation cubicles and adolescent rooms. Approximately 12 outpatient clinics take place each week.

This audit aimed to evaluate inpatient and outpatient activity of one acute paediatric consultant and his team over a 5.5-year period, interpreting the findings in the context of previous relevant studies. There were three general areas for

consideration. Over the last decade numbers of children admitted to hospital have significantly increased, however the average length of stay for each child has decreased [2]. One aim of the survey was to compare the hospital's admissions with trends identified elsewhere in the country. Secondly, planned admissions of children are less common than in the adult population, suggesting different reasons for admission. The range of diagnoses seen in this cohort was analysed to further clarify the reasons for admission. Non-attendance rates are high among paediatric outpatients resulting in significant financial implications for the NHS [3]. The collection of data on non-attendance rates in this hospital will aid discussion on the potential consequences for child health resulting from poor interaction with the healthcare system [4, 5]. Finally, in 2010 the Department of Health re-enforced payment by results (PbR) which is a system of clinical costing standards for acute hospitals. The purpose of PbR is the standardisation, efficiency and comparability of costing of health services in England [6].

## METHODS

All children under the care of one paediatric consultant between March 2005 and September 2010 were included in this audit. A hospital database search covering the 5.5-year period was conducted and information gathered on inpatients, outpatients and those attending the CAU. For inpatients, data fields focused around demographic factors. Date of birth, gender, ethnicity, postcodes, length of hospital stay, diagnoses, months they attended and discharge method and destination were collated. The same data was collected for outpatients and those attending CAU with the exception of the patient's diagnoses. For these patients it was also noted, if the

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consultation was a first appointment or a follow up appointment.

In order to anonymise the data, patients' dates of birth were removed post-analysis. The remaining information was transferred to a personal computer for the purpose of producing the report. Inpatient diagnoses were decoded and grouped using the International Classification of Diseases [7]. The average number of hospital admissions was plotted monthly to clarify any seasonal variation. The average duration of stay for inpatients was plotted yearly. Ethnicity data was grouped allowing comparisons to be drawn against regional statistics. Gender ratios were also produced for the data set.

Postcode analysis included all inpatients; however elsewhere in the audit healthy newborn infants were omitted. Duplicate postcodes were manually removed and the resulting data input into an online mapping service [8]. This program plots up to 5000 postcodes on a map of the UK without fee and it also groups areas of dense postcode population together allowing the user to see the spread of postcodes and therefore the true catchment area of the hospital. The volume of revenue generated by the consultant's work for the Trust was calculated for inpatients, outpatient appointments and CAU attendances by multiplying patient numbers with the respective tariffs. Standard rates were applied for outpatient and CAU attendances however inpatient rates varied according to the complexity of each case. As such averages were used in calculation of inpatient revenue.

The project was registered with the local research and development department. Formal ethics approval was not considered necessary.

## RESULTS

The audit used data from a total of 9711 patients. Of the 6063 inpatients, 12.7% were healthy newborn infants (total number of deliveries was 5,373). To improve validity, these children, who were mainly cared for by midwives, were removed from further analysis of diagnosis. This also allowed accurate estimation of paediatric service usage. There were six inpatients for which no diagnosis was available and 3 stillbirths; they were also removed from the diagnosis data set leaving a sample of 5282 inpatients. They included 22 newborns requiring transfer to a neonatal intensive care unit. The data sample for outpatient appointments and CAU attendances stood at 2972 and 676, respectively. The male/female ratio was 53.7/46.3 for inpatients, 50.4/49.6 for day care attenders and 47.4/52.6 for outpatients.

### Ethnicity

The majority of patients (92.6%) were of white British background (77.1%) or any other white background (15.5%). Ethnicity was not stated in 4.2%, and only 3.2% of children belonged to an ethnic minority (Asian, African or mixed background).

### Age Distribution

The department accepts children ages 0 to 16, however, the results show younger trends in attendance (mean age 4.1 years). Variation in ages was seen with outpatients having the highest average age (5.2 years) and inpatients having the lowest average age (3.1 years). Patients attending the CAU had an average age of 4.0 years.

### Inpatients

Inpatient admissions showed variability according to month of the year. Over the 5.5 years, average admissions peaked in December (120 admissions) and were at their lowest in July and September (66 and 68 admissions, respectively). No clear seasonal variation was seen in admission rates, this is shown in Fig. (1).

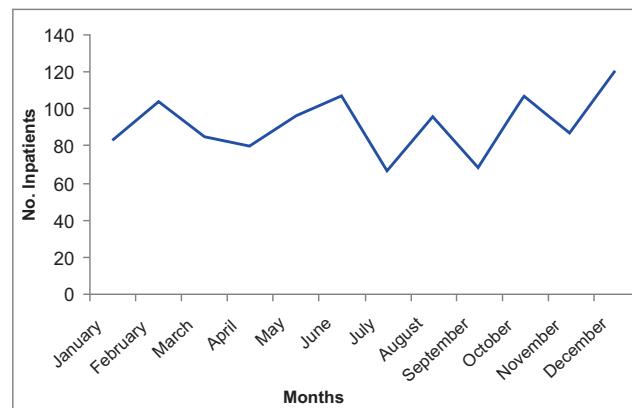


Fig. (1). Average numbers of patients admitted per month over 5.5 years.

### Length of Stay

Fig. (2) shows there is a consistent downward trend appearing in the average length of stay of inpatients. In 2005 the average stay was 1.5 days. This remained stable during 2008/2009 at 0.8 days and dropped to 0.7 days in 2010. The maximum stay for each year varied from 73 days in 2005 to 10 days during 2010.

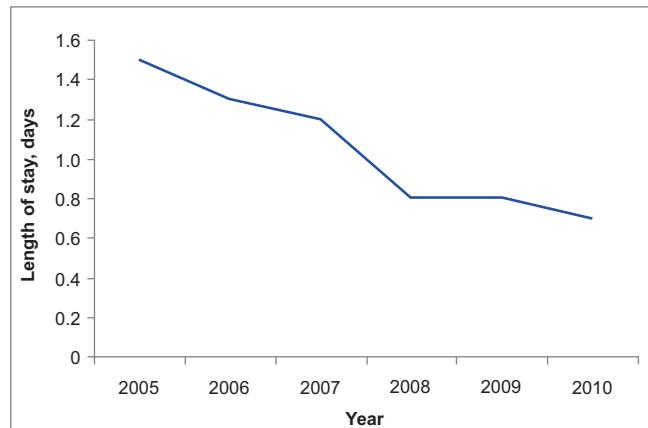


Fig. (2). Average length of stay for inpatients across the 5.5 years.

### Discharge

The vast majority (98.4%) of children were discharged to their usual place of residence with the rest discharged to either paediatric intensive care (1.1%), neonatal intensive care (0.4%) or alternative care (0.1%). Alternative care included 3 patients discharged to foster care, 1 to a non-NHS hospital and 1 patient to high security psychiatric care. The overwhelming majority were discharged on clinical advice or consent (99.8%), rather than self-discharge (0.2%). No deaths were recorded in this consultant's team however 3 still births occurred over the 5.5

year period. Still births were recorded within paediatrics as every newborn has an allocated Consultant Paediatrician.

## Postcodes

All inpatients were included in postcode analysis and following removal of duplicates, 3032 postcodes remained. From these, two groups were created comprising those from within the Northumberland and North Tyneside region (2948 postcodes) and those classed as 'out of area' (84 postcodes). Several distant locations occurred in the 'out of area' category including postcodes from Glasgow, Belfast, Bristol and 1 address in Bulgaria.

The Northumberland and North Tyneside area postcode distribution is displayed in Fig. (3). It shows heavy concentration around villages and small towns in North Tyneside and the south east of Northumberland for example North Shields, Whitley Bay and Bedlington. The postcodes reach approximately 60 miles north, 28 miles west and extend south, crossing the River Tyne. However the majority are situated along the coast coinciding with densely populated areas in the Trust. This produces a triangular catchment area between Bamburgh, Hexham and Sunderland.

## **Outpatients and Children's Assessment Unit**

The total number of paediatric outpatients was 2972. Seventy percent of outpatient attendances were for follow-up and 30% for first time appointments (2086 and 886, respectively). However, in the CAU the opposite was true with 90% of patients (611) seen for first appointments and 10% (65) for follow up. Non-attendance was recorded, when a family did not bring their child for a scheduled outpatient appointment without prior notification (cancellation). The data showed that the non-attendance rate was lower for first time appointments (11.1%) than for follow up appointments (29.1%). The overall non-attendance rates have not changed over the 5.5 years with an average of 24.6%.

### **Diagnoses**

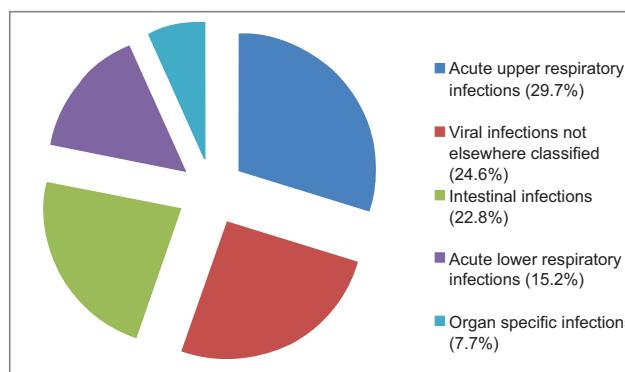
Admissions of children fell into two distinct classifications. A total of 5282 diagnoses were recorded, 44.8% of which were infections and the remaining 55.2% non-infectious.

Fig. (4) shows the range of infectious diagnoses with a large proportion due to respiratory tract infections (44.9%). Of these, two thirds originated in the upper respiratory tract and include: common cold (acute nasopharyngitis), croup (acute obstructive



**Fig. (3).** Distribution of postcodes for admitted patients across the region.

laryngitis) and acute tonsillitis. The lower respiratory tract infections comprise illnesses such as pneumonia and bronchiolitis. The category of intestinal infections is divided into bacterial, viral and gastroenteritis of presumed infectious origin and accounts for almost a quarter of all infectious diagnoses. Viral infections not elsewhere classified account for 24.6% of infectious diagnoses. This group includes influenza, viral pneumonia, meningitis and viral infection with an unknown primary location.



**Fig. (4).** Range of inpatient diagnoses – infectious causes (n = 2364).

Table 1 shows the classification of non-infectious diagnoses. The largest category was when no specific diagnosis was recorded (32.4%). In this instance the symptoms of the child's presentation were coded according to the ICD-10 classification. The significant number in the 'perinatal conditions and congenital malformations' category is accounted for by the broad range of diagnoses grouped, for example birth injury, respiratory distress and neo-natal jaundice. Only the primary diagnosis of each child was used to create the tables and charts. However, almost half of children had more than 1 diagnosis and a proportion (1.7%) had over 5 diagnoses as represented in Fig. (5).

## Revenue

The revenue accumulated by the consultant over the 5.5 years is displayed in Table 2. The income created from outpatient appointments was £473,962, £156,533 for CAU patients and the remaining £5,418,669 for inpatient care. This totals £6,049,164.

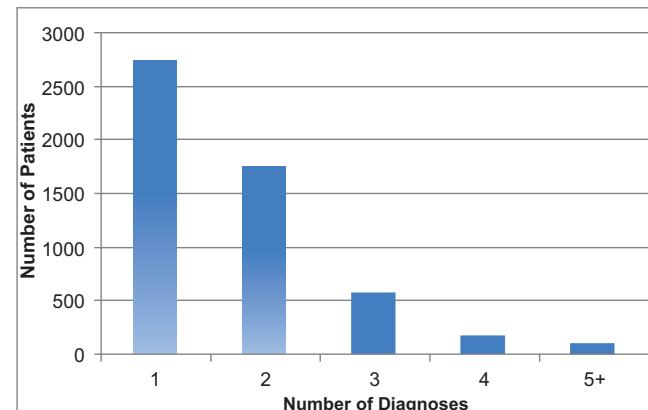
## DISCUSSION

This study analysed data from almost 10,000 patients over 5.5 years. Throughout the study period approximately £6 million was generated for the Trust resulting from the work of the studied consultant and his team. Limitations include the analysis of only one consultant's practice. However, personal communication of the authors with colleagues and the information department revealed that results are representative for the whole paediatric department.

**Table 1.** Range of Inpatient Diagnoses – Non-Infectious Causes

| Inpatient Diagnoses (Non-Infectious Causes)       | Patients | Percentage |
|---------------------------------------------------|----------|------------|
| No specific diagnosis recorded, only symptoms     | 945      | 32.4%      |
| Perinatal conditions and congenital malformations | 458      | 15.7%      |
| Injury to body                                    | 254      | 8.7%       |

|                                               |             |             |
|-----------------------------------------------|-------------|-------------|
| Diseases of the gastrointestinal tract        | 236         | 8.1%        |
| Diseases of the genitourinary system          | 168         | 5.8%        |
| Burns, poisoning and toxic effects            | 159         | 5.5%        |
| Diseases of the respiratory tract             | 157         | 5.4%        |
| Other medical problems                        | 118         | 4.0%        |
| Diseases of the nervous system                | 112         | 3.8%        |
| Diseases of the musculoskeletal system        | 102         | 3.5%        |
| Diseases of the skin and subcutaneous tissue  | 58          | 2.0%        |
| Endocrine, nutritional and metabolic diseases | 53          | 1.8%        |
| Mental and behavioural disorders              | 35          | 1.2%        |
| Diseases of blood and blood-forming organs    | 34          | 1.2%        |
| Diseases of the circulatory system            | 16          | 0.5%        |
| Complications of surgical and medical care    | 11          | 0.4%        |
| Benign neoplasm                               | 2           | <0.1%       |
| <b>Total</b>                                  | <b>2918</b> | <b>100%</b> |



**Fig. (5).** Proportions of patients with one or more diagnoses (n = 5282).

The paediatric department of this district general hospital is fairly typical for the UK in size, staffing and patient volume. Comparable published data from other parts of the country are scarce. The results described here will naturally differ from tertiary referral centres and regions with a higher proportion of ethnic minorities, for instance central London.

The ethnic background of the child population attending the paediatric department reflects the ethnic diversity of the region's population [9]. However, data were not available or not disclosed in 4.2% which may have modified results.

Several factors may explain the age related variations that were identified. A significant proportion of admissions due to infection were a result of gastrointestinal infection. As a common cause of volume depletion it may significantly account for admissions in young children, a group highly susceptible to dehydration [10]. Infections have also been noted to spread more rapidly between younger children, and underpinning this is the relative immaturity of the immune system at younger ages [11]. Our findings replicate those of other studies [12, 13]. The number of admissions varied throughout the year however no clear seasonal variation was found. The decreased admissions during July and September coincide with local school holidays

**Table 2.** Number of Patients in Each Setting, the Revenue Per Patient and the Total Revenue Calculated Across the 5.5 Years

| Hospital Setting   | Patient Numbers | Revenue/Patient | Total Revenue     |
|--------------------|-----------------|-----------------|-------------------|
| First OPA          | 886             | £243            | £215,298          |
| Follow-up OPA      | 2086            | £124            | £258,664          |
| First CAU          | 611             | £243            | £148,473          |
| Follow-up CAU      | 65              | £124            | £8,060            |
| Inpatient Day Case | 48              | £1,373          | £65,904           |
| Inpatient Elective | 55              | £1,963          | £107,965          |
| Inpatient Acute    | 5960            | £880            | £5,244,800        |
| <b>Total</b>       | <b>9711</b>     | -               | <b>£6,049,164</b> |

and the clinician's annual leave, respectively. Increased admission rates in December may be explained by the rising incidence of respiratory conditions during the winter months such as bronchiolitis and croup [14].

Inpatient stay is gradually decreasing and this is mirrored elsewhere in the country [15]. Explanations include increased parental awareness leading to earlier presentation of disease along with the lowering threshold for discharge encouraged by improving community care [2]. On an individual level increased clinical experience and/or changes in personal practice may have resulted in earlier discharges. However, clinicians must be mindful that a very short hospital stay may detrimentally affect patient's health with the potential for increasing morbidity and readmissions [16]. Almost half of admissions were due to infection and this is supported by evidence from other hospitals in the country. Some of the most frequent presenting symptoms in other hospitals are breathing difficulties, febrile illness and diarrhoea which can all be attributed to infection, especially in the younger child [13, 17].

There is currently no Trust information for outpatient diagnoses but the following common diagnoses are recognised: urinary tract infection, headache, abdominal pain, constipation, allergy, epilepsy and asthma. These diagnoses show a marked difference from the inpatient data with only one of the conditions being of infectious origin. The ratio of new patients to follow up patients in the paediatric outpatient department was 2.35 which is common practice. The higher percentage of follow up appointments can be explained by the potentially chronic nature of the aforementioned diseases requiring non-urgent investigations and in some cases, regular review.

CAU assesses patients referred from other hospitals, A&E and GPs and works to prevent the inappropriate admission of children to hospital. The high percentage of first appointments may reflect that children with chronic illnesses may use various other points of access to healthcare such as consultant review, specialist nurses and day unit care. Children presenting with acute illnesses of sudden or recent onset may conversely need immediate review or treatment and as such are more likely to attend CAU for their first appointment. Later, follow up care may be transferred to other departments.

A potential data quality issue arose with the identification of two patients aged 28 and 40 within the data set which were removed prior to analysis. Although insignificant in number it was raised with the Patient Administration System (PAS) team.

The authors were not involved in the original coding of diagnoses however appreciate the margins for error at this stage. Occasions where information was absent, patient's notes were illegible or wrong information was provided are all potential sources of error and as such are acknowledged [18]. Similarly, classification according to ICD-10 was occasionally difficult as certain diagnoses spanned more than one category [19].

High non-attendance rates in outpatients clearly reflect an area for conservation of valuable NHS resources. There is evidence to show simple measures such as reminder letters, emails, text messages and telephone calls drastically improve non-attendance rates [20, 21]. Current hospital policy is to phone parents one day prior to their child's appointment. Mortality rates have been shown to increase in children with poor attendance rates [4, 5]. Patient groups known to have poor attendance include males, ethnic minorities and those from deprived areas [22-24]. The latter two patient groups are at increased risk when compared with other non-attendees [25]. Deprivation poses many challenges to patients accessing healthcare such as transport costs and reduced flexibility with working hours. In children with less severe conditions these obstacles may be perceived to outweigh a parent's capabilities in attending an appointment. Non-attendance at appointments can also be a red flag sign for family vulnerability. The several clusters of deprivation seen within its catchment area may therefore explain this department's high rate of non-attendance. As such it is this clinician's policy not to discharge children after one or two occasions of non-attendance depending on the severity of the child's condition.

A third of all the non-infectious diagnoses had only symptoms recorded, for example cough, fever, pain, nausea and vomiting and rash. Discussion with the coding department of the hospital revealed that definitive diagnoses are often elusive with only possible diagnoses recorded in patient notes. This may further highlight discussion regarding consistency of note keeping. Inaccurate records can have adverse implications ranging from financial and auditing issues to altered patient care. As such, education is required regarding the consequences of inaccurate or incomplete record keeping for all those concerned.

## CONCLUSION

In summary, it was found that the duration of inpatient stay has reduced significantly since 2005. Approximately half of inpatient diagnoses resulted from infections. Respiratory

pathogens were a major contributor. In one third of the non-infectious causes only symptoms were recorded rather than a diagnosis. Perinatal conditions, injury and gastrointestinal disorders were common reasons for admission. Approximately half of children admitted as inpatients had more than one diagnosis reflecting the proportion of chronic disease in children. Most attendees lived in areas neighbouring the hospital, nevertheless, non-attendance for outpatient appointments reached almost 25%. There has been discussion regarding the potential detrimental effects of non-attendance and inaccurate record keeping on child health. However, these factors appear amenable to improvement, and through further research into the causes and long-term implications of these issues it is anticipated, they may be remedied in the future.

### Recommendations for Practice

- Accurate recording and coding of diagnoses are important for clinical care, hospital budget and audit.
- When children do not attend hospital appointments, efforts should be made to identify the reasons for this, and support should be provided for the families as appropriate.
- Regular evaluation of clinical services can highlight areas where performance can be improved.

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### CONFLICT OF INTEREST

Declared none.

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