



British Thoracic Society
BTS National Paediatric Asthma Audit Summary Report
National Audit Period: 1 November – 30 November 2015
Dr James Paton

Number of records submitted: Part 1 = 5443; Part 2 = 108

Number of participating institutions: Part 1 = 153; Part 2 = 108

Summary/Abstract

This report summarises the results of the 2015 British Thoracic Society (BTS) national paediatric asthma audit which took place in November 2015. The audit first took place in 1998 and has taken place as a national audit almost every year since then with only minor adjustments to the datasets to allow comparisons over time.

Key Findings

What's going well?

- Medical care of children with acute wheezing/asthma continues to be highly efficient and effective.
- Most children received appropriate first line rescue care.
- Second line approaches, such as intravenous therapies or ventilation and paediatric intensive care unit were used in a very small proportion of children.
- Duration of stay in hospital is short with a substantial proportion of children receiving care entirely within the emergency department.

Room for Improvement

- Exposure to environmental tobacco smoke was reported in 32% of children. However, this was an area where missing data was common and data recording should be improved.
- Both the use of CXRs and the prescription of antibiotics appeared to be used more commonly than evidence suggests is appropriate.
- Most aspects of discharge planning remain less than optimal with fewer than 60% of children and families recorded as being given a personal asthma action plan.

National Improvement Objectives:

1. Demonstrate an improvement in the proportion of children who are recorded to have been given a written asthma action plan (Target in 2 years: 95%)
2. Demonstrate an improvement in the proportion of children with follow up arranged with their GP within two working days of discharge (Target in 2 years: 95%)
3. Demonstrate a reduction in the use of CXRs in children with wheezing/asthma (Target in 2 years: 15%)
4. Demonstrate an improvement in the proportion of children who have exposure to tobacco smoke documented within the medical record (Target in 2 years: 80%)

Timeframe: to be achieved by the time of local re-audit in 2017/18

Background

Acute attacks of asthma are amongst the most common medical reasons for hospital admissions in children in the UK. National guidelines on the management of asthma in adults were first published in 1990 and from 1993 have included the management of childhood asthma. Although there have been many updates since, the key elements in the management of acute severe asthma in children have remained largely unchanged.

Standards/guidelines/evidence base

This audit examined the demographic profile, severity at presentation, processes of care and outcomes of children over 1 year of age admitted to hospital in the UK with an acute attack of wheezing/asthma during the month of November 2015. The audit standards were derived from the SIGN/BTS guideline on the management of asthma¹. The SIGN/BTS guideline highlights that a hospital admission represents a window of opportunity to review self-management skills and effective discharge planning is therefore an important part of acute asthma management.

Aims and objectives

The aim of the 2015 BTS paediatric asthma audit was to examine the quality of care and outcome in a large national sample of children admitted to hospital with acute attacks of wheezing/asthma.

The key objectives were:

1. To examine the baseline demographics and illness severity of children admitted with acute wheeze/asthma
2. To examine processes of care and outcome measures associated with the management of acute wheezing in relation to standards in the BTS/SIGN guideline on the management of asthma
3. To identify areas for improvement in the management of acute wheezing

Development of the national paediatric asthma audit

The BTS paediatric acute wheeze/asthma audit first took place in November 1998. It used a simple dataset based on the SIGN/BTS guidelines for the management of acute asthma in children¹ and collected information in 4 key areas:

- patient demographics including age, sex and length of stay;
- initial assessment of asthma severity;
- in-hospital treatment;
- discharge planning - asthma prophylaxis (if any) at discharge, asthma education and emergency planning, and follow-up arrangements.

The same dataset has been used with only minor additions since that time allowing comparisons over time across the domains. In the beginning, the audit was limited to paediatricians with a respiratory interest listed in the BTS handbook and consultant paediatricians in all acute paediatric units in Scotland. Around 50-60 units submitted data on approximately 1000-1500 children. From 2007 the audit was included on the list of National Audits for inclusion in the Department of Health Quality Accounts in England. This led to a sharp increase in the number of centres participating and the number of cases submitted. The audit continued annually until 2013 but was not carried out in 2014. In 2015, 153 centres submitted data on 5543 children. This was the largest return to date.

Year	No. of Institutions	Submissions
2010	97	2164
2011	127	3195
2012	144	4060
2013	148	4263
2015	153	5543

Table 1: Participation in BTS wheeze/asthma audit by year of audit

Methodology

For the 2015 audit, participating units were invited to submit data for children with acute wheezing/asthma who were admitted to hospital in November 2015. There were 2 parts to the audit.

Part 1 represented the main audit data set

Participating centres were invited to enter data on children admitted to hospital with an acute attack of wheezing/asthma during the period of the audit. There was no adjustment for case mix. In each centre, a consultant paediatrician with an interest in asthma was asked to oversee the audit.

Case Definition: children were included in the audit if they were:

- Over 12 months old at the time of the audit, **AND**
- Admitted to a paediatric unit, under paediatric care, with a primary diagnosis of wheezing/asthma during November 2015.

Children under 1 year of age were excluded because bronchiolitis due to respiratory syncytial virus (RSV), a common cause of wheezing in infants, is most common in the first year of life. In most years, the main peak of the RSV epidemic occurs in December.

An admission was defined as being in hospital for more than 4 hours from triage to discharge.

Recognising that many children will present with wheezing attacks, often with no previous history of wheezing, and with no history of interval symptoms the audit did not limit inclusion to only those children with a definite prior diagnosis of asthma.

As long as children were admitted to a paediatric unit and under paediatric care, there was no specific upper age cut-off. The oldest child on whom data was submitted was 18 years.

Data collection: data in the main audit dataset was collected in domains:

- Patient demographics
- Initial asthma severity assessment
- In-hospital treatment
- Discharge planning (including asthma education, emergency planning, and follow-up arrangements).

Data were entered through the secure BTS audit system with the website being open from 1 November 2015 until the end of February 2016. The end date was delayed to allow information on readmissions up until 31 January 2016 to be captured.

Case identification, whether prospective or retrospective, depended on local hospital arrangements. A simple pre-formed electronic report was used to provide rapid feedback of a centre's performance in the current audit, either compared with their own previous returns or with national data.

Part 2 captured data on institutional participation

Each unit was asked to complete a short questionnaire on whether they had participated previously and, if so, whether they had made any changes as a result of previous audits. This data is not presented in this report.

Response rate

Part 1 data were collected from 153 participating institutions; 5545 records were submitted. After data cleaning, there were 5443 records. While this is the largest number of cases submitted for the paediatric asthma audit, we know this does not represent all the cases admitted in November. Not every unit took part and because of the difficulty of tracking records not every case in every unit was returned. The total number of children with acute asthma/wheezing in the UK is not known. However, it is likely that the number of cases returned in the audit does represent a substantial proportion of the total cases admitted that month in the UK.

Results/Findings

Domain 1 - Patient Demographics

Admissions with asthma/wheezing are heavily skewed towards younger children (Figure 1). Seventy four per cent of the children admitted were under 5 years of age with 24% being between 12 and 24 months.

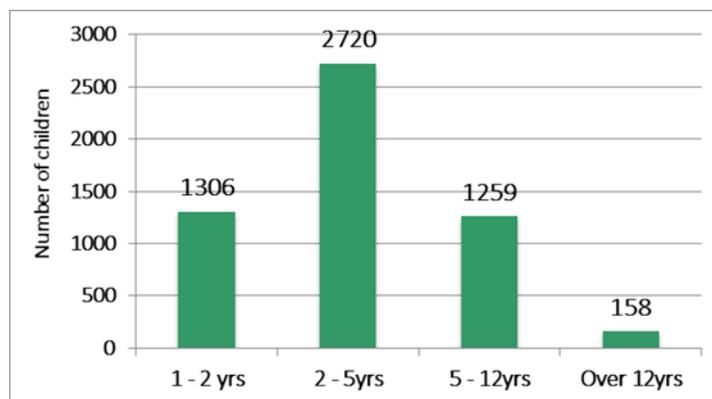


Figure 1: Age of children admitted

Around two thirds (62%) were male. A change in the sex ratio from a male preponderance in the pre- adolescent years to a female preponderance in adolescence was noted (Figure 2).

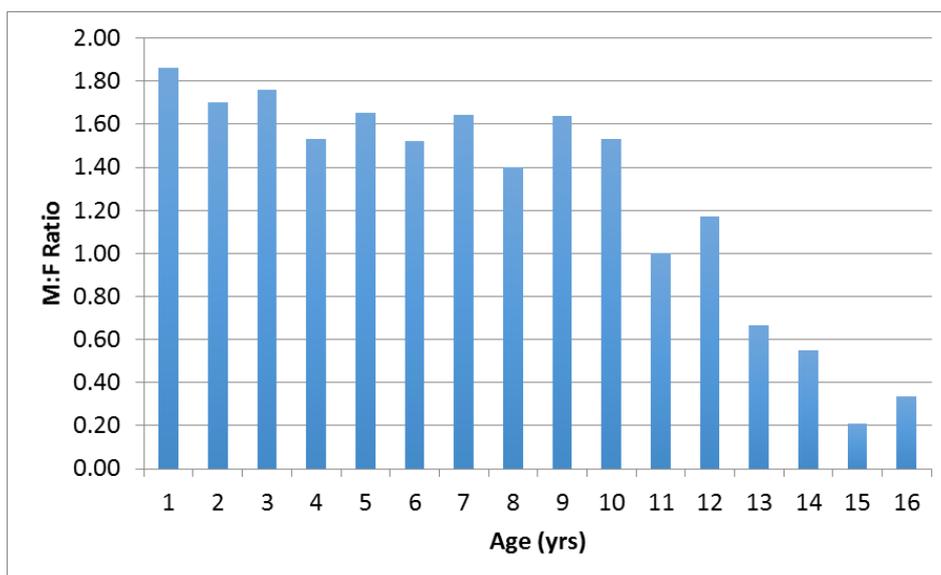


Figure 2: Male: female ratio of children admitted

Twenty eight per cent of the children were recorded as having no previous history of wheezing, 47% had wheezing only with colds while only 25% had a history of interval symptoms with wheezing between colds. Sixty per cent of children had had no previous admission with an attack of wheezing/asthma.

The proportion of children with different wheezing histories changed over time. The number of children with no previous history of wheezing was greatest between 1 and 2 years and declined with time. The proportion of children with a history of wheezing only with colds increased until three years and then declined. The proportion of children with a history of interval symptoms in keeping with a diagnosis of asthma steadily increased with age.

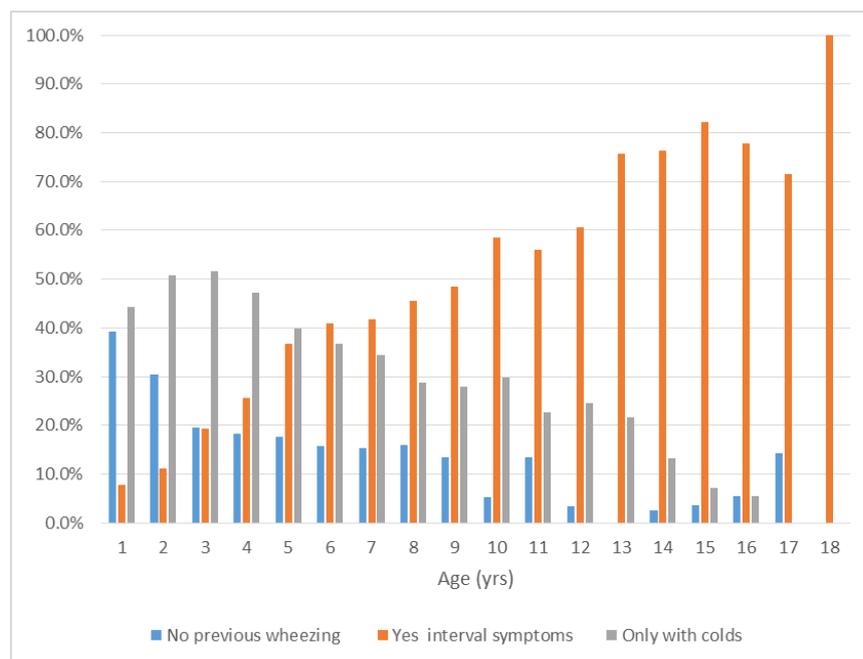


Figure 3: History of previous wheezing in relation to age

The average length of stay was short. Three quarters of children were in hospital for one day or less. Just less than 40% (37.4%) were reported as managed entirely within an emergency room or short stay ward.

Thirty two percent of cases with data available were reported as being exposed to cigarette smoke. However, this was an area where missing data were common with 44% of children marked as having no data recorded on smoking in the clinical record.

Domain 2 - Initial Assessment of Asthma Severity

The BTS SIGN asthma guideline gives the following physiological cut offs as indicating severe asthma in children.

- SpO2 <92%
- PEF 33–50% best or predicted
- Respiratory rate: >40/min in children aged 2–5 years; >30/min in children aged >5 years
- Heart rate: >140/min in children aged 2–5 years; >125/min in children aged >5 years

The data on the physiological parameters of respiratory rate, heart rate, oxygen saturation and peak expiratory flow are given below for the current audit and for comparison from the 2013 audit.

2013					2015				
Age	Count	Min	Med	Max	Age	Count	Min	Med	Max
Initial Respiratory Rate					Initial Respiratory Rate				
1-2	921	22	46	85	1-2	1271	22	45	88
2-5	1931	14	40	90	2-5	2643	20	40	90
5-12	1063	15	32	82	5-12	1234	15	32	86
Over 12	194	12	26	60	Over 12	196	12	28	70
Initial Pulse Rate					Initial Pulse Rate				
1-2	914	86	156	210	1-2	1268	52	156	203
2-5	1942	60	149	205	2-5	2640	50	148	206
5-12	1057	60	130	195	5-12	1227	65	130	208
Over 12	194	68	116	171	Over 12	197	62	119	190
Initial SaO2%					Initial SaO2%				
1-2	924	76	96	100	1-2	1282	74	96	100
2-5	1951	79	95	100	2-5	2672	45	95	100
5-12	1072	63	95	100	5-12	1240	63	95	100
Over 12	197	77	96	100	Over 12	200	69	96	100

Table 2: Physiological vital signs at presentation 2013 and 2015

The data in Table 2 show that the median values for respiratory rate and heart rate up until the age of 12 are close to the severe asthma cut off values listed in the BTS/SIGN Guideline. However, the median initial oxygen saturation in air is 95-96%, considerably higher than the 92% cut off value. Only 11% of children had an initial saturation less than 92%.

Domain 3 - Treatment in hospital

a. Initial treatment

The SIGN/BTS asthma guideline recommends that the initial treatment of children in hospital with an asthma attack should include:

1. Oxygen therapy to achieve target oxygen saturations of 94-98%
2. Inhaled short-acting beta-2 agonists
 - a. initially using a pMDI with spacer in children with mild to moderate asthma
 - b. children with severe or life threatening asthma should receive frequent bronchodilators via nebuliser driven by oxygen. If there is a poor response to the initial dose, subsequent doses should be given in combination with ipratropium bromide
3. Steroid therapy – usually oral prednisolone

The data (Figure 4) show that virtually all children received treatment with a beta agonist. About half were of sufficient severity to be treated with ipratropium bromide. Around 40% received oxygen at some point during their admission. Despite being a useful objective marker of severity, peak expiratory flow was rarely measured. Only 10% of children ≥ 5 years had peak flow measured at the initial assessment.

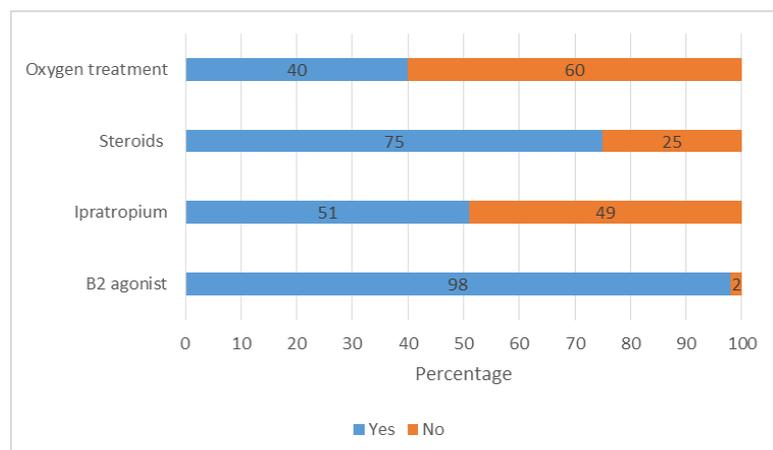


Figure 4: Data on initial asthma treatment in hospital

In thirty nine per cent of children, the only device used during their admission was an MDI with spacer (Table 3). Fifty four per cent of children were treated with nebuliser and an MDI plus spacer. This reflects the fact that children with a more severe or life threatening attack usually receive treatment with a combination of nebulised beta2-agonist and ipratropium initially. As they improve, they are moved to less intense bronchodilator therapy, usually given via a spacer using, or another inhaler device. Only 5.6% of children were treated entirely with nebuliser therapy.

	Nebuliser	Nebuliser and other device	Nebuliser and spacer unit and other device	Nebuliser and spacer unit	Other device	Spacer unit
Patients	301	29	52	2866	10	2072
Percentage	5.65%	0.54%	0.98%	53.77%	0.19%	38.87%

Table 3: Data on devices used through the duration of the stay in hospital

Although steroids are considered an important component of the management of acute asthma in children, these were given in 75% per cent of children. However, the proportion of children who received steroids rose with age such that around 90% of children aged 6 years or over were treated with steroids (Figure 5).

In 17% of children, the course of steroid had been started before the children came to hospital with 63% started at admission.

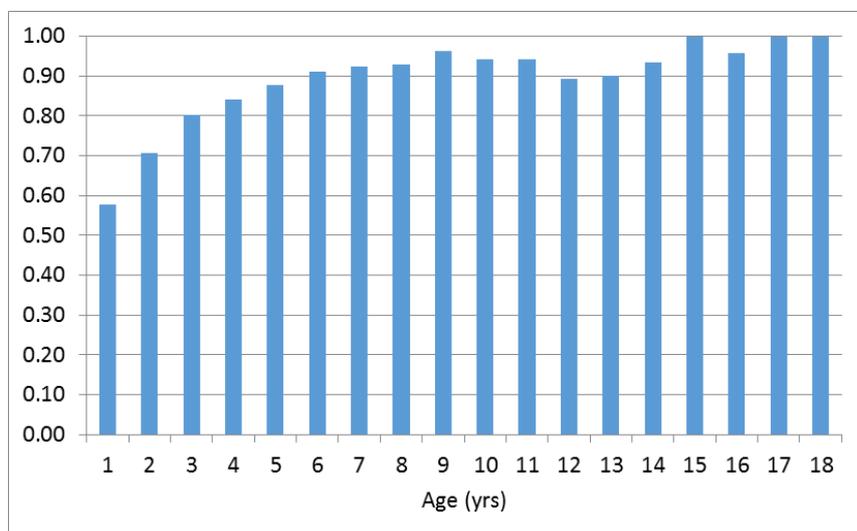


Figure 5: Percentage of children receiving steroid treatment in relation to age.

b. Second line treatment

For most children, the initial intensive treatment was highly effective. Only a very small proportion of children received second line treatment or was admitted to a PICU.

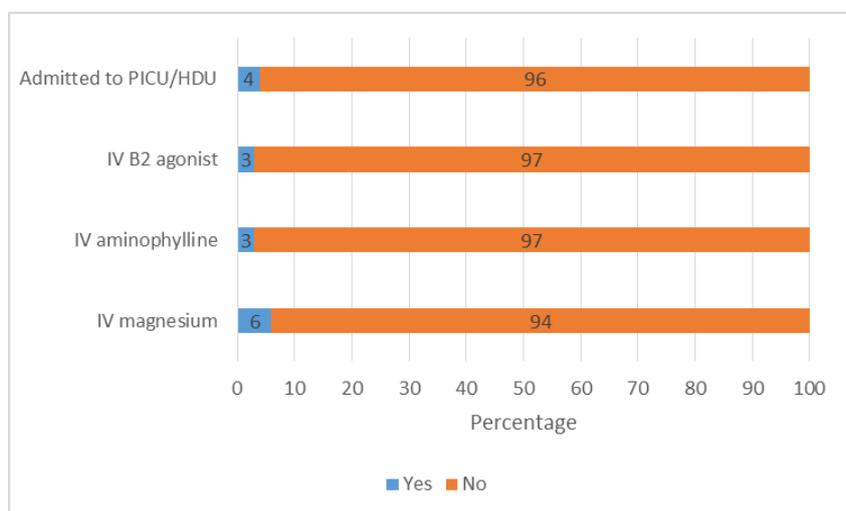


Figure 6: Percentages of children receiving additional treatment

An even smaller number of children received assisted ventilation (n= 73; 1.3%) (Table 4). In 62% only non-invasive support was used. No child was reported to have died from an asthma attack.

	Both non-invasive and invasive	Invasive only	Non-invasive only	Total
Female	2	8	21	31
Male	7	11	24	42
Total	9	19	45	73

Table 4: Data on number of children receiving assisted ventilation

There appeared to be regional differences in whether aminophylline or salbutamol was used (Figure 7). It can be seen that in some areas (e.g. East Midlands) salbutamol use is more common while in others aminophylline use predominates (e.g. Yorkshire and Humber)

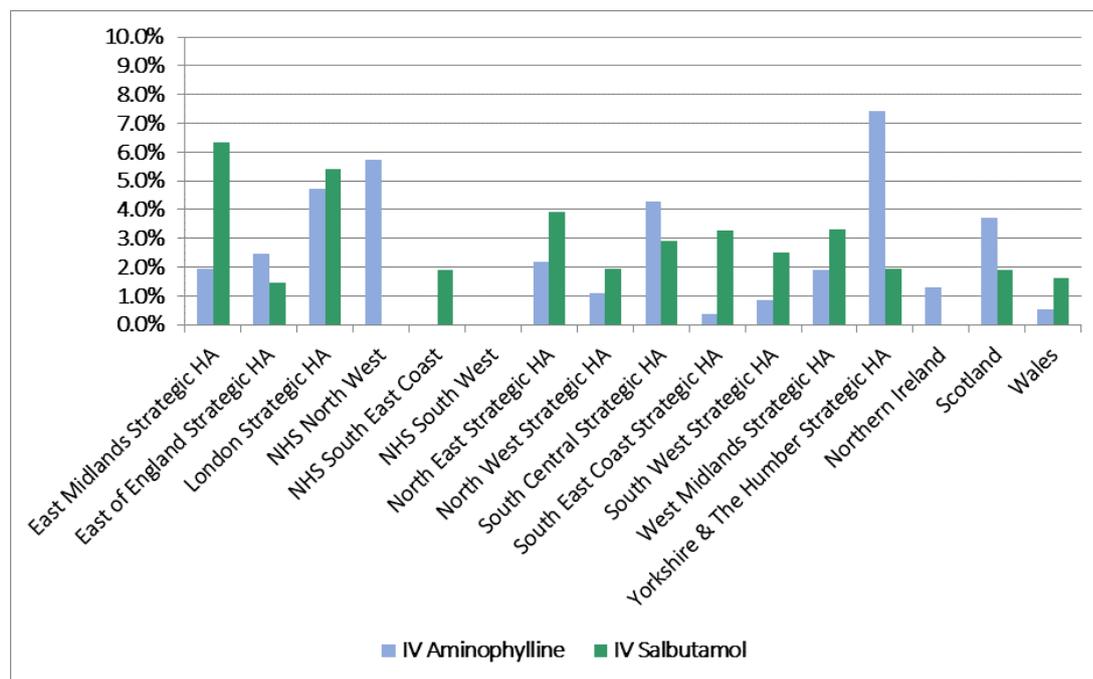


Figure 7: Proportions of children receiving IV salbutamol and IV aminophylline in different geographical areas

c. CXRs and the use of antibiotics

Overall, 25% of children received a CXR and 28% were given antibiotics. There was a highly significant association between having a CXR and being given antibiotics (Chi-square 1318.4, p <0.0001). Data on the number of children who received CXRs and the number given antibiotics broken down by country in the UK is given in Table 5.

England	No Antibiotics	Antibiotics	Total	Percent X-rayed	25.4%
No X-ray	2849	560	3409	X-rayed and not given antibiotics	32.4%
X-ray	375	784	1159	X-rayed and given antibiotics	67.6%
Total	3224	1344	4568		
Scotland	No Antibiotics	Antibiotics	Total	Percent X-rayed	21.0%
No X-ray	394	31	425	X-rayed and not given antibiotics	43.4%
X-ray	49	64	113	X-rayed and given antibiotics	56.6%
Total	443	95	538		
Wales	No Antibiotics	Antibiotics	Total	Percent X-rayed	27.4%
No X-ray	129	6	135	X-rayed and not given antibiotics	41.2%
X-ray	21	30	51	X-rayed and given antibiotics	58.8%
Total	150	36	186		
N Ireland	No Antibiotics	Antibiotics	Total	Percent X-rayed	28.9%
No X-ray	46	8	54	X-rayed and not given antibiotics	36.4%
X-ray	8	14	22	X-rayed and given antibiotics	63.6%
Total	54	22	76		

Table 5: Data on number of children receiving a chest X-ray and given antibiotics

Domain 4 - Discharge planning and Follow-up

The proportion of children receiving key components of discharge planning (information about asthma, inhaler device technique check and a written asthma plan) was less than 50% (Figure 8).

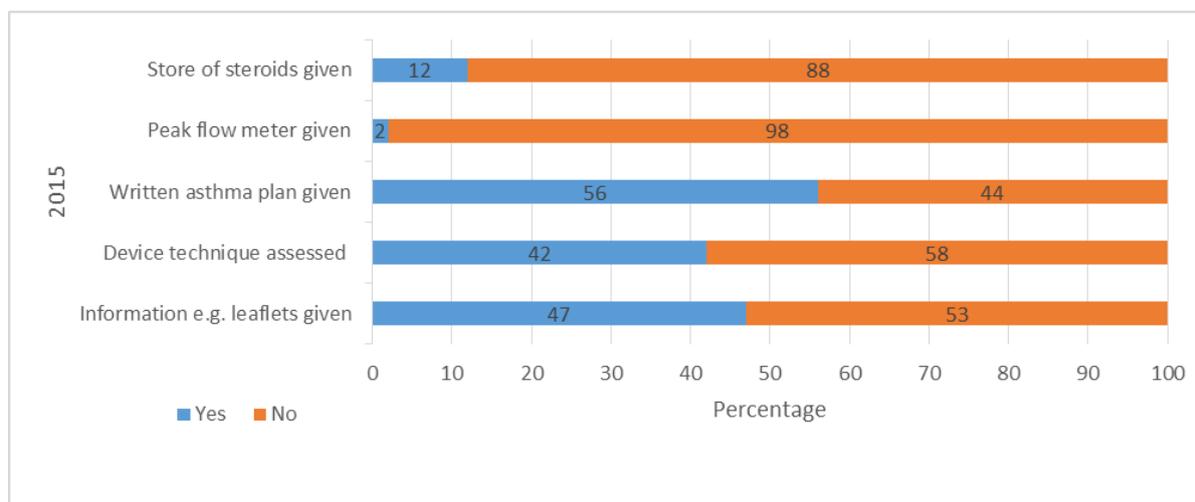
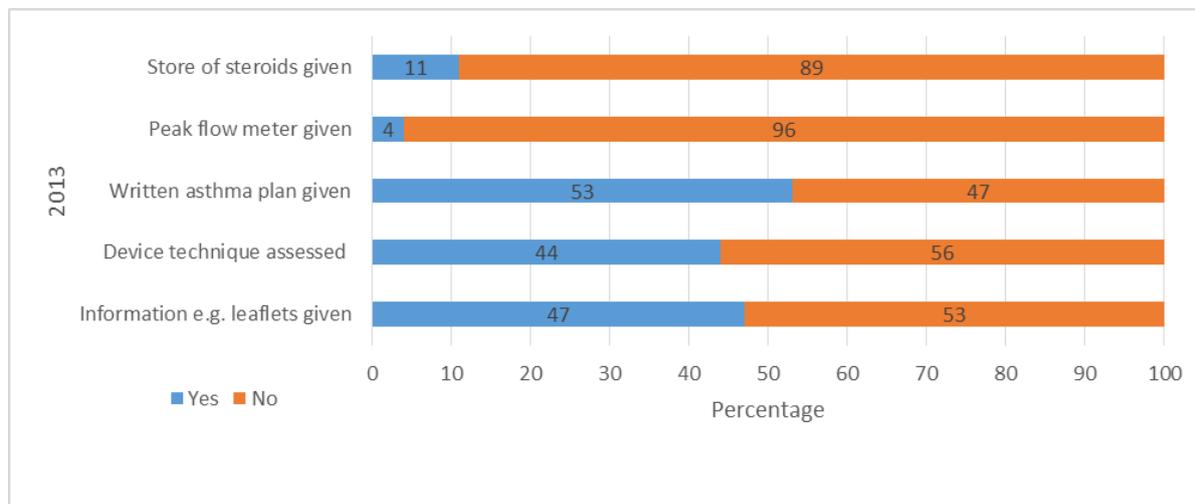


Figure 8: Proportions of children receiving different components of discharge planning in 2013 and 2015

The proportion of children recorded as having been given an asthma plan varied in different units from 0% of children to 100% of children (Figure 9).

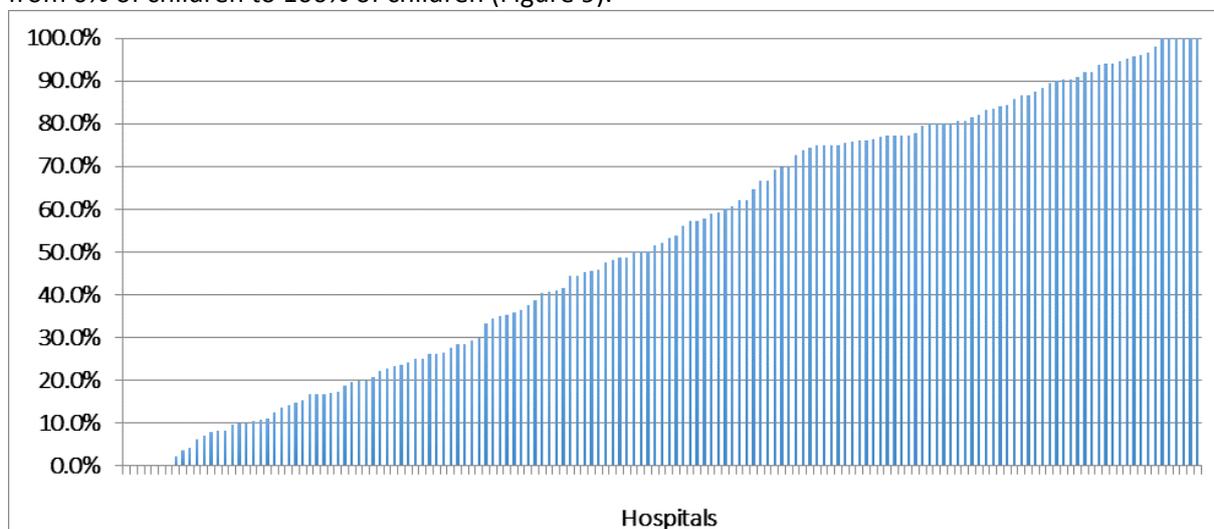
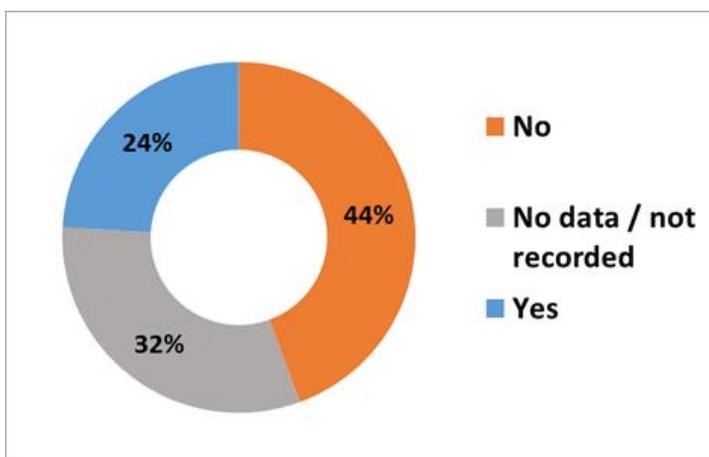
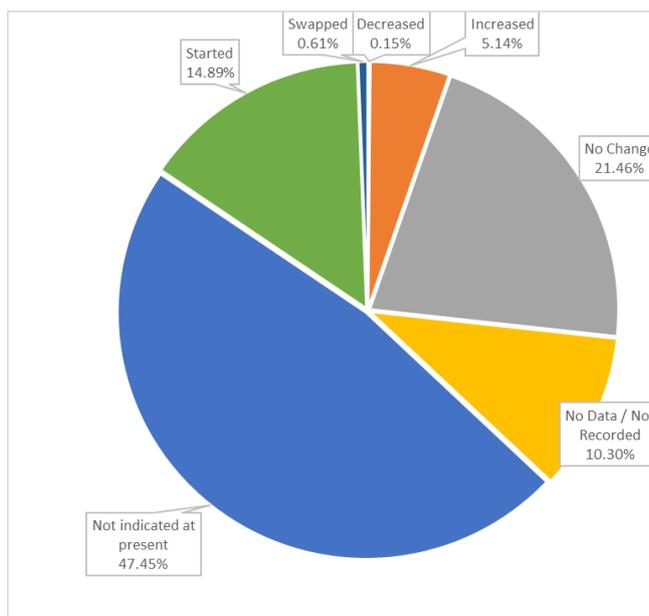


Figure 9: Proportion of children recorded as having been given an asthma plan at each hospital

Data on the asthma prophylaxis at discharge is shown in Figure 10. Only 20% of children were either started on (15%) or had asthma preventive treatment increased (5%) at discharge. In 47%, asthma prophylaxis was recorded as not indicated at present. This declined from 65% in the 1-2 year old to around 25% in 7 year olds.

Figure 10: Data on asthma prophylaxis at discharge

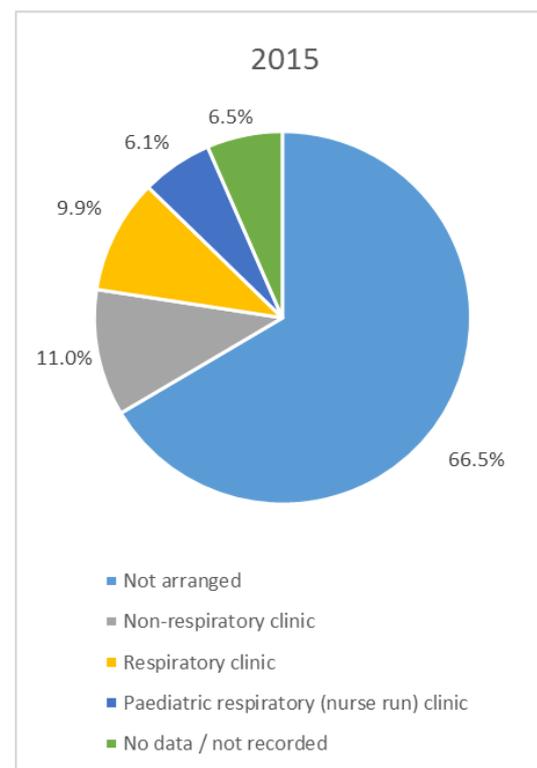
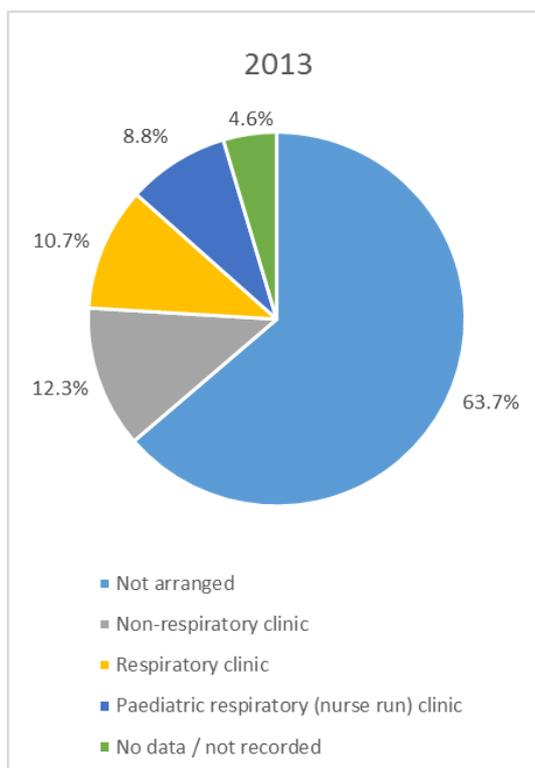


The guidelines suggest that children should be seen by their GP within 2 working days of discharge. This was poorly recorded in a third of cases. Overall, only 24% were recorded as being advised to visit their GP within 2 working days.

Figure 11: Proportion of children advised to see their GP within 48hrs of hospital discharge

Hospital follow up was arranged in a third of cases only. In only 16% of cases was the follow-up with a respiratory specialist health professional (doctor or nurse). This represented a small decline from the 2013 audit

Figure 12: Hospital Follow up arrangements



Outcome

Fifteen percent of children were readmitted by 31 January 2016 following the initial admission in November 2015, sometimes on more than one occasion (Figure 13).

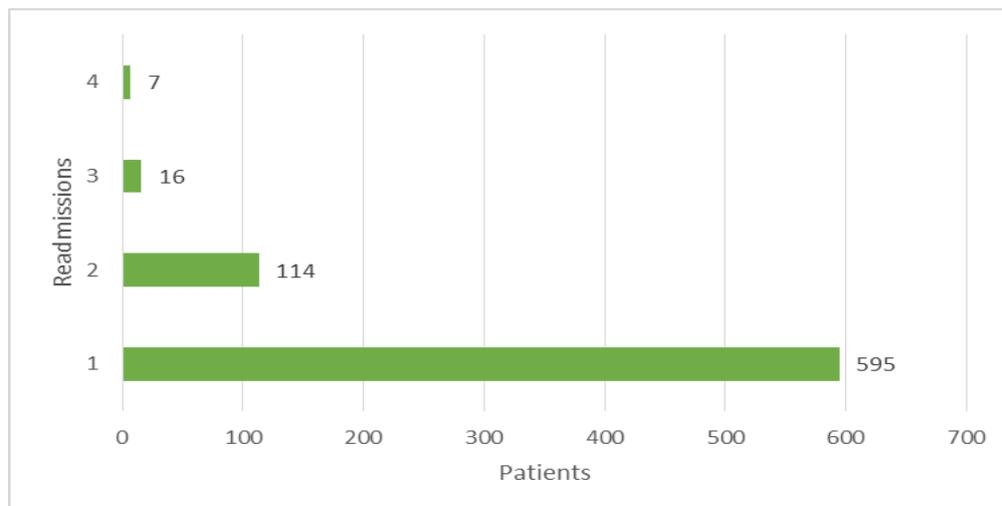


Figure 13: Number of readmissions per child by 31 January 2016 with a further episode of wheezing/asthma

Comparison with previous audits

Demographics

Age, sex distribution, number of previous admissions and length of stay were all similar to the 2013 audit. Both recorded exposure to cigarette smoke and missing data about smoking were also very similar to the levels reported in the previous 2013 audit.

Assessment of severity

The data for 2015 are similar to the previous data from 2013 both in terms of the median values and the range from minimum to maximum values. This suggests the severity of asthma at the time of presentation to hospital is not changing. It is of interest that in many children admitted to hospital with asthma, the oxygen saturation is within the normal range.

Treatment

There has been little change in the proportion of children receiving beta-2 agonists, ipratropium or oxygen. The overall proportion receiving steroids has declined slightly.

The need for second line treatments has remained low and stable at around 3-4% of children. One change over the last 5 years has been a decline in the numbers of children that only received treatment via a nebuliser (24% in 2010 to 6% in 2015).

Discharge / follow up

The proportion of children receiving key various components of discharge planning has changed little since the 2013. The proportion of children readmitted and the number of admissions per child was also similar.

Comment

Demographics

The observed male preponderance reflects the fact that attacks of wheezing are more common in boys up to the age of puberty. The reasons for the shift to a female preponderance after puberty are not understood. These data are very similar to previous findings².

The data on whether there was a history of wheezing was of interest because it shows wheezing only with colds is common in younger children peaking at around 3 years. Intermittent symptoms gradually become more prominent with age.

It is noteworthy that children between 12 and 24 months of age continue to account for a quarter of admissions. This is an age group where the evidence base for treatment is most limited and guideline recommendations sparse.

Smoking

Exposure to passive smoking is recognised as an important factor in asthma attacks in children that lead to hospitalisation³. The Health and Social Care Information Centre Report on Statistics on Smoking for England in 2016 reported the population prevalence of smoking as 20% in men and 17% in women⁴. Of mothers, 11.4 per cent were recorded as smokers at the time of delivery in 2014-15. This continues a steady year-on-year decline in the percentage of women smoking at the time of delivery from 15.1% in 2006/2007. In that light, the fact that one third of children admitted in this audit were recorded as being exposed to cigarette smoking is worrying. However, the extent of missing data for this question means that definitive comment is not possible. Collecting accurate data on children admitted with wheezing should be a high priority.

Assessment of severity

The fact that the vital signs at admission have changed so little suggests that the severity of attacks leading to hospital admission has changed little over time.

Treatment

In most cases, the initial medical treatment was highly effective. Few children needed second line treatments, even fewer children were ventilated and no child was reported to have died. As noted, and in keeping with this, the duration of stay in hospital was generally very short.

The lower levels of oral steroid use in children under 5 years is of interest. Recent evidence from high quality RCTs has cast doubt on the value of steroids for acute wheezing attacks in pre-school children⁵. It appears that this evidence is positively affecting practice.

There is debate about whether IV aminophylline or salbutamol is the best drug to use first and there is no clear consensus about which to use⁶. This appears to be reflected in the evidence of regional differences in the use of these two drugs.

It is pleasing to note that the number of children who received treatment via nebuliser alone has declined. Most children are now treated by spacer during some part of their hospital admission. This is valuable because it familiarises families with the use of spacer as a means of delivering emergency treatment.

Previous audits have documented the use of CXR and antibiotics in between 20-30% of children, similar to 2015. Evidence suggests CXRs are probably only required in about 10% of children's wheezing attacks. Since most acute episodes of wheezing/asthma in children are triggered by viruses, antibiotics should be needed only rarely. Having a CXR is strongly associated with the prescription of an antibiotic, presumably because of the over-interpretation of findings on CXR as indicating infection⁷. Therefore, reducing the number of children who are X-rayed is likely to reduce the number of children who receive antibiotics.

Discharge / follow up

The relative lack of data on children exposed to tobacco smoke has already been highlighted.

Discharge planning in the form of education about asthma and its treatment, including asthma inhaler device technique, are important not least because they have been shown to decrease the number of future admissions with the asthma attacks. There has been no sign of systematic improvement in recent audits. While this is an area where it is difficult to know whether 'not recorded' accurately reflects 'not done', it would appear that many children are not getting appropriate discharge planning. If discharge planning were to be improved, published evidence of the number of children readmitted with further episodes of wheezing/asthma, particularly those with more than one admission, might be reduced.

Many young children have attacks of wheezing without necessarily either having previous attacks or a history of interval symptoms. These children may not require or benefit from regular preventer treatment. This seems to be reflected in the audit data with fewer younger children having preventive inhaled corticosteroids (ICS) started or increased paralleled with a greater number of responses in younger children indicating that ICS were not indicated.

Conclusions/Observations

The audit demonstrates that the medical care of children with acute wheezing/asthma continues to be highly efficient and effective. Most children receive appropriate first line rescue care. Second line approaches, such as intravenous therapies or ventilation are used in a very small proportion of children. The duration of stay in hospital is short with a substantial proportion receiving care entirely within the emergency department.

The principle areas where improvements are required are in relation to discharge planning. The proportion of children receiving key components of discharge planning continues to be less than optimal. It seems likely that units will need to use quality improvement methods if they are to consistently deliver appropriate discharge planning. The payback should be a reduction in the numbers of children readmitted with further episodes of wheezing/asthma, currently running at 15%. In view of the large number of children admitted, even a modest reduction in readmissions would equate to a substantial number of hospitalisations avoided.

Two areas might be particularly highlighted. Firstly, a substantial number of children are reported as being exposed to environmental tobacco smoke. However, in around 40% there was no record of exposure recorded. Paediatricians may have become complacent about the need to record and advise parents about the hazards of smoke exposure in children with wheezing/asthma. Secondly, families do not appear to be advised to visit their GP within two working days of discharge. Such a visit provides GPs and families with a chance to review the recent attack and put in place and/or confirm plans for managing future wheezing/asthma episodes.

One area of concern remains the overuse of CXRs and the close linkage of whether a child receives a CXR with antibiotic prescribing. In the absence of fever and/or focal signs or of very severe/life-threatening asthma, most children do not require a CXR. If children with asthma are x-rayed then non-specific changes are often present which cannot reliably distinguish a bacterial infection. Since most episodes of wheezing/asthma are triggered by viral infections, particularly rhinovirus, antibiotics are not usually appropriate. At a time when there are concerns about both cost and good antimicrobial stewardship, there is a need to be more restrictive in the use of CXR in children with asthma.

The very low use of peak flow meters as part of the initial assessment of children with wheezing is striking. There is increasing concern about the fact that asthma is often diagnosed without any objective measurements. In children over 5 years, who should be able to produce a satisfactory

measurement, documentation that the peak flow is reduced during an acute attack of wheezing and increases as the child improves particularly after bronchodilator administration would provide clear objective evidence of airways obstruction and reversibility to support a diagnosis of asthma.

Finally, some of the current uncertainties in the management of wheezing are evident in the data, particularly in relation to the management in young children. The place of oral steroids in young children with wheezing attacks and the question of when young children should receive preventative asthma medication following an attack are areas where further research is required.

Recommendations/Quality Improvement Plan

1. Demonstrate an improvement in the proportion of children who are recorded to have been given a written asthma action plan (Target in 2 years: 95%)
2. Demonstrate an improvement in the proportion of children advised to see their GP within two working days of discharge (Target in 2 years: 95%)
3. Demonstrate a reduction in the use of CXRs in children with wheezing/asthma (Target in 2 years: 15%)
4. Demonstrate an improvement in the proportion of children who have exposure to tobacco smoke documented within the medical record (Target in 2 years: 80%)

29 November 2016

British Thoracic Society

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