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Investigating Pediatric Asthma Emergency Attendances in North East Essex: Themes, Findings and Opportunities for Improvement

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Abstract

Objectives: To determine the rate of pediatric A&E attendances and admissions for asthma exacerbations in North East Essex and identify any potential causative factors.

Design: Retrospective service evaluation of routine data collected in A&E and children's inpatient unit.

Setting: Colchester General Hospital Emergency Department, Essex, UK.

Participants: 55 children aged 2-17 (inclusive) attending A&E for an acute asthma exacerbation between 1 March 2017 and 28 February 2018 identified using A&E records.

Main outcome measures: The primary outcome measures were number of attendances and hospital admissions for asthma exacerbations. Secondary outcome measures included number of attendances coming from schools, re-attendance rate, length of stay, proportion of new asthma diagnoses, proportion of patients attending with an inhaler, age at presentation, time of day of presentation, time of the year of presentation and day of the week of presentation.

Results: The attendance rate for asthma was around 114 per year, with around 43 admissions. Three attendances with one admission came from schools. 78% of those attending had a pre-existing diagnosis of asthma; however 18% of those attending had an inhaler, but no previous diagnosis of asthma.

Conclusions: Pediatric asthma in North east Essex is perhaps less of an issue than it was previously reported to be and only a very small minority of attendances are from schools. There is a significant minority of patients who are being prescribed inhalers, but do not have a documented asthma diagnosis; this is a potential area for improvement.

Keywords: Asthma; A & E; Pediatrics

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Introduction

Asthma is the most common chronic illness amongst children, affecting up to 1 in 11 or 1.1 million children in the UK [1]. In 2016 North East Essex (NEE) clinical commissioning group (CCG) had 173 emergency admissions for asthma in under 18s with a population of 73 758, (235 per 100 000, CI: 201, 272); a 40% higher rate with an 18% higher non-elective spend when compared to its 10 most similar CCGs. NEE also has a higher all-age mortality rate for asthma, however this is not statistically significant [2]. Various hypotheses have been put forward to explain these statistics. One is that schools were responsible for a disproportionately high number of attendances, potentially due not following guidelines from the London Asthma Toolkit [3]. An alternate hypothesis was that children with moderate-severe asthma were not being referred to secondary care for further asthma management. It could also be attributed to local policy favoring a more cautious approach; making pediatric and A&E clinicians less willing to discharge patients.

According to the national British Thoracic Society (BTS) pediatric asthma audit, carried out from 1 November 2016 to 31 October 2017 (the only 12 month period available), 80.6% (n=36) of children presenting to Colchester General Hospital (CGH) emergency department, the sole emergency department in the CCG, were discharged home from either the emergency department, or short stay ward, with the remainder admitted. This is in contrast with national figures, where 59.3% of patients were admitted [4]. The definition of the term "short stay ward" is likely open to interpretation however, potentially leading to differences in the auditing of data between hospitals. BTS states that "admitted means an admission of 4 hours or more" [5], however this recursive definition does not state whether the time starts at arrival to A&E, referral to pediatrics, or transfer to a ward. Month-long audits carried out in November 2015 and November 2013 show 64% (n=16) and 100% (n=12) admission rates, respectively. However a member of the pediatric department did confirm that the November 2013 audit was carried on inpatients only, so it is unknown if any of the audits for which data are available are representative of all pediatric attendances for asthma exacerbations.

This study was intended to identify potential causes of the high number of admissions in NEE, in particular, if a higher than expected number of admissions was associated with schools. CGH emergency department was chosen as it was assumed that most, if not all, hospital admissions for acute asthma exacerbations would be via the emergency department. An alternate route would be via referrals from GPs or community nurses directly to children's assessment unit (CAU). Those with severe or life-threatening exacerbations would be expected to attend A&E however. Alternatively the data could be distorted due to coding practices. It was highlighted by A&E staff that a significant number of the children were moved from A&E to CAU for a period of observation to avoid breaching the 4 hour A&E target. Every patient seen in CAU is counted as a hospital admission, even if discharged within the space of a few hours. However for the purposes of the BTS audit, it is likely that CAU was regarded as a short stay ward, as it is not intended for overnight admissions. Patients seen in A&E, transferred to CAU for observation for less than four hours and then discharged could therefore be counted as both a hospital admission and a discharge from a short stay ward, thus inflating both figures.

Previous public health interventions aimed at reducing the frequency of acute asthma exacerbations have included both school and primary care-focused initiatives. A project carried out in Ealing from 2010-2014 led to a 40% reduction in hospital admissions for acute asthma exacerbations with a corresponding estimated £90 000 cumulative saving [6]. Limited research has been carried out on the effectiveness of entirely school-based initiatives. A systematic review of such initiatives in the US showed an increased knowledge and improvement in self-management. However there was no statistically significant reduction in number of school days missed however and number of A&E attendances was not assessed [7]. Another systematic review did show a reduction in number of A&E attendances, but no improvement in number of hospital admissions [8]. A more recent randomized controlled trial showed no significant improvement in number of A&E attendances or hospital admissions [9]. Of the school based interventions, only those facilitated by a medical professional were found to be effective; those lead by a lay facilitator found no improvement in symptoms, quality of life or use of resources [10].

Methods

A focus group was arranged with A&E staff at CGH to identify any potential common factors in acute asthma exacerbations. Patients and the public were unfortunately not included in this however. A set of questions was then drawn up using focus group observations, national BTS pediatric asthma audit criteria and other hypotheses [11]. A list of A&E attendances which met the inclusion criteria was requested from CGH business informatics department. Unfortunately A&E attendances were not coded by specific diagnosis until November 2017, therefore the free text presenting complaint field was searched using terms related to asthma and their common misspellings. This returned 677 attendances. The A&E attendances were reviewed in a random order using random numbers generated by Microsoft Excel. Scanned copies of the A&E documentation of the attendance were viewed using Windip. If, after reviewing the A&E documentation, an attendance was deemed not to be an asthma exacerbation then it was discarded and the next attendance in the sequence was reviewed. Those identified as having a diagnosis of acute asthma exacerbation were reviewed against the survey questions by a single reviewer.

Inclusion criteria

- Age 2 – 17.
- Presenting to CGH emergency department with an acute asthma exacerbation between 1 March 2017 and 28 February 2018.

Data retrieval

Some of the data fields, such date/time of attendances, incident location, age, outcome, post code and GP practice were coded and therefore retrieved automatically. Previous and following A&E attendances could be found using Windip. The remainder of the data had to be retrieved from the handwritten A&E documentation.

58 attendances with a diagnosis of asthma exacerbation from either the A&E documentation or inpatient discharge summary, if available, were identified by reviewing 341 attendances selected by random number generator from the full set. In addition, since attendances are coded by incident location, all of those with an incident location of "educational establishment" were reviewed. Three of these were identified as asthma exacerbations, of which two also belonged to the random set of 58. The attendances for other diagnoses were not analyzed and henceforth will not be discussed. The one attendance from school identified by filtering by location was used only to calculate proportion of attendances from school and was not analyzed further. The attendances

were by 54 unique participants; if any participant had multiple attendances, re-attendance data was calculated only based on their attendance with the lowest random number (**Figure 1**).

Results

Overall the admission rate for acute asthma exacerbations was 38%. Of those who were admitted, a significant minority were discharged within the space of a few hours (**Figure 2**). Mean time from presentation to discharge was 17 hours. Mean length of stay on the ward was 37 hours.

The overwhelming majority of attendances came from home (**Figure 3**). Due to the low numbers of patients attending from a location other than home, it was not possible to determine if admissions rates varied with any significance. Those arriving by ambulance had a higher admission rate (64%), compared to those arriving via private transport (30%).

94% of participants had an inhaler; one participant with asthma did not have his inhaler with him at the time of his asthma exacerbation, 18% of those attending had an inhaler, without having a documented diagnosis of asthma. 78% of those attending had a previous diagnosis of asthma (**Figure 4**). However, 67% of those who did not have a previous diagnosis of asthma were admitted, compared to only 30% of those who did (**Figure 5**). The majority of patients had no attendances for asthma/wheeze in the preceding 12 months (**Figure 6**) or following 3 months (**Figure 7**). No participants had more than two additional attendances within the 15 month range, with the exception of one participant, who had two previous attendances and two re-attendances.

Attendances and subsequent admissions were higher amongst younger participants; the median age for attendances was 6 years and for admissions was 4 years (**Figure 8**). There was a rise in attendances and admission rate between 18:00 and 00:00 each day (**Figure 9**). There were a greater number of attendances on Friday, Saturday and Sunday, however absolute numbers of admissions remained consistent throughout the week (**Figure 10**). There were fewer attendances and admissions over the summer months (**Figure 11**) (**Tables 1-10**).

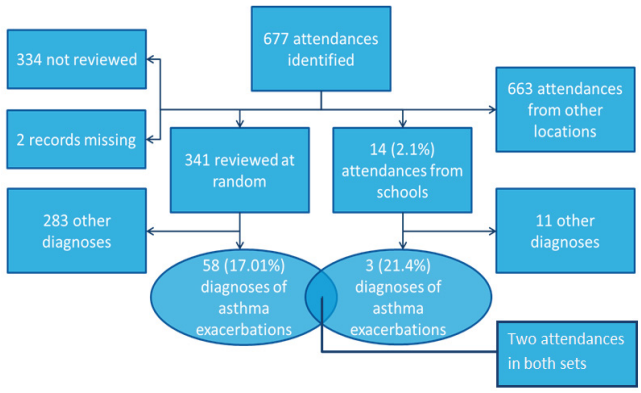

Figure 1 Participant outcomes.

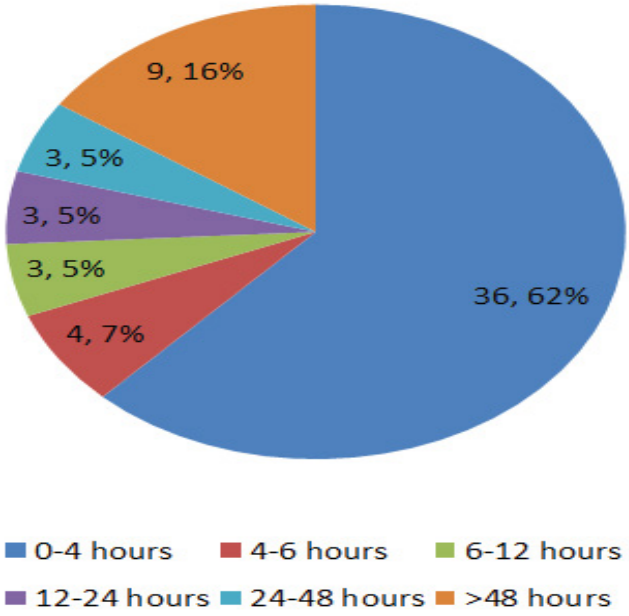

Figure 2 A & E asthma attendances by length of stay.

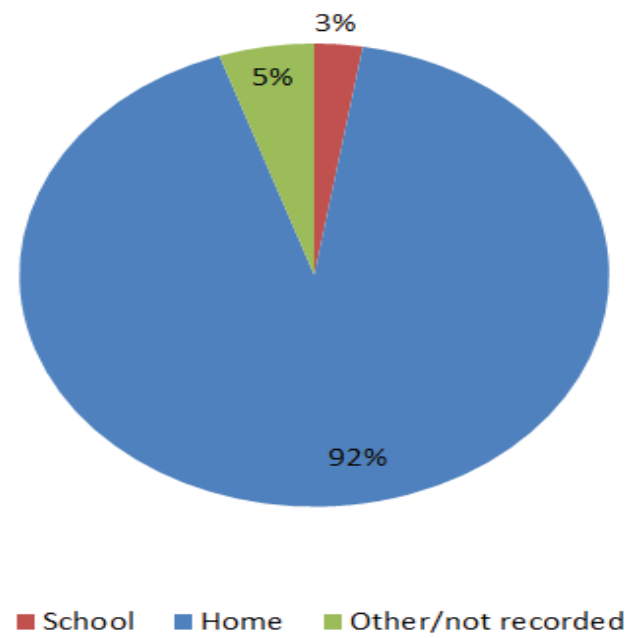

Figure 3 A & E asthma attendances by location of onset.

Discussion

The most significant limitation of this study is that the vast majority of the data is cross-sectional; the only data collected over a period of time was the re-attendance data. The data was also drawn only from one source; the ability to incorporate primary care data would have improved its usefulness, at the expense of complexity.

Several observations can be made from the data. Firstly it

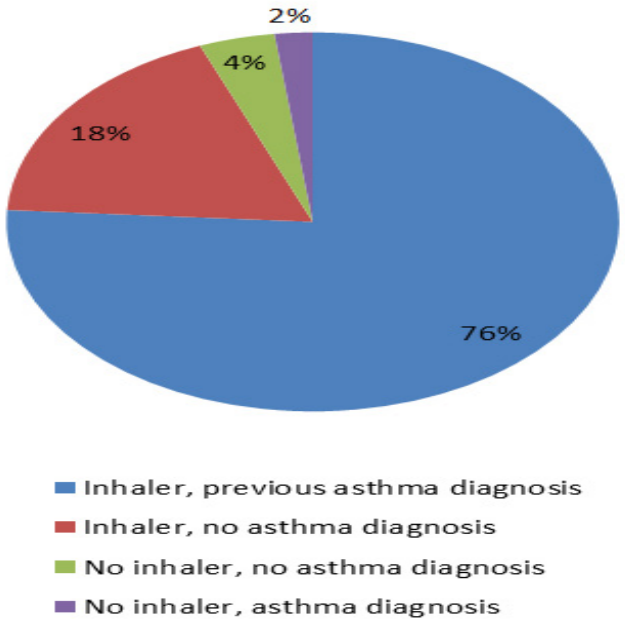

Figure 4 A & E asthma attendances by presence or absence of inhaler (unique participants only).

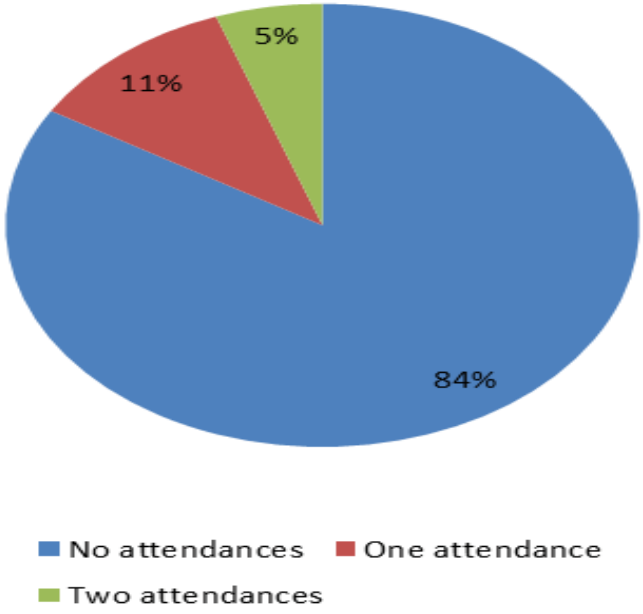

Figure 6 Number of attendances for asthma/wheeze in preceding 12 months (one attendance used per participant).

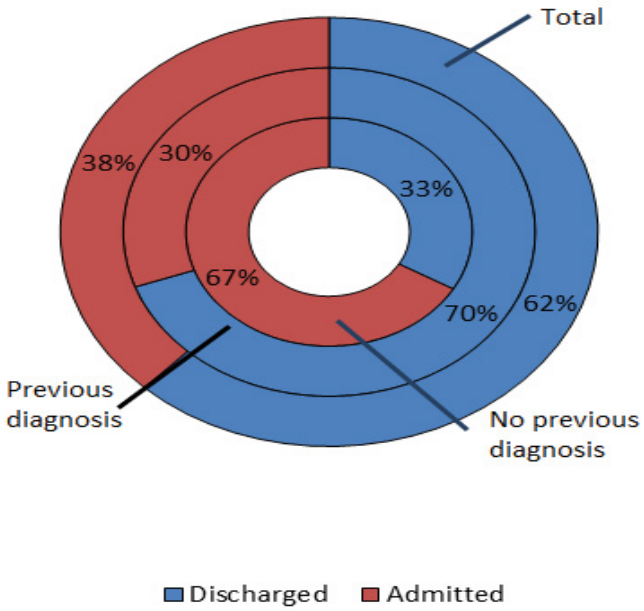

Figure 5 A & E asthma attendances by outcome.

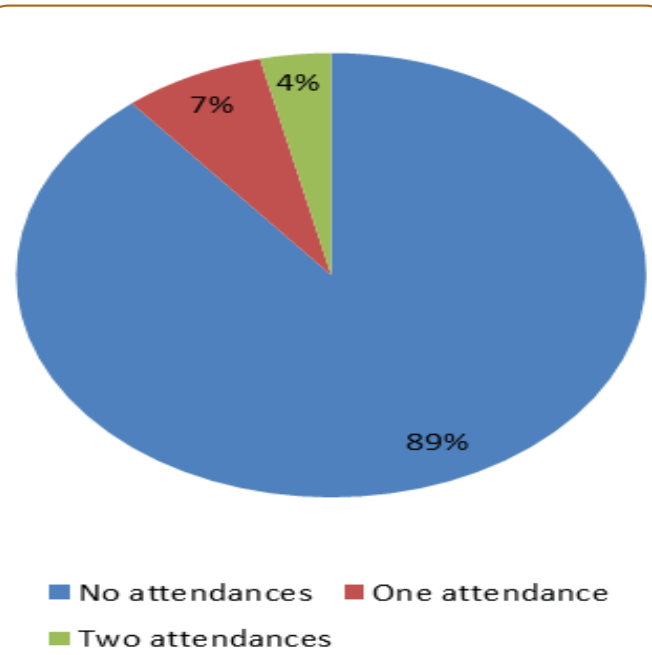

Figure 7 Number of attendances for asthma/wheeze in following 3 months (one attendance used per participant).

refutes the hypothesis that schools are associated with a disproportionately high number of attendances. This, combined with the fact that a significant proportion of participants attending are younger than school age, implies that there may be better areas to target interventions.

The significantly higher admission rate for those without a diagnosis of asthma compared to those with a diagnosis, although plausible, may have been biased due to the relative willingness of pediatricians to give a diagnosis of asthma compared to A&E staff. For example, if a patient with a past medical history of viral-induced wheeze attends A&E with acute shortness of breath, but responds well to salbutamol, they are likely to be discharged with another diagnosis of viral-induced wheeze. However if the same patient were to only partially respond and was admitted under pediatrics, they may be more likely to diagnose the episode as an acute asthma exacerbation.

The higher number of attendances over the weekend was

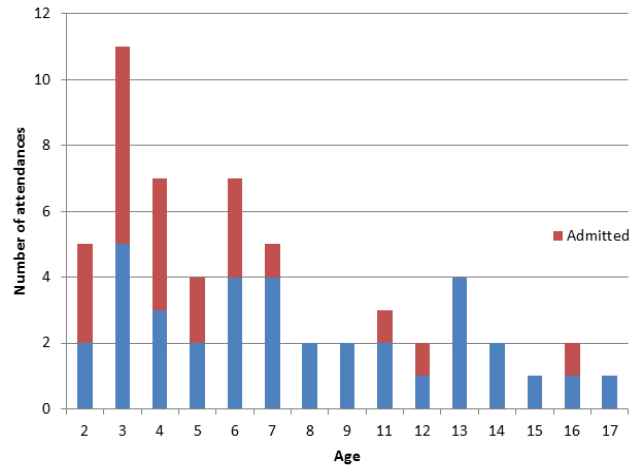

Figure 8 A & E asthma attendances by age.

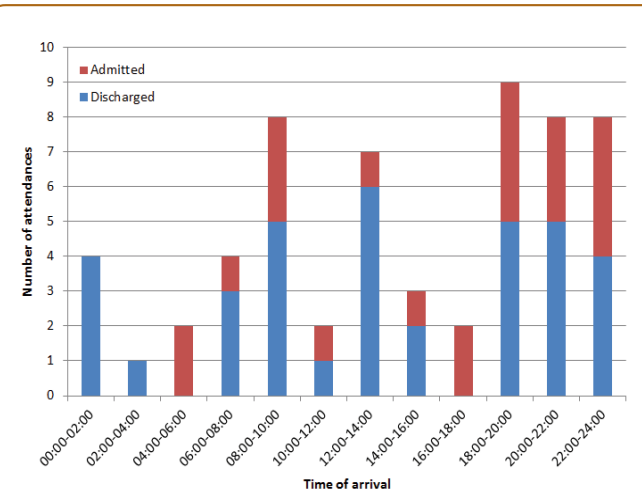

Figure 9 A & E asthma attendances by time of arrival.

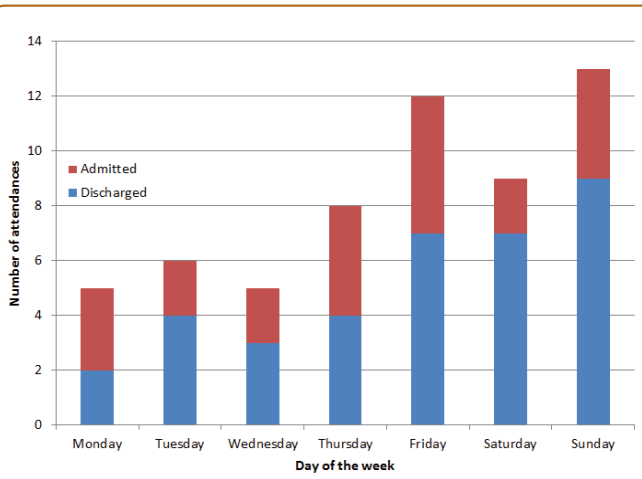

Figure 10 A & E asthma attendances by day of the week.

thought to be due to reduced access to primary care services and the increased number of attendances in the evening was

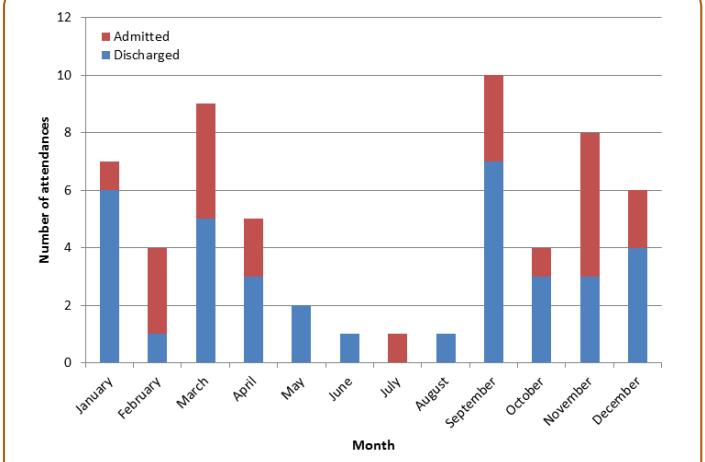

Figure 11 A & E asthma attendances by month.

Table 1 A & E asthma attendances by length of stay from A & E presentation to discharge.

Length of Stay	
0-4 hours	36
4-6 hours	4
6-12 hours	3
12-24 hours	3
24-48 hours	3
>48 hours	9
Total	58

Table 2 A & E asthma attendances by location of onset (values for school are absolute, whereas values for home or other/not recorded were multiplied by 675/341 to represent the full data set).

Location of Onset	Total	Discharged	Admitted
School	3	2	1
Home	105	67	38
Other/not recorded	6	2	4
Projected total	114	71	43

Table 3 A & E asthma attendances by presence or absence of an inhaler (unique participants only).

Inhaler	Total	Previous Asthma Diagnosis	New Asthma Diagnosis
Have inhaler	47	38	9
Do not have inhaler	3	1	2
Not recorded	4	3	1
Total	54	42	12

Table 4 A & E asthma attendances by presence or absence of a previous asthma diagnosis.

Asthma diagnosis	Total	Discharged	Admitted
Previous asthma diagnosis	46	32	14
New asthma diagnosis	12	4	8
Total	58	36	22

Table 5 Number of attendances for asthma/wheeze in the 12 months prior to A & E asthma attendance within study range (unique participants only).

Attendances in prior 12 months for asthma/wheeze	Total	Discharged	Admitted
No attendances	46	28	18
One attendance	5	5	0
Two attendances	3	1	2
Total	54		

Table 6 Number of re-attendances for asthma/wheeze in the 3 months following A & E asthma attendance within study range (unique participants only).

Attendances in following 3 months for asthma/wheeze	Total	Discharged	Admitted
No attendances	48	29	19
One attendance	4	4	0
Two attendances	2	1	1
Total	54		

Table 7 A & E asthma attendances by age.

Age	Total	Discharged	Admitted
2	5	2	3
3	11	5	6
4	7	3	4
5	4	2	2
6	7	4	3
7	5	4	1
8	2	2	0
9	2	2	0
11	3	2	1
12	2	1	1
13	4	4	0
14	2	2	0
15	1	1	0
16	2	1	1
17	1	1	0
Total	58		

Table 8 A & E asthma attendances by time of arrival.

Time of arrival	Total	Discharged	Admitted
00:00-02:00	4	4	0
02:00-04:00	1	1	0
04:00-06:00	2	0	2
06:00-08:00	4	3	1
08:00-10:00	8	5	3
10:00-12:00	2	1	1
12:00-14:00	7	6	1
14:00-16:00	3	2	1
16:00-18:00	2	0	2
18:00-20:00	9	5	4
20:00-22:00	8	5	3
22:00-24:00	8	4	4
Total	58		

thought to be due to asthma symptoms inherently worsening in the evening. Similarly, the lower number of attendances over the

Table 9 A & E asthma attendances by day of the week.

Day of the week	Total	Discharged	Admitted
Monday	5	2	3
Tuesday	6	4	2
Wednesday	5	3	2
Thursday	8	4	4
Friday	12	7	5
Saturday	9	7	2
Sunday	13	9	4
Total	58		

Table 10 A & E asthma attendances by month.

Month	Total	Discharged	Admitted
January	7	6	1
February	4	1	3
March	9	5	4
April	5	3	2
May	2	2	0
June	1	1	0
July	1	0	1
August	1	1	0
September	10	7	3
October	4	3	1
November	8	3	5
December	6	4	2
Total	58		

summer months may be due to asthma symptoms increasing in severity in colder weather. The lower number of attendances also coincides with the school summer holidays, however it is unclear that the two are connected. The relatively low numbers of re-attenders could be due to asthma exacerbations necessitating A&E attendances being inherently rare occurrences; however it could also be attributed to GPs acting in accordance with NICE guidelines, reviewing patients within two days of attendance and appropriately stepping up their management to keep them from re-attending. Further investigation would be required to determine if the latter was the case.

It was not possible to determine how many of the attendances were severe or life-threatening. Very few sets of documentation categorized the severity of exacerbation, nor had peak flow meter readings or other determinants as to the severity. The closest proxy measurement obtained was length of stay, which showed that only four attendances out of 58 led to admissions of three days or more. Interestingly, none of those four arrived via ambulance.

The most surprising statistic was that 18% of those attending had an inhaler, but did not have a documented diagnosis of asthma. This presumably means that they are known to their GPs as having episodes of wheeze, but are being prescribed salbutamol inhalers, perhaps repeatedly, but have never been given a formal diagnosis of asthma. They would therefore never have been started on preventer inhalers or have access to regular GP or specialist asthma nurse reviews. What supports this hypothesis is the fact that, while salbutamol inhaler spending is similar

between NEE and the best five CCGs, beclomethasone spending in NEE is only around 60% of the best five CCGs [2]. These figures are unfortunately not broken down by age or condition though. While reviewing the notes, it was often difficult to ascertain whether certain patients had asthma or not, as often asthma would appear and disappear from document to document pertaining to one patient. Some patients also had diagnoses of "Probable asthma" or "? Asthma". In these cases discretion had to be used. This in itself may be indicative of a larger problem however; it would seem that a significant number of patients are not sure whether or not they have asthma and therefore would not be adequately educated on how to manage asthma either acutely or long-term. On reviewing primary care prescribing in North East Essex it was found that prescribing for respiratory medication per 1000 age-matched population in those <20 years of age varies by over 12 times from GP practice to practice [12].

Conclusion

The high proportion of patients attending A&E with inhalers, but no asthma diagnosis was concerning and is indicative of delays or difficulties in converting those diagnoses of "recurrent viral-induced wheeze", or similar, to asthma and initiating full management. This is the area where there is the greatest opportunity for improvement; however it is likely due to lack of capacity in primary care. Likewise the large discrepancy in primary care respiratory prescribing was somewhat alarming, as it implies that some general practitioners are deviating significantly from guidelines. There are a number of avenues for further investigation. Firstly the study could be repeated, either retrospectively or prospectively, to observe any year-on-year variation and trends, including any increases in the number of patients with long admissions. This same study would be much easier to carry out using records after A&E diagnosis coding was implemented in November 2017. Secondly, those patients with very long attendances could have their primary care documentation analyzed to establish whether their community management had been in accordance with guidelines, as they are a small enough group that it this would likely be feasible. Thirdly, the same could be carried out for those without an asthma diagnosis who had an inhaler, to attempt to spot any missed opportunities for diagnosis. Fourthly, attempts could be made to stratify the respiratory spending figure to determine the spending for those of the population of interest.

Conflict Of Interest

No conflict of interests to declare.

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