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Seasonality of medical contacts in school-aged children with asthma: Association with school holidays

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SUMMARY

Objectives: To assess the seasonality of medical contacts in children with asthma, to compare England with Scotland, and to assess the impact of medication compliance on the frequency of medical contacts.

Study design: A retrospective study taken from the General Practice Research Database of daily medical contacts from 1999 to 2005 in a population of school-aged (5–16 years) children with a diagnosis of asthma, and age- and gender-matched controls.

Primary outcome measure: All unscheduled medical contacts. Prescription frequency for inhaled corticosteroids over the same period was also assessed.

Results: Data from 76,924 children were analyzed. There was an increase in unscheduled medical contacts for all children on return to school in September. Unscheduled medical contacts occurred almost twice as frequently in children with asthma compared with non-asthmatic children. The frequency of medical contacts in children with asthma could be predicted from the frequency of medical contacts in non-asthmatic children. In the 3 months from September to December, unscheduled medical contacts were disproportionately greater than would be predicted for children with asthma relative to non-asthmatic children in both England and Scotland. The rise in medical contacts in Scotland preceded that in England by approximately 14 days, reflecting the earlier date for returning to school. The number of prescriptions for inhaled corticosteroids decreased in August. A higher incidence of unscheduled medical contacts was noted during September in those not receiving a prescription in August.

Conclusions: Returning to school after the summer break is associated with a sharp increase in unscheduled medical contacts in school-aged children, particularly in those with asthma. This follows a decrease in the number of prescriptions for inhaled corticosteroids. It is suggested that at least part of the excess numbers of unscheduled contacts in children with asthma is because they do not maintain their inhaled corticosteroids over the summer holidays.

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Introduction

Asthma episodes and deaths are known to be seasonal.¹ A number of reports have shown peaks in asthma episodes in school-aged children associated with the return to school following the summer break.^{2–10} Most of these studies reported hospital admissions, although one study reported peaks in hospital admissions and all medical contacts.¹⁰

Children returning to school are exposed to various novel respiratory insults, including allergens and viruses, at a time of changing climatic conditions. It has previously been shown that viral infection and allergen exposure in allergen-sensitized asthmatics are associated with increased hospital admissions for acute asthma. The same study demonstrated the protective effect of inhaled corticosteroids on acute asthma exacerbations in a pediatric asthma population.¹¹

If viral challenges are the cause of the peak associated with the return to school, peaks should also be seen in school-aged children who are not asthmatic. For this reason, non-asthmatic controls (matched with children with asthma by primary care practice, age and gender) were included in the analysis. The controls were included to enable assessment of whether there is seasonal variation in medical contacts in non-asthmatic children, and if there is an excess in contacts by children with asthma compared with non-asthmatic children.

One problem is to adjust properly for weather conditions. However, whilst England and Scotland have broadly similar weather patterns, children in Scotland return to school up to 1 month earlier than children in England. This difference was exploited to examine whether the frequency of unscheduled medical contacts in children with asthma was plausibly associated with the return to school after the summer break.

The primary objective of this study was to assess whether medical contacts in primary care for asthma in school-aged children are associated with the return to school. The secondary objectives were to assess whether there is a difference in the frequency of medical contacts between children with and without asthma; and to examine possible reasons for differences, including changes in the number of prescriptions for asthma medications.

Methods

Data

Data were obtained from the General Practice Research Database (GPRD) for England and Scotland separately. The GPRD has ethical approval from the Trent Multicentre Research Ethics Committee (Rec No: 05/MRE04/87). The GPRD database is approximately a 10% sample of all GP patients in the UK. A random sample of approximately 75 000 school-aged (5–16 years) children with a documented medical diagnosis of asthma was taken from the data set from 1999 to 2005. Subsequently, data on every contact made by these patients was obtained, amounted to 10 million contacts. Age (within 2 years) and gender matched controls from the same practice were identified. The medical contacts of interest are given in [Appendix 1](#), and code lists for asthma including the READ and

OXMIS codes are given in [Appendix 2](#). Controls were patients without a recorded medical diagnosis of asthma during the study period. They could become cases if they were diagnosed with asthma during the study period. Medical contacts included ‘out of hours’ contacts, emergency department contacts, and primary care consultations excluding routine asthma reviews. Data on prescribing of inhaled corticosteroids were obtained from the same sources. These data were aggregated by month.

Statistical analysis

A linear regression analysis on the daily counts of medical contacts was performed using data from children with asthma as the dependent variable and data from non-asthmatic children as the independent variable. A set of six dummy variables was used to model the days of the week, and the residuals from this analysis were taken to represent the difference in the number of medical contacts in the children with asthma from that expected by prediction from their peers. Thus, the equation $y_t = a + bx_t$ was formulated, where y_t is the number of medical contacts on day t for the children with asthma, x_t is the number of contacts in non-asthmatic children, and a and b are the regression coefficients. Therefore, if Y_t is the number of cases predicted from the controls, the residuals are $e_t = y_t - Y_t$. The mean of the residuals is zero. As Christmas Day and New Year’s Eve show a marked drop in medical contacts, as primary care services are reduced at these times, the two leap days 29/02/2000 and 29/02/2004 were removed from the data set to ensure that Christmas Day and New Year’s Eve appear as the same day number in each year. Residuals were averaged for a particular day over the 7 years.

Average daily counts and average residuals were plotted by day for England and Scotland separately, together with a low-ess (sometimes known as ‘loess’) smoothing plot (with bandwidth 0.2).¹² This is a locally weighted smoothing curve which enables trends to be seen. The choice of 0.2 for the bandwidth is a compromise between being affected by random noise and being insensitive to medium-term trends. In addition, a correlation of the residuals over the 7 years between England and Scotland was computed for the months of August and September alone. This was computed for lags of up to 30 days with England lagging Scotland, and also for Scotland lagging England. A value of 30 days was chosen as Scottish schools return to school up to 1 month before English schools.

Three outlying days (residuals >4 standard deviations from the mean) were removed from the Scottish data. These were 4 February 2002, 27 November 2002 and 26 September 2003. These data represent primary care consultations entered on to the database retrospectively with the date of the consultation being given as the date of data entry. These data points were removed since the analysis can be sensitive to outliers. All analyses were undertaken using Stata Version 11 (Statacorp, College Station, TX, USA).

Results

In total, 76,115 school-aged children with a diagnosis of asthma, matched within the same primary care practice by age

and gender to children without a diagnosis of asthma, were included. It was not possible to find a match for a further 808 children with asthma, but they were included in the analysis for completeness as it was believed that they would not bias the results (they accounted for 1% of the number of controls).

The mean age of the children increased from 10 years in 1999 to 11 years in 2005. This was because only children under 16 years of age were included in the initial 1999 cohort, but school age was extended for subsequent years to 16.5 years as the children in the initial cohort grew older. There was a slightly higher proportion of males (56%) than females (44%) in the data set. For children with asthma, the mean age of diagnosis was 6.0 years (median 5.0 years). This was lower in boys (mean 5.6 years, median 4.8 years) compared with girls (mean 6.0 years, median 5.0 years).

The numbers of daily averaged unscheduled medical contacts for children with asthma and controls for England and Scotland between 1999 and 2005 are shown in Fig. 1. The graph starts in the middle of July so that the effect of Christmas and New Year does not appear at the ends of the graph. Three outliers are evident in the Scottish graph due to abnormal values on individual days (as discussed in Methods). Unscheduled medical contacts decreased over the summer months (July–August) in England and increased at the beginning of September. In Scotland, the increase occurred approximately 21 days earlier. The effect of Christmas and New Year is clearly apparent in both England and Scotland, with a reduction in the number of medical contacts at these times. The apparent outlying points which form curves above and below the main data for England, for both children with asthma and controls, are due to the weekday effect; i.e. when a month has more weekend days than average, the number of medical contacts will be less as primary care services are reduced at weekends. If a month has fewer weekend days than an average month, the number of medical contacts will be greater than the average. This effect is less pronounced in Scotland, in absolute terms, due to the smaller sample size.

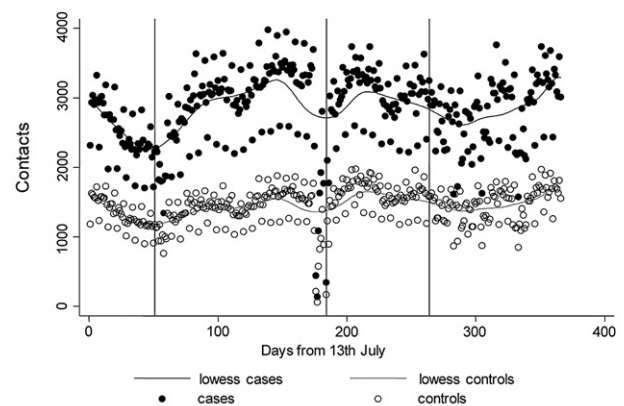
The regression coefficients for England and Scotland were 1.93 [95% confidence interval (CI) 1.92–1.95, $R^2 = 0.96$] and 1.88 (95% CI 1.85–1.91, $R^2 = 0.78$), respectively. This indicates that children with asthma are almost twice as likely to require an unscheduled medical contact than non-asthmatic children. In addition, it is possible, for most months, to predict medical contacts in children with asthma from the variation in medical contact rates for non-asthmatic children. The mean residual unscheduled medical contacts for England and Scotland are depicted in Fig. 2. These are the values over and above those that would be predicted from the controls. The regression equation is such that the overall average error is zero, i.e. the predictions are not biased. In England, the excess in unscheduled medical contacts is confined to the autumn school term from approximately 1 September to 22 December, with a peak in excess medical contacts building until October and subsiding in December. This effect is also seen, although less markedly, in Scotland. During this period, it is no longer possible, therefore, to predict medical contacts in children with asthma from the frequency of medical contacts in non-asthmatic children.

Fig. 3 shows the cross-correlation of residuals between England and Scotland restricted to the months of August and September between 1999 and 2005. For a positive lag (England

leading Scotland), the cross-correlations are small and both positive and negative, indicating no association. For a negative lag (Scotland leading England), the correlations are largely positive over the 30 days, with a peak at 14 days. Without correcting for multiple testing, a correlation of 0.05 is statistically significant at the 5% level, suggesting that most of the observed correlations with a negative lag are statistically significant. This means that the greatest concordance between England and Scotland in the excess number of medical contacts in children with asthma would be obtained if the Scottish data could be shift delayed by 14 days, which reflects an average of the return to Scottish schools relative to English schools.

The data for the number of prescriptions for inhaled corticosteroids are given in Fig. 4. These data show a trough in the prescription of inhaled corticosteroids in August followed by successive monthly increases in September, October, November and December. This observation raises the possibility that a causal relationship exists between reductions in inhaled corticosteroid use in the summer months by children with asthma, and subsequent increases in unscheduled

a England



b Scotland

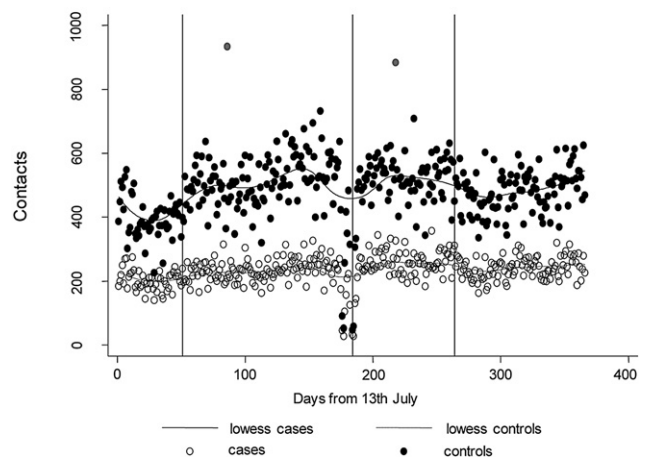


Fig. 1 – Daily unscheduled medical contacts in children with asthma and controls averaged over the years 1999–2005. The three vertical lines represent, from left to right, 1 September, 1 January and 1 April.

medical contacts following the return to school. To examine this further, the prescribing histories of all patients with an unscheduled medical contact in September were assessed. These data are shown in Table 1a (England) and Table 1b (Scotland). The data for Scotland and England are consistent except for patients receiving 13 or more prescriptions for inhaled corticosteroids per year. For patients receiving fewer than 13 prescriptions per year, there are statistically significant differences between those receiving and those not receiving a prescription in August, with a lower frequency of medical contacts (in September) in those receiving a prescription.

To summarize the data expressed in Table 1, a multiple regression analysis was conducted regressing the number of medical contacts occurring in September on the number of prescriptions received over the whole year, and on whether a prescription for inhaled corticosteroids was received in August. The number of prescriptions received by a patient predicted the number of medical contacts, i.e. those receiving a high number of prescriptions had a high number of unscheduled medical contacts. Patients who received a prescription for inhaled corticosteroids had 0.14 fewer contacts per patient (England: 95% CI 0.12–0.16, $P < 0.001$; Scotland: 95% CI 0.10–0.18, $P < 0.001$) than those who did not receive a prescription in August. To interpret the figure of 0.14 hypothetically, imagine a cohort of 200 children with asthma

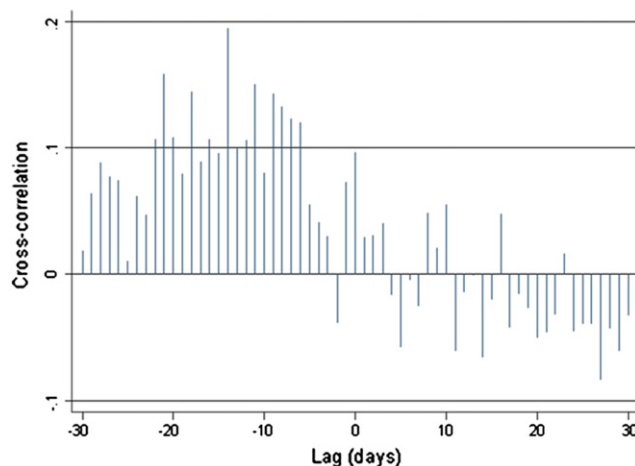
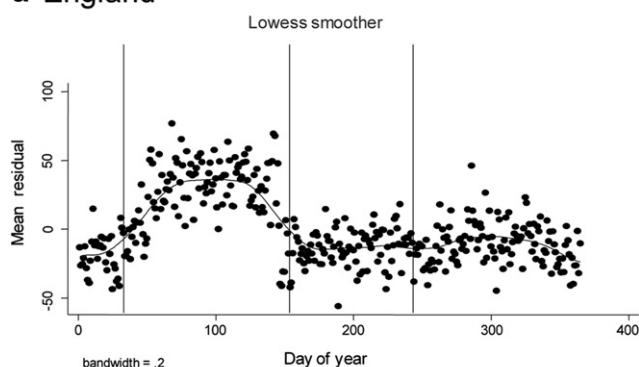


Fig. 3 – Cross-correlation of the residuals between England and Scotland for August and September.

on inhaled corticosteroids, where 100 receive a prescription in August and 100 do not. If the 100 patients with a prescription make a total of 50 unscheduled medical visits (0.5 mean visits/patient), then 64 unscheduled medical contacts would be made by those not receiving a prescription (0.64 mean visits/

a England



b Scotland

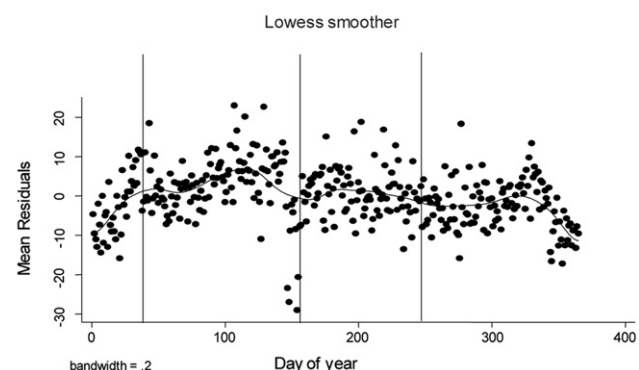
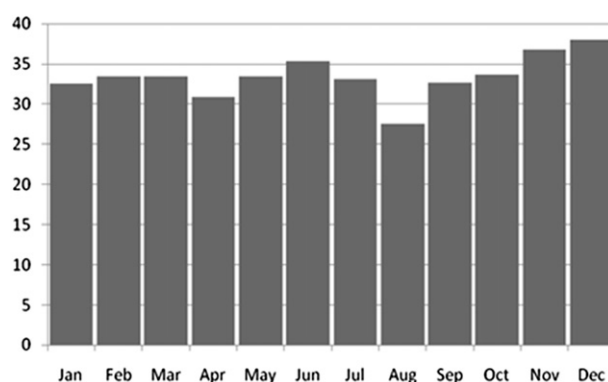


Fig. 2 – Mean residuals for excess medical contacts in children with asthma for England and Scotland between 1999 and 2005. The vertical lines represent, from left to right, 1 September, 1 January and 1 April.

a England



b Scotland

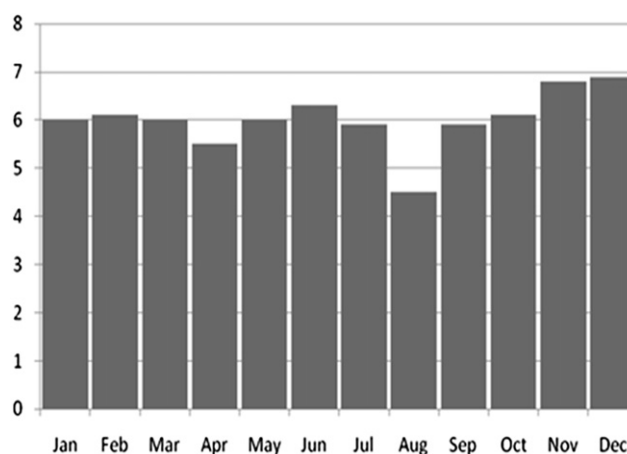


Fig. 4 – Average daily prescriptions by month for England and Scotland.

Table 1 – Comparison of the unscheduled number of medical contacts in September for patients who received or did not receive a prescription in August broken down by the number of prescriptions received per year.

No of prescriptions	Prescription in August		Difference	95% CI	P-value
	Yes	No			
	Mean (n)	Mean (n)			
(a) England					
1–4	0.11 (3108)	0.19 (23 560)	–0.08	–0.11 to –0.06	<0.001
5–8	0.27 (1727)	0.46 (2349)	–0.19	–0.023 to –0.16	<0.001
9–12	0.59 (528)	0.75 (254)	–0.17	–0.26 to –0.07	0.001
13+	0.90 (167)	0.80 (26)	0.10	–0.23 to 0.42	0.555
(b) Scotland					
1–4	0.10 (538)	0.20 (4365)	–0.09	–0.14 to –0.05	<0.001
5–8	0.28 (248)	0.47 (455)	–0.15	–0.24 to –0.06	<0.001
9–12	0.44 (90)	0.71 (45)	–0.27	–0.48 to –0.05	0.016
13+	0.88 (35)	1.40 (5)	–0.51	–1.30 to –0.28	0.190

CI, Confidence interval.

patient; difference 0.14). Hence, per 100 children with asthma on inhaled corticosteroids not receiving a prescription in August, there is an excess of 14 unscheduled medical contacts. The average GP practice has 100 school-aged children with asthma. In the study data, 21.5% of school-aged children with asthma received a prescription for steroids during the study, and 12.5% in a given year. Hence, for an average GP practice, these percentiles, 21.5 and 12.5% respectively, would equate to 3.0 or 1.5 unplanned medical contacts in September from these children alone.

Furthermore, from the data for children with asthma, 30% will have an unplanned medical contact in September following their return to school in September; they are twice as likely to have an unplanned medical contact compared with a non-asthmatic school-aged child. Thus, even for non-steroid-treated children with asthma, their medication use may become low during the summer holidays, which may affect their ability to control their asthma upon returning to school, which may account for more unplanned medical contacts.

Discussion

Although there is robust and well-documented evidence that the return from the summer break is associated with increased morbidity in children with asthma,¹³ identifying the plethora of causally related factors is complex. It is likely that the diverse and ‘novel’ microbiological environment into which children return is relevant. Studies also suggest that the presence of allergen exposure in allergen-sensitive individuals is also involved.¹¹ These same studies, in addition to several other treatment intervention studies,¹⁴ implicate the use of inhaled corticosteroids as protective in terms of asthma exacerbation. Regular use of inhaled corticosteroids over 12 months has been associated with a stable asthma cohort (compared with those admitted to hospital with acute asthma), and hospital admissions for acute asthma were reduced significantly in patients using inhaled corticosteroids regularly.¹¹ Covar *et al.* used regression modeling to demonstrate the superiority of inhaled corticosteroids over montelukast (leukotriene receptor antagonist) in modifying the risk of exacerbation in pediatric patients with asthma.¹⁴

The present study, in a very large cohort of patients and controls, confirms the increase in unscheduled medical contacts in children with asthma throughout the year, with an approximate doubling in medical contacts compared with non-asthmatic children. Regression analysis shows that children with asthma are approximately twice as likely as controls to have unscheduled medical contacts. If children with asthma were at a constant increased risk of medical contacts throughout the year, Fig. 2 would show a random scatter of the residuals. However, there is a pronounced positive increase in the value of residuals around the time of returning to school. This indicates that there is a greater than expected increase in the number of medical contacts by children with asthma compared with non-asthmatic children at this time. Previous evidence suggests a link between asthma exacerbation and viral challenge. Johnston *et al.*,¹³ in a study of 157 controls (children either without asthma or with asthma not requiring admission to hospital) and 57 cases (children with asthma presenting to hospital for emergency treatment), found high levels of viral particles in 41% of controls and 62% of cases. However, although the observed increase in medical contacts in non-asthmatic children in the present study would support the viral causation theory, at least in part, the regression analysis indicates that additional factors are driving the deterioration of symptoms in children with asthma on their return to school.

This study also demonstrates the ability to predict the number of unscheduled medical contacts in children with asthma from the frequency of contacts in non-asthmatic children. This may be relevant in strategic planning of primary and secondary care services. A peak in medical contacts for children with asthma was seen between September and December that was greater than would be expected based on the prediction model described. Using the natural experiment of Scottish schools commencing the autumn term 14–21 days earlier than English schools, it was possible to demonstrate the peak in medical contacts occurring in Scotland between 14 and 21 days earlier than the peak seen in England.

Although a reduction in the number of prescriptions for inhaled corticosteroids in late summer in children with asthma has been reported previously,¹³ we believe that this is

the first study to present statistically robust data in a large cohort to demonstrate an association between low collection of prescriptions and increased requirement for non-elective medical contacts in this group of patients. It is postulated that July and August are periods of reduced viral exposure (due to better weather and reduced contact with other children because of the school holidays) and reduced pollen (antigen) exposure for children with asthma. It is possible that during these periods of good symptom control, patients may 'step down' or discontinue protective medications such as inhaled corticosteroids. This study has shown that, in patients receiving fewer than 13 prescriptions for inhaled corticosteroids per year, failure to receive a prescription in August is associated with a statistically relevant increase in the likelihood of an unscheduled medical visit during September. This result is consistent for both England and Scotland. An association was found between the total number of prescriptions received and the total number of unscheduled medical contacts. We suggest that this is a biologically plausible association, in that those receiving and requiring higher doses of medication are likely to represent those with more severe disease and less good asthma control. Further analysis of these data shows that there is a significant reduction in unscheduled medical contacts in September in those who received a prescription in August compared with those who did not receive a prescription in August. Again, the data are consistent for both Scotland and England.

This study has two unique strengths. Firstly, the use of a matched control population of substantial size can allow for factors that would cause medical contacts in all children (e.g. viruses). This allowance does not detract from a causal relationship between these factors and asthma exacerbations, but indicates a possible requirement for additional factors, specific to children with asthma, that would drive the increase in medical contacts over that which would be anticipated. Secondly, the data are replicated in both England and Scotland with an appropriate lag time related to different term commencement dates.

This study has shown that the excess number of medical contacts in children with asthma occurs at the start of the autumn term. There are a number of factors that occur at this time. However, the fact that schools in Scotland start earlier than those in England has been used to show that this excess in medical contacts also starts earlier in Scotland than in England. In addition, the number of prescriptions for inhaled corticosteroids has been shown to decrease in the summer, and the failure to receive a prescription in August has been shown to be associated with a higher chance of an unscheduled medical contact in September. It is possible that children stop taking or reduce their use of inhaled corticosteroids over the summer months, and fail to restart them before the return to school, rendering them more vulnerable to acute asthma exacerbation. The data available, however, are not sufficiently robust to indicate the number of inhalers prescribed on each prescription, and it is possible that GPs may batch asthma medication in June or July to last patients over the summer holidays, especially if patients are holidaying away from home. In such a circumstance, one would expect a peak of prescriptions in June or July, which was not observed. In addition, the issuing and collection of a prescription does not

relate linearly to utilization of medication by an individual. The data set cannot categorically determine whether or not patients are definitely using their inhaled therapy; simply that less medication is being dispensed in August than during any other month of the year.

In conclusion, therefore, this study clearly demonstrated an increase in unscheduled medical contacts in all children returning to school after the summer break. Regression analysis showed a disproportionate increase in medical contacts in children with asthma on their return to school, that is temporally related to a reduction in prescriptions for inhaled corticosteroids. Therefore, it is recommended that children with asthma should be encouraged to continue to take their inhaled medication throughout the summer months, even during periods of apparent well-being or good symptom control. Particular attention should be paid by primary care physicians and asthma management teams to the weeks preceding the commencement of the autumn term, encouraging children to medicate themselves appropriately, with a view to reducing asthma morbidity in the early autumn.

Acknowledgements

Ethical approval

The GPRD has approval for the provision of anonymized data for use in observation public health research (REC No. 05/MRE04/87).

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Competing interests

None declared.

REFERENCES

1. Campbell MJ, Holgate ST, Johnston SL. Seasonality of asthma deaths. *Br Med J* 1997;**315**:1012.
2. Storr J, Lenney W. School holidays and admissions with asthma. *Arch Dis Child* 1989;**64**:103–7.
3. Grech V, Balzan M, Distefano S. Paediatric wheezy admissions at and around school holiday periods. *Malta Med J* 2004;**16**: 23–6.
4. Kimes D, Levine E, Timmins S, Weiss SR. Temporal dynamics of emergency and hospital admissions of pediatric asthmatics. *Environ Res* 2004;**94**:7–17.
5. Kimbell-Dunn M, Pearce N, Beasley R. Seasonal variation in asthma hospitalizations and deaths in New Zealand. *Respirology* 2000;**5**:241–6.
6. Gergen PJ, Mitchel H, Lynn H. Understanding seasonal pattern of childhood asthma: results from the National Cooperative Inner City Asthma Study (NCICAS). *J Pediatr* 2002; **141**:631–6.
7. Harju T, Keistinen T, Tuuponen T, Kivela SL. Seasonal variation in childhood asthma hospitalisations in Finland, 1972–1992. *Eur J Pediatr* 1997;**156**:436–9.
8. Julious SA, Jiwa M, Osman L. Hospital asthma admissions in school age asthmatics associated with the return back to school. *Public Health* 2007;**121**:482–4.

9. Sliverman RA, Stevenson L, Hastings HM. Age-related seasonal patterns of emergency department visits for acute asthma in an urban environment. *Ann Emerg Med* 2003;**42**: 577–87.
10. Fleming DM, Cross KW, Sunderland R, Ross AM. Comparison of seasonal patterns of asthma identified in general practitioner episodes, hospital admission and deaths. *Thorax* 2000;**55**:662–5.
11. Murray CS, Poletti G, Keadze T, Morris J, Woodcock A, Johnston SL, et al. Study of modifiable risk factors for asthma exacerbations: virus infection and allergen exposure increase the risk of asthma hospital admissions in children. *Thorax* 2006;**61**:376–82.
12. Cleveland WS, Devlin SJ. Locally-weighted regression: an approach to regression analysis by local fitting. *J Am Stat Assoc* 1988;**83**:596–610.
13. Johnston NW, Johnston SL, Duncan JM, Duncan JM, Greenea JM, Keadze T, et al. The September epidemic of asthma exacerbations in children: a search for etiology. *J Allergy Clin Immunol* 2005;**115**:132–8.
14. Covar RA, Szefer SJ, Zeiger RS, Sorkness CA, Moss M, Mauger DT, et al. Factors associated with asthma exacerbations during a long-term clinical trial of controller medications in children. *J Allergy Clin Immunol* 2008;**122**: 741–7.

Appendix 1. List of medical contacts of interest

Clinic

Night visit, deputizing service
 Night visit, local rota
 Night visit, practice
 Out of hours, practice
 Out of hours, non-practice
 Surgery consultation
 Telephone call from a patient
 Acute visit
 Other
 Emergency consultation
 Casualty attendance
 Telephone call to a patient

Appendix 2. Code lists for asthma

202172 599 2 OXMIS 493 CL ASTHMA MEDICATION
 REGULARLY
 204183 427 0 READ 663N100 Asthma disturbs sleep weekly
 204184 1986 0 READ 663f.00 Asthma never restricts exercise
 210535 228 14 OXMIS L493OLO LATE ONSET ASTHMA
 211152 128 0 OXMIS 493 CK ASTHMA MEDICATION PRN
 213217 4268 8 READ 663N.00 Asthma disturbing sleep
 213218 335 0 READ 663N000 Asthma causing night waking
 213219 2682 2 READ 663P.00 Asthma limiting activities
 213220 4132 0 READ 663W.00 Asthma prophylactic medication
 used
 213221 2059 1 READ 663e000 Asthma sometimes restricts
 exercise
 216144 3068 108 READ H331.11 Late onset asthma
 216145 9166 168 READ H33z.00 Asthma unspecified
 216156 16 0 READ H47y000 Detergent asthma
 220242 1342 5 OXMIS 493 AE ASTHMA SEASONAL

222256 5759 0 READ 663h.00 Asthma - currently dormant
 222257 4247 3 READ 663j.00 Asthma - currently active
 225248 116 2 READ H330100 Extrinsic asthma with status
 asthmaticus
 225249 35 0 READ H331000 Intrinsic asthma without status
 asthmaticus
 225250 24 0 READ H33zz12 Allergic asthma NEC
 234378 1304 3 READ H330.13 Hay fever with asthma
 234378 1304 3 READ H330.13 Hay fever with asthma
 234379 947 120 READ H33z000 Status asthmaticus NOS
 234380 1061 4 READ H33zz11 Exercise induced asthma
 238257 362 3 OXMIS 493 GS ASTHMA POLLEN INITIATED
 240350 1339 0 READ 663e.00 Asthma restricts exercise
 240351 225 0 READ 663e100 Asthma severely restricts exercise
 243390 16822 367 READ H33.11 Bronchial asthma
 243391 39 0 READ H331100 Intrinsic asthma with status
 asthmaticus
 243392 92 3 READ H331111 Intrinsic asthma with asthma
 attack
 243393 33800 1380 READ H33z100 Asthma attack
 243394 2 0 READ H35y700 Wood asthma
 249550 775 0 READ 663N200 Asthma disturbs sleep frequently
 249551 9988 1 READ 663O.00 Asthma not disturbing sleep
 252517 1078 3 READ H330.14 Pollen asthma
 252518 343 2 READ H33z200 Late-onset asthma
 256651 311 3 OXMIS 493 CJ ASTHMA MEDICATION
 INTERMITTENTLY
 256652 318 16 OXMIS 493 JC CHRONIC ASTHMA
 258757 8641 0 READ 663Q.00 Asthma not limiting activities
 261748 3045 6 READ H330.00 Extrinsic (atopic) asthma
 261749 7438 79 READ H330.12 Childhood asthma
 261750 56 1 READ H331z00 Intrinsic asthma NOS
 261751 8457 563 READ H33z011 Severe asthma attack
 265869 223 3 OXMIS 493 BG ASTHMA FREQUENCY REGULARLY
 267062 13469 50 READ 173A.00 Exercise induced asthma
 268000 1955 5 READ 663V000 Occasional asthma
 271042 1405526 8265 READ H33.00 Asthma
 271043 1837 1 READ H330011 Hay fever with asthma
 271043 1837 1 READ H330011 Hay fever with asthma
 271044 116 1 READ H330z00 Extrinsic asthma NOS
 271045 179 2 READ H332.00 Mixed asthma
 271046 17481 14 READ H33zz00 Asthma NOS
 275019 36 1 OXMIS 493 HT INTRINSIC ASTHMA
 277041 685 0 READ 663O000 Asthma never disturbs sleep
 277043 50129 1 READ 663V.00 Asthma severity
 277044 4106 5 READ 663V100 Mild asthma
 277045 3307 1 READ 663V200 Moderate asthma
 280087 1130 19 READ H312000 Chronic asthmatic bronchitis
 280092 754 13 READ H330111 Extrinsic asthma with asthma
 attack
 284119 49 0 OXMIS 493 BI ASTHMA FREQUENCY ON EXERCISE
 ONLY
 286207 264 2 READ 663d.00 Emergency asthma admission
 since last appointment
 287656 6328 679 READ 8H2P.00 Emergency admission,
 asthma
 289196 4198 56 READ H330.11 Allergic asthma
 289197 77071 1144 READ H333.00 Acute exacerbation of
 asthma
 289198 415 10 READ H33z111 Asthma attack NOS

295370 45457 2 READ 663U.00 Asthma management plan given	306888 160 27 OXMIS 691 TM ECZEMA WITH ASTHMA
295371 687 21 READ 663V300 Severe asthma	308638 30 0 READ h33z100 Asthma attack
298479 160 1 READ H330000 Extrinsic asthma without status asthmaticus	309475 5319 0 READ 663n.00 Asthma treatment compliance satisfactory
298480 831 4 READ H331.00 Intrinsic asthma	309585 1162 0 READ 663p.00 Asthma treatment compliance unsatisfactory
303974 899277 25357 OXMIS 493 ASTHMA	309607 1882 0 READ 663v.00 Asthma causes daytime symptoms most days
303975 25036 2634 OXMIS 493 AA ASTHMA ACUTE	309610 192 1 READ 663y.00 Number of asthma exacerbations in past year
303976 14023 3589 OXMIS 493 AB ASTHMA ATTACK	310118 4424 1 READ 663q.00 Asthma daytime symptoms
303977 495 6 OXMIS 493 AD ASTHMA OCCASIONAL	331603 71 0 READ 663m.00 Asthma accident and emergency attendance since last visit
303978 177 7 OXMIS 493 BH ASTHMA FREQUENCY CONSTANTLY	331626 443 0 READ 663r.00 Asthma causes night symptoms 1 to 2 times per month
303979 14670 467 OXMIS 493 BR BRONCHIAL ASTHMA	331714 165 0 READ 66YC.00 Absent from work or school due to asthma
303981 407 9 OXMIS 493 CH CHILDHOOD ASTHMA	331790 3560 0 READ 663s.00 Asthma never causes daytime symptoms
303982 1164 289 OXMIS 493 D STATUS ASTHMATICUS	331791 979 0 READ 663t.00 Asthma causes daytime symptoms 1 to 2 times per month
303983 2136 25 OXMIS 493 EB ASTHMA EXERCISE INDUCED	331792 1176 0 READ 663u.00 Asthma causes daytime symptoms 1 to 2 times per week
303984 1265 74 OXMIS 493 F ASTHMATIC ALLERGY	336015 82 0 READ 663x.00 Asthma limits walking on the flat
303985 1028 6 OXMIS 493 GR ASTHMA ALLERGIC GRASS	336059 246 0 READ 663w.00 Asthma limits walking up hills or stairs
303986 102 3 OXMIS 493 HR ASTHMA HIGH RISK	339880 1017 5 READ 1O2.00 Asthma confirmed
303987 7011 723 OXMIS 493 KA EXACERBATION OF ASTHMA	340378 1054 0 READ 66YP.00 Asthma night-time symptoms
303988 21261 1006 OXMIS 493 KB ASTHMA EXACERBATION	340949 2598 3 READ 178.00 Asthma trigger
303989 523 6 OXMIS 493 NA NOCTURNAL ASTHMA	341590 12 1 READ 1780.00 Aspirin induced asthma
306531 653 132 OXMIS 493 AH ASTHMA HOSPITALIZED	344837 51 5 READ 8HTT.00 Referral to asthma clinic
306532 649 7 OXMIS 493 AI ASTHMA SEVERITY MILD	345151 36 1 READ H334.00 Brittle asthma
306533 555 9 OXMIS 493 AJ ASTHMA SEVERITY MODERATE	
306534 385 35 OXMIS 493 AK ASTHMA SEVERITY SEVERE	
306536 666 21 OXMIS 493 BD ASTHMA AND BRONCHITIS	
306537 150 0 OXMIS 493 BF ASTHMA FREQUENCY RARELY	
306538 1133 1 OXMIS 493 CM ASTHMA MEDICATION PROPHYLACTICLY	
306539 446 3 OXMIS 493 EA ASTHMA EXERCISE INCLUDED	
306540 821 9 OXMIS 493 EP ASTHMA EPISODIC	