

The impact of thunderstorm asthma on emergency department attendances across London during July 2013

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ABSTRACT

Background This study illustrates the potential of using emergency department attendance data, routinely accessed as part of a national syndromic surveillance system, to monitor the impact of thunderstorm asthma.

Methods The Emergency Department Syndromic Surveillance System (EDSSS) routinely monitors anonymised attendance data on a daily basis across a sentinel network of 35 emergency departments.

Attendance data for asthma, wheeze and difficulty breathing are analysed on a daily basis.

Results A statistically significant spike in asthma attendances in two EDSSS emergency departments in London was detected on 23 July 2013, coinciding with a series of large violent thunderstorms across southern England. There was also an increase in the reported severity of these attendances.

Conclusions This preliminary report illustrates the potential of the EDSSS to monitor the impact of thunderstorms on emergency department asthma attendances. Further work will focus on how this system can be used to quantify the impact on emergency departments, thus potentially improving resource planning and also adding to the thunderstorm asthma evidence-base.

INTRODUCTION

There have been a small number of reports of localised epidemics of asthma associated with the occurrence of thunderstorms. These epidemics are often characterised by a sudden increase in patients presenting to EDs or general practitioner (GP) services with exacerbations of asthma.^{1–5} The majority of these reports have been based on retrospective analyses of data; previously there have been no mechanisms available in the UK to monitor the impact of thunderstorms on public health in real-time or on a wide geographic level.

The Emergency Department Syndromic Surveillance System (EDSSS) is a national sentinel surveillance system, developed to meet enhanced surveillance needs during the London 2012 Olympic and Paralympic Games, and now continuing as a long-term national public health legacy of the Games.⁶ The EDSSS monitors anonymised emergency department attendance data on a near real-time basis for public health surveillance purposes, requiring no extra input from emergency department staff. Emergency department syndromic surveillance forms part of the Public Health England (PHE) syndromic surveillance service, which includes data feeds from other nationwide

systems (a telephone health advice line service, a GP network and a GP out-of-hours service).⁷ This service routinely monitors the emergence and spread of common infectious diseases including influenza and norovirus, and the public health impact of non-infectious events (eg, heat waves, potential chemical, biological, radiological, nuclear, and explosive incidents), in the community, in near real-time.⁸

In this paper, we report an increase in emergency department asthma attendances across London on 23 July 2013 and the potential link to the occurrence of large thunderstorms within the area at this time.

METHODS

The EDSSS has been previously described⁶; in summary, anonymised attendance data are extracted automatically on a daily basis from a network of 35 emergency departments across England and Northern Ireland. Data are securely transferred to PHE where they are analysed and grouped into syndromic indicators, which are based upon the diagnosis code entered into the patient record by the emergency medicine clinician. Surveillance data are monitored on a daily basis to identify trends in attendances.⁷ A statistical algorithm is also employed to detect unusual patterns in activity; a Shewhart range chart is used to detect recent increases in activity, using a baseline based on the previous 2 weeks' activity. Statistical signals are generated at emergency department-level alongside a combined signal for all emergency departments in the EDSSS.

Lightning strike plots were provided by the Met Office and used as a measure to determine thunderstorm activity.⁹

RESULTS

Meteorological conditions

Lightning strike plots demonstrated numerous lightning strikes on 23 July 2013 between 4:00–5:00, concentrated over an area of the West Midlands (Gloucestershire and Worcestershire) and scattered over the Greater London and the South-East regions (figure 1A). There were several thunderstorms throughout the morning until 13:00. During the evening of 23 July 2013, there were numerous lightning strikes, especially concentrated over an area of the East Midlands between 18:00 and 19:00 (figure 1B).

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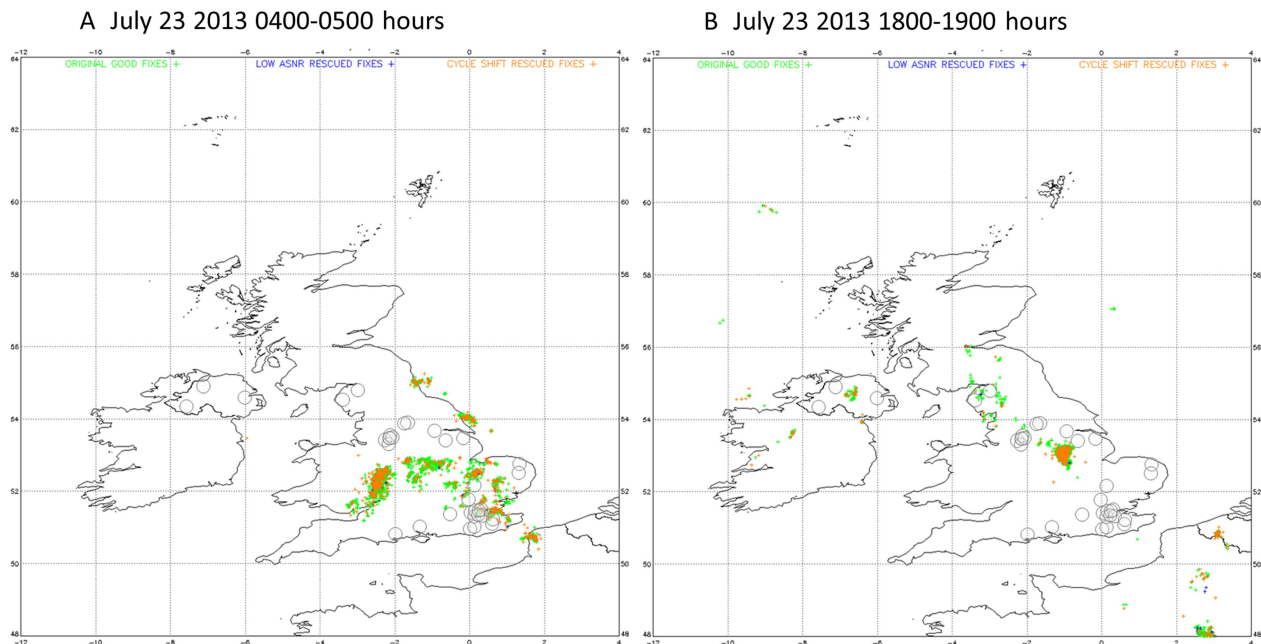


Figure 1 Lightning strikes across the UK: (A) 23 July 2013 from 4:00 to 5:00; lightning strikes were concentrated over an area of the West Midlands (Gloucestershire and Worcestershire) and scattered over London and the South-East: (B) 23 July 18:00–19:00; lightning strikes were concentrated over an area of the East Midlands. The approximate location of each participating EDSSS site is marked by a grey circle.

Emergency department attendances

The total number of EDSSS attendances remained within expected levels on 23 July 2013 (figure 2); however, a statistically significant increase in ‘asthma/whoeeze/difficulty breathing’ attendances in London was detected in several London EDSSS emergency departments on 23 July, peaking at a total of 40 attendances (figure 3). When this indicator was further refined to include ‘asthma’ attendances only, a statistically significant spike was still observed, peaking at 24 attendances. The age of the asthma attendees on the 23 July were predominantly in the 15–44 years age group. This age group routinely forms the largest group of patients in total emergency department attendances.⁶

The EDSSS triage severity ratio monitors the proportion of ‘severe’ to ‘non-severe’ triage scores and thus identifies possible increases in the severity of attendances.⁶ On 23 July, the number of urgent asthma triage presentations and the triage severity ratio for asthma attendances increased, a likely indication that patients were presenting to the emergency department with more severe asthma symptoms compared with other days.

Asthma attendances in London over the period 11–24 July were plotted by hourly cumulative attendance per day. Each day had a slightly different pattern of cumulative attendance over the 24 h period; however, Tuesday, 23 July, demonstrated a sharp increase in asthma attendances between 7:00 and 8:59 (figure 4), shortly after the peak of lightning strike activity in

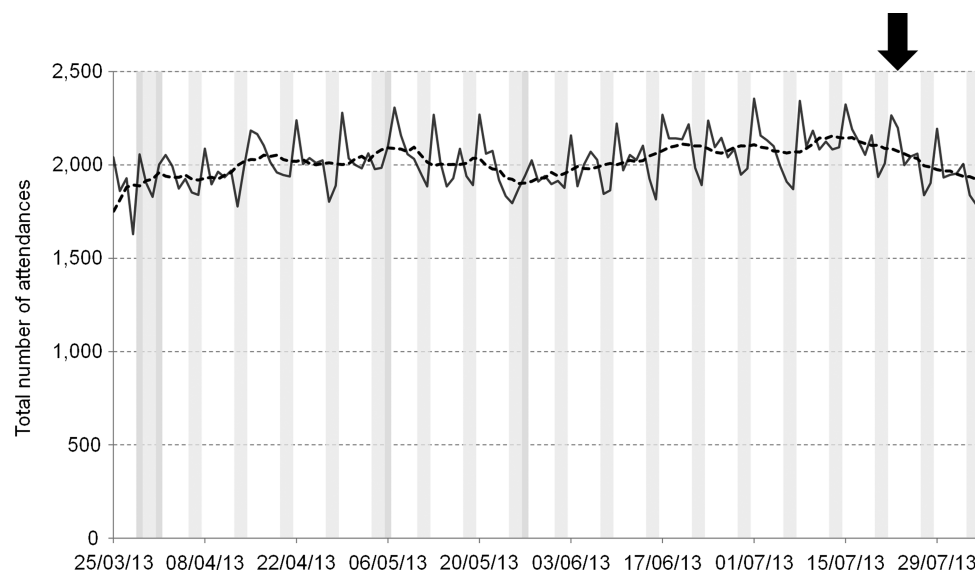


Figure 2 Daily number of EDSSS total attendances across London emergency departments 25 April 2013 to 4 August 2013. Arrow illustrates the day of the thunderstorms.

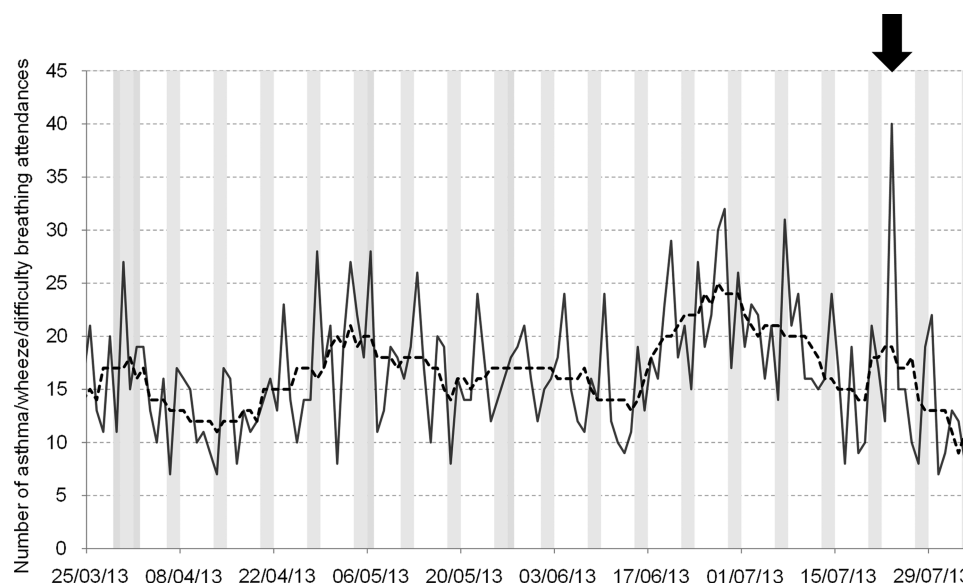


Figure 3 Daily number of EDSSS attendances included within the 'asthma/wheeze/difficulty breathing' syndromic surveillance indicator (includes those EDs able to report diagnosis ICD10 and SnoMed coding). Arrow illustrates the day of the thunderstorms.

Greater London, SE England and the West Midlands. Cumulative attendances continued to increase over the day.

DISCUSSION

The impact of thunderstorm asthma on healthcare services, including emergency department attendances and GP consultations has been previously documented, albeit on a very limited frequency in the UK.²⁻⁵ These studies often use retrospective analysis after the event; however, we present here attendance data collected prospectively as part of a routine near real-time national syndromic surveillance system. The EDSSS detected a spike in asthma attendances in London on 23 July 2013, shortly after thunderstorm activity in this region. These data illustrate that the EDSSS asthma indicator was sufficiently sensitive to detect a sudden increase in asthma attendances across several emergency departments in London during a period of thunderstorm activity.

The advantage of the EDSSS is that the impact of thunderstorm asthma can be detected in near real-time across any geographic region where an EDSSS emergency department is reporting, potentially allowing better public health alerting of the impact of these incidents. The EDSSS is a sentinel system, with 35 emergency departments recruited and located across England and Northern Ireland. However, there are currently areas of England where no emergency departments are recruited to the EDSSS, for example, the Midlands, which explains the lack of EDSSS asthma attendances in parts of the country where thunderstorm activity was also recorded.

We plan to further analyse these preliminary findings to determine whether any other meteorological or environmental factors might have contributed to the increase in asthma attendances (eg, humidity, pollen or fungal spores), which will further add to the existing evidence-base for thunderstorm asthma.¹ We are currently piloting the use of ambulance

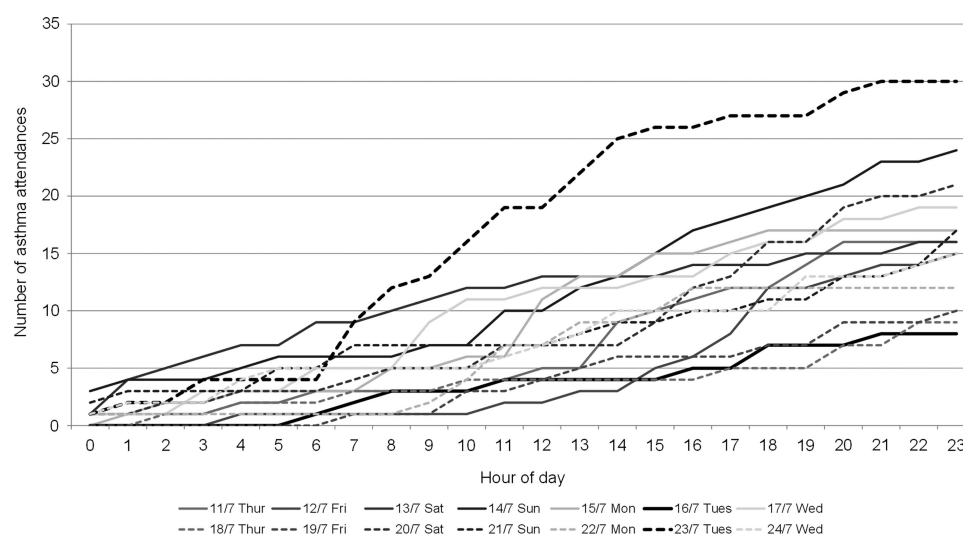


Figure 4 Number of EDSSS asthma attendances by hour of arrival across London from 11 July 2013 to 24 July 2013 illustrating the sharp increase on Tuesday, 23 July 2013 (corresponding with the thunderstorm activity).

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dispatch data for syndromic surveillance, and this will provide further evidence of the health impact of this event if similar spikes in asthma dispatches are observed. We also plan to assess the potential to develop tools to improve situational awareness within the emergency department, for example, providing SMS alerts during incidents to clinicians to aid planning within the National Health Service to cope with these sudden unexpected increases in severe asthma attendances associated with thunderstorms events. Advances in meteorological forecasting have improved the ability to predict severe thunderstorms. Documenting these events, as reported here, can increase awareness of the possible impact within emergency medicine, thus potentially facilitating more effective resource management within the emergency department (eg, increased pharmacy stocking of inhalers during the hayfever season and lowering the threshold for prescribing steroids for exacerbations of asthma if thunderstorms are predicted).

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Contributors AJE designed the study and drafted the original manuscript. HEH and AJE undertook the data analysis and CS provided meteorological data maps. All authors contributed to drafting and have seen and approved the final version of the manuscript.

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Competing interests None.

Provenance and peer review Not commissioned; externally peer reviewed.

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