Public health action and mass chemoprophylaxis in response to a small meningococcal infection outbreak at a nursery in the West Midlands, England

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Abstract

Background: Meningococcal infection is fatal in 10% of cases, and age-specific attack rates are highest in infancy. A nursery outbreak was declared just before a bank holiday weekend in August 2010, when two children attending the same nursery were confirmed to have meningococcal infection. Although such outbreaks are rare, they generate considerable public alarm and are challenging to manage and control. This report describes the investigation and public health response to the outbreak.

Results: Both cases had relatively mild disease and were confirmed as having serogroup B infection. Chemoprophylaxis and advice were given to most of the 146 children and 30 staff at the nursery. Within 28 hours of declaring the outbreak, over 95% of parents received information, advice and prescriptions for their children. GPs were also given information and the after-hours service provided continuity over the weekend. No further cases were identified and the outbreak was closed four weeks after being declared.

Conclusions: Considerable logistical challenges were involved in providing timely advice and chemoprophylaxis to the entire nursery and staff one day before a bank holiday weekend. The speed of the public health response and implementation of preventive measures was crucial in providing assurance to parents and staff, and reducing their anxiety. The decision to provide on-site prescribing at the nursery (coupled with information sessions and individual counselling) proved to be a key implementation-success factor. Effective coordination and management by the outbreak control team was able to rapidly provide leadership, delegate tasks, identify gaps, allocate resources and ensure a proactive media response. A number of useful lessons were learnt and recommendations were made for future local practice.

INTRODUCTION

Meningococcal infection is caused by the bacterium *Neisseria meningitidis* and invasive disease may present as meningitis, septicaemia or a combination of both.[1] Most cases are caused by serogroup B or C strains, with a marked reduction in serogroup C cases resulting from the introduction of the meningococcal C conjugate vaccination programme. Annual rates of invasive disease in the UK vary between two and six per 100,000 (highest rates in the winter months), with case fatality rates of 10%. Age-specific attack rates are highest in infancy, declining in childhood, with a secondary rise in young adults.[2,3]

On 26th August 2010, a nursery outbreak was declared when two children attending the same nursery in the West Midlands, England were confirmed as having serogroup B meningococcal infection. This report describes the investigation and public health response to the outbreak.

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Box 1: Case definition

Confirmed case

Clinical diagnosis of meningitis, septicaemia or other invasive disease AND at least one of:

- *Neisseria meningitidis* isolated from normally sterile site
- Gram negative diplococci in normally sterile site
- Meningococcal DNA in normally sterile site
- Meningococcal antigen in blood, cerebrospinal fluid (CSF) or urine.

Probable case

Clinical diagnosis of meningitis or septicaemia or other invasive disease where the public health physician, in consultation with the physician and microbiologist, considers that meningococcal infection is the most likely diagnosis.

Possible case

Clinical diagnosis of meningitis or septicaemia or other invasive disease where the public health physician, in consultation with the clinician and microbiologist, considers that diagnoses other than meningococcal disease are at least as likely. This category includes cases who may have been treated with antibiotics but whose probable diagnosis is viral meningitis.

CASE IDENTIFICATION

Case definition

The case definition given by national guidance at the time of the outbreak was used to define cases, and case finding for other linked cases (see Box 1).[4]

Public health action is indicated only for confirmed and probable cases, but prompt response is required for these cases in order to implement preventive measures and reduce anxiety.[4] Although harm may arise from drug side effects, development of antibiotic resistance and eradication of naturally immunizing strains from the nasopharynx, the use of mass prophylaxis is important to reduce the possibility of people at high risk of acquiring meningococcal infection and disease, as there is a high immediate risk of further cases.[4]

Cases

Case 1 (index case)

A three-year-old child attending the nursery was notified to the health protection unit (HPU) on 18th August 2010 as a probable case of meningococcal septicaemia. Onset of illness was on 17th August 2010, with hospital admission on the same day. The case responded well to standard treatment and was discharged from hospital within a few days. Four household contacts were given antibiotic chemoprophylaxis as per national guidance. The child was confirmed as having serogroup B infection by polymerase chain reaction (PCR) blood test on 23rd August 2010.

Case 2

A second three-year-old child attending the same nursery experienced symptom onset on 23rd August 2010. The case was notified to the HPU on 24th August 2010 when the child was admitted to hospital with symptoms of probable meningococcal septicaemia. The child was known to have overlapping classroom sessions with case 1 in the week prior to symptom onset and had a history of complete primary immunizations. Following a 12-hour delay due to insufficient molecular material in the sample, serogroup B infection was confirmed by PCR blood test on 26th August 2010.

OUTBREAK CONFIRMATION

Outbreak definition

An outbreak is defined as increased transmission of *N. meningitidis* is in a population, manifested by an increase in cases of the same serogroup. This definition holds true for community-wide outbreaks, but is less useful if a specific institution or organization is implicated.[5] For the purpose of this incident, an outbreak was defined as two or more cases of meningococcal disease (of the same serogroup) occurring in the nursery within four weeks of disease confirmation in case 1 on 23rd August 2010.[4]

An outbreak (linked to the nursery) was declared on 26th August 2010 when the reference laboratory confirmed a second nursery child with serogroup B infection (case 2) within one week of confirming the same infection in case 1. Further genetic sub-typing of these two samples was not possible due to insufficient molecular material, and hence it was not possible to establish the likelihood of direct transmission between the two cases.

Case ascertainment

On 26th August 2010, general practitioners (GPs) and hospital consultants in the surrounding district (microbiology, paediatrics, infectious diseases, accident and emergency (A&E) doctors) were informed of the outbreak and asked to be vigilant regarding any further linked cases, and to urgently report these to the consultant in communicable disease control (CCDC).

On 28th August 2010, reports were received of a third child who attended the nursery and was admitted to hospital, meeting the criteria of a possible case. This child presented with mild disease clinically judged to be viral infection, and discharged from hospital in under 12 hours. PCR (blood) confirmation was not obtained and blood cultures (taken prior to antibiotic therapy) were negative. This case therefore remained classified as a possible case – with no further public health action indicated in terms of the outbreak at the nursery. No further probable or confirmed nursery-linked cases were detected. The outbreak was declared over on 23rd September 2010, four weeks after it was first detected.

RISK ASSESSMENT

Population at risk

The nursery population was 146 children and 30 staff members. The age (years) distribution of children is as follows:

< 2 = 19%; 2 = 15%; 3–4 = 44%; 5–11 = 21%.

There was considerable mixing of children and staff, and no logical exclusive subgroups could be considered more exposed. No obvious additional social links were identified between cases (e.g. social activities, classroom or friends).

The infectious period of cases is considered to be from seven days prior to onset of symptoms – up to one day post-treatment. Case 1 was considered infectious at the nursery from 10th to 17th August 2010, and case 2 from 16th to 23rd August 2010. Based on these periods, the exposed population at the nursery (i.e. close contacts at the nursery) was defined as all children and staff who regularly attended/worked at the nursery from 10th to 23rd August 2010. In line with national guidance, this group (children and staff) were considered to be equally exposed and were offered chemoprophylaxis to reduce their risk of developing meningococcal infection.[4]

Table 1

Antibiotic prophylaxis prescriptions and dispensing

Description	*n*
Nursery close contacts	176 (of which 30 staff)
Prophylactic antibiotic prescriptions given to contacts	173 (2 not reachable; 1 refused)
Prescriptions dispensed	129 (73%)
Contacts where GPs were informed/ telephoned	176

Control measures

Household contacts of cases 1 and 2 were offered chemoprophylaxis and information on the disease was given to parents/close contacts.[4]

When the outbreak was declared on 26th August 2010, the following public health interventions were implemented in line with national guidance:[4]

Within the nursery:

- All children and staff at the nursery were offered chemoprophylaxis on 26th August 2010. There was no indication for mass vaccination, as currently no licensed product is available against serogroup B infection. At the time of the outbreak, rifampicin or ciprofloxacin were the recommended antibiotics for chemprophylaxis (although it should be noted that revised guidance in 2011 made changes to the recommended antibiotics used).[4] Due to its availability in liquid form, rifampicin was prescribed to the children in the nursery despite the need for two days of treatment. Staff members were offered ciprofloxacin as prophylaxis except for one pregnant staff member who received rifampicin. Details of prescriptions given out and dispensed are shown at Table 1.
- Arrangements were made for: (1) community medical/nursing staff to deliver medicines and information with support from primary care trust (PCT) staff; (2) working with nursery management to inform parents of the outbreak, and obtain consent; (3) pharmacists to supply antibiotics (in correct formulation, dosage and with information sheets); (4) prescribing the antibiotic prophylaxis by using FP10 prescription forms (provided by the local PCT professional executive committee (PEC) chair following agreement by medicines management that GP prescription budgets would not be impacted upon), the only method available due to inflexible nature of packaging licences when using patient group directives (PGD); and (5) providing information on meningococcal infection to all parents/staff, including Meningitis Research Foundation leaflets and details of 24-hour helplines.

Within GP practices:

- Staff members and parents of contacts not attending at the nursery on 27th August 2010 were telephoned and asked to contact their GP to receive antibiotic chemoprophylaxis prescriptions.
- GPs were given the details of contacts under their care requiring prescriptions, pharmacies carrying antibiotic chemoprophylaxis and additional information on the need for early recognition and referral.
- The local media – both press and radio – were briefed on 26th August 2010.

Within out-of-hours service:

- Agreement was reached with the out-of-hours (OOH) service to provide extended service over the bank holiday weekend to accommodate for possible influx of contacts requiring prophylaxis prescription.
- The OOH service was given details of prescriptions and additional information of pharmacies carrying relevant antibiotic prophylaxis including opening hours of relevant pharmacists.

OUTBREAK MANAGEMENT

The outbreak was managed by an outbreak control team (OCT). The HPU declared the outbreak, led the risk assessment and initial OCT meeting on 26th August 2010, and provided ongoing specialist health protection advice during the subsequent phases of the response.

Table 2

Timeline of outbreak control team (OCT) meetings and key points

Date	Key Points
Monday 23rd August 2010 Case 1 confirmed (serogroup B)	• Attended nursery
Thursday 26th August 2010 Case 2 confirmed (serogroup B) 15:00 OCT meeting at HPU	• Links of both cases to nursery confirmed • Outbreak declared • PCT operational response with DPH planned • Informed hospital doctors (microbiology, paediatrics, infectious disease, A&E)
Friday 27th August 2010 09:30 OCT meeting at PCT	• PCT incident control room activated (maintained all day) • Operations team assembled; responsibilities and actions defined • Drug stock ordering and distribution methods agreed
10:45 Site visit to nursery	• Meeting with management; staff briefing • Defined population at risk; demographics, GP and contact details confirmed
13:00 OCT meeting	• Confirmed arrangements for distribution of chemoprophylaxis • Confirmed media communications and press release; briefings for GPs and hospital/A&E doctors • Database of contacts set up; drafting of script for admin staff to contact parents and staff members
14:30 Operational team established at nursery	• Parents and staff contacted by phone and provided with detailed information • Health protection nurse and PCT doctors attended nursery to deliver health information and advice and prescribe chemoprophylaxis
17:00 OCT meeting at PCT	• Progress over day reviewed; actions and cover for weekend agreed • Media communications and press release; radio interview with CCDC • For parents and staff not contactable by phone, letters sent out by first-class post to reach by Saturday 28th August 2010
18:45 Conclusion of work of on-site operational team at nursery	• Nursery closed for bank holiday weekend
Saturday 28th August 2010	• Uptake of prescriptions via out of hours reviewed; issues arising from previous night reviewed; arrangements for duration of weekend confirmed
09:00 OCT meeting at PCT	• Completion of contacts database; all contacts sent letter by second-class post
10:00 Visit OOH services to confirm arrangements	
Sunday 29th – Monday 30th August 2010 HPU and PCT OOH cover provided	• Arrangements put in place to reconvene OCT at short notice
Tuesday 31st August 2010 07:30 CCDC and health visitor meet with staff at the nursery 09:00 OCT meeting at PCT – with oversight by incident management team for rest of day	• Assurance given to staff and concerns of staff and parents addressed • Actions over week reviewed • Reactive media strategy agreed; database updated • GPs contacted and provided with information of contacts registered within their practice; GPs also provided with information of those already prescribed prophylaxis • OOH service provided with information of contacts prescribed prophylaxis over bank holiday weekend • Contacts not recorded as having been prescribed prophylaxis contacted by phone
23rd September 2010 Outbreak declared over	• No further confirmed or probable cases detected

Figure 1

Outbreak control team (OCT) membership

PCT
DPH (OCT chair)
Specialist registrar in public health medicine
Consultant in public health
Vaccination and immunization lead
Medicines management lead
Chief information officer
Locality services manger
Deputy community support services
Head of communications
Director of operations
F2 public health

HPU
CCDC
Health protection nurse

Nursery
Nursery centre managers

As of 27th August 2010, the outbreak response was led by the local PCT – consisting of an OCT chaired by the Director of Public Health (DPH) and supported by HPU staff (CCDC and health protection nurse). The timeline and OCT meeting dates are given in Table 2 and membership of the OCT is given in Figure 1.

DISCUSSION AND CONCLUSIONS

This report presents the background and public health response to a meningococcal infection outbreak (two linked cases) at a preschool (day nursery) institution. Although such outbreaks are rare events, they typically generate considerable public alarm due to their unpredictable nature.[4] Both cases had relatively mild disease and were confirmed as having serogroup B infection, but genetic sub-type could not be established.

As is typical of preschool settings, it was not possible to identify a specific subgroup (class, activity group, etc.) of children considered to have had more exposure than others. Chemoprophylaxis and advice was therefore given to *all* children and staff at the institution, with the added benefit of a general increase in awareness of infection symptoms. There were considerable logistic challenges of providing advice and prophylaxis to the entire preschool and staff in a short window of opportunity before the bank holiday weekend. The speed of the public health response and implementation of preventive measures was critical in providing assurance to parents and staff, and reducing anxiety levels. Within 28 hours of declaring the outbreak, more than 95% of parents received explanatory phone calls and chemoprophylaxis prescriptions for their children. On-site prescribing at the nursery (coupled with information sessions and individual counselling) proved to be a key implementation-success factor. GPs were also given timely information and background to the incident, and the after-hours service provided continuity throughout the weekend.

Mild disease in case 2 may have contributed to delayed confirmation of serogroup B status – a necessary step in declaring an outbreak of two linked cases at the nursery. With earlier confirmation of two serogroup B cases, the outbreak could have been declared earlier with additional working days available to plan and distribute mass chemoprophylaxis at the nursery. Overall, 129 out of 176 contacts (73%) received prophylaxis prescriptions – and this may have been improved if there had been more time before the weekend. We were unable to ascertain compliance to treatment offered. The remainder of contacts were away on holiday at the time of the outbreak, or preferred to receive a prescription directly from their GP.

The coordination and management of the outbreak by the OCT, based in the incident control room, was able to rapidly provide leadership, delegate tasks, identify gaps, allocate resources and ensure a proactive media response. Government plans to change the current public health system in England, with DsPH no longer working in the NHS, are likely to pose a significant risk in ensuring rapid response to similar outbreaks in future. The general principles of ensuring a rapid coordinated response are applicable to similar settings across the world. Despite increasing awareness of this incident among parents, GPs and hospital consultants, no further cases (confirmed or probable) were identified, and the outbreak was closed four weeks after being declared.

Although we did not investigate this, it is likely that mass chemoprophylaxis of the nursery did limit carriage of the outbreak strain and may have reduced the risk of invasive disease in this population. Research evidence for the effectiveness of mass chemoprophylaxis in nursery (preschool) outbreaks is lacking.[4] Indirect evidence from observational studies suggests significant benefit in giving chemoprophylaxis to all close nursery contacts of even single cases, and a number of European countries have adopted this practice.[6] Considerable resources (clinical staff, public health staff and antibiotics) were allocated to this outbreak, and giving mass chemoprophylaxis in response to single cases would have further logistical and cost implications. A future evaluation of the benefits and costs of the public health interventions in similar small nursery outbreaks would be useful in informing practice.

RECOMMENDATIONS

A full incident debrief meeting was held on 26th November 2010. The recommendations below are an extract from the full debrief report:

- PCT plans should be reviewed to ensure that medication (prophylactic antibiotics/vaccines) can be accessed and prescribed/dispensed quickly and safely during future community outbreaks. Plans should include developing the necessary PGDs, having a medicines management pharmacist available after hours, available prescription pads for the public health team, and plans for wholesaler and/or acute trusts to supply medication.
- PCT on-call staff and directors need to be more familiar with major incident procedures (including activating the incident control room), incident leadership skills, plans and

communication plans. Specific training sessions and desktop exercises are indicated for all PCT staff responding to major incidents. Joint exercises with the HPU should take place.

- Proactive communication with the media, nursery staff, parents and GPs was successful. This model, requiring more than a minimal resource (e.g. admin team to telephone all parents; clinical staff present in nursery to brief parents), should be deployed during future incidents.
- As the NHS faces changes (abolishment of PCTs, establishment of Public Health England and location of DsPH in local authorities), the HPU should work closely with the DPH and local health resilience forum (LHRF) to ensure continuity of plans and the ability to effectively respond to similar incidents in future.

It is hoped that these recommendations will be incorporated into future local practice.

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