

# Practical guidelines for responding to an outbreak of meningococcal disease among university students based on experience in Southampton

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**Summary:** Six students at the University of Southampton developed meningococcal disease in October 1997, five of them with confirmed serogroup C infections, and three died. The outbreak had major organisational and financial implications for the agencies involved. Detailed planning and good working relationships with the management of higher educational institutions can prove invaluable in such situations. This paper summarises the management of the outbreak in Southampton and presents recommendations based on our experience.

**Key words:**  
communicable disease control  
disease outbreaks  
hotlines  
meningococcal infections  
universities

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## Introduction

Serogroup C strains of *Neisseria meningitidis* are responsible for 35% to 40% of cases of meningococcal disease in England and Wales. Group C strains are associated with clusters of disease more often than group B strains<sup>1</sup> and have been responsible for community and institutional outbreaks of disease in recent years, both in the United Kingdom (UK)<sup>2-5</sup> and abroad<sup>6-9</sup>. Guidance for responding to individual cases and outbreaks of meningococcal disease has been produced by the PHLS Meningococcus Working Group<sup>10-11</sup>. The current public health interventions for responding to outbreaks of group C disease are antibiotic chemoprophylaxis and immunisation.

Many papers published on outbreaks of meningococcal disease have focused on the epidemiology of the outbreaks or on the success or otherwise of immunisation campaigns mounted in response<sup>4-8</sup>, although the report of a college-based outbreak briefly discussed logistical and organisational issues<sup>5</sup>. A MEDLINE search revealed two papers that specifically addressed the operational response to outbreaks<sup>2,12</sup>. One reported how an American hospital developed a policy for managing outbreaks of infectious disease in the community<sup>12</sup>. This was prompted by a community outbreak of hepatitis A, but many aspects of outbreak management apply to any

disease. The other described both the epidemiology and operational response to a community outbreak of group C meningococcal disease in the Trent region in 1995 and 1996<sup>2</sup>, in which over 15 000 doses of vaccine were administered. We present our experiences of managing an outbreak of group C meningococcal disease that occurred at the University of Southampton. We include considerable operational detail in order to enable others to develop more detailed plans and to be better prepared. This outbreak also prompted the publication in higher educational journals of papers that examined institutional responses to public health crises<sup>13,14</sup>.

## Outbreak of group C meningococcal disease at the University of Southampton: October and November 1997

In October 1997, an outbreak of group C meningococcal disease occurred in students attending the University of Southampton. Six students were affected, three of whom died. A report of the epidemiology of the outbreak is in preparation and will be published separately.

The first case, a first year woman student, was found dead in her room in Montefiore House, one of three halls of residence in Wessex Lane, on Saturday 11 October. Meningococcal septicaemia was confirmed as the cause of death at necropsy on the following Monday. The organism was confirmed as being *N. meningitidis*, group C. Early on Monday 27 October, the second case, a first year student from Connaught Hall, also in Wessex Lane, was admitted to hospital with meningococcal septicaemia and died later that morning. The serogroup of the causative organism was not known. A decision was taken to offer antibiotic prophylaxis to all first year students in all three Wessex Lane halls (about 1100 students), starting at 1400 on Tuesday 28 October. On the evening of Monday 27, we were notified that another first year student at Montefiore House had been admitted to Wycombe General Hospital with meningococcal septicaemia a day earlier. The infecting strain had been

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**TABLE 1 Membership of the outbreak control team and its members' roles and responsibilities**

| Membership  | Role of member   |
|---|--|
| Consultant in communicable disease control (CCDC) | Chair of outbreak control team<br>Coordination of outbreak management<br>Media spokesperson for the health authority and on health issues              |
| Director of public health (DPH)                   | Executive support to CCDC<br>Handling resource issues<br>Liaison with health and local authority chief executives, chairmen, members of parliament etc |
| Consultant in public health medicine              | Organisation of health authority input to helpline<br>Communication with general practitioners, trusts etc<br>Organisation of immunisation sessions    |
| Communicable disease control doctor/nurse         | Case finding and follow up<br>Specific medical queries<br>'Holding the fort' (maintaining a service for other infections)                              |
| Health authority public relations                 | Media relations  |
| Consultant microbiologist                         | Expert advice and feedback on results<br>Liaison with microbiology laboratory  |
| Acute trust representative                        | Liaison with acute trust<br>Feedback on admission pressures  |
| Community trust representative                    | Liaison with community trust<br>Feedback on staffing pressures   |
| Regional epidemiologist                           | Expert advice and support in decision making<br>Communication with regional office, CDSC, DH etc<br>Organising epidemiological studies                 |
| University health services                        | Liaison with and feedback from student primary care services   |
| University – public affairs <sup>1,2</sup>        | Coordination of all university external and internal communications<br>Media relations coordinator<br>Media spokesperson for the university            |
| University – student services                     | Helpline staffing and organisation<br>Coordination of university welfare services, tutors, and academic staff<br>Liaison with families of students     |
| University – accommodation management             | Support to hall wardens<br>Communication with residents<br>Organisation and staffing of immunisation sessions in residences                            |
| University – counselling service                  | Support to students and staff in general and at immunisation sessions  |
| Students' union president                         | Represent views/concerns of students<br>Coordinate activities of the union with those of the outbreak control team                                     |
| Administrative support                            | Keep a comprehensive record of the outbreak control team meetings  |

1. At Southampton, the head of public affairs was the 'core' university representative on the outbreak control team. This role needs to be designated in advance.  
2. As incidents develop, media spokespersons may need to be rotated in response to the severity of the incident and the need of the media. At Southampton, both the DPH and the vice-chancellor acted as media spokesperson at certain times.

identified provisionally as group C.

An outbreak control team met on Tuesday 28 October and agreed to offer immunisation against group C meningococcal disease to the target group already identified. This was planned to start at 1400 on Wednesday 29 October. On Tuesday afternoon, a further two first year students at Montefiore House were admitted to hospital with probable meningococcal disease. The outbreak control team met daily for the rest of the week at the health authority. The university set up a telephone helpline on Tuesday 28 October and the health authority set up a separate helpline on Wednesday 29 October, both of which ran until the end of the week.

The sixth case, a first year student in a hall of residence three miles from Wessex Lane, died of meningococcal disease on Sunday 2 November. The outbreak control team met the same day and agreed that antibiotic prophylaxis and immunisation should be offered to an extended target group (a further 3000 students) consisting of all first year students and all students and staff in halls of residence. This began at 1400 hours on Monday 3 November and was completed by the next evening. The helpline was reestablished from 0830 on Monday 3 November on a single site at the university and operated all week. The outbreak control team met each morning of the week. No further cases occurred and the outbreak was considered over on Monday 1 December.

In response to the anxieties of staff and other students, the university organised a free voluntary immunisation programme for all staff and students not covered by the health authority programme. This was not advised on public health grounds and was carried out separately, at the cost of the university.

### Issues to be considered during the management of an outbreak

The executive management of health authorities and large educational establishments should understand that an outbreak on this scale is a major organisational emergency. Routine work will be delayed and people from diverse departments may have to be re-deployed at short notice. It is helpful if a statement to this effect can be made by the chief executive of the organisation or his/her equivalent. In Southampton, good working relationships and joint planning with the University management before the outbreak ensured that the outbreak response operated as smoothly as possible.

Important areas to be considered during planning are the composition and location of the outbreak control team, the organisation of telephone helplines and antibiotic prophylaxis and immunisation sessions, and communications and media management.

### Outbreak control team Composition and responsibilities

Successful management of an outbreak depends on having an outbreak control team composed of key personnel with clear and explicit roles and responsibilities. Table 1 lists the members of the team that managed this outbreak and their suggested roles

and responsibilities. Not all of these people attended every meeting but full attendance is vital at initial meetings as the outbreak is unfolding. A member may play more than one role, particularly for the university. If preparing detailed plans, it is worth developing a draft agenda that can be modified to suit particular situations. This can save valuable time.

**Location**

The outbreak control team should ideally meet on the university site. The meeting room should, if possible, be within easy reach of helpline staff and the public relations department. The meeting room should be reserved exclusively for the outbreak control team at all times to allow for emergency meetings and for news conferences. This has the following advantages:

- Communication is easier if the outbreak control team is based where outbreak interventions are taking place.
- Less time is spent travelling between sites.
- Key personnel and senior university managers are easily accessible.
- Liaison with the media is easier to coordinate.

Nevertheless, moving key health authority staff away from their base can cause problems. Consider the following:

- Ensure that office space – with phone, fax and photocopier facilities – is made available on the university site.
- Provide adequate car parking space.
- Consider your computing needs - use of laptop computers and portable printers.
- Bring your own support staff to answer the phone and carry out secretarial/administrative duties.
- Leave a member of the public health or communicable disease control team in the office to 'hold the fort', respond to specific medical enquiries, and carry out case finding and follow up.
- Brief those who remain at the health authority regularly as they will receive many enquiries and can help carry the workload.

**Communications**

In every emergency, problems arise due to a lack or a perceived lack of information. The requirement for up-to-date information as the outbreak develops is immense. This information is requested/demanded not only by those involved directly or indirectly in the outbreak but also by local medical practitioners, local and neighbouring trusts and health authorities, chairmen and chief executives, local authority officers, local councillors and members of parliament, consultants in communicable disease control (CCDCs), the NHS Executive regional office, the PHLS Communicable Disease Surveillance Centre (CDSC), the Department of Health, other universities, meningitis charities, news media, the general public, and staff and students of the university affected. Documents prepared in advance may be useful – to describe the rationale for antibiotic prophylaxis and immunisation, describe the symptoms

**TABLE 2 Communications with different groups during the outbreak**

| Communications with  | Responsibility of   | Mechanisms  |
|--|---|---|
| Students and staff at the university                                       | University public affairs department  | <ul style="list-style-type: none"> <li>• frequent editions of existing newsletter</li> <li>• Log-on message on university computer network</li> <li>• University website</li> <li>• Briefings of university management and students' union</li> </ul> |
| General practitioners, local and neighbouring trusts, meningitis charities | Consultants in public health medicine   | <ul style="list-style-type: none"> <li>• Phone/fax</li> <li>• Email</li> </ul>  |
| Chairmen, chief executives, local politicians, and members of parliament   | Directors of public health  | <ul style="list-style-type: none"> <li>• Briefings</li> <li>• Phone/fax</li> <li>• Email</li> </ul>   |
| CCDCs, Regional Office, CDSC, Department of Health                         | Regional epidemiologist   | <ul style="list-style-type: none"> <li>• Phone/fax</li> <li>• Epinet</li> </ul>   |
| Media and the general public   | University public affairs, department and health authority public relations staff | <ul style="list-style-type: none"> <li>• Press conferences</li> <li>• Press statements</li> <li>• Television, radio, and press interviews</li> <li>• Helpline</li> </ul>  |

and signs of the disease, and advise what to do if feeling unwell. Table 2 summarises our methods of communicating with these diverse groups of people.

Communications with individuals involved in the outbreak response may also be imperfect. Heavy reliance will inevitably be placed on mobile phones but these can be unreliable because of areas of poor reception and limited battery capacity.

- Ensure key individuals have mobile phones with adequate battery capacity.
- Ensure that communication lists are up-to-date and that key personnel can be contacted at all times (or substitutes clearly identified).
- Mobile pagers can be useful but must be checked.

In dealing with departments such as microbiology and pharmacy, agree with senior staff the identity of key people through whom all communications can be channelled to avoid duplication and frustration. Increased admissions of suspected cases of meningitis will increase the workload of the microbiology department. Someone needs to take responsibility for managing specimens from these patients, ensuring that all the appropriate specimens have been taken and that all appropriate tests are performed. In pharmacy, vaccine and antibiotic ordering, distribution, and return of unused supplies need coordination.

**Telephone helpline**

Telephone helplines are increasingly being used to respond to public concerns about health matters. Without a dedicated helpline switchboards may become blocked and other activities of the organisation disrupted. Consequently, consideration should be given to identifying and providing training for a cohort of staff

who can be called upon to work on helplines in an emergency.

#### **Location and organisation**

A combined university/health service helpline based on the university site worked better than separate helplines. The helpline was set up near the room where the outbreak control team met and the public affairs department so that it was easier to ensure that helpline staff had the latest information.

- The helpline had six phones with a single helpline number. More phones were needed at peak times but this has staffing implications (see below).
- The helpline operated from 0800 to 2300 so that it was available to take calls made in response to the transmission of the helpline number on the late night local news.
- After 2300 an answerphone message advised callers to contact the support lines of meningitis charities or to ring back in the morning. Meningitis charities were briefed frequently with the latest information.
- White noticeboards were used in the helpline room to present the latest situation and messages for easy reference for operators. Printed information and press cuttings were kept by each telephone and updated as information changed.
- A facsimile machine in the helpline room enabled the latest press statements or information sheets to be faxed to callers.
- Refreshments were available in the helpline room as the operators were often too busy to leave the room to get a drink.

#### **Staffing**

- Helpline operators were drawn from many different departments of the university and health services.
- Health staff consisted of health visitors and nurses drawn from the community trust and staff with a nursing background from the department of public health medicine and other departments in the health authority.
- Helpline staff felt that shifts should be no longer than two hours, ideally 90 minutes. With six phones, this represents 42 to 56 shifts to be filled each day.
- A university manager was seconded full time to organise and supply staff for the helpline.
- A doctor, who was present at all times, was responsible for organising the health staffing of the helpline in association with the university manager, for briefing the staff before their shifts, and for taking particularly difficult calls or calls that required medical expertise.
- Many calls were from extremely angry and worried people. These were difficult to handle. Consideration should be given to organising de-briefing sessions at the end of shifts.

#### **Workload**

- The two helplines operating during the first week received just under 1000 calls.
- During the second week, the combined helpline

received about 1800 calls.

- Support lines of the meningitis charities received about 670 calls.
- The information requested varied enormously, from asking the location of an individual student to requests from medical practitioners for detailed medical information.

#### **Antibiotic prophylaxis and immunisation clinics**

Distribution of antibiotic prophylaxis and the administration of group C meningococcal vaccine are the cornerstones of the public health intervention in outbreaks of this type. The following issues need to be considered if these interventions are required.

#### **Location**

- Large rooms are needed – dining rooms or assembly halls are ideal.
- Set up screens to prevent students from watching the immunisation teams while queueing.
- Ideally, there should be adequate covered space outside the hall to shelter queues of students from rain and snow.
- A supervised recovery area should be available so that students can wait for 20 to 30 minutes after receiving medication in case of adverse effects.

#### **Organisation**

Inevitably, the early sessions will be the busiest. University administrative staff ticked off students' names against a register. While they queued students were given a letter that explained why they were being offered antibiotics and vaccine and described possible adverse effects and contraindications. Students who were not in the target groups but wanted prophylaxis were referred to the doctor for an explanation. University counselling staff were also available. Students were given a 500 mg oral dose of ciprofloxacin by a nurse and then moved to an immunisation station where they received the vaccine before going to the recovery area.

Two doctors were present at each session to coordinate the session, authorise the administration of antibiotics and vaccine, answer medical queries, and respond to any adverse reactions. Several immunisation stations operated at each session. Each was staffed by a nurse who gave the vaccine (these were mainly school nurses) and one or two nurses who drew up the vaccine. If a vaccine preparation is used that comes with the diluent in a prefilled syringe, then only one nurse is needed for drawing up.

Medical and nursing staff were drawn from the Department of Public Health Medicine, Southampton Community Health Services Trust, the university health service and the occupational health department. Counselling staff were provided from the university counselling service. The following points may be helpful:

- Each station can immunise 60 to 80 students per hour.
- Record vaccine batch numbers.
- Emergency resuscitation (crash) boxes should be available at every session. We found it useful to

include oral chlorpheniramine (piriton) to treat mild allergic reactions, probably caused by ciprofloxacin. These affected about one in a thousand recipients.

- Some students were very anxious. It is important to have counsellors available at the sessions.
- Sessions usually lasted for two to two and a half hours.
- Provide adequate refreshment breaks for staff and organise staff rotation within the clinic.
- Security staff are required at the sessions to ensure that journalists do not interfere and that staff belongings are safe.

#### **Antibiotic and vaccine issues**

It is advisable to contact the local pharmacy to ascertain the size of their normal stocks of ciprofloxacin and meningococcal vaccine and to estimate how long it would take to get larger quantities, particularly out-of-hours. Check that the on-call pharmacist, who is often relatively junior, would be able to handle a large emergency order of this nature or would have appropriate senior support (for example, for arranging transport). The pharmacy may want to explore the possibility of buying the vaccine on a sale or return basis and of negotiating bulk purchase discounts. The doctor at the session is responsible for checking and recording antibiotic and vaccine stock levels and ensuring that unused drugs are returned to the pharmacy at the end of the last session. Other actions include:

- Check with the supplies department about the provision – at short notice – of syringes, needles, swabs, and sharps boxes.
- Prepare drug information sheets for ciprofloxacin and meningococcal vaccines. These should include reference to pregnancy and possible interactions (for ciprofloxacin) with alcohol and other drugs, particularly for diabetes and epilepsy. Women can be reassured that the prophylactic dose of ciprofloxacin will not affect the efficacy of the combined oral contraceptive pill.
- The commonest adverse reaction encountered was mild facial oedema, probably caused by the ciprofloxacin. This responded to oral antihistamines.
- Clarify the cold chain requirements of the vaccines.

#### **Medical records**

Student's general practitioners should be informed that they have received antibiotic prophylaxis and meningococcal vaccine. This is probably best achieved by recording the names of general practitioners at the time of registration so that relevant lists can be compiled and sent to practices after the outbreak.

#### **Uptake of prophylaxis**

Ninety-two per cent of those identified in the target groups in Southampton received both antibiotic prophylaxis and immunisation. Non-attenders were identified and followed up by university staff. Most of the non-attenders had received prophylaxis from other sources but local general practitioners helped to provide prophylaxis for any students who had been missed.

#### **News media**

Media relations requires consummate skill, meticulous planning, and rapid responses. Media interest can escalate very rapidly – and diminish equally rapidly. The media are not constrained by the same rules of confidentiality as the university and the NHS and will try to publish personal details. The longer the outbreak continues the more important becomes the public relations strategy to ensure that news media remain generally supportive. In these situations, it may be useful to engage a public relations company to provide external, expert advice, and a second opinion.

- Universities usually have larger public relations departments than health authorities and are therefore better placed to lead the public relations response.
- The university and the health authority issued separate press statements on certain issues specific to them, but most statements were issued jointly.
- All press statements were seen by both the CCDC and the university before issuing.
- Television, radio, and press interviews were handled by the CCDC and the regional epidemiologist and the university head of public affairs, his deputy, and the vice-chancellor.
- News conferences involved the director of public health (DPH), the CCDC or deputy, the vice-chancellor, and the president of the students' union.
- Facilities were requested by the media at immunisation clinics; media were given time-limited access and accompanied at all times by public affairs staff. Pool facilities (whereby one journalist provides material for colleagues) may be considered.
- All statements to news media were also available to university audiences, electronically or as internal university newsletters. At all times, the university's internal communications strategy was run in parallel with media relations.
- The previous day's media coverage and the current position were discussed each day at the outbreak control team meeting, when actions were agreed for the next 24 hours.
- Record all television and radio appearances and keep a file of the press coverage. This material can be a useful training resource and provide material for future presentations on the outbreak.

#### **Other issues**

##### **Acute hospital**

The publicity and the anxiety generated by the outbreak will result in many referrals to the local acute hospital of patients with suspected meningococcal disease. Over 80 admissions occurred over the two weeks of the outbreak in Southampton. The following actions may be appropriate.

- Consider establishing an admission ward for cases of suspected meningococcal disease. This makes follow up easier, ensures that all patients are investigated appropriately, and prevents patients being dispersed to wards all over the hospital.
- Consider, in association with the medical director and the consultant microbiologist, a letter to

clinicians raising awareness of the diagnosis in young adults, the importance of appropriate investigations, and the recommended treatments.

- Remember that hospital staff will be concerned about their own health and that of their families. This will need to be addressed.
- Discuss with the occupational health department the guidance relating to prophylaxis of contacts.

#### **Other institutions**

Students and staff at other higher education institutions in the area will naturally be concerned. Students often mix socially between institutions and decisions will have to be taken, as soon as the outbreak has been controlled, on the course of action to recommend. News media will make comparisons with other institutions in their broadcast/circulation area.

#### **Bereavement**

Deaths occurring during an outbreak increase the levels of anxiety and the interest of news media. Parents, close friends, and colleagues of the deceased will require varying degrees of support to come to terms with bereavement, some of which will be provided by the university through its counselling and pastoral services. The death of a student not resident in the UK may require help from embassy staff.

#### **Support from outside the district**

Neighbouring health authorities may release public health staff to help in the control of the outbreak and with the helpline.

#### **Stress**

These are very high pressure situations for all staff involved. Long hours are worked in often very intense circumstances and regular breaks are essential. Keep staff fully informed and do not forget that they may also have their own health concerns. It is up to senior staff to ensure that the team's coping and that they take regular refreshment breaks. Senior staff may also suffer stress. Even an hour off can revitalise and restore a healthy perspective.

#### **Costs**

The total cost of the outbreak to the health authority was in the region of £60 000, of which £40 000 were direct costs for antibiotics, vaccine, and supplies. The costs incurred by the university are believed to have been greater.

#### **Consequences**

Some form of enquiry, internal to the authority and/or university or external, is likely. All available records and information should be retained. Emergency plans should be revised as soon as practicable, noting that some media interest will continue for many months.

#### **General practitioner remuneration**

Some general practitioners will have been approached directly by the student and will have given meningococcal vaccine. As long as the student is within the target group, an item of service payment can be made to the general practitioner under paragraph 23.4 of the *Statement of Fees and Allowances* (the 'Red Book').

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#### **References**

1. Hastings L, Stuart JM, Andrews N, Begg N. A retrospective survey of clusters of meningococcal disease in England and Wales, 1993 to 1995: estimated risks of further cases in household and educational settings. *Commun Dis Rep CDR Rev* 1995; 7: R195-200.
2. Irwin DJ, Miller JM, Milner PC, Patterson T, Richards RG, Williams DA, et al. Community immunisation programme in response to an outbreak of invasive *Neisseria meningitidis* serogroup C infection in the Trent region of England 1995-1996. *J Public Health Med* 1997; 19: 162-70.
3. CDSC. Outbreak of meningococcal disease in students in Cardiff. *Commun Dis Rep CDR Wkly* 1996; 6: 311.
4. Koh YM, Barnes GH, Kaczmarek E, Stuart JM. Outbreak of meningococcal disease linked to a sports club. *Lancet* 1998; 352: 706-7.
5. Riordan T. A college outbreak of group C meningococcal infection: how widely should investigation and prophylaxis extend? *Commun Dis Rep CDR Rev* 1997; 7: R5-9.
6. Rosenstein N, Levine O, Taylor JP, Evans D, Plikaytis BD, Wenger JD, et al. Efficacy of meningococcal vaccine and barriers to vaccination. *JAMA* 1998; 279: 435-9.
7. Roberts CL, Roome A, Algert CS, Walsh SJ, Kurland M, Lawless K, et al. A meningococcal vaccination campaign on a university campus: vaccination rates and factors in non-participation. *Am J Public Health* 1996; 86: 1155-8.
8. Jackson LA, Schuchat A, Reeves MW, Wenger JD. Serogroup C meningococcal outbreaks in the United States. An emerging threat. *JAMA* 1995; 273: 383-9.
9. Gemmill I. An outbreak of meningococcal disease in Ottawa-Carleton December 1991 - February 1992. *Can J Public Health* 1992; 83:134-7.
10. PHLS Meningococcal Infections Working Group and Public Health Medicine Environmental Group. Control of meningococcal disease: guidance for consultants in communicable disease control. *Commun Dis Rep CDR Rev* 1995; 5: R189-95.
11. Stuart JM, Monk PN, Lewis DA, Constantine C, Kaczmarek E, Cartwright KAV. Management of clusters of meningococcal disease. *Commun Dis Rep CDR Rev* 1997; 7: R3-5.
12. Frace RM, Jahre JA. Policy for managing a community infectious disease outbreak. *Infect Control Hosp Epidemiol* 1991; 12: 364-7.
13. Newby H. The killer stalking campuses. *The Higher* 1997; 19 December: 11.
14. Reader P, Green RJ. Public health crises and the institution. *Journal of the Association of Principals and Wardens of University Halls of Residence* 1997; 14-25.