An outbreak of meningococcal disease in Stonehouse: planning and execution of a large-scale survey

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SUMMARY

In November 1986 a large-scale survey was undertaken in the Gloucestershire town of Stonehouse during an outbreak of meningococcal disease due to group B type 15 subtype PI.16 sulphonamide-resistant strains. There were 15 cases in Stonehouse residents during the 4 years from April 1983, an annual attack rate of 56.5 per 100000. Four secondary cases occurred despite rifampicin prophylaxis. The objectives of this community survey were to investigate patterns of meningococcal carriage, transmission and immunity and to determine the proportion of non-secretors of blood group antigens in the Stonehouse population and amongst meningococcal carriers. A total of 6237 subjects participated including 75% of the 6635 Stonehouse residents. Over 97% of the participants provided all three of the requested specimens – nasopharyngeal swabs, saliva and blood samples.

The co-operation between the many organizations involved in the detailed
preliminary planning was instrumental in the success of the survey; in particular
the value of effective collaboration between Departments of Community Medicine
and Microbiology and of the Public Health Laboratory Service network of
laboratories in undertaking investigations of this size and type was clearly
demonstrated.

INTRODUCTION

Since 1974 meningococcal disease due to group B type 15 p1.16 sulphonamide-
resistant (B15.16R) strains has been encountered increasingly in several European
countries including Britain (Poolman et al. 1986). It has been characterized by
prolonged outbreaks with high attack rates in teenagers and young adults and a
low carriage rate in community contacts (Cartwright, Stuart & Noah, 1986). These
unusual features of meningococcal disease suggest that B15.16R strains have a
greater virulence, longer duration of carriage and lower transmissibility than most
other strains of meningococci and that they may not have circulated in the
affected communities for 20 years or more.

The factors influencing susceptibility of the non-immune individual to men-
ingococcal disease are not fully understood though recent studies have shown that
a genetically determined inability to secrete ABO blood group antigens in saliva
and other body fluids (non-secretion) is one such predisposing factor (Blackwell
et al. 1986).

In south-west England both Gloucester and Plymouth Health Districts have
experienced prolonged outbreaks of meningococcal disease due to B15.16R
strains since 1981 (Cartwright, Stuart & Noah, 1986; Dawson, Rickard &
Wilkinson, 1986). In Gloucester Health District (population 308500) 94 cases
occurred between 1 October 1981 and 31 March 1987, an average annual attack
rate of 5.5 per 100 000. Of these cases 15 occurred in the parish of Stonehouse
(population 6635), a town in Stroud Local Authority District. Eleven of the 15
cases lived on one estate, which housed 26% of the town’s population.

This report describes the outbreak in Stonehouse and the planning and
execution of a large scale study which had the following principal objectives:

1. To measure the prevalence of nasopharyngeal carriage of, and immunity to,
B15.16R and other strains of meningococci in the Stonehouse population by age,
sex, school and area of residence during an outbreak of meningococcal disease
caused by B15.16R strains.

2. To examine the hypothesis that B15.16R meningococci have a relatively low
transmissibility and long duration of carriage.

3. To determine the proportion of non-secretors in the Stonehouse population
and amongst meningococcal carriers.

The bacteriological findings are described in the companion article (Cartwright
et al. 1987). The serological and secretor results will be described in further
papers.

METHODS

Planning

Planning meetings were held during the summer and autumn of 1986. Six of the
authors (J.S., K.C., D.J., N.N., R.W., C.B.) constituted the core planning team.
The local planning team was made up of one nursing, one administrative and one finance officer, a general practitioner, a computer programmer, two head medical laboratory scientific officers (MLSOs), a county education officer, a community physician and three Public Health Laboratory (PHL) directors. The laboratory planning team consisted of the Directors and Head MLSOs of Gloucester, Manchester, Bristol and Hereford PHLs.

**Timing**

The duration of the survey needed to be as short as practicable so that an estimate of point prevalence of meningococcal carriage and immunity could be obtained. It was also considered important to complete the survey before the end of 1986 in order to study the community during a period of high disease activity. The two weeks beginning 3 November 1986 were chosen; sampling sessions were planned on weekday evenings and Saturdays at Stonehouse Health Clinic and at Stonehouse schools during the week days.

**Sample size**

A low carriage rate of B15.16R organisms (1% or less) was anticipated. The uneven distribution of the cases made it important to compare the prevalence of immunity, carriage rates and secretor state in different areas of the town. With the exception of infants who were excluded for practical reasons, all residents of Stonehouse Parish were invited to participate. All children and staff at Stonehouse schools, whether or not Stonehouse residents, were included so that comparisons could be made between schools. The total sample size was estimated as 7700 from Gloucestershire Family Practitioner Committee (FPC) records and school lists.

**Specimens**

Postnasal swabs were needed to determine rates of nasopharyngeal carriage of meningococci, saliva samples to determine secretor status, and blood samples to validate the secretor results and to detect specific IgM and IgG antibodies against B15.16R and other meningococci by ELISA tests.

**Staff and equipment**

A ‘dummy run’ was held at the Health Clinic. Estimates were made of the time to complete sampling, the staff and equipment needed, and costs. Calculations were based on a 90% attendance rate with a maximum throughput of 90 people per hour in each evening session and 60 per hour in each school session. Medical, nursing, laboratory, administrative and clerical staff were recruited and equipment was ordered pending approval of funding.

**Ethical issues**

Approval for the study was obtained from the District Ethical Committee and medico-legal advice was sought on wording of consent forms.

**Publicity**

Plans of the survey giving details of the reasons for its undertaking, the dates, and further general information were made widely available through the local media.
Representatives of the national press and television were invited to a press conference on the first morning of the survey. This increased local awareness and allowed the survey to proceed thereafter without disruption from the media. The Press Office of the South Western Region Health Authority handled enquiries during the survey.

Implementation

The Meningitis Trust, a locally based charity, arranged for the separate delivery of two explanatory letters, the second with four registration cards, to each household in Stonehouse Parish. The registration cards included details of surname, forename, date of birth, sex, address, postcode, general practitioner, school and class (where relevant) and signed consent.

The 1985 electoral register was used to divide the town into 10 localities with approximately equal adult populations. Householders were asked if possible to attend Stonehouse Health Clinic with their completed cards on one of the 10 designated weekday evenings between 4 p.m. and 9 p.m. Children of pre-school age or at school outside Stonehouse were also invited to these evening sessions. Residents who were unable to attend during a weekday evening were asked to come between 9 a.m. and 6 p.m. on one of the two Saturdays.

The head teachers of the Stonehouse schools issued a letter to parents and a registration card to each pupil prior to the start of the survey. Pupils were asked to take the letter and card home, complete the card, obtain signed parental consent (if aged less than 16) and return the completed card to form teachers. Days and times for sampling at schools were agreed with head teachers.

Three teams, each consisting of one clerical assistant, three nurses, one MLSO and one phlebotomist, collected the specimens at each evening session; there were two teams at the schools. In addition there was an administrator assisted by volunteers to control flow of subjects to the teams, a medical officer to deal with emergencies and to assist in taking blood samples, the two co-ordinators (K. C. and J. S.) to supervise and to assist in specimen collection, a volunteer from the Red Cross to administer first aid, a clerical officer to enter registration data on to a computer and a driver to transport specimens. Each team had the use of three rooms – the first for checking data registration and for saliva collection, the second for throat swabbing and plating and the third for blood sampling.

Room One: A clerical officer helped to complete registration cards where necessary and checked that data entry was complete and legible. Postcodes were cross-checked against addresses on a Post Office list. Six adhesive labels bearing an identical number were used to identify the registration card and all the specimens from one subject. No other specimen identification system was used.

Saliva specimens (2 ml) were collected by a nurse. Subjects expectorated into 20 ml sterile Universal containers; plastic disposable pipettes were used when necessary in young children. A flow of saliva was stimulated by smelling fresh cut lemons. Samples were frozen to —20 °C within 3 h of collection and subsequently transferred to Edinburgh in insulated containers.

Room Two: A nurse swept the posterior pharyngeal wall behind the uvula with a fluffy charcoal swab. Pernasal swabs were used if necessary in small children. Plates were inoculated directly by an MLSO and taken by van in alternate 3 h batches to Gloucester and Bristol PHLs.
Room Three: Blood samples were collected by a phlebotomist and doctor, assisted by a nurse, using the ‘Vacutainer’ system into EDTA tubes (0-5–1-0 ml) for red cell grouping and into sterile plain screwtop tubes (9–10 ml) for serology. Both sets of specimens were taken to Gloucester PHL for overnight storage at 4 °C and clotted specimens were then transferred to Hereford PHL for serum separation.

Data processing

Data recorded on the cards were transferred to two microcomputers (Apricot Xi) using a proprietary software package (ASPECT, Micro ft Corp.) and programs written by PHLS Computer Services. All records were subsequently recalled and checked.

Following verification the database was distributed on floppy diskettes to the Meningococcal Reference Laboratory, Manchester and the Department of Bacteriology, Edinburgh University for entry on to Apricot XEN microcomputers using the same software. Test results were added to a linked database and redistributed to the collaborators by the same means.

RESULTS

The outbreak of meningococcal disease due to B15.16R strains in Gloucestershire began in 1981; the first case in the parish of Stonehouse occurred in May 1983 and a further 11 cases were recorded here prior to the survey (Table 1). Three more cases occurred during the 4 months following the survey. The average attack rate in Stonehouse during the 4 years from 1 April 1983 was 56-5 per 100000 per annum. Two children died.

Despite the routine prescription of a 2-day course of rifampicin to household contacts at the time of illness of the index case, a high secondary attack rate was observed (Table 1). Three pairs of cases occurred in siblings, the father in one of these families also subsequently developing meningococcal disease. The average time between index and secondary cases was 124 days.

Stonehouse is situated three miles west of Stroud and nine miles south of Gloucester. The parish is largely residential, with mixed council and private housing and there is an industrial estate to the west of the town. For the purposes of analysis the town was divided into five areas using main roads, the railway line, and natural boundaries between the main housing estates (Fig. 1). Eleven of the cases lived in Park Estate at the time of their illness, three in Verney Fields, and one in Rosedale.

The town has state secondary, junior and infant schools, the latter two on the same central site. There are in addition two private junior schools, one private senior school and a small special school (Fig. 1). All of these schools except the state infant and primary school take most of their pupils from outside the town. Of the 11 cases of meningococcal disease in Stonehouse school-children eight attended the state infant and junior school, one was at the secondary school, one at the special school and one at a school outside Stonehouse (Table 1).

The population of Stonehouse according to FPC records in October 1986 was 6635 and estimates from the County Planning Department agreed within 2%. The population aged under 16 years comprised 27-4% of the total compared with an
Little Australia
   (0)

Parish boundary

Verney Fields
   (3)

Industrial estate

Bridgend
   (0)

Stonehouse Health Clinic

Rosedale
   (1)

Fig. 1. Map of Stonehouse. Key to schools: A, Special; B, state secondary; C, state infant and junior; D, private junior (a); E, private senior; F, private junior (b). Numbers of cases of meningococcal disease are shown in parentheses. ——, Boundaries between areas.

Table 1. Meningococcal disease in Stonehouse residents: case details

<table>
<thead>
<tr>
<th>Case number</th>
<th>Disease onset (month/year)</th>
<th>Age at onset</th>
<th>Sex</th>
<th>Area of residence</th>
<th>School</th>
<th>Organism isolated</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5/83</td>
<td>46</td>
<td>M</td>
<td>PE</td>
<td>——</td>
<td>B15:P1.16R</td>
</tr>
<tr>
<td>2</td>
<td>3/84</td>
<td>10</td>
<td>M</td>
<td>PE</td>
<td>State junior</td>
<td>B15:P1.16R</td>
</tr>
<tr>
<td>3</td>
<td>9/84</td>
<td>12</td>
<td>F</td>
<td>PE</td>
<td>State secondary</td>
<td>B2bR</td>
</tr>
<tr>
<td>4</td>
<td>12/85</td>
<td>11</td>
<td>F</td>
<td>PE</td>
<td>Outside Stonehouse</td>
<td>CSF film positive</td>
</tr>
<tr>
<td>5</td>
<td>12/85*</td>
<td>6</td>
<td>M</td>
<td>PE</td>
<td>State infant</td>
<td>B15:P1.16R</td>
</tr>
<tr>
<td>6</td>
<td>1/86*</td>
<td>11</td>
<td>F</td>
<td>PE</td>
<td>Special</td>
<td>B15R</td>
</tr>
<tr>
<td>7</td>
<td>3/86**</td>
<td>5</td>
<td>M</td>
<td>PE</td>
<td>State infant</td>
<td>B15:P1.16R</td>
</tr>
<tr>
<td>8</td>
<td>6/86**</td>
<td>9</td>
<td>F</td>
<td>PE</td>
<td>State junior</td>
<td>B15:P1.16R</td>
</tr>
<tr>
<td>9</td>
<td>7/86*</td>
<td>32</td>
<td>M</td>
<td>PE</td>
<td>——</td>
<td>B15:P1.16R</td>
</tr>
<tr>
<td>10</td>
<td>7/86***</td>
<td>4</td>
<td>M</td>
<td>VF</td>
<td>——</td>
<td>Clinical diagnosis</td>
</tr>
<tr>
<td>11</td>
<td>7/86 (Died)</td>
<td>7</td>
<td>M</td>
<td>PE</td>
<td>State infant</td>
<td>Clinical diagnosis</td>
</tr>
<tr>
<td>12</td>
<td>7/86</td>
<td>6</td>
<td>M</td>
<td>VF</td>
<td>State infant</td>
<td>Clinical diagnosis</td>
</tr>
<tr>
<td>13</td>
<td>12/86 (Died)</td>
<td>7</td>
<td>M</td>
<td>PE</td>
<td>State junior</td>
<td>B15:P1.16R</td>
</tr>
<tr>
<td>14</td>
<td>12/86***</td>
<td>2</td>
<td>M</td>
<td>VF</td>
<td>——</td>
<td>B15:P1.16R</td>
</tr>
<tr>
<td>15</td>
<td>3/87</td>
<td>9</td>
<td>F</td>
<td>R</td>
<td>State junior</td>
<td>B15:P1.16R</td>
</tr>
</tbody>
</table>

*, **, *** indicate cases in same households.
PE, Park Estate; VF, Verney Fields; R, Rosedale.

estimated 20.7% in Stroud District; the proportions in Park Estate and Verney Fields were close to the mean for Stonehouse (Table 2). The proportion of people aged 65 and over was 17.6% in Stonehouse compared with an estimated 16.0% in Stroud District; of the five Stonehouse areas Park Estate had the highest figure at 20.6%.
Stonehouse survey – epidemiology

Table 2. Population and age distribution in Stonehouse

<table>
<thead>
<tr>
<th>Population</th>
<th>Park Estate</th>
<th>Verney Fields</th>
<th>Little Australia</th>
<th>Rosedale</th>
<th>Bridgend</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>1729</td>
<td>1836</td>
<td>869</td>
<td>1423</td>
<td>778</td>
<td>6635</td>
</tr>
<tr>
<td>&lt; 16 years (%)</td>
<td>26-3</td>
<td>27-9</td>
<td>31-8</td>
<td>26-8</td>
<td>24-9</td>
<td>27-4</td>
</tr>
<tr>
<td>&gt; 64 years (%)</td>
<td>20-6</td>
<td>20-1</td>
<td>8-8</td>
<td>15-9</td>
<td>18-1</td>
<td>17-6</td>
</tr>
</tbody>
</table>

Sources: Glos. F.P.C.; Stroud District Council.

Table 3. Housing, population density and occupation in Stonehouse

<table>
<thead>
<tr>
<th></th>
<th>Park Estate</th>
<th>Verney Fields</th>
<th>Little Australia</th>
<th>Rosedale</th>
<th>Bridgend</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of houses</td>
<td>641</td>
<td>760</td>
<td>370</td>
<td>541</td>
<td>289</td>
<td>2610</td>
</tr>
<tr>
<td>Council-owned (%)</td>
<td>56-5</td>
<td>57-2</td>
<td>0</td>
<td>5-2</td>
<td>17-5</td>
<td>33-6</td>
</tr>
<tr>
<td>Mean no. people per house</td>
<td>2-7</td>
<td>2-4</td>
<td>2-4</td>
<td>2-6</td>
<td>2-5</td>
<td></td>
</tr>
<tr>
<td>Mean no. people per acre</td>
<td>26-6</td>
<td>24-6</td>
<td>28-8</td>
<td>14-6</td>
<td>12-1</td>
<td>20-0</td>
</tr>
<tr>
<td>Household heads with manual occupation (%)</td>
<td>77-5</td>
<td>74-1</td>
<td>51-7</td>
<td>46-5</td>
<td>65-0</td>
<td>63-7</td>
</tr>
</tbody>
</table>

Sources: Glos. F.P.C.; Stroud District Council; 1981 Census.

Boundaries of enumeration districts did not coincide with the boundaries of the designated areas. An analysis of the 1981 Office of Population Census and Surveys Small Area Statistics showed that in those enumeration districts most closely corresponding to Park Estate and Verney Fields there was a higher incidence of employed household heads in Social Classes III, IV and V compared with the rest of Stonehouse (Table 3). Another socio-economic indicator, the proportion of council-owned housing, was 33-6% in Stonehouse at the time of the survey compared with 17-8% in Stroud District. Park Estate and Verney Fields contained 91% of council-owned housing in Stonehouse. There was little variation in the average number of people per house though Park Estate had the highest figure; estimates of population density within the residential parts of each area averaged 20 people per acre, the highest density being in Little Australia (Table 3).

During the fortnight of the survey 6237 persons attended for screening; 5006 were Stonehouse residents and the remaining 1231 were non-resident pupils and staff of Stonehouse schools. This represented a 75% attendance by the residents of Stonehouse and included 87% of the 1–19-year-olds (Table 4). The under 1-year-olds had not been invited but 16 (15%) were tested on request by their parents.

The lowest attendance from the five areas was 66% from Verney Fields (Table 5). All the schools had very high attendance figures including those pupils not living in Stonehouse. The overall percentage of school-children tested was 96% (Table 6). Technical failures in testing or refused consent were uncommon – 99-8% of the 6237 attenders provided a nasopharyngeal swab, a saliva sample was collected from 98-9% and a blood sample from 97-5% (Table 7). Even in the 1–4-year age group venepuncture was successful in 87%.
### Table 4. Attendance of Stonehouse residents by age and sex

<table>
<thead>
<tr>
<th>Age in years</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tested</td>
<td>(%)</td>
</tr>
<tr>
<td>&lt; 1</td>
<td>59</td>
<td>(10-2)</td>
</tr>
<tr>
<td>1–4</td>
<td>214</td>
<td>(83-9)</td>
</tr>
<tr>
<td>5–9</td>
<td>237</td>
<td>(95-4)</td>
</tr>
<tr>
<td>10–14</td>
<td>182</td>
<td>(90-5)</td>
</tr>
<tr>
<td>15–19</td>
<td>261</td>
<td>(71-6)</td>
</tr>
<tr>
<td>20–24</td>
<td>257</td>
<td>(68-9)</td>
</tr>
<tr>
<td>25–34</td>
<td>402</td>
<td>(78-9)</td>
</tr>
<tr>
<td>35–44</td>
<td>421</td>
<td>(77-0)</td>
</tr>
<tr>
<td>45–54</td>
<td>298</td>
<td>(72-5)</td>
</tr>
<tr>
<td>55–64</td>
<td>300</td>
<td>(71-3)</td>
</tr>
<tr>
<td>65+</td>
<td>475</td>
<td>(50-4)</td>
</tr>
<tr>
<td>Total</td>
<td>3196</td>
<td>(74-0)</td>
</tr>
</tbody>
</table>

### Table 5. Attendance of Stonehouse residents by area

<table>
<thead>
<tr>
<th>Area</th>
<th>Population</th>
<th>No.</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Park Estate</td>
<td>1729</td>
<td>1273</td>
<td>(73-6)</td>
</tr>
<tr>
<td>Verney Fields</td>
<td>1836</td>
<td>1216</td>
<td>(66-2)</td>
</tr>
<tr>
<td>Little Australia</td>
<td>809</td>
<td>750</td>
<td>(86-3)</td>
</tr>
<tr>
<td>Rosedale</td>
<td>1423</td>
<td>1226</td>
<td>(86-2)</td>
</tr>
<tr>
<td>Bridgend</td>
<td>778</td>
<td>541</td>
<td>(69-5)</td>
</tr>
<tr>
<td>Total</td>
<td>6635</td>
<td>5006</td>
<td>(75-4)</td>
</tr>
</tbody>
</table>

### Table 6. Attendance rate of children at school in Stonehouse

<table>
<thead>
<tr>
<th>School*</th>
<th>No. of children on school roll</th>
<th>Resident in Stonehouse</th>
<th>Pupils tested</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>No.</td>
<td>(%)</td>
</tr>
<tr>
<td>State infant/junior</td>
<td>443</td>
<td>428</td>
<td>(96-6)</td>
</tr>
<tr>
<td>Private junior (a)</td>
<td>49</td>
<td>4</td>
<td>(8-2)</td>
</tr>
<tr>
<td>Private junior (b)</td>
<td>194</td>
<td>19</td>
<td>(9-8)</td>
</tr>
<tr>
<td>State secondary</td>
<td>781</td>
<td>280</td>
<td>(35-0)</td>
</tr>
<tr>
<td>Private senior</td>
<td>337</td>
<td>14</td>
<td>(4-2)</td>
</tr>
<tr>
<td>Special</td>
<td>58</td>
<td>5</td>
<td>(8-6)</td>
</tr>
<tr>
<td>Total</td>
<td>1802</td>
<td>750</td>
<td>(40-3)</td>
</tr>
</tbody>
</table>

* See Fig. 1.
Table 7. Sampling compliance in all attenders

<table>
<thead>
<tr>
<th>Age group in years</th>
<th>Total no. of attenders</th>
<th>Postnasal swab samples</th>
<th>Saliva samples</th>
<th>Blood samples</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>No. (%)</td>
<td>No. (%)</td>
<td>No. (%)</td>
</tr>
<tr>
<td>1-4</td>
<td>324</td>
<td>324 (100-0)</td>
<td>296 (91-4)</td>
<td>282 (87-0)</td>
</tr>
<tr>
<td>5-9</td>
<td>537</td>
<td>535 (99-3)</td>
<td>531 (98-9)</td>
<td>515 (95-9)</td>
</tr>
<tr>
<td>10 &amp; over</td>
<td>5376</td>
<td>5375 (100-0)</td>
<td>5340 (99-3)</td>
<td>5285 (98-3)</td>
</tr>
<tr>
<td>Total</td>
<td>6237</td>
<td>6234 (99-9)</td>
<td>6167 (98-9)</td>
<td>6082 (97-5)</td>
</tr>
</tbody>
</table>

Throughput sometimes reached the planned maximum of 90 subjects per hour but waiting rarely exceeded 15 min at any time. The school testing also kept to schedule.

One brief grand mal seizure was recorded in a boy with no history of fits; there were no other serious adverse events.

DISCUSSION

Interesting features of the Stonehouse outbreak include the localization of the disease within the town, the high attack rate in 5- to 9-year-old children and the high secondary attack rates.

It is difficult to obtain an accurate age-sex structure of any defined population between each 10-year census. Electoral registers are updated annually but provide only a list of residents eligible to vote. Consequently it was considered that the computerized FPC registration list, despite inaccuracies due to logistic delays, would provide the most accurate estimate of the Stonehouse population without conducting a separate household census. Although Stonehouse had a 7% higher proportion of under-16-year-olds than the mean for the Stroud District, the proportions of under-16-year-olds (and of 5- to 9-year-olds) in Park Estate and Verney Fields were close to the mean for Stonehouse so that the higher disease rates in these areas could not be explained by a predominance of the more susceptible age groups. The mean number of people per house was marginally higher in Park Estate but the population density was higher in Little Australia. The main associations found in this analysis were that the two areas in which all but one of the cases lived had considerably higher proportions of council-owned housing and of correspondingly lower social class in household heads than the rest of the town. Previous research has also shown an association between lower socio-economic indicators and meningococcal disease (Farries et al. 1975).

Rifampicin prophylaxis for household contacts of a case of meningococcal disease is recommended in Britain and North America in order to reduce secondary attack rates (PHLS, 1986; Centers for Disease Control, 1981). Compliance is likely to be good in the family members of a child with meningococcal disease. The high secondary attack rate reported here is disappointing and raises doubts about the effectiveness of rifampicin in preventing secondary cases. The long delay between index and secondary cases could be explained by the time taken for the virulent strain to be reintroduced into the family and thence to reach another susceptible family member; rifampicin may do
no more than defer the onset of disease in close contacts of cases. The long interval
between primary and secondary cases adds further weight to the hypothesis that
B15.16R organisms are less transmissible than other strains of pathogenic
meningococci.

Although there have been extensive studies of meningococci in military
populations, particularly in the USA (Goldschneider, Gotschlich & Artenstein,
1969), no study on this scale has been previously undertaken to investigate
meningococcal carriage and immunity in a civilian population. The relationship
between non-secretion and meningococcal carriage has not been examined
previously.

There was a very high overall attendance and nearly all who came to a sampling
session provided all three requested samples. Several factors may have contributed
to the high attendance. First, meningococcal disease can be frightening in its
severity. It often begins suddenly in previously healthy individuals and may cause
death within a few hours. A case in a school causes intense anxiety in pupils,
parents and teachers, whereas cases occurring in infants generally receive less
publicity. As several cases had occurred recently in school-children living in
Stonehouse, parents and school-children were all well aware of the problem.
Second, enlisting the support of the local and national media ensured that interest
was maintained at a high level. Third, individual explanatory letters to each
household accompanied by registration cards ensured that all individuals were
aware that their active participation was being sought. Fourth, the provision of
an adequate number of sampling sessions ensured that processing of subjects was
rapid and that delays were minimal. The co-operation of the school authorities in
this respect was invaluable in providing facilities for sampling at the individual
schools and in releasing children class by class to attend.

The high compliance in providing all three specimens was primarily a reflection
of the willingness of nearly all the subjects to help. An additional factor was the
use of a single signed consent for all three tests. Separate rooms for the sampling
procedures assisted in reducing anxiety and in improving compliance in blood
testing. Only a few individuals declined to provide the full set of specimens. The
main reason for not achieving even higher compliance for blood collection was
occasional technical failure, particularly in very young children. Nevertheless it is
possible, with the co-operation of parents, to collect blood samples from the
majority of children as young as 1 year of age.

The survey was completed within the planned 2-week period, and continuing
disease activity was confirmed by the occurrence of the three further cases.

Early recruitment of nurses, phlebotomists, technical, clerical and medical staff
and their subsequent briefing meant that all the teams were well informed about
the methods and objectives of the survey. Sharing of data in the collaborating
centres was made possible by the use of compatible computer hardware and by the
early involvement of PHLS Computer Services in the design of programs. The
division of the laboratory work between four Public Health Laboratories proved
essential in managing the large workload additional to the routine services. The
high attendance and high compliance for all three sampling procedures emphasized
the importance of detailed preliminary planning. Effective collaboration between
the Departments of Community Medicine and Microbiology and within the
network of PHLS laboratories was vital to the success of this survey.
Stonehouse survey – epidemiology

We gratefully acknowledge the willing assistance of the population of Stonehouse, the headmasters, staff and pupils of Stonehouse schools, voluntary helpers and all the professional, technical and clerical staff involved in the collection and handling of specimens and data. We also thank Professor J. R. T. Colley for advice on the organization of the survey.

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REFERENCES


