

Auditing and improving notification and chemoprophylaxis in bacterial meningitis

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Abstract

Study objective—The aim was to audit, against agreed standards, the control of bacterial meningitis, in particular completeness of notification and appropriateness of distribution of chemoprophylaxis to contacts; and to implement appropriate changes and monitor their impact.

Design—The first phase involved determination, for the years 1983 and 1984, of completeness of notification by comparison with a comprehensive case register. Information about chemoprophylaxis was obtained from case notes, questionnaires to general practitioners and other records. The second phase involved introducing a programme of clinician education in the hospital with the poorest observed notification performance and re-examining performance during 1988. Districtwide education regarding chemoprophylaxis was undertaken and the situation re-examined in 1988.

Setting—The study took place in Mid Glamorgan Health Authority (population 536 000), with four acute hospitals.

Population—Consisted of all the residents of Mid Glamorgan Health Authority.

Main results—During the first phase of the audit only 28 out of 79 cases of bacterial meningitis were notified (35%). Performance in one hospital was significantly worse than in the other three. Chemoprophylaxis was distributed to 20 out of 26 (77%) cases of meningococcal meningitis but inappropriate drugs were used in four cases and prophylaxis was distributed more widely than is recommended in 10 cases. In the phase 2 re-examination, a significant improvement in notification was observed in the hospital where special measures were taken, with no change in a "control" hospital. Chemoprophylaxis improved throughout the District, although rifampicin continued to be distributed too widely.

Conclusions—As a result of this audit, measurable improvements in both infectious disease notification and chemoprophylaxis practice were obtained by the education of clinicians. The study provides a good example of a completed audit cycle in public health medicine.

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into other specialties, but there is a pressing need for it to audit its own practice. The Faculty of Public Health Medicine has published guidance on the subject.¹ One of the acknowledged roles of the specialty is in the control of infectious disease. A comparison of the control measures taken during infectious disease incidents against agreed standards is vital.

A guiding principle of medical audit is that areas selected for audit should cover significant health problems.² Among notifiable infectious diseases, meningococcal meningitis has been a major cause of public concern in the United Kingdom since the most recent epidemic began in 1985. Public health physicians take a leading role in its control.³ In response to local anxiety and to the evidence that Mid Glamorgan had at that time the fourth highest incidence of notified meningococcal meningitis among the counties of England and Wales,⁴ a broadly based study of all types of bacterial meningitis was started in Mid Glamorgan Health District in late 1986. The district has a population of 536 000 (1988 mid-year estimate) making it the fourth largest in England and Wales. There were at that time four medical officers of environmental health working with six district councils.

The principal audit objectives of the planned study were: (1) to audit and, if necessary, take measures to improve all aspects of distribution of chemoprophylaxis to contacts of cases of meningococcal meningitis; and (2) to audit and, if necessary, take measures to improve notification to the medical officers for environmental health of meningitis of all types within the district. A further important principle in audit is that the audit cycle should be completed by the development, implementation, and subsequent evaluation of appropriate changes. This study presents an example of such a completed audit cycle.

Methods

A register of all cases of all types of meningitis occurring in Mid Glamorgan residents for the years 1983 and 1984 was established in autumn 1986. The data sources used in compiling this were: hospital activity analysis; statutory infectious disease notifications; laboratory data; death returns; and paediatric ward admission books. Hospital case notes and, in a few cases, necropsy reports and discharge summaries were then examined in order to validate the diagnoses. Detailed descriptions of the methods and of the case definitions used have been given elsewhere.⁵ The two years in question were chosen because they were the years covered by the most up to date hospital activity analysis data then available.

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In the United Kingdom, public health medicine is the medical specialty most commonly associated with a role in facilitating the introduction of audit

This comprehensive case register was used to determine the proportion of confirmed cases of meningitis which had in fact been notified. The standard set for comparison was that 100% of cases should be notified. Information about distribution of chemoprophylaxis to contacts of meningococcal meningitis was based on several data sources: hospital case notes, records kept by the four medical officers for environmental health, and the responses to a questionnaire sent to the current general practitioner of each of the cases of meningococcal disease. In this questionnaire they were asked to determine from their records (and where there was uncertainty by asking the patient's family) whether prophylaxis was given and, if so, of what type. In Mid Glamorgan general practitioners are frequently involved in the distribution of chemoprophylaxis. All questionnaires were completed and returned. The standard for comparison was that disseminated by the Communicable Disease Surveillance Centre (CDSC) which recommends that rifampicin, to be given for two days in appropriate dosage, should be distributed as soon as possible to household members and to persons kissing contacts of cases on the mouth in the 10 days preceding admission.

In the light of the results (presented below), which indicated performance falling short of the standards set, various measures were taken during 1987. Strenuous efforts were made by the Public Health Medicine department to improve notification in the management unit of the health authority with the worst performance. These measures included: the distribution of a plastic card (listing all notifiable infectious diseases) to all hospital clinicians and general practitioners in that unit; discussion of the importance of notification at medical executive committee meetings and postgraduate meetings; active liaison with the hospital microbiology department to encourage informal communication of laboratory results to the medical officer of environmental health (laboratories are not currently obliged to

notify cases, but many of the unnotified cases were identified in laboratory records); the transfer of the infectious disease register from the environmental health department of the local district council to the public health medicine department in order to shorten lines of communication; and change from a manual to a computerised system.

In order to improve chemoprophylaxis distribution, meetings were organised throughout the district, particularly with paediatricians, and clinicians were involved in the formulation of written policies.

It is vital in medical audit to close the "audit cycle" by evaluating the impact of measures taken. This was done as follows.

NOTIFICATION

In the unit where measures to improve notification had been taken, laboratory confirmed cases of the three main types of bacterial meningitis (meningococcal, pneumococcal, and *H. influenzae*) were identified from laboratory records for a one year post-implementation period (January 1988–December 1988). Together these three types accounted for 76% (60/79) of cases of bacterial meningitis in the initial study period. Furthermore laboratory records were felt to provide an adequate way of ascertaining cases of these three diseases [16/19 (84%) during the initial study period in the unit concerned]. The proportion of these cases notified was compared with the pre-implementation situation in the same Unit. Similar data were collected for a control hospital where no changes were implemented. This approach gave an unbiased comparison of practice during the two periods.

CHEMOPROPHYLAXIS

Post-implementation data for the whole of Mid Glamorgan were obtained from an all Wales database [compiled by Communicable Diseases Surveillance Centre (Wales)]. This contained information provided by Medical Officers for Environmental Health about the chemoprophylaxis given to meningococcal contacts during 1988.

STATISTICAL METHODS

We used χ^2 tests for significance where appropriate. Where expected values were less than five in any one cell of a table, a hypothesis test based on permutations was used. This is analogous to Fisher's exact test but can be used on tables of size $k \times 2$. A Fortran program to do this based on a published version⁶ has been devised by one of the authors (TJP).

Results

PRE-IMPLEMENTATION

Notification

The baseline results shown in table I indicate the low overall proportion of cases notified, for both meningococcal meningitis alone (65%, 17/26) and for all types of bacterial meningitis (35%, 28/79). Of unnotified cases of bacterial meningitis, 49% (25/51) were nonetheless recorded in laboratory records. There was also statistically significant heterogeneity between units in the proportion notified for all cases of bacterial meningitis com-

Table I Mid Glamorgan 1983/84: notification of cases of bacterial meningitis subdivided by unit (U1–4)

Disease	Notified				Not notified			
	U1	U2	U3	U4	U1	U2	U3	U4
Meningococcal meningitis ^a	3	3	8	3	2	6 ^b	1	0
Pneumococcal meningitis	1	0	0	1	4	3	4	2
<i>H. influenzae</i> meningitis	4	0	0	3	3	7	3	0
Other bacterial meningitis	0	0	1	1	4	6	3	3
All bacterial meningitides ^c	8	3	9	8	13	22	11	5

^aTwo cases of meningococcal septicaemia are excluded since this condition was not notifiable at the time of the study

^bComparison of meningococcal meningitis notification in Unit 2 versus other units combined: two tailed $p=0.028$, based on 15 000 random permutations

^cComparison of notification of all bacterial meningitides in the four units: two tailed, $p=0.013$, based on 15 000 random permutations

Table II Evaluation of measures to improve notification in unit 2 (U2), with unit 3 (U3) as a control (based on laboratory confirmed cases)

Disease	Pre-implementation (1983/84)				Post-implementation (1988)			
	Notified		Not notified		Notified		Not notified	
	U2	U3	U2	U3	U2	U3	U2	U3
Meningococcal meningitis	3	7	4	1	8	4	1	4
Pneumococcal meningitis	0	0	3	3	0	0	2	1
<i>H. influenzae</i> meningitis	0	0	6	3	5	0	0	1
Total	3	7	13	7	13	4	3	6

Comparison of proportions notified *v* not notified for all types of meningitis, before and after measures:

Unit 2 (intervention): $\chi^2=10.1$, 1DF, $p=0.0014$

Unit 3 (control): $p=0.47$ (Fisher's exact test)

bined. The worst performance was in unit 2, which includes a 400 bed acute hospital. It was here that efforts to improve notification were concentrated.

Chemoprophylaxis

In 77% of cases of meningococcal meningitis (20/26) chemoprophylaxis was distributed to contacts. In four notified cases prophylaxis was not given—in three cases the reasons for this omission were inappropriate. Prophylaxis was distributed to contacts in 7/9 cases which were not notified, usually by the hospital clinician. In 4/20 cases a drug other than rifampicin was given and in 5/20 cases the prophylaxis was given for longer than the recommended two days. In 50% of cases (10/20) prophylaxis was distributed more widely than is recommended.

POST-IMPLEMENTATION

Notification

The effect of the measures introduced in unit 2 (U2) are shown in table II. This before and after comparison was confined to laboratory confirmed cases of the three main types of bacterial meningitis. This will nonetheless give an unbiased comparison of performance. There was a statistically significant improvement in the proportion notified in the post-implementation period. By contrast in the control unit (U3) there was no statistically significant alteration in the proportion notified.

Chemoprophylaxis

Data on 15 cases of meningococcal meningitis were available during the year following implementation of the measures. In all cases a two day course of rifampicin was used. However, in 47% (7/15) of cases prophylaxis continued to be distributed more widely than is recommended. This was largely attributable to the unnecessary administration of prophylaxis to nursing, medical, and ambulance staff and further discussions have taken place to reassure these groups concerning the safety of current policies.

Discussion

The results presented strongly suggest that measures introduced in response to the initial data collection led to an improvement in the notifi-

cation of bacterial meningitis in one unit and in most aspects of chemoprophylaxis throughout the district. These measures were largely educational and involved a conscious attempt to make clinicians aware of the need for infectious disease control measures in the community. The improvement in notification (table II) of meningococcal and *H. influenzae* meningitis (treated largely by paediatricians) contrasts with the unchanged position for pneumococcal (treated largely by adult physicians). This confirms our impression of a generally higher level of interest amongst paediatricians in these issues.

The relocation and computerisation of the notification register also appear to have had the desired effect of shortening the time that elapses between notification occurring and preventive measures being instituted.

A recurrent problem in medical audit is that of orphan data,⁷ whereby changes are either not implemented or their effects not monitored. This study provides an example of a completed audit cycle. Baseline data were gathered and then compared with agreed standards. This in turn led to the development and implementation of changes and a subsequent evaluation of their impact. With a relatively unusual disease such as meningitis a considerable period of time (this study spanned almost three years) was necessary in order to accumulate sufficient cases to make valid before and after comparisons, but the cycle can be completed more rapidly for other conditions.

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