# The Impact of Meningococcal group C immunisation on Bacterial Meningitis in the South Eastern Health Board 1999-2002

B.M O'Connor, M.I O'Connor, M. Mahon, O. O'Reilly

Department of Public Health, South Eastern Health Board, Lacken, Dublin Road, Kilkenny

## Introduction

Bacterial meningitis is a significant cause of morbidity and mortality[1]. It also represents considerable workload, both in terms of the individual case and in the wider public health context. Bacterial meningitis causes concern and anxiety among the public and vigilance is required to ensure early detection and prompt antibiotic treatment for suspected cases along with other appropriate public health measures.

This report examines the impact of meningococcal C vaccination in the South Eastern Health Board (SEHB) along with information obtained during enhanced surveillance of bacterial meningitis for the period 1999-2002.

The SEHB Department of Public Health collates the clinical and laboratory, including surveillance, information on all cases of bacterial meningitis in the South East. The objectives of the surveillance are to ; investigate the impact of meningococcal C immunisation in the SEHB and to monitor changes in the epidemiology of bacterial meningitis.

The conjugated meningococcal C vaccine was introduced in Ireland in October 2000 and became part of the routine schedule of infant immunisation. A "catch-up" programme of immunisation recommended on introduction of the vaccine to include everyone up to 22 years of age.

## Methods

Bacterial meningitis cases were identified from the SEHB surveillance database of notifiable diseases. The surveillance database used in the SEHB is Epi Info 6 (Epidemiological Information database version 6)[2].

Details from bacterial notification forms are entered on the Epi Info database on the date the disease is notified. Details, where available, included symptoms at presentation, age, pre-admission antibiotics, and length of hospital stay, final diagnosis, disease classification (presumed, probable definite), outcome, vaccination status, laboratory confirmation and contact details.

The SEHB Hospital Inpatient Enquiry (HIPE) database, which covers all admissions to acute public hospitals was accessed to obtain information on the length of hospital stay for each case. Seven per cent of cases attended hospitals outside the SEHB, and information was incomplete on these cases. The HIPE database was searched using ICD (International Classification of Diseases) codes that correspond to meningococcal disease[3].

Incidence rates were calculated by using 2002 census figures[4]. Microsoft Excel and SPSS were used for statistical analysis of the data.



## Results

Bacterial Meningitis

There were 219 cases of bacterial meningitis notified over the period 1999-2002. Invasive Meningococcal Disease (IMD) accounted for the majority of bacterial meningitis notifications in 1999-2002 (Table 1). The total number of bacterial meningitis notifications decreased by 49% in the period 1999-2002.

Table 1: Bacterial Meningitis notifications 1999-2002

| Year | 1999 | 2000 | 2001 | 2002* |
|---|---|---|---|---|
| *Streptococcus Pneumonia* | 4 | 1 | 1 | 1 |
| *Group B Streptococcus* | 1 | 1 | 1 | 0 |
| *Streptococcus bovis* | 1 | 0 | 0 | 0 |
| *E.Coli* | 1 | 0 | 0 | 0 |
| Unknown | 3 | 9 | 4 | 2 |
| Invasive Meningococcal Disease | 49 | 70 | 43 | 27 |
| Total Bacterial Meningitis | 59 | 81 | 49 | 30 |

* 2002 Provisional SEHB data

Invasive Meningococcal Disease

Invasive Meningococcal Disease accounted for 86% of bacterial meningitis cases in the period 1999-2002. IMD includes all meningococcal IMD infections (meningococcal meningitis and meningococcal septicaemia) and is classified according to serogroup in table 2.

Table 2: IMD notification classifications 1999-2002

| | 1999 | | | 2000 | | | 2001 | | | 2002 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Cases | Rate[a] | | Cases | Rate[a] | | Cases | Rate[a] | | Cases | Rate[a] | |
| | Cases | SEHB | Nat[b] | Cases | SEHB | Nat[b] | Cases | SEHB | Nat[b] | Cases | SEHB | Nat[c] |
| B | 21 | 4.95 | 7.56 | 27 | 6.37 | 6.58 | 24 | 5.66 | 6.25 | 17 | 4.81 | 4.00 |
| C | 19 | 4.48 | 3.44 | 24* | 5.66 | 3.54 | 5 | 1.18 | 0.89 | 1 | 0.23 | 0.36 |
| Other | 0 | | | 0 | | | 0 | | | 2 | 0.46 | 0.21 |
| Unknown | 9 | | | 19 | | | 14 | | | 7 | | |
| Total IMD | 49 | 11.56 | 13.68 | 70 | 16.52 | 13.14 | 43 | 10.15 | 8.32 | 27 | 6.37 | 5.24 |

* Meningococcal group C vaccine introduced in Oct 2000

a Rate per 100,000 population (based on 2002 census figures)

b National figures for IMD available at http://www.ndsc.ie/Publications/BacterialMeningitisReports/d471. PDF-

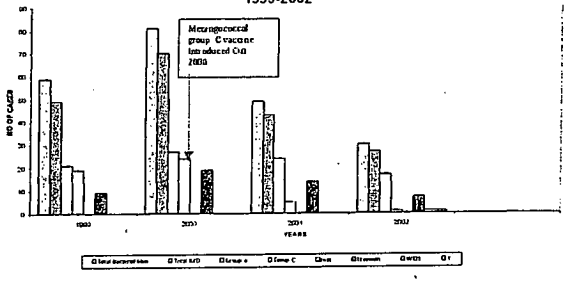
c Provisional 2002 national figures for Q1, Q2 & Q3 only available at http://www.ndsc.ie/publications/BacterialMeningitisReports/d624. PDF-

There was an increase in group B meningococcal disease between 1999 (4.95/100,000) and 2000(6.37/1000,000) with a decrease of 11% seen in 2001 (5.66/1000,000) and a decrease of 29% in 2002 (4.01/100,000). Nationally figures showed a decrease in group B cases between 1999-2000 with a rate of 7.56/100,000 in 1999 and 6.58/100,000 in 2000. Cases decreased nationally by 6% in 2001 (6.25/100,000) and by 36% (4.00/100,000) in 2002 (table 2).

The three-year rolling average (1999-2001) shows an incidence rate of 5.66/100,000 for group B meningococcal compared to an incidence rate of 5.34/100,000 for (2000-2002). The national incidence rate for the three-year rolling averages (1999-2001) and (2000-2002) was 6.8/100,000 and 5.61/100,000 respectively.



Figure 1: Number of cases of Bacterial Meningitis notified in SEHB 1999-2002




Classification of IMD is defined by group (figure 1) and also as Definite, Presumed or Possible (table 3)[5]. The percentage of notifications defined as definite meningococcal disease cases was 67%, 62%, 46%, and 60% for 1999, 2000, 2001 & 2002 respectively.

Table 3 Classification of IMD 1999-2002

| Classification | 1999 | 2000 | 2001 | 2002[1] |
|---|---|---|---|---|
| Definite | 33 | 43 | 20 | 18 |
| Presumed | 7 | 7 | 5 | 1 |
| Possible | 9 | 20 | 18 | 8 |

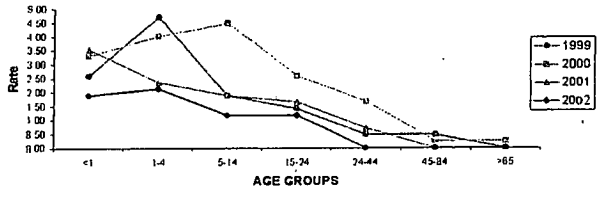
IMD Epidemiology

Incidence rates were higher for males for IMD in 1999(64%) and 2000 (61%), with incidence rates higher for females in 2001(51%) and 2002(52%).

The highest age-specific incidence rates were in the 1-4 age group for 1999 (4.72/100,000) and 2002 (2.12/100,000) with the highest age-specific incidence rates in the 5-14 age group for 2000 (4.49/100,000) and in the <1 age group for 2001 (3.54/100,000). (figure 2). There was a statistically significant difference in the incidence of bacterial meningitis cases between those < 24 years and those >24 years over the four years. (Independent t-tests df=26, p=<0.001) (figure 2).



Figure 2: IMD by age groups




The General Medical Scheme ( GMS) in Ireland provides persons who are unable, without undue hardship, to arrange General Practitioner Medical and Surgical Services for themselves and their dependants. Eligibility to be included on this system is dependent on a financial assessment. GMS eligibility in the SEHB is 35.2%[6].

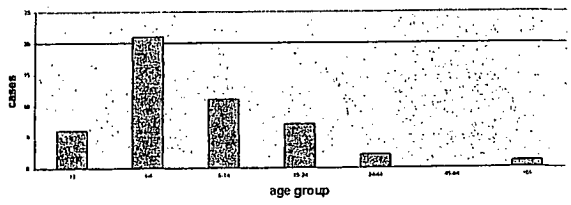
General Medical Scheme (GMS) status was recorded for 163 cases of bacterial meningitis between 1999-2002 with 44% of these patients on the GMS scheme suggesting a possible association between bacterial meningitis and social deprivation.

Meningococcal C

There has been a dramatic decrease in group C meningococcal disease in the SEHB over the period 1999-2002. Cases decreased by 79% between 2000(5.66/100,000) and 2001 (1.18/100,000) with a further decrease of 81% seen in 2002 (0.23/100,000). This decrease was preceded by the introduction of the meningococcal C vaccine.

Sixty five percent of meningococcal C cases that were notified in the 1999-2002 period were in the 1-4 age group (43%) and the 15-24 age group (22%). (Figure 3)

Figure 3: Meningococcal C cases by age group



The average incidence rate for meningococcal C in the SEHB for the period 199-2000 is 5.07/100,000 (3.5/100,000 Nationally) compared to an average incidence rate of 0.7/100,000 (0.6/100,000 Nationally) for the period 20001-2002 period.

In the period since the meningococcal vaccination was made available there was one death due to a definite group C meningococcal disease in the SEHB. Nationally, there have been no deaths due to group C meningococcal disease in 2002, whereas there were 5 deaths in 1999 and 11 deaths in 2000 and 3 deaths in 2001.

Since the introduction of the Meningococcal group C conjugate vaccine in October 2000, there has been an immediate and significant decrease in the cases of group C meningococcal disease notified to the SEHB (average cases 1999/2000 = 22 vs. average cases 2001/2002=6, p=<0.05, z-test). The average incidence rate of meningococcal C reported in the period 1999-2000 was 5.07/100,000 compared to an average incidence rate of 0.70/100,000 for 2001-2002, which is an 86% reduction.

Immunisation status and pre-hospital antibiotics

The outcome of meningococcal disease is influenced greatly by prompt treatment with antibiotics[7,8]. Information on pre-admissions antibiotic treatment was not documented in most cases. Twenty-nine cases recorded administration of preadmission antibiotics and 48% (14 cases) received rifampicin. Between October 2000 and 2002 forty bacterial meningitis cases had received the Meningococcal C vaccine.

Contact tracing was performed on all cases, with rifampicin and vaccination administered as necessary. Of the 57 cases where contact details were recorded a total of 717 contacts were traced with 60% of those receiving rifampicin and five contacts offered Meningococcal C vaccine in 2002.

Resource implications

Information on the length of stay in hospital was gathered on 70% of cases over the four year time period with the average length of stay in hospitals varying from between 7-9 days.

The average daily cost for staying in hospital is €718.2[9]. The annual average cost for patients admitted to hospital with bacterial meningitis for the period 1999-2002 is detailed in table 4.

Table 4: Average hospital cost for bacterial meningitis cases

| Year | No of cases | Average Length of stay (days) | Total length of stay | Cost |
|---|---|---|---|---|
| 1999 | 43 | 9 | 369 | €264,942 |
| 2000 | 57 | 8 | 449 | €322,382 |
| 2001 | 39 | 8 | 316 | €226,888 |
| 2002 | 17 | 7 | 117 | €84,006 |

Symptoms

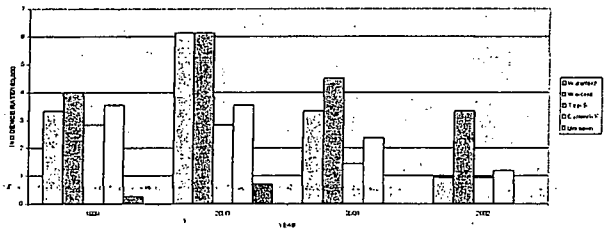
Rash, fever, headache, vomiting and neck stiffness were the most frequently reported symptoms reported in cases of bacterial meningitis with the majority of these symptoms being present in IMD cases.



Geographical location

Bacterial meningitis cases were stratified by Community Care area with the average highest average incidence rate reported in Wexford (4.48) for the period 1999-2002. The lowest incidence rate (2.0) was seen in the Tipperary-South with average incidence rates of 2.6 and 3.4 in the Carlow/Kilkenny and Waterford Community Care areas respectively. The differences in incidence rates between Wexford and Tipperary -South were not statistically significant. (p= 0.01, DF 6)

Figure 4: Bacterial Meningitis by CCA Area



Laboratory data

Blood culture and blood PCR were the most common laboratory methods used to confirm bacterial meningitis cases. Sixty percent of bacterial meningitis cases were confirmed using the above laboratory methods.

## Conclusion

The main findings from this review have shown that the cases of IMD that have occurred in the South Eastern Health Board between 1999-2002 tend to be predominantly group B meningococcal ( 47%), followed by group C (26%), with other serogroups being rare.

The highest incidence rates for bacterial meningitis occurs in the 1-4 age group and in the teenage years.

There has been a decrease in the incidence rate of bacterial meningitis in the last four years in the South Eastern Health Board and this decrease has been seen nationally. This decline has reduced hospital costs significantly with a reduction of 72% in the cost of hospital beds for cases of bacterial meningitis.

The Wexford community care area of the SEHB has had the highest rate of bacterial meningitis cases for each of the last 4 years. Further research is required to investigate if there is an association between the incidence of bacterial meningitis cases and geographical location.

The number of cases of meningococcal C has decreased by 86% since the introduction of the meningococcal C vaccine. This demonstrates the immediate effect of the vaccine and the success of "catch-up" programme in the South Eastern Health Board.



In Quarter 4 2002, the uptake rate of meningococcal C vaccination in children 12 months of age in the SEHB was 83% compared to a figure of 78% for the same cohort nationally. The vaccine uptake in the 24-month-old cohort was 85% compared to a figure of 79% nationally. Although the uptake rate of meningococcal C vaccine in the SEHB is 5-6% higher than the national uptake rate, it still falls short of the 95% uptake needed to provide immunity for group C meningococcal disease.

Failure in the SEHB to achieve the target uptake rate of 95% by a shortfall of between 15-17% is a cause for concern, as there is a section of the population left at risk of contracting group C meningococcal disease.

Acknowledgments

This report is produced with data provided by the Area Medical Officers, Senior Area Medical Officers, Waterford Regional Laboratory, Hospital Clinicians and General Practitioners.

References

1 The Department of Health and Children's Working Group Report on Bacterial Meningitis and Related Conditions, July 1999. Available at http://www.doh.ie/publications/bm99html

2 Epi info CDC website: http://www.cdc.gov/epiinfo/Epi6/EI6dnjp.htm

3 ICD 10th version www.who.int

4 2002 preliminary census data www.cso.ie/census/preliminary_details.html

5 http://www.doh.ie/pdfdocs/meningfn.pdf

6 1999-2002 Report of the Director of Public Health

7 Cartwright K, Reilly S, White D, Stuart J, Early treatment with parenteral penicillin in meningococcal disease BMJ 1992: 305: 143-7

8 Strang JR, Pugh EJ, and Meningococcal Infections: reducing the case fatality rate by giving penicillin before admidstration to hospital. BMJ 1992: 305: 141-3

9 SEHB in-house data on hospital costs