



**MID-WESTERN**  
HEALTH BOARD

**The Epidemiology of  
Bacterial Meningitis  
in the  
MWHB, 1998 to 2003**

**Date: 28<sup>th</sup> February 2004**

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## The Epidemiology of Bacterial Meningitis in the MWHB, 1998 to 2003.

### Introduction:

Bacterial meningitis (including meningococcal septicaemia) is a serious and potentially fatal disease. Different types of bacteria can cause meningitis. The most commonly isolated organisms are:

*Neisseria meningitidis* (Group A, B, C and W135) – causing meningococcal disease (MCD)

*Streptococcus pneumoniae*

*Haemophilus influenzae* b (rare due to primary childhood immunisation)

Outbreaks of meningococcal disease can occur in the community and the illness can give rise to fear in the general public. Early recognition, detection, diagnosis and reporting are essential if further disease is to be prevented. Intervention by health professionals can take the form of advice and re-assurance, chemoprophylaxis or vaccination.

In Ireland, **all cases of suspected** bacterial meningitis (including meningococcal septicaemia) are statutorily notifiable by clinicians. When the clinician makes a notification to the Senior Area Medical Officer in the Community Care Area, the case is investigated by the Area Medical Officer (AMO) and an enhanced surveillance form for bacterial meningitis is completed and sent to the Department of Public Health and the National Disease Surveillance Centre. Contact tracing, intervention as appropriate and follow-up is carried out by AMOs.

Because the notification system records suspected cases of disease, there are occasions where laboratory confirmation of a pathogen (organism) is not present. In some cases, the diagnosis may be changed, in which case, denotification occurs. There have been advances in diagnostic tests and the sensitivity and specificity of tests in recent years, so year to year comparisons are interpreted with caution. Awareness of the illness and information systems and quality of data recorded has changed over time in the MWHB. This makes some trends over the years difficult to interpret. This report makes clear the distinction between bacterial meningitis and meningococcal disease where possible.

Rates, where calculated are per 100,000 population and are based on the data published by Central Statistics Office for Census 1996 (1997-1999) or 2002 (2000-2003).

The case definitions for the diagnosis of possible, presumed and definite meningococcal disease are given in Appendix 1, as recommended by the Department of Health and Children Working Group Report on Bacterial Meningitis and Related Conditions, July 1999.

### Acknowledgements:

The Department of Public Health is very grateful for the efforts and time given by Senior Area Medical Officers and Area Medical Officers in Clare, Limerick and Tipperary North to the surveillance of bacterial meningitis. The co-operation of the staff in the Mid-Western Regional Hospital Microbiology Department is greatly appreciated.

## Results:

There were 205 notifications of “bacterial meningitis including meningococcal disease” in the MWHB from January 1<sup>st</sup> 1998 to December 2003.

*Table 1: Number of notifications of bacterial meningitis and causative organism in MWHB 1998-2003.*

Organism	<i>N. meningitidis</i>				<i>Spn</i>	<i>M.tb</i>	<i>Hinf</i>	GBS	Unk	Total	
	B	C	W135	Untyp All							
Year											
1998	5	7	-	9	21	0	0	0	0	3	24
1999	20	10	-	9	39	1	0	0	0	8	48
2000	13	9	-	8	30	0	0	1	0	10	41
2001	22	2	1	2	27	0	0	0	0	5	32
2002	19	1	-	4	24	2	1	0	0	5	32
2003	23	0	0	0	23	2	0	0	1	2	28
<b>Total</b>	<b>102</b>	<b>29</b>	<b>1</b>	<b>32</b>	<b>164</b>	<b>5</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>33</b>	<b>205</b>

*Spn* – *Streptococcus pneumoniae*; *Hinf* – *Haemophilus influenzae* GBS-Group B *Streptococcus*

One case no date given.

One case of *S. pneumoniae* meningitis was in a 3 month old child, another was a case of meningitis a 4 year old child and one was meningitis detected in a 58 year old. Two cases in 2003 involved a 2 year old child and a five year old child, one male and one female, both recovered.

The Group B streptococcus case was in an adult and proved fatal.

The case of *H. influenzae* meningitis was detected in a 3 year old.

As the numbers of Group B *Streptococcus*, *S. pneumoniae* and *H. influenzae* are small, no further analysis is done for these organisms.

One case of TB meningitis (*M. tuberculosis*) was reported in 2002 in a non-national.

The proportion of *N. meningitidis* isolates that are “untyped” has reduced over the years, probably due to the increasing usage of better diagnostic tests such as the PCR test, performed on an EDTA blood sample or cerebrospinal fluid (CSF) at The Children’s Hospital, Temple Street, Dublin. This test may detect more subclinical cases as well.

*Table 2: Annual incidence rate (per 100,000) of meningococcal disease in MWHB and Ireland, 1997-2003.*

<i>N. meningitidis</i>	Year	n	MWHB			Ireland			
			All	B	C	n	All	B	C
	1997	33	10.41	2.84	4.10	448	12.35	5.02	3.78
	1998	21	6.62	1.58	2.21	448	12.35	6.15	3.47
	1999	39	12.30	5.68	2.84	533	14.70	8.00	3.70
	2000	30	8.83	3.83	2.65	513	14.15	7.06	3.83
	2001	27	7.95	5.89	0.59	322	8.88	6.67	0.94
	2002	24	7.07	5.59	0.29	243	6.7	5.35	0.4
	2003	23	6.77	6.77	0.0	-	-	-	-

(data excludes imported cases)

The rate in both populations for all types of meningococcal disease is illustrated in Figure 1. The rate for group B and C are presented separately to demonstrate the

changing epidemiology of group C infection following the introduction of the conjugate meningococcal C vaccine in October 2000, see Figure 2 and 3.

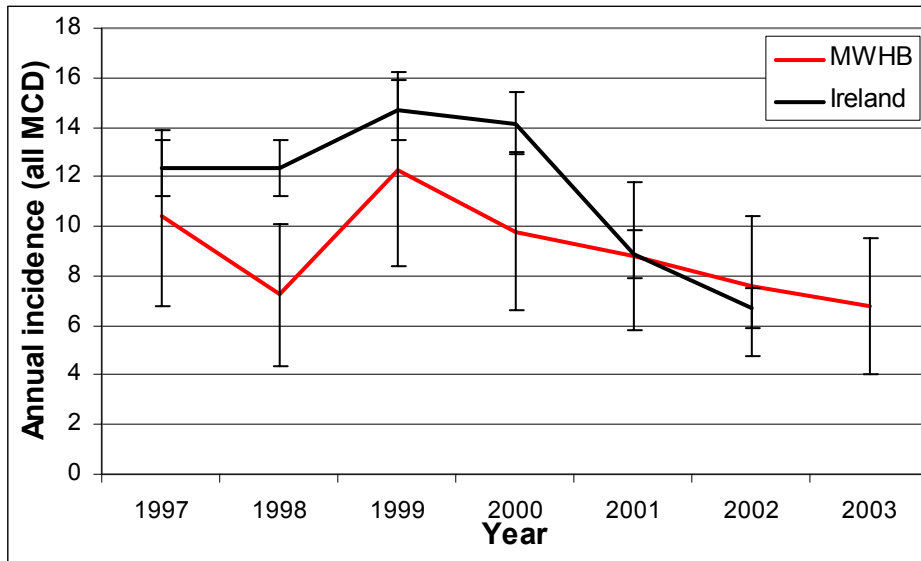


Figure 1: Annual incidence rate (per 100,000) of all meningococcal disease (MCD) in MWHB and Ireland, 1997-2003, including 95% confidence intervals.

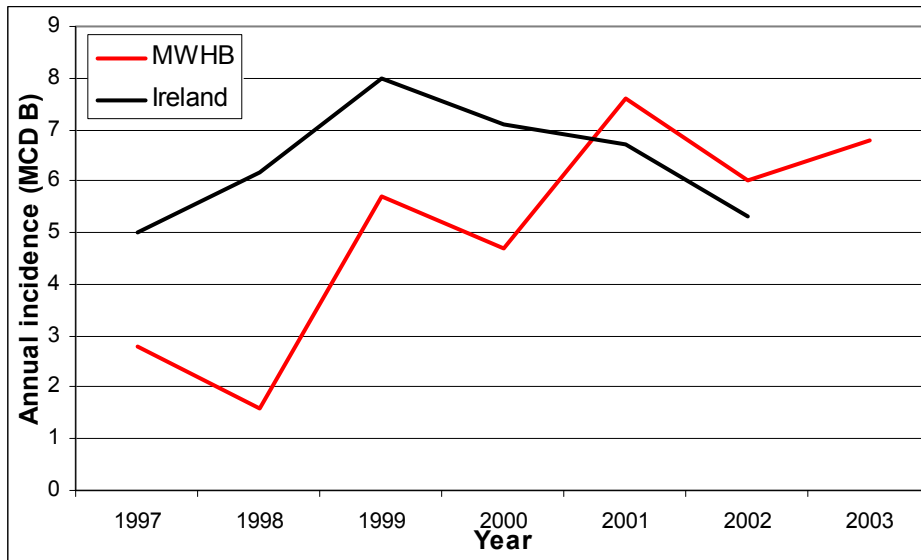


Figure 2: Annual incidence rate (per 100,000) of group B meningococcal disease in MWHB and Ireland, 1997-2003.

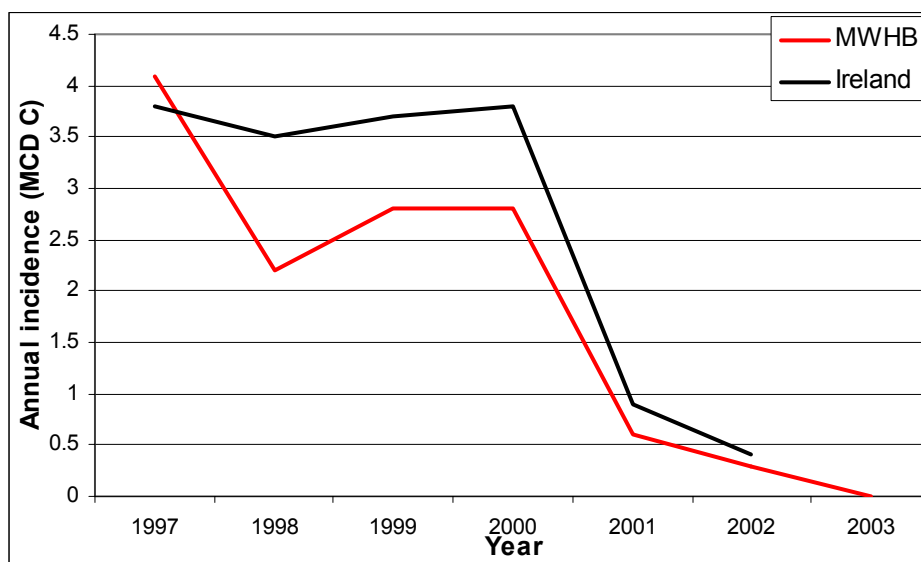


Figure 3: Annual incidence rate (per 100,000) of group C meningococcal disease in MWHB and Ireland, 1997-2003.

Within the MWHB, the variation in meningococcal disease (MCD) between counties is striking over the period 1998 to 2003. Table 3 shows the annual incidence rates (expressed per 100,000 population) for each county.

Table 3: Annual incidence rate for meningococcal disease (MCD) by county, 1998 – 2003 (n=164).

	County (population)						MWHB Rate
	Clare		Limerick		Tipperary N		
	Cases	Rate	Cases	Rate	Cases	Rate	
1998	3	3.19	14	8.48	4	6.89	6.62
1999	15	15.96	8	4.85	16	27.58	12.3
2000	11	10.66	7	3.99	12	19.67	8.83
2001	9	8.71	14	7.99	4	6.56	7.95
2002	6	5.81	15	8.56	3	4.92	7.07
2003	12	11.62	10	5.70	1	1.64	6.77
Total	56		68		40		

Rate expressed per 100,000 population.

**Seasonality (based on date of notification):**

There is a typical seasonality reported to be associated with meningococcal disease (MCD). The disease is more prevalent in the months September through winter until May. This seasonality is also seen in the cases of confirmed meningococcal disease in the MWHB, see Figure 4. However, in more recent times 2000/2001, 2001/2002 and the 2002/2003 periods, there have been cases intermittently throughout the year. In December 2002, the region experienced a large number of cases.

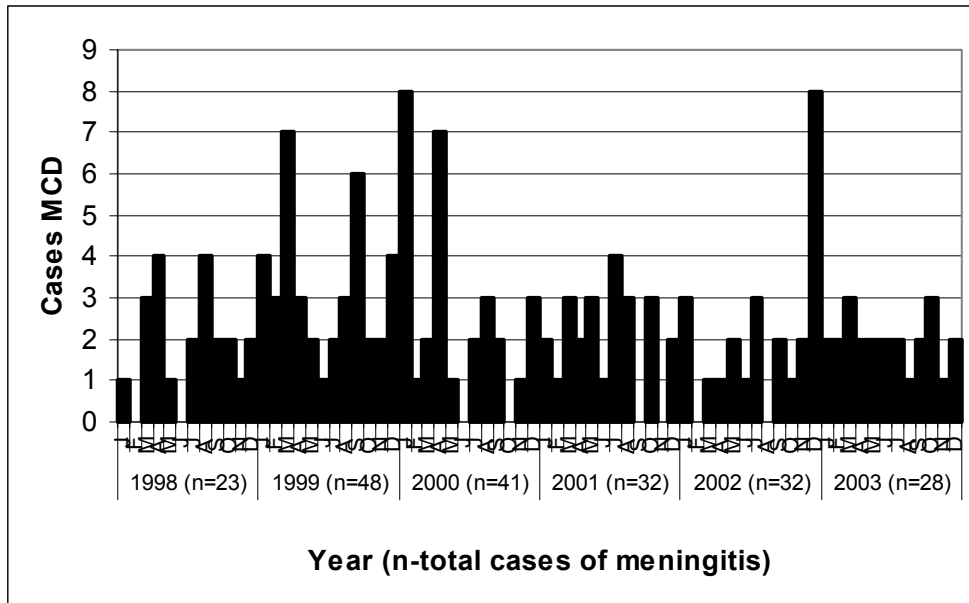


Figure 4: Cases of meningococcal disease notified in the MWHB, 1998-2003.

This is also the case for *N. meningitidis*, groups B and C, though numbers are small, see Figure 5 and Figure 6, respectively.

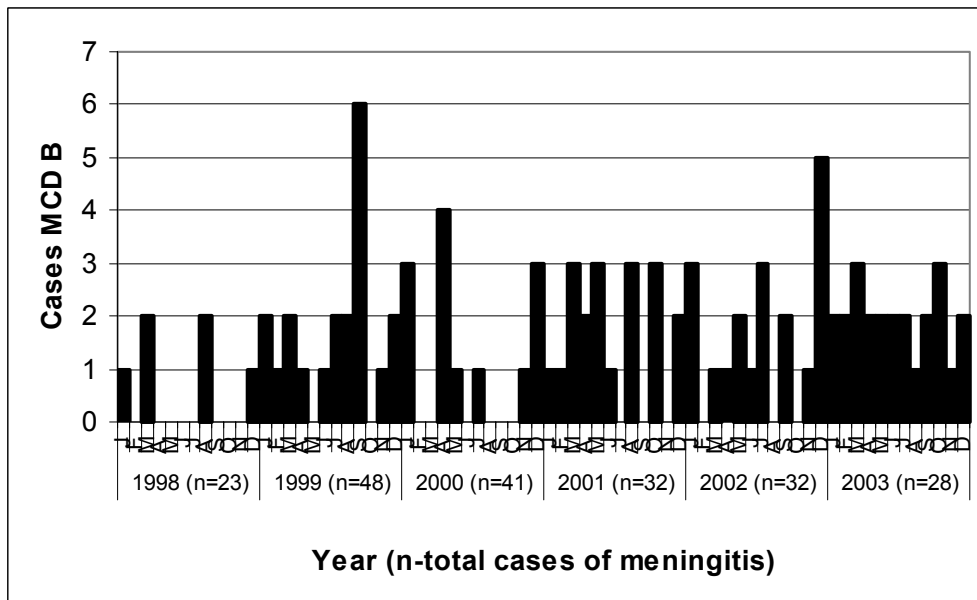


Figure 5: Cases of meningococcal disease group B notified in the MWHB, 1998-2003.

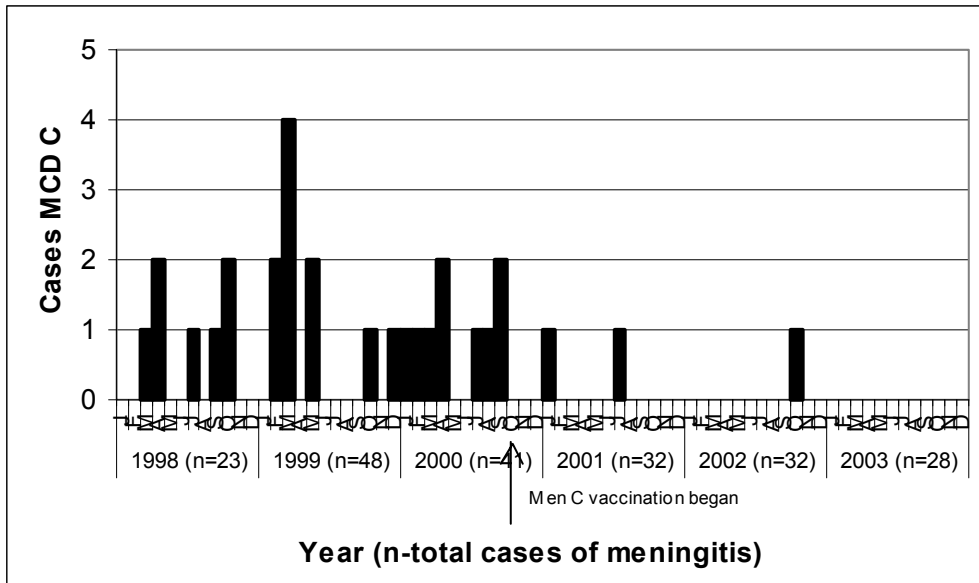


Figure 6: Cases of meningococcal disease group C notified in the MWHB, 1998-2003.

## Sex Distribution:

The population estimates for CCA are not as reliable as county estimates and data were missing for this category for earlier years, so further rates are based on county population.

From 1998 to 2003, 115 cases of bacterial meningitis were detected in males and 90 were female. The average male to female ratio was 1.3:1. This pattern varies from year to year and in different areas.

A detailed description by county is provided in Table 4.

*Table 4: Sex distribution of bacterial meningitis by county in MWHB, 1998-2003 (n=205).*

County	Clare (n=75)		Limerick (n=80)		Tipperary N (n=50)		MWHB	
	M	F	M	F	M	F	M	F
<b>Year</b>								
1998	5	1	9	5	1	3	15	9
1999	10	8	4	4	16	6	30	18
2000	12	6	4	6	9	4	25	16
2001	4	6	8	10	2	2	14	18
2002	4	6	8	9	3	2	15	17
2003	8	5	7	6	1	1	16	12
<b>Total</b>	<b>43</b>	<b>32</b>	<b>40</b>	<b>40</b>	<b>32</b>	<b>18</b>	<b>115</b>	<b>90</b>

From 1998 to 2003, ninety-one cases of meningococcal disease were detected in males and seventy-three were in females. The male to female ratio was 1.25:1. A detailed description by county is provided in Table 5.

*Table 5: Sex distribution of meningococcal disease by county in MWHB, 1998-2003 (n=164).*

County	Clare (n=56)		Limerick (n=68)		Tipperary N (n=40)		MWHB	
	M	F	M	F	M	F	M	F
<b>Year</b>								
1998	3	0	9	5	1	3	13	8
1999	8	7	4	4	12	4	24	15
2000	7	4	2	5	8	4	17	13
2001	4	5	6	8	2	2	12	15
2002	3	3	7	8	1	2	11	13
2003	8	4	5	5	1	0	14	9
<b>Total</b>	<b>33</b>	<b>23</b>	<b>33</b>	<b>35</b>	<b>25</b>	<b>15</b>	<b>91</b>	<b>73</b>

From 1998 to 2003, forty-five cases of group B meningococcal disease were detected in males and thirty-four were female. The male to female ratio was 1.32:1. This pattern was common but varied between area and year. A detailed description by county is provided in Table 6.

*Table 6: Sex distribution of meningococcal disease group B by county in MWHB, 1998-2003 (n=102).*

County	Clare (n=41)		Limerick (n=40)		Tipperary N (n=21)		MWHB	
	M	F	M	F	M	F	M	F
<b>Year</b>								
1998	2	0	1	0	1	1	4	1
1999	6	3	3	2	5	1	14	6
2000	2	2	1	1	5	2	8	5
2001	3	5	5	6	1	2	9	13
2002	3	3	6	5	1	1	10	9



2003	8	4	5	5	1	0	14	9
<b>Total</b>	<b>24</b>	<b>17</b>	<b>21</b>	<b>19</b>	<b>14</b>	<b>7</b>	<b>59</b>	<b>43</b>

From 1998 to 2003, fourteen cases of group C meningococcal disease were detected in males and fifteen were female. The male to female ratio was 0.93:1. This pattern varied between area and year but numbers are small.

A detailed description by county is provided in Table 7.

*Table 7: Sex distribution of meningococcal disease group C by county in MWHB, 1998-2003 (n=29).*

<b>County</b>	<b>Clare (n=4)</b>		<b>Limerick (n=13)</b>		<b>Tipperary N (n=12)</b>		<b>MWHB</b>	
<b>Sex</b>	<b>M</b>	<b>F</b>	<b>M</b>	<b>F</b>	<b>M</b>	<b>F</b>	<b>M</b>	<b>F</b>
<b>Year</b>								
1998	1	0	4	1	0	1	5	2
1999	0	2	0	1	5	2	5	5
2000	1	0	1	3	2	2	4	5
2001	0	0	0	2	0	0	0	2
2002	0	0	0	1	0	0	0	1
2003	0	0	0	0	0	0	0	0
<b>Total</b>	<b>2</b>	<b>2</b>	<b>5</b>	<b>8</b>	<b>7</b>	<b>5</b>	<b>14</b>	<b>15</b>

## Age Distribution:

The age distribution of cases of bacterial meningitis provides important information about the target populations requiring interventions to prevent and control disease in the region, especially if a vaccination campaign is to be introduced in a targeted way at specific groups in the population.

In the MWHB, the number of cases of bacterial meningitis is highest in the very young, see Table 8, but meningococcal disease represents a high proportion of all cases of bacterial meningitis (89%). There was no significant difference between the crude and age-standardised rate of bacterial meningitis in the MWHB for any of the years studied.

*Table 8: Age distribution of all cases of bacterial meningitis 1998-2003.*

Year	Age Group (Years)										Total
	0-4	5-9	10-14	15-19	20-24	25-34	35-44	45-54	55-64	65+	
1998	15	0	4	2	1	0	0	0	0	1	23
1999	29	7	1	2	1	1	2	0	3	1	47
2000	18	6	5	7	1	1	1	1	0	0	40
2001	15	9	2	2	0	1	1	1	0	1	32
2002	21	4	2	1	2	1	1	0	0	0	32
2003	15	3	2	0	2	0	2	1	2	1	28
<b>Total<sup>§</sup></b>	<b>113</b>	<b>29</b>	<b>16</b>	<b>14</b>	<b>7</b>	<b>4</b>	<b>7</b>	<b>3</b>	<b>5</b>	<b>4</b>	<b>202</b>

<sup>§</sup>Three cases no data on age.

For the prevention and control of meningococcal disease (MCD) it is important to ascertain whether the case attends a crèche or school (primary or secondary) or a college. The number of cases in young children is also high for MCD, see Table 9. There was no significant difference between the crude and age-standardised rate of MCD in the MWHB for any of the years studied.

In 2002 alone, fourteen cases were reported to have attended a crèche, six attended a primary school and two a 3<sup>rd</sup> level college.

*Table 9: Age distribution of all cases of meningococcal disease 1998-2003.*

Year	Age Group (Years)										Total
	0-4	5-9	10-14	15-19	20-24	25-34	35-44	45-54	55-64	65+	
1998	14	0	3	2	1	0	0	0	0	1	21
1999	24	7	1	2	0	1	1	0	1	1	38
2000	14	5	5	4	0	0	1	1	0	0	30
2001	14	8	1	1	0	1	0	1	0	1	27
2002	16	4	2	0	1	0	1	0	0	0	24
2003	14	2	2	0	2	0	0	1	2	0	23
<b>Total<sup>§</sup></b>	<b>96</b>	<b>26</b>	<b>14</b>	<b>9</b>	<b>4</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>163</b>

<sup>§</sup>One case no data on age.

In Table 10, the age-specific attack rates for each age group is presented and shown graphically in Figure 7.

Table 10: Age-specific attack rates of meningococcal disease 1998-2003.

Year	Age Group (Years)									
	0-4	5-9	10-14	15-19	20-24	25-34	35-44	45-54	55-64	65+
1998	64.5	0.0	10.2	6.5	3.9	0.0	0.0	0.0	0.0	2.7
1999	110.6	28.2	3.4	6.5	0.0	2.4	2.3	0.0	3.9	2.7
2000	58.6	21.5	20.1	14.3	0.0	0.0	2.1	2.3	0.0	0.0
2001	58.6	34.4	4.0	3.6	0.0	2.0	0.0	2.3	0.0	2.5
2002	62.7	17.2	8.1	0.0	3.6	0.0	2.1	0.0	0.0	0.0
2003	58.6	8.6	8.1	0.0	7.1	0.0	0.0	2.3	6.3	0.0

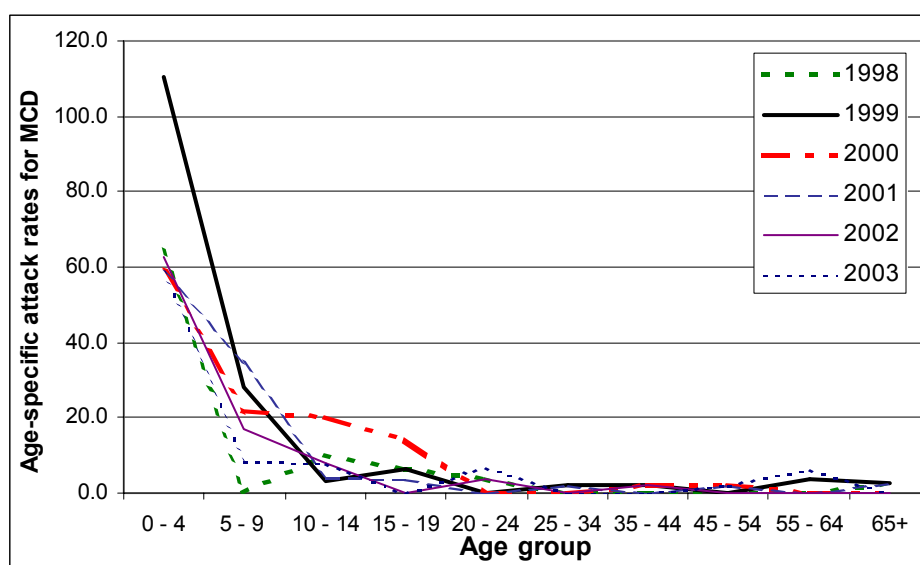


Figure 7: Age-specific attack rates of meningococcal disease 1998-2003.

The incidence of MCD is highest in those aged under 20 years. The introduction of the new meningococcal C conjugate vaccine has begun to alter the epidemiology of the disease in Ireland. The incidence of disease has fallen since 2001. However, this effect is only seen for group C meningococcal disease. The rate of group B disease is unaffected, if not higher in the MWHB.

#### Outbreaks:

Over the period 1998 to 2003, there were a number of outbreaks investigated. Two cases were detected in siblings in 1999 (*N. meningitidis* B). The same group was responsible in 2001/2002 for two cases in cousins.

#### Disease Classification:

The classification of disease for all notified cases are presented in Figure 8. Meningococcal septicaemia was the most common diagnosis over the period 1998 – 2003.

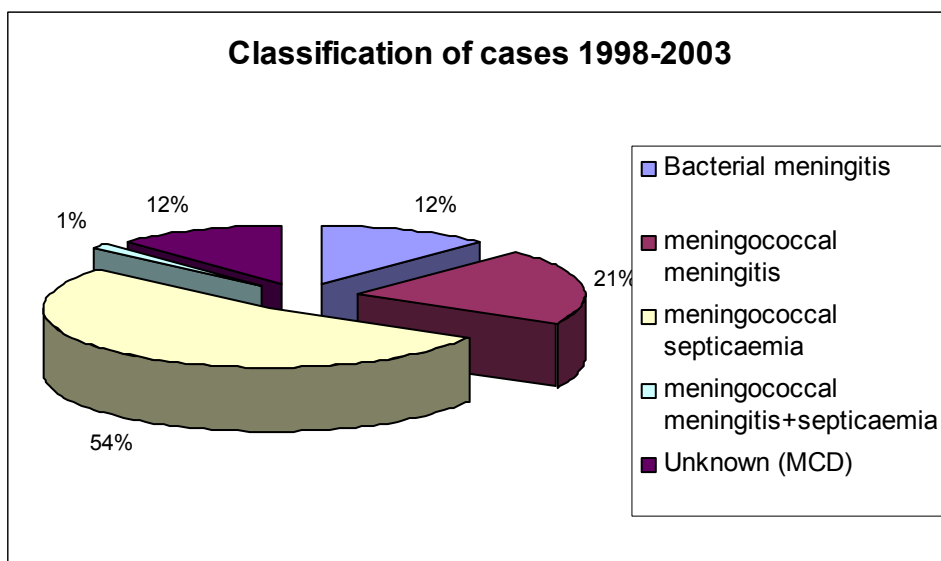


Figure 8: Diagnosis made for cases of bacterial meningitis (including meningococcal disease, 1998-2003).

In 2002, 19 cases of meningococcal disease were recorded as definite cases; no classification was made on five cases. In 2003, 23 cases of meningococcal disease were recorded as definite cases; one presumed case of meningococcal disease was recorded but not included in this analysis.

**Outcome:**

Eleven of the 205 cases from the MWHB were reported to have died – six in Clare, five in Limerick and one in Tipperary North. There was one death in 1998, 2000 and 2001. There were three deaths in 1999 and there were five in 2003. Of those fatalities from invasive meningococcal disease, five were group B, two were group C, one was group W135 and one was organism unknown, see Table 11. Case fatality in 2003 was higher than that seen in previous years.

Table 11: Groups reported in fatal cases due to meningococcal disease with case fatality rate (CFR).

County	Clare	Limerick	Tipperary	Annual CFR
1998	-	C	-	5%
1999	B	C	-	5%
2000	B	-	-	3%
2001	-	-	W135	4%
2002	-	-	-	0%
2003	B,B,B	-	-	13%

(CFR is expressed as a proportion of all confirmed cases of MCD in that year)

Of the 32 cases in 2002, 20 reported recovery and no outcome details were available on 12 cases. Of the 28 cases in 2003, 23 reported recovery.

The case of invasive meningococcal disease in 2002 was not a vaccine failure.

## **Weekly Infectious Disease Notifications and Enhanced Surveillance of Bacterial Meningitis:**

Under the weekly notifications to the Department of Public Health, thirty-nine cases were notified in 2000, 29 were notified in 2001 and 23 were notified in 2002. This compares to 41, 32 and 32 respectively under the enhanced surveillance system. In 2003 there were 24 cases notified under the weekly notification of infectious diseases (three of these were not eventually confirmed as definite), seven were not notified.

It is possible that some cases do not get notified under the weekly notification system. Alternatively, some cases notified under enhanced surveillance are not denotified when diagnosis is changed.

## **Conclusions:**

Parents and clinicians must continue to be vigilant for signs of bacterial meningitis and meningococcal disease. Prompt reporting to senior area medical officers and the Director of Public Health via telephone by clinicians of **all “suspected” cases** will optimise the response to disease and may prevent further spread and outbreaks of this serious and potentially fatal illness.

Reporting through the weekly infectious disease notification system, and the enhanced surveillance system introduced in 1997, will assist in the descriptive epidemiology of the disease in Ireland.

Cases are occurring throughout the year in the MWHB and the usual peak over winter levelled in recent time but peaked again in December 2002.

The epidemiology of the disease has changed with the introduction of the meningococcal C vaccination campaign. We must continue to monitor the epidemiology of the disease for changes in age profile and classification.

The young are particularly vulnerable to disease, those under five years especially but also those up to 20 years of age.

The advent of molecular methods has assisted clinicians with a more rapid and sensitive means to confirm some cases of meningococcal disease. The EDTA blood sample can be taken from all age groups with suspected meningitis. The test can confirm in many instances the serogroup of the pathogen. Further typing will require the growth of the pathogen. If possible, laboratories should arrange for isolates to be transported to the Meningococcal Reference Laboratory for this investigation.

Protection against *N. meningitidis* group C is available to these groups with a safe and effective conjugate vaccine that was introduced in Ireland in October 2000. All children and young adults up to and including 22 years of age were offered vaccination. The vaccine is now part of the Primary Childhood Immunisation Schedule, being offered at 2, 4, and 6 months.

Vaccination against *H. influenzae* b has been part of the primary immunisation schedule since 1992 – only one case was reported in the MWHB between 1998 and 2002. Cases of invasive *Haemophilus influenzae* b (Hib) are now rare but there is no room for complacency. Cases of invasive Hib are notifiable. Any possibility of vaccine failure must be fully investigated with the assistance of the Meningococcal Reference Laboratory, Temple Street, Dublin.

Vaccination against *Streptococcus pneumoniae*, against which there is a vaccine, may be considered for the future.

**It is very important that every effort is made to determine whether vaccination was offered and administered to all cases of meningococcal disease notified and that all cases of apparent vaccine failure are fully investigated and notified to the National Meningococcal Reference Laboratory in The Children’s Hospital, Temple St, Dublin 1.**

## Appendix 1: **Case Definitions**

For surveillance purposes the diagnosis of IMD is classified as **Definite**, **Presumed** or **Possible**.<sup>1</sup>

A **Definite** case of IMD includes children or adults who have:

- *Neisseria meningitidis* isolated from blood, CSF or other normally sterile body site (e.g. synovial, pleural or pericardial fluid) or from a petechial or purpuric lesion.
- A positive PCR test for *N. meningitidis* obtained on blood, CSF or specimen from another sterile site.

A **Presumed** case of IMD includes children or adults who have:

- Gram negative intracellular diplococci detected in CSF on microscopy.
- *N. meningitidis* isolated from eye, throat or nasal swab, together with a characteristic purpuric rash.
- *N. meningitidis* isolated from eye, throat or nasal swab and who have clinical and laboratory features of bacterial meningitis (CSF pleocytosis) in whom no other cause of meningitis is identified.
- A clinically compatible illness and who have Gram negative intracellular diplococci detected in skin scrapings taken from the characteristic haemorrhagic rash.
- A clinically compatible illness with a serological response, which is reported by a reference laboratory as consistent with recent acute infection.

A **Possible** case of IMD includes children and adults who have:

- Evidence of acute sepsis, with or without meningitis, together with characteristic haemorrhagic purpura.
- Clinical evidence of sepsis without purpuric rash, in whom no other cause of sepsis, is identified, and in whom *N. meningitidis* is isolated from an eye, throat or nasal swab.

Received pre-admission antibiotics and have laboratory evidence of bacterial meningitis but are culture negative.

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<sup>1</sup> The Department of Health and Children's Working Group Report on Bacterial Meningitis and Related Conditions, July 1999. <http://www.doh.ie/publications/bm99.html>

<b>BactMenin</b>	<b>Clare</b>		<b>Limerick</b>		<b>Tipperary North</b>		<b>MWHB</b>
	<b>Cases</b>	<b>Rate/100,000</b>	<b>Cases</b>	<b>Rate/100,000</b>	<b>Cases</b>	<b>Rate/100,000</b>	<b>Rate/100,000</b>
1998	5	5.32	14	8.48	4	6.89	7.25
1999	18	19.15	8	4.85	22	37.9	15.17
2000	18	17.43	10	5.70	13	21.31	12.07
2001	10	9.68	18	10.27	4	6.56	9.42
2002	10	9.68	17	9.70	5	8.20	9.42
2003	13	12.59	13	7.42	2	3.28	8.24
<b>MCD</b>	<b>Clare</b>		<b>Limerick</b>		<b>Tipperary North</b>		
	<b>Cases</b>	<b>Rate/100,000</b>	<b>Cases</b>	<b>Rate/100,000</b>	<b>Cases</b>	<b>Rate/100,000</b>	
1998	3	3.19	14	8.48	4	6.89	6.62
1999	15	15.96	8	4.85	16	27.58	12.30
2000	11	10.65	7	3.99	12	19.67	8.83
2001	9	8.71	14	7.99	4	6.56	7.95
2002	6	5.81	15	8.56	3	4.92	7.07
2003	12	11.62	10	5.70	1	1.64	6.77
<b>MCD B</b>	<b>Clare</b>		<b>Limerick</b>		<b>Tipperary North</b>		
	<b>Cases</b>	<b>Rate/100,000</b>	<b>Cases</b>	<b>Rate/100,000</b>	<b>Cases</b>	<b>Rate/100,000</b>	
1998	2	2.13	1	0.61	2	3.45	1.58
1999	9	9.57	5	3.03	6	10.3	6.31
2000	4	3.87	2	1.14	7	11.47	3.83
2001	8	7.75	9	5.13	3	4.917	5.89
2002	6	5.81	11	6.27	2	3.28	5.59
2003	12	11.62	10	5.70	1	1.64	6.77
<b>MCD C</b>	<b>Clare</b>		<b>Limerick</b>		<b>Tipperary North</b>		
	<b>Cases</b>	<b>Rate/100,000</b>	<b>Cases</b>	<b>Rate/100,000</b>	<b>Cases</b>	<b>Rate/100,000</b>	
1998	1	1.06	5	3.03	1	1.72	2.21
1999	2	2.13	1	0.61	7	12.06	3.15
2000	1	0.97	4	2.281	4	6.56	2.65
2001	0	0	2	1.14	0	0	0.59
2002	0	0	1	0.57	0	0	0.29
2003	0	0	0	0	0	0	0