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Invasive *Haemophilus influenzae* Disease in Ireland, 2007/2008

Background

Haemophilus influenzae, a gram-negative coccobacillus, occurs exclusively in humans, principally in the upper respiratory tract; no other natural host is known.^{1,2} It is usually the non-encapsulated, non-typable strains that are harbored as normal flora by up to 80% of healthy persons.¹ Serious infection is usually caused by strains carrying a polysaccharide capsule. Of the six capsular types, *Haemophilus influenzae* type b (Hib) causes most invasive disease. Before the widespread use of conjugate vaccines, type b strains colonized the nasopharynx of children at a rate of 2% to 4%.¹ Prior to the introduction of the vaccine, Hib was a common cause of meningitis and other severe infections (e.g. pneumonia, bacteraemia, cellulitis, septic arthritis and epiglottitis)¹, primarily among infants and children <5 years of age. With appropriate management, the overall mortality rate from *H. influenzae* meningitis is less than 5%, but apparently permanent sequelae occur in many of the survivors.¹

The Hib vaccine was introduced into the primary schedule in Ireland in 1992 and subsequently there has been a dramatic fall in the incidence of invasive Hib disease.³ However, from late 2004 a resurgence in Hib disease was seen, with most cases occurring in vaccinated children.⁴ This led to concerns that a three-dose infant schedule was no longer sufficient to maintain long term protection. Consequently, a catch-up campaign offering a Hib booster dose to children over 12 months and <4 years of age was launched on 21st November 2005 and ran until May 2006. Since 18th September 2006, a Hib booster has been included in the childhood immunisation schedule after 12 months of age.⁴ The vaccine is specific for diseases caused by Hib, but does not protect against infections caused by other *haemophilus* strains.²

This paper reviews the epidemiology of invasive *H. influenzae* disease from July 2007 to June 2008 (2007/2008) using enhanced notification data extracted from the Computerised Infectious Disease Reporting (CIDR) system on 14th August 2008.

Results

In 2007/2008, 25 cases (0.6/100,000 population) of invasive *H. influenzae* were notified. These notifications ranged in age from 1 week to 95 years. The disease was twice as common in males (M:F 2.1:1.0). The number of *H. influenzae* notifications in 2007/2008 was less than that in 2006/2007 when 31 cases were notified (figure 1). *H. influenzae* type b (Hib) accounted for just 24% (n=6) of the *H. influenzae* notifications in 2007/2008 compared to a nearly a third in 2006/2007 (32.3%; n=10). In addition, the number of cases due to *H. influenzae* non-capsular strains decreased from 14 in 2006/2007 to 11 in 2007/2008. Three of the latter 11 non-capsular cases occurred in elderly adults aged ≥ 65 years, five arose in children <10 years of age (range 1 week–9 years) and the remaining three cases occurred in adults aged 21–55 years. The remainder of the invasive *H. influenzae* infections in 2007/2008 were due to type e (n=1), type f (n=3), and isolates not typed (n=4).

Protecting Children Through Immunisation, 2007

Introduction

Immunisation against vaccine preventable diseases is one of the cornerstones of public health practice. Monitoring immunisation uptake rates is important in identifying under-vaccinated groups and to evaluate the effectiveness of efforts to increase uptake rates.

Each Health Service Executive (HSE) Area in Ireland maintains an immunisation database. Since October 2000 each HSE Area provides quarterly reports to the Health Protection Surveillance Centre (HPSC) on immunisation uptake rates for children 12 and 24 months of age in their Area. HPSC collates the national immunisation uptake data and produces quarterly and annual reports which are available on the HPSC website. The annual immunisation uptake rates presented here represent the collation of the 2007 quarterly data. The proportion of children who completed the recommended childhood immunisation schedule by 12 months (born between 01/01/2006 and 31/12/2006) or 24 months (born between 01/01/2005 & 31/12/2005) of age in 2007 is reported.

The Irish childhood primary immunisation schedule during 2005 to 2007 recommended that babies receive one dose of vaccine against tuberculosis (BCG vaccine) at birth¹ or by one month of age and three doses of vaccines against diphtheria (D₃), pertussis (P₃), tetanus (T₃), *Haemophilus influenzae* type b (Hib₃), polio (Polio₃) and meningococcal group C (MenC₃) with one dose of each given at two, four and six months of age. Between 12 and 15 months of age children were recommended to receive the first dose of the measles-mumps-rubella vaccine (MMR₁) and from September 18th 2006 a routine Hib booster (Hib_b) was recommended at the same time as MMR₁. The introduction of the routine Hib booster followed a Hib booster catch-up campaign from November 2005 to May 2006 among children less than four years of age.

Vaccinations recommended for older children during 2005 to 2007 included boosters for DTaP/Polio (at four-five years of age), a second dose of MMR (at four-five years of age) and a booster of tetanus and diphtheria (at 11-14 years of age). However, immunisation uptake data on older children are not reported to a national level.

The immunisation uptake rates were published and mapped by Local Health Office (LHO) for the first time in 2007. While there are 32 LHOs the immunisation uptake rates for the LHOs of North Lee and South Lee are reported as a combined figure.

Immunisation uptake rates at 12 months

National immunisation uptake rates for D₃, T₃, P₃, Hib₃, Polio₃ and MenC₃ in children 12 months of age in 2007 were 87%. Compared to 2006 this was an improvement of one percent for D₃, T₃, P₃, Hib₃ and Polio₃ uptake and an improvement of two percent for MenC₃ uptake. Uptake rates for

D₃, T₃, P₃, Hib₃, Polio₃ and MenC₃ ranged from 84% in the HSE-Southern Area to 92% in the HSE-Midland Area (table 1).

Among the LHOs, uptake rates for D₃, T₃, P₃, Hib₃ and Polio₃ ranged from 79% to 93% and the uptake rate for MenC₃ ranged from 79% to 94%. Ten of the LHOs had uptake rates of ≥90% for D₃, T₃, P₃, Hib₃ and Polio₃ while eight had uptake rates of ≥90% for MenC₃.

BCG uptake data were available from five of the eight HSE Areas,² which represent approximately a third of the national birth cohort. Where data were available national BCG uptake was 93% in 2007, unchanged compared to 2006. Among the 12 LHOs that reported BCG uptake data, uptake rates ranged from 90% to 98%. The target uptake rate of 95% was reached and/or exceeded in three of the 12 LHOs.

Immunisation uptake rates at 24 months

National immunisation uptake rates, in children 24 months of age in 2007, for D₃, T₃, P₃, Hib₃ and Polio₃ were 92% and 91% for MenC₃. Compared with 2006 the uptake rates for these vaccines increased by one percent in 2007 (figure 1).

Uptake of D₃, T₃, P₃, Hib₃, Polio₃ and MenC₃ ranged from 89% in the HSE-Eastern Region to 97% in the HSE-Midland Area (table 1). The target uptake of 95% was reached and/or exceeded for D₃, T₃, P₃, Hib₃, Polio₃ and MenC₃ in the HSE-Midland Area and for D₃, T₃, P₃, Hib₃ and Polio₃ in the HSE-North Western Area during 2007 (table 1).

Among the LHOs, uptake rates for D₃, T₃, P₃, Hib₃, Polio₃ and MenC₃ ranged from 82% to 98%. Only nine of the LHOs reached and/or exceeded the target uptake rate of 95% for D₃ (figure 2a), P₃, T₃ and Polio₃. Only eight LHOs reached and/or exceeded the target uptake rate of 95% for Hib₃ and only five reached and/or exceeded the target rate for MenC₃.

During 2007 MMR₁ uptake was 87% nationally; an increase of one percent when compared to 2006 (figure 1). In 2007, uptake rates for MMR₁ ranged from 84% in the HSE-Eastern Region to 94% in the HSE-Midland Area (table 1). None of the HSE Areas achieved the target uptake of 95% for MMR₁ for all of 2007; however, in Quarter 1 and Quarter 3 2007 MMR₁ uptake was 95% in the HSE-Midland Area. Among the LHOs, uptake rates for MMR₁ ranged from 76% to 95%. Only one LHO reached the target uptake rate of 95% (figure 2b).

Hib_b national uptake statistics were reported for the first time in 2007. These figures relate to children who received a dose of Hib after 12 months of age. In 2007 national uptake of Hib_b, in those 24 months of age, was 74% (table 1). However, the Hib_b figure is incomplete, as the HSE-Western Area data for Quarter 1 2007 and the HSE-North Western

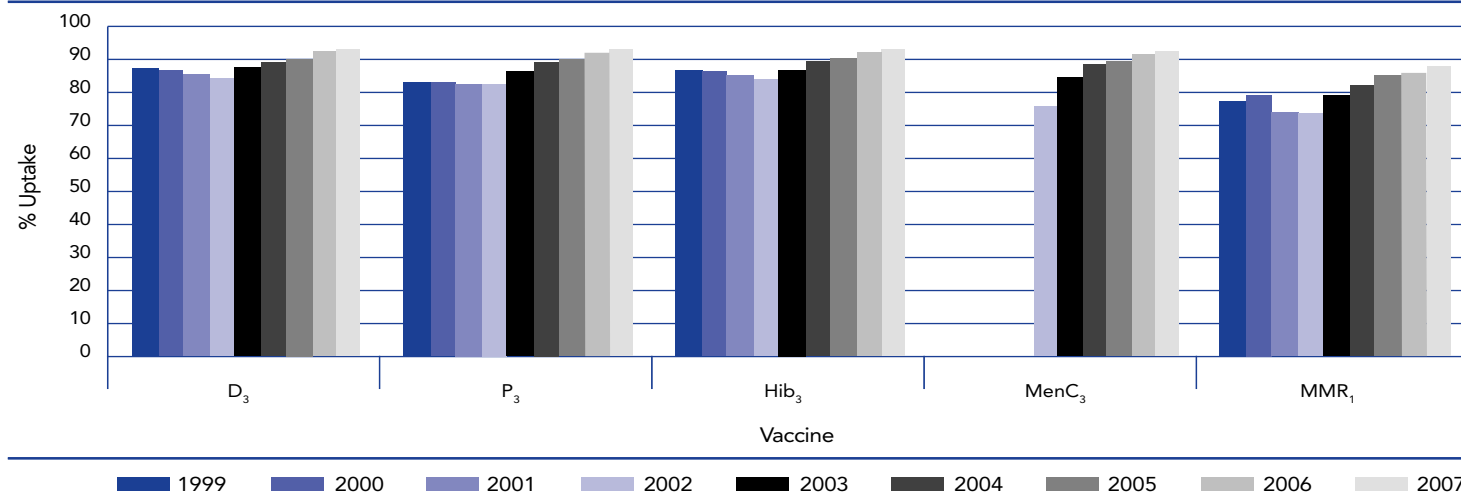


Figure 1. National annual immunisation uptake rates at 24 months, 1999-2007

Since T₃ uptake identical to D₃ uptake only D₃ uptake figures presented and since Polio₃ uptake almost identical to Hib₃ uptake only Hib₃ figures presented
 The 2006 MMR₁ figure includes the Quarter-1 2006 HSE-Eastern Region figure, which is an estimate only due to technical problems with extraction of MMR₁ data from the HSE-Eastern Region database. The 2005 MMR₁ uptake figure is incomplete as the HSE-Eastern Region was unable to provide MMR data for Quarter-4 2005, due to technical problems with extraction of MMR₁ data from the HSE-Eastern Region database

Area data for Quarter 3 2007 were not available. The figure also includes the HSE-South Eastern Area data which are an underestimate due to data extraction methods.

Discussion

Monitoring immunisation uptake, comparing data between and within HSE Areas and providing feedback to service providers is used to improve the national childhood vaccination programme. 2007 was the first year immunisation uptake rates were published and mapped by LHO. These maps highlight LHOs that have achieved the target immunisation uptake rate of 95% necessary to control these diseases and LHOs that fall short of this target. The target uptake is not being reached for childhood vaccines in the majority of LHOs in children 12 and 24 months of age. However, national uptake rates have been improving since 2002 (figure 1). Further improvements in uptake are necessary in order to reach the 95% target rate nationally for all vaccines and to prevent outbreaks of these vaccine preventable diseases in the future. Areas with poor uptake are identifying reasons for low uptake and striving to address the problems.

A new childhood immunisation schedule is effective from September 1st 2008. Changes include the addition of pneumococcal conjugate vaccine and hepatitis B vaccine to the schedule and a change in the recommended

age of the Hib booster and MenC vaccine. These and other changes to the childhood immunisation schedule can found in the 2008 edition of the Immunisation Guidelines for Ireland (available at www.immunisation.ie and www.hpsc.ie).

The 2007 immunisation uptake rates for each LHO are presented in tables in a separate report. This LHO report and the immunisation reports for Quarters 1 to 4 2007 are available on the HPSC website in *Topics A-Z* under the heading *vaccination*.

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HPSC would like to thank the HSE Areas for providing these data. In particular, thanks to the specialists in public health medicine, surveillance scientists, immunisation co-ordinators and system analysts for their help.

Notes

1. BCG vaccine is routinely administered within the neonatal period in six of the eight HSE Areas. In the HSE- Southern (Cork only) and Western Areas BCG is administered to older children and at risk groups.
2. BCG uptake data at 12 months is not available in the HSE- Southern (Cork) and Western Areas for the reason outlined above. In the HSE-Eastern and North Eastern Areas BCG vaccination uptake data is not readily available for national reporting purposes.

Table 1. Annual immunisation uptake rates by HSE Area for children 12 and 24 months of age in 2007

HSE Area	% Uptake at 12 months						% Uptake at 24 months						
	Cohort born 01/01/2006 - 31/12/2006						Cohort born 01/01/2005 - 31/12/2005						
	D ₃	P ₃	Hib ₃	Polio ₃	MenC ₃	BCG	D ₃	P ₃	Hib ₃	Hib _b	Polio ₃	MenC ₃	MMR ₁
HSE Eastern	86	86	86	86	86	na	89	89	89	69	89	89	84
HSE Midland	92	92	92	92	92	91	97	97	97	90	97	97	94
HSE Mid Western	89	89	89	89	89	97	92	92	92	85	92	92	90
HSE North Eastern	90	90	90	90	88	na	93	93	93	88	93	93	90
HSE North Western	92	92	91	92	90	94	97	97	95	87 [‡]	97	93	92
HSE South Eastern	86	86	86	86	85	92	91	91	90	62 [‡]	91	90	86
HSE Southern	84	84	84	84	84	90*	94	94	94	74	94	94	88
HSE Western	86	86	86	86	87	na	93	93	93	68 [‡]	93	93	85
Ireland	87	87	87	87	87	93 [†]	92	92	92	74 [‡]	92	91	87

Since T₃ uptake identical to D₃ uptake only D₃ uptake figures presented

*HSE Southern part coverage of neonatal BCG (i.e. Kerry only)

[†]Based on data from five of the eight HSE Areas

[‡]The national Hib_b figure is incomplete, as the HSE-Western Area data for Quarter 1 2007 and the HSE-North Western Area data for Quarter 3 2007 were not available. The national Hib_b figure also includes the HSE-South Eastern Area data which are an underestimate due to data extraction methods

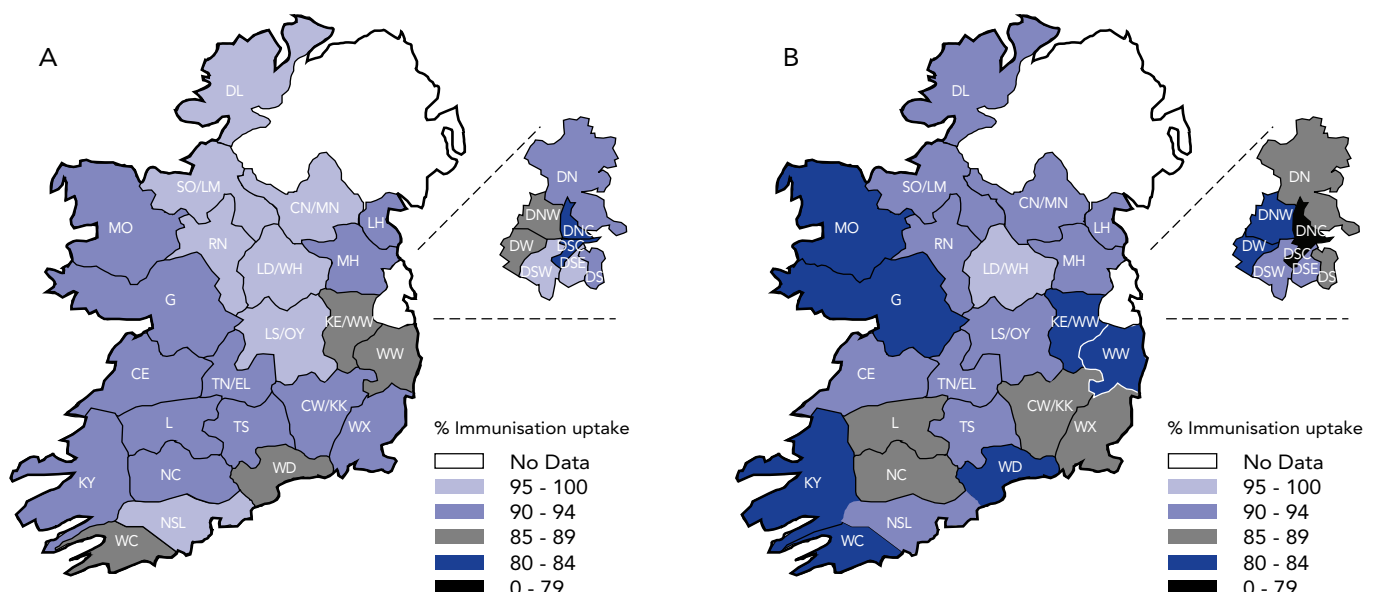


Figure 2. D₃ (A) and MMR₁ (B) immunisation uptake rates (%) by Local Health Office (LHO) in those 24 months of age in 2007

LHOs in Dublin are highlighted separately for ease of viewing

North Lee and South Lee are separate LHOs, however, their combined (labelled NSL on the map) immunisation uptake rates are reported here

Of the six Hib cases reported in 2007/2008, one occurred in a child <1 year old, two in children aged 1-4 years and three in adults aged ≥25 years. The total number of Hib cases was below the average number reported between 1996/1997 and 2003/2004 (average 9.4, range 6-17 per year). One death from Hib disease occurred in an elderly adult in 2007/2008, compared to one death in a child ≤10 in both 2006/2007 and 2005/2006. There was no change in the number of Hib cases in 2007/2008 seen in <5 year olds (n=3) when compared with the previous year. In contrast, there was a marked decrease in the number of notifications in ≥5 year olds, from seven to three cases. The clinical manifestations of the six Hib cases in 2007/2008 were: epiglottitis (n=2), cellulitis (n=2), septicaemia (n=1) and not specified (n=1) (figure 1).

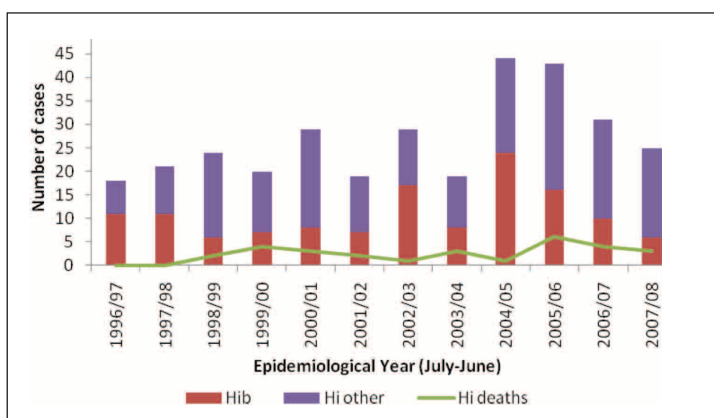


Figure 1. Number of invasive *Haemophilus influenzae* notifications (including deaths) in Ireland by type and epidemiological year (July-June)

In 2004/2005, a peak in the number of True Hib Vaccine Failures (TVFs) occurred, with 13 cases reported. TVF is defined as invasive Hib disease occurring in an individual despite being fully vaccinated.⁵ Since then, following the booster campaign and introduction of a routine booster, the number of TVFs has dropped, with none being reported in 2007/2008.

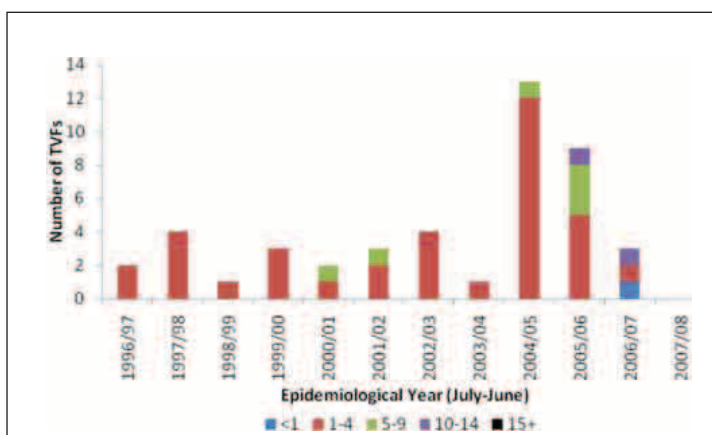


Figure 2. Number of true Hib vaccine failures in Ireland by age group and epidemiological year (July-June)

Discussion

The latest trends regarding the epidemiology of invasive Hib disease in Ireland reflect the continuing positive impact the Hib booster dose has had since November 2005 on the overall incidence of Hib disease, demonstrating the herd immunity effect associated with Hib vaccination. Between 2006/2007 and 2007/2008, the incidence of the disease declined from 10 cases to six, but remained the same in the <5 year age group, with three cases reported during each period. No cases associated with Hib vaccine failures were reported in 2007/2008, decreasing from 13 in 2004/2005, to nine in 2005/2006 and three in 2006/2007, which is below the average level seen in the years before the upsurge in 2004/2005. The continuing decline in Hib disease and especially in cases associated with vaccine failures is encouraging.

To control and prevent the occurrence and transmission of invasive Hib disease, particularly in children, it is essential that high uptake rates of Hib vaccination are reached for the three doses of Hib vaccine at 2, 4 and 6 months. To ensure long term protection from the disease it is also vital that children receive the booster dose at 13 months of age as recommended by the National Immunisation Advisory Committee 2008 schedule.² It is worth noting that according to the Q1-2008 immunisation uptake statistics in Ireland, the national uptake for the Hib booster was 78% with rates in children aged 12 months at 87% and 92% in children aged 24 months.⁶ The target uptake rate at 12 and at 24 months of age is 95%.

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