

08

Measles

Introduced in 1985 / MMR introduced in 1988

NOTIFIABLE

Introduction

Measles is an acute viral illness caused by a morbillivirus of the paramyxovirus family. There is only one antigenic type, with a number of genotypes. Humans are the only known host. Both infection and appropriate immunisation confer long-lasting immunity.

One case of measles can infect 15-20 unvaccinated people. A vaccine uptake rate of at least 90-95% with 2 doses is required to halt endemic transmission of the virus and thus eliminate measles.

Measles remains a leading cause of vaccine-preventable death worldwide. In 2004 an estimated 450,000 people died from measles, mostly in low-income countries. Eighty percent of those dying were aged under 5 years. In Europe in 2004, 29,000 cases were reported. The WHO has set a target date of 2010 for the elimination of measles and rubella in Europe.

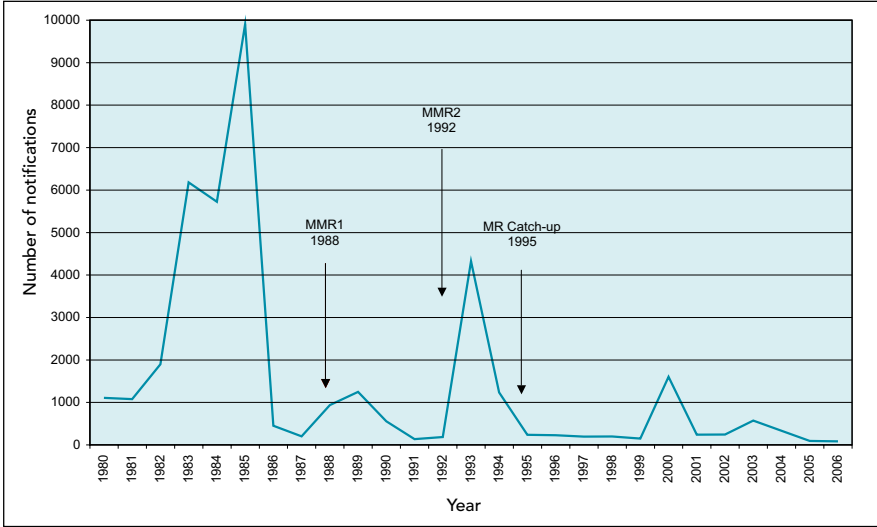
Epidemiology

The incidence of measles in Ireland declined dramatically after the introduction of monocomponent measles vaccine in 1985, from 10,000 cases in that year to 201 cases in 1987. In 1988 a combined measles, mumps and rubella vaccine (MMR) was introduced for children aged 12-15 months. In 1992 a second dose of MMR was recommended to be given at 10-14 years of age. In 1995 a measles and rubella (MR) catch-up campaign was carried out. In 1999 the age for the second dose of MMR was reduced to 4-5 years.

An outbreak of measles in 1993 affected more than 4,000 people, and in 2000 over 1,600 cases of measles were reported, with 3 associated deaths (Figure 8.1).

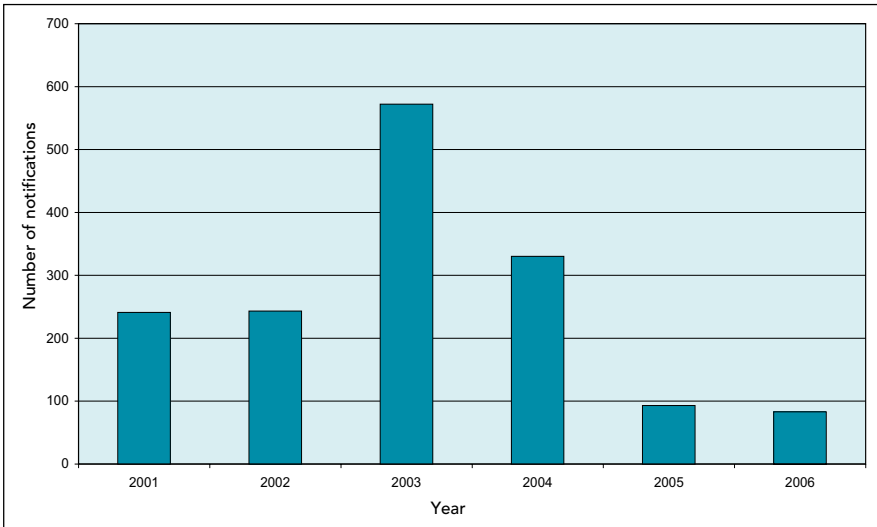
Chapter 8 Measles

Figure 8.1 Number of measles notifications in Ireland, 1980-2006.
Source: HPSC



From 2001-2006 there were 1,562 cases of measles notified in Ireland. Incomplete vaccine coverage together with a pool of susceptible unvaccinated older children resulted in rapid spread of the infection during these outbreaks (Figure 8.2).

Figure 8.2 Number of measles notifications in Ireland, 2001-2006.
Source: HPSC



Transmission of measles is by droplet infection. The virus can remain viable on infected surfaces for up to 2 hours.

The incubation period is 10 days (range 7-18 days) with a further 2-4 days before the rash appears. Patients are infectious from 4-5 days before to 4 days after the onset of rash.

Effects of measles

The prodromal phase is characterised by fever, malaise, rhinitis, conjunctivitis and cough. The erythematous and maculopapular rash first appears behind the ears and spreads to the face, trunk and limbs over 3-4 days. The rash may become confluent in places. It begins to fade after 3-4 days, leaving a temporary brownish discolouration. Koplik's spots, which are small red spots with blueish-white centres, may appear on the mucous membranes of the mouth from 2 days before to 2 days after the rash appears.

Approximately 30% of measles cases have one or more complications, which are more common in children under 5 years of age and in adults over 20 years of age. The complications include pneumonia (1-6%), otitis media (7-9%), diarrhoea (8%), convulsions (0.5%) and encephalitis (0.1%). Transient immunodeficiency can occur, with decreased numbers of T cells and leucopenia, which can last for weeks.

There are three types of measles encephalitis:

1. Acute demyelinating encephalomyelitis occurs about one week after the onset of the rash in approx 1/1,000 cases, has a mortality of about 15% and results in residual neurological sequelae in 20-40% of survivors.
2. Measles inclusion body encephalitis, a delayed type of encephalitis, occurs in immunocompromised patients. It can occur without a preceding measles-like illness, and is characterised by acute neurological compromise, loss of consciousness, seizures and progressive neurological damage.
3. Sub-acute sclerosing panencephalitis (SSPE), a degenerative CNS disease progressing to death. If measles infection occurs in children under 2 years of age the rate of SSPE is 1 in 8,000 infections. If infection occurs in children under 1 year of age, the risk of SSPE is 16 times greater than with infection occurring over 5 years of age.

Death occurred in 1 in 500 notified cases in Ireland in the outbreak

of 2000. The case fatality rate is highest in children under 1 year of age, lowest in those aged 1-9 and rises again in teenagers and adults. Pneumonia accounts for 56-86% of measles-associated deaths.

Complications and mortality rates are high in the immunocompromised, the malnourished and in those with vitamin A deficiency. Severe complications may occur in up to 80% of these patients, with case-fatality rates of 70% in patients with cancer. Measles is the most important cause of blindness in children with borderline vitamin A levels, by precipitating xerophthalmia.

Modified measles occurs primarily in those who receive immunoglobulin as post-exposure prophylaxis or in infants with residual maternal antibodies. It is characterised by a prolonged incubation period, mild prodrome and a sparse, discrete rash of short duration. A similar illness has been reported in previously vaccinated persons.

Measles vaccine

Measles vaccine is only available as MMR (Measles, Mumps and Rubella vaccine). The vaccine contains attenuated measles, mumps and rubella viruses which are cultured separately and mixed before lyophilisation.

The lyophilised powder is reconstituted using the diluent supplied and shaken well to completely dissolve the pellet. The reconstituted vaccine is yellow in colour and should only be used if clear and free from particulate matter.

An up-to-date list of licensed vaccines is contained in Appendix 1, or can be accessed on the IMB website, www.imb.ie.

MMR does not contain thiomersal or any other preservatives. It must be kept refrigerated at 2-8°C, and protected from light. It should be used within 1 hour of reconstitution. Failure to adhere to these recommendations can result in loss of vaccine potency and diminished effectiveness.

Over 90% of individuals develop immunity to measles and rubella after 1 dose of vaccine. Two doses give protection in over 98% of people (see point 1, Indications). Between 61% and 91% are protected against mumps after 1 dose; and 98% are protected after 2 doses. Serological and epidemiological evidence indicates that vaccine-induced immunity is possibly lifelong.

Low rates of seroconversion occur in those under 12 months of age, because of maternal antibodies.

Deferral of MMR following blood or immunoglobulin transfusion

Blood and blood products may contain significant levels of virus-specific antibody, which could prevent vaccine virus replication. Where possible, MMR should be deferred for at least 3 months after receipt of low-dose immunoglobulin, 6 months after red-cell transfusion, and 11 months after high-dose immunoglobulin (as for Kawasaki Disease). If the MMR vaccine is administered within these timeframes, a further dose should be given outside these times.

Laboratory investigation to determine vaccine response is not routinely recommended.

Persons who are tuberculin-positive may have a negative tuberculin test for 3 months after measles infection or MMR vaccine.

Scientific evidence shows no association between the MMR vaccine and autism or inflammatory bowel disease.

Dose and route of administration

The dose is 0.5 ml by deep intramuscular injection. The deltoid is the recommended site of administration. The anterolateral thigh may also be used.

Alcohol swabs are best avoided as alcohol can inactivate the MMR vaccine. If alcohol is used to clean the skin it must be allowed to evaporate completely before the injection is given.

When other injectable vaccines are being given concurrently with MMR, different sites should be used.

MMR may be given at the same time as DTaP, IPV, MenC, Hib and Hep B in situations where the latter are overdue.

Indications

1. All children at 12-15 months of age, with a second dose at 4-5 years of age. For older children who have not received 2 doses, MMR vaccine should be given as soon as possible, and a second

dose one month later. Allowing 3 months between doses is likely to maximise the response rate in children aged under 18 months. Where protection against measles is urgently required the second dose can be given 1 month after the first. If children aged under 18 months are given the second dose less than 3 months after the first dose, they need a third dose to ensure full protection. This can be given at 4-5 years.

MMR vaccine can be given to those who have a history of measles, mumps or rubella infection.

2. Measles outbreaks

Outbreaks of measles should be controlled by immunising all susceptible individuals within 72 hours of contact, as vaccine-induced immunity develops more rapidly than natural antibody.

- If these persons have had no previous measles vaccine, a second dose is given one month later.
- During an outbreak, particularly if there are high attack rates in younger infants, MMR vaccine may be given to children as young as 6 months of age. However, maternal antibodies may compromise the response to the vaccine. Therefore children vaccinated before their first birthday should have a repeat vaccination at 12-15 months of age, at least 1 month after the first vaccine, with a further dose at 4-5 years of age.
- Some persons may require HNIG (see below).

3. Children with chronic conditions such as cystic fibrosis, congenital heart or kidney disease, failure to thrive or Down syndrome are at particular risk of measles infection and should be immunised with MMR vaccine.

4. Children coming from low-income countries have probably received measles vaccine but not rubella or mumps vaccine. Therefore, unless there is a reliable history of vaccine administration, these children should be regarded as unimmunised, and given 2 doses of MMR one month apart.

5. Individuals born before 1978 are likely to have had measles infection. MMR vaccine should be offered to such individuals on request if they are considered at high risk of exposure.

6. Health-Care Workers (HCWs) in the following situations (see Chapter 18). Protection is important both for themselves and in the context of their ability to transmit measles to vulnerable groups.

- Those who do not have evidence either of measles infection or of having received 2 doses of MMR vaccine should be given 2 doses of MMR, separated by at least 1 month.

- If an outbreak occurs in an institution or an area served by an institution, HCWs should be given 1 dose of MMR.

When measles outbreaks occur, susceptible persons should be given MMR within 72 hours of contact with a case.

Antibody response to the mumps and rubella components of the MMR vaccine **does not** develop quickly enough to provide effective prophylaxis after exposure to suspected mumps or rubella. Human normal immunoglobulin is not recommended for the post-exposure protection of pregnant women exposed to rubella. Human normal immunoglobulin is not routinely used as post-exposure protection from mumps.

Contraindications

1. Anaphylaxis following a previous dose of MMR or one of its constituents (e.g. Neomycin, Gelatin)
2. Significantly immunocompromised persons, such as those with untreated malignant disease and immunodeficiency states other than HIV infection, and those receiving immunosuppressive therapy, high-dose x-ray therapy and current high-dose systemic corticosteroids (see Chapter 2)
3. Pregnancy. Furthermore, pregnancy should be avoided for 1 month after MMR

There is no evidence to recommend or support the use of single vaccines against measles, mumps or rubella in place of the combination MMR vaccine.

The following are **NOT** contraindications to MMR vaccine

1. Allergy to egg, even anaphylaxis following egg. If there is a genuine concern regarding serious allergy, a paediatrician may be consulted and the vaccine given in hospital although this is not medically necessary. Currently-used measles and mumps vaccines do not contain significant amounts of egg cross-reacting proteins and recent data suggest that anaphylactic reactions to MMR are not associated with hypersensitivity to egg antigens but to other vaccine components (Gelatin or Neomycin)
2. Breast-feeding

3. HIV-positive patients who are not severely immunocompromised
4. Personal or family history of convulsions. Advice regarding the possibility and treatment of pyrexia should be given
5. Immunodeficiency in a family member or household contact
6. Uncertainty as to whether a person has had 2 previous MMR vaccines
7. If women have received anti-RhD immunoglobulin it is not necessary to defer rubella vaccination as the response to the vaccine is not affected

Precautions

1. Acute severe febrile illness, defer until recovery
2. Injection with another live vaccine within the previous 4 weeks
3. Recent administration of blood or blood products (see above)
4. Patients who developed thrombocytopenia within 6 weeks of their first dose of MMR should undergo serological testing to decide whether a second dose is necessary. The second dose is recommended if the patient is not fully immune to the 3 component viruses.

Adverse reactions

Soreness and erythema may occur at the injection site (3-8%). Fever (6%), rash (7%), headache, vomiting and salivary gland swelling may occur. A febrile convulsion occurs in 1 in 1,000 children.

'Mini-measles' may occur 6-10 days after immunisation and consists of mild pyrexia and an erythematous rash. 'Mini-mumps' with salivary gland swelling may rarely occur during the third week after immunisation. Very rarely, anaphylaxis, erythema multiforme, thrombocytopenia, and nerve deafness have been reported.

The rubella component may occasionally produce a rash, mild arthralgia, and lymph-node swelling 2-4 weeks post-vaccination, particularly in post-pubertal females (up to 25% of recipients). The incidence is lower than after natural disease.

There is no evidence of congenital rubella syndrome or increase in other teratogenic effects in women inadvertently given rubella vaccine before or during early pregnancy, but pregnancy remains a contraindication.

Adverse reactions are considerably less common (under 1%) after a second dose of MMR.

Protection of contacts with immunoglobulin

The following children and adults who come into contact with measles should be considered for treatment with human normal immunoglobulin (HNIG) as soon as possible after exposure (at least within 5 days):

1. Those with compromised immunity (see Chapter 2)
2. Infants age 5-12 months (those aged under 5 months will usually have maternal antibodies)
3. Infants of mothers who develop measles, as such infants will not have maternally derived antibodies
4. Non-immune pregnant women. As most such women are immune to measles, measles IgG should be checked. HNIG can be offered to non-immune subjects. They should also be offered MMR vaccine after delivery, at least 3 months after receiving HNIG.

Although administration should not wait for laboratory confirmation of measles in the index case, a complete risk assessment should be undertaken prior to administration of the HNIG.

If HNIG is not available, in certain high-risk situations IVIG can be given, as it usually contains similar measles antibody levels to HNIG.

Those contacts on maintenance IVIG do not need either HNIG or IVIG if they have been given IVIG within 3 weeks prior to exposure.

Bibliography

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Department of Health UK (2006). Immunisation against infectious disease (the Green Book). 3rd ed. London: The Stationery Office.