Combined Factsheets 1 – 4 on the Measles, Mumps and Rubella (MMR) Vaccine

This document was originally published as four separate factsheets in 1997, 1998, 2001, 2002 and made available to health professionals. The content of the factsheets has not been altered but is now being made available in one booklet to provide parents and the general public with the full background information.
Contents

The key topics covered in each of the factsheets are listed below:

**Factsheet 1, 1997**
- Symptoms and complications of the diseases.
- Safety and effectiveness of the MMR vaccine.
- When your child should receive MMR.

**Factsheet 2, 1998**
- The research into measles, measles vaccine and MMR, and the postulated link with Crohn's disease and autism.
- Advice on the suggestion that MMR be split into three separate injections.

**Factsheet 3, 2001**
- Update on the evidence surrounding autism and Crohn's disease with MMR.
- Licensing and safety of MMR.
- Single vaccines and the reason why MMR is the best way to protect your child.
- MMR immunisation policy in other countries.

**Factsheet 4, (new) 2002**
- Summary of the main findings of research papers published in the last year relating to autism, bowel disease and MMR vaccine.
- More detailed discussion on the issue of single vaccines and parental choice.
# Measles, Mumps and Rubella Vaccine Factsheet 1

## What are these diseases?
Measles, mumps and rubella (also known as German measles) are diseases that are caused by infectious agents known as viruses. They are spread when the viruses are passed from an infectious person to someone who is not immune.

## Symptoms and complications of the diseases

<table>
<thead>
<tr>
<th></th>
<th>Usual symptoms</th>
<th>Serious complications</th>
<th>Duration</th>
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</thead>
<tbody>
<tr>
<td>Measles</td>
<td>Almost all who are infected develop symptoms, such as:</td>
<td>ear infection (1 in 20)</td>
<td>Children usually have to spend about 5 days in bed and may be off school for about 10 days. Adults are likely to be ill for longer.</td>
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<tr>
<td></td>
<td>fever, rash, cough, red and painful eyes, swollen glands, loss of appetite, generally unwell</td>
<td>pneumonia/bronchitis (1 in 25)</td>
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<td></td>
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<td>convulsion (1 in 200)</td>
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<td></td>
<td></td>
<td>diarrhoea (1 in 6)</td>
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<td></td>
<td></td>
<td>hospital admission (1 in 100)</td>
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<td></td>
<td></td>
<td>meningitis/encephalitis (1 in 1,000)</td>
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<td></td>
<td></td>
<td>late onset: SSPE* (1 in 8,000 children under 2 years old)</td>
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<td></td>
<td></td>
<td>death (1 in 2,500-5,000)</td>
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<td></td>
<td></td>
<td>* Subacute sclerosing panencephalitis</td>
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<td>see explanation on page 7.</td>
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<tr>
<td>Mumps</td>
<td>60-70% of those infected develop symptoms, such as:</td>
<td>swollen, painful testes in older males (1 in 5)</td>
<td>7-10 days</td>
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<td></td>
<td>painful and swollen glands in the cheeks, neck or under the jaw</td>
<td>central nervous system involvement is common - meningitis/encephalitis (1 in 200-5,000)</td>
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<td></td>
<td>fever, headache, abdominal pain, loss of appetite, generally unwell.</td>
<td>pancreatitis (1 in 30)</td>
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<td></td>
<td>deafness - usually with partial or complete recovery (1 in 25)</td>
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<td></td>
<td></td>
<td>Mumps during pregnancy can lead to spontaneous abortion.</td>
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<tr>
<td>Rubella</td>
<td>50-75% of those who are infected develop symptoms, such as:</td>
<td>joint symptoms</td>
<td>48-72 hours</td>
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<td></td>
<td>low grade fever, headache, conjunctivitis, rash, sore throat, cough, swollen glands, joint pains (mainly women), loss of appetite, generally unwell</td>
<td>encephalitis (1 in 6,000)</td>
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<td>bleeding disorders (1 in 3,000)</td>
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<td></td>
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<td>Rubella during pregnancy can lead to spontaneous abortion.</td>
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<td></td>
<td></td>
<td><strong>Congenital rubella syndrome</strong></td>
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<td></td>
<td></td>
<td>babies can be born with:</td>
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<td></td>
<td></td>
<td>deafness</td>
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<td></td>
<td></td>
<td>blindness</td>
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<td>heart problems</td>
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<td></td>
<td></td>
<td>brain damage</td>
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<td></td>
<td></td>
<td>other serious problems.</td>
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Despite recent improvements in general health and the quality of treatment, measles still causes serious problems for people who develop complications. A study in 1978 showed that, whilst the number of measles cases had decreased considerably since the introduction of measles vaccine, the rate of serious illness as a result of measles infection remained the same. Between 1989 and 1991 a measles epidemic in the USA killed 130 children and more than 5,000 children were admitted to hospital.

**How common are these diseases?**

Since the introduction of vaccines against measles, mumps and rubella the incidence of these diseases has decreased considerably. These diseases only became rare after the vaccines were introduced.

When a country has high vaccine coverage, as in the UK, the diseases that vaccines prevent become extremely rare. In the absence of immunisation these diseases would become common again and would cause significant amounts of serious illness and potentially some deaths. For example, in the 1970s, when there was a loss of confidence in whooping cough vaccine, and coverage fell, there were three major epidemics of whooping cough, with thousands of children being admitted to hospital. When vaccine coverage rose again, whooping cough declined.

![Measles](image1)

![Mumps](image2)

![Rubella - children (1-14 years)](image3)

The following graphs show how measles, mumps and rubella have declined since MMR vaccine was introduced. All of these diseases are now rare in childhood.

**If these diseases are so rare in the UK now, why should children be immunised?**

There are really two key reasons. These diseases are rare in the UK now, but:

- they remain common in many parts of the world;
- if uptake of vaccine falls, the diseases would return in the future.

It is true that the risk of getting these diseases in the UK at present is very low. This is because such a high proportion of the population is immunised. But unimmunised children can still be at risk, either from cases of measles brought into this country, or by travelling to countries where there are many more measles cases than here. The older people are when they catch measles, mumps or rubella, the more serious the disease, and the higher the complication rate. It is estimated that 1 to 2 million children worldwide die each year from measles. Even in countries such as the UK, previously healthy children can still die from measles, especially if they catch measles when they are older.
The final decision on immunisation is the parents'. But if a child is not immunised, he/she will remain at risk. The child will then rely on other people immunising their children to avoid becoming infected. There will always be children who are left unprotected because:

- they cannot be immunised for medical reasons;
- they are too young to be immunised;
- they do not access vaccine services; and
- for some, the vaccine didn't work.

If more people choose not to immunise, then there will be pools of susceptible children and before long, outbreaks of disease will occur.

The effect of decreased vaccine coverage has been seen in Russia:

Russia used to have a well-established vaccine programme where a high proportion of children were immunised. Following the dissolution of the USSR, shortages of vaccine and indifference about the need for immunisation, led to a dramatic fall in vaccine coverage. Since then there has been a huge epidemic of diphtheria causing more than 125,000 cases and 4,000 deaths have been reported.

The only time to stop immunising children is when a disease has been eradicated worldwide. When every country had eliminated smallpox, all countries stopped immunisation. Hopefully polio will be eradicated soon, and measles may follow.

**What is the MMR vaccine?**

MMR vaccine is a live vaccine - it contains measles, mumps and rubella viruses that have been modified (or attenuated) so that they no longer cause disease symptoms in humans. The vaccine has been developed to produce an immune response sufficient to protect children against the real disease, with no illness at all or only a very mild version of the illness. The viruses have been attenuated by growing successive generations of the virus under specially modified conditions that select for these mild strains.

**How does the vaccine work?**

A child will be injected with the vaccine and this causes their immune system to respond and make antibodies against the viruses in the vaccine. These antibodies then destroy the vaccine viruses but special cells (lymphocytes) of the immune system 'remember' the virus so that there is a prompt response if exposure occurs again. Because the viruses in the vaccine and the natural viruses are very similar, the immune system responds to both. This means that if a child is later infected with the real viruses, these are very quickly recognised by the immune system and large numbers of antibodies are produced rapidly to halt the infection.

**How effective is the vaccine?**

The level of effectiveness varies for the different components of the MMR vaccine:

- 90-95% of people will be immune to measles after the first dose,
- 90-95% of people will be immune to mumps after the first dose,
- 97-99% of people will be immune to rubella after the first dose.

It is not known why some people don't get a good response. Sometimes the vaccine may have been improperly stored, or the viruses had lost their potency.

**How long does a child remain immune after receiving the vaccine?**

There is very little evidence that immunity to the measles, mumps or rubella vaccines wanes with time. It is known that children will remain immune for at least 27 years against measles, 18 years against rubella and 14 years against mumps - in other words for the amount of time that the vaccines have been available. Even if individuals are not fully protected, the immune system will have some memory and be able to respond more quickly in the immunised than in those who have not been immunised. Immunised children with low levels of antibodies are likely to have a modified, less serious, illness. Long-term studies on the duration of protection are continuing.

The immunity against infection has been shown to last such a long time without waning that, in those people with protection, it is likely to be lifelong.

**Isn't the protection from measles itself better than that from the vaccine?**

The immunity from immunisation appears to be long lasting and effective. The problem with immunity that follows natural measles is that the child has to have had the disease. That's fine if the child doesn't have any of the complications of the disease, but it's a pretty risky option for the child's health. Recent evidence suggests that natural measles actually damages the immune system, an effect not seen in children who had the measles vaccine.
Is there evidence that vitamin A reduces the need for immunisation against measles in the UK?

No. There is evidence that vitamin A will reduce the likelihood of complications from measles in populations that are deficient in vitamin A, such as children with malnutrition in developing countries. There is no convincing evidence for this in the developed world, and a well-nourished child is unlikely to benefit from this vitamin supplement. Excessive amounts of vitamin A can be dangerous, causing damage to the liver and other organs.

Why do people who have been immunised still suffer from measles, mumps and rubella?

As explained earlier, MMR vaccine is not 100% effective. If there are outbreaks, some of the people who are in the 5 to 10% who were not protected by the vaccine will become infected. If almost everyone has been immunised, almost everyone with measles has a history of being immunised. This can be better explained using the following example.

<table>
<thead>
<tr>
<th>SCHOOL POPULATION</th>
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<tbody>
<tr>
<td>1000 children - 930 immunised, 70 not immunised</td>
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</tbody>
</table>

- Every child is exposed to natural measles infection
- 930 children have been immunised against measles
- 70 children have never been immunised against measles
- 856 children (92%) are immune to measles because of the vaccine
- The vaccine did not work in 74 children (8%). These children are susceptible to measles
- These 70 children are susceptible to measles
- 856 immunised children do not get measles
- 74 immunised and 70 unimmunised children get measles

Therefore, in this example, of those who got measles in the school about a half had been immunised. But remember, 856 students were protected against measles and did not get the disease. All of those not immunised got measles.

When is MMR vaccine given routinely?

- **First dose**: by injection at 12-15 months, usually on its own.
- **Second dose**: by injection between 3 and 5 years of age as part of the pre-school booster programme. Other booster doses of diphtheria/tetanus should be given by separate injection and polio vaccine by mouth at the same time. It is best to have all the vaccines at the same visit.

Why is the vaccine given at these ages?

Babies are born with some protection against measles, mumps and rubella from maternal antibodies that are passed on to them in the womb. This protection begins to wane shortly after birth as the antibody levels from the mother fall. If MMR vaccine were given before 12 months of age, the antibodies that have been passed from the mother could prevent the viruses in the vaccine from working. It is however important to get immunity to measles, mumps and rubella before children have opportunities to catch and pass these infections to each other. Where rubella is concerned, many cases of congenital rubella syndrome used to occur because mothers got rubella from their own or their friends' children.

The MMR second dose is usually given at the same time as the pre-school boosters to reduce the number of visits needed. The best time to give it is before school entry, before children start to mix with a new group of children.

Why are two doses of MMR vaccine needed?

Not all children receive the first dose of MMR vaccine and in 5-10% of those who do, the vaccine doesn’t work. This means that each year the number of children who remain susceptible to measles, mumps and rubella will increase. The second MMR visit is needed to protect those children who did not respond to the first dose, and provides an opportunity to give a first dose to children who didn’t receive the vaccine earlier. Children who did respond to the first dose get a boost to their antibodies with a second dose.
If a child didn't respond to the first MMR, will they respond to the second?

A second dose of vaccine has been shown to significantly increase protection. Amongst children who did not respond to a first dose of MMR vaccine, over 90% have a good response to a second dose. Children with low levels of antibodies after the first dose, are boosted.

What are the side effects from a second dose of MMR?

Experience from the USA and Scandinavia has shown that the type of reactions after the second dose are essentially the same as after the first dose, but if they do occur they are even rarer. There are no new side effects after the second dose that do not happen after the first dose. In one study, there were just as many symptoms in students who had not been vaccinated, as in a group who had just had their second dose. This suggests that the 'reactions' reported were probably unrelated to the vaccine.

If children have responded to the vaccine the first time, they will not have any problem from being exposed to the viruses again. It's like any of us who are immune meeting someone with the disease - the infection can't get established. If a child did not respond the first time, they remain susceptible to natural infection, and need the second dose.

Why not do a blood test to see if each child needs the immunisation?

First, this would mean that all children would have to have a blood test, which itself is unpleasant. Second, blood tests are not 100% accurate and some children who were not immune would not be identified, would not receive MMR and would therefore remain susceptible to these diseases. Then there would have to be a mechanism for calling back children according to the results, and experience with rubella immunisation in this country, and testing for immunity before immunisation in other countries, has shown that this is not effective. The World Health Organization actually recommends that this is not done.

Children who do not have antibodies or who have low levels of antibodies need a second dose. Reactions after a second dose are even rarer than after a first dose, and often happen because the first dose did not give them sufficient protection. Over 30 European countries, the USA and Canada, give routine second doses of MMR and nobody tests for immunity beforehand.

Are there any children who should not be immunised?

Very few children cannot have the vaccine. Even children with a very severe allergy when they eat food containing egg (involving swollen mouth and throat, breathing difficulties, shock) can be given MMR vaccine. Over 1,000 children with egg allergy have been studied - they were immunised safely with MMR vaccine. If a child has had a serious reaction when eating eggs, or food containing egg, then the parent should talk to their doctor about making special arrangements for the child's immunisation. This can usually be done as a day-case at the Paediatric Department of the local hospital.

Some children who are on medication that affects their immunity should not have live vaccines such as MMR. The number of children with valid contraindications to MMR is less than one in a thousand.

Immunisation may need to be delayed: if a child has a fever, has received another live vaccine recently, such as BCG, or has received immunoglobulin or another blood product in the past three months. Children with suppressed immunity, or those who had a serious reaction after the first dose of MMR, may not be able to receive the vaccine.

Parents should be encouraged to discuss these issues with the doctor or nurse if they are unsure whether their child should be immunised.

What should a parent expect after their child has received the MMR vaccine?

Because MMR vaccine contains viruses that are very similar to those that cause the actual diseases, mild symptoms of the disease can occur. This is a sign that the vaccine is working properly and causing an immune response. Many children will have no symptoms at all. Children cannot infect other children with the viruses contained in the MMR vaccine.

Soon after immunisation there may be soreness, redness or swelling at the injection site. After immunisation it is not unusual for children to experience a very mild form of measles with rash (about 1 in 10), fever (about 1 in 15), loss of appetite and a general feeling of being unwell for 2 or 3 days. More rarely (1 in 50) a child may develop a mild form of mumps with swelling of the glands in the cheek, neck or under the jaw about 3 weeks after immunisation. This only lasts a day or two. One to three weeks after the first dose there may be pain, stiffness or swelling in one or more joints because of the rubella component; this usually lasts