

11

The UK immunisation schedule

The routine immunisation schedule

The overall aim of the routine immunisation schedule is to provide protection against the following vaccine-preventable infections:

- diphtheria
- *Haemophilus influenzae* type b (Hib)
- hepatitis B
- human papillomavirus (certain serotypes)
- influenza
- measles
- meningococcal disease (certain serogroups)
- mumps
- pertussis (whooping cough)
- pneumococcal disease (certain serotypes)
- polio
- rotavirus
- rubella
- shingles
- tetanus

The schedule for routine immunisations and instructions for how they should be administered are given in Table 11.1. The relevant chapters on each of these vaccine-preventable diseases provide detailed information about the vaccines and the immunisation programmes.

Table 11.1 Schedule for the UK's routine immunisation programme (excluding catch-up campaigns)

| Age due | Vaccine given | How it is given¹ |
|---|---|--|
| Eight weeks old | Diphtheria, tetanus, pertussis, polio, Haemophilus influenzae type b (Hib) and hepatitis B (DTaP/IPV/Hib/HepB) Meningococcal B (MenB) Rotavirus | One injection One injection One oral application |
| Twelve weeks old | Diphtheria, tetanus, pertussis, polio, Hib and hepatitis B (DTaP/IPV/Hib/HepB) Rotavirus Pneumococcal conjugate vaccine (PCV13) | One injection One oral application One injection |
| Sixteen weeks old | Diphtheria, tetanus, pertussis, polio, Hib and hepatitis B (DTaP/IPV/Hib/HepB) Meningococcal B (MenB) | One injection One injection |
| One year old (on or after the child's first birthday) | Hib/MenC Pneumococcal conjugate vaccine (PCV13) Meningococcal B (MenB) Measles, mumps and rubella (MMR) | One injection ² One injection ² One injection ² One injection ² |
| Eligible paediatric age groups <u>Chapter 19</u> | Live attenuated influenza vaccine (LAIV) | Nasal spray, single application in each nostril (if LAIV is contraindicated and child is in a clinical risk group, give inactivated flu vaccine; see Chapter 19) |
| Three years four months old or soon after | Diphtheria, tetanus, pertussis and polio (dTaP/IPV) Measles, mumps and rubella (MMR) | One injection One injection |
| Twelve to thirteen years old | Human papillomavirus (HPV) | Course of two injections at least six months apart |
| Fourteen years old (school year 9) | Tetanus, diphtheria and polio (Td/IPV) Meningococcal ACWY conjugate (MenACWY) | One injection One injection |
| 65 years old | Pneumococcal polysaccharide vaccine (PPV) | One injection |
| 65 years of age and older | Inactivated influenza vaccine | One injection annually |
| 70 years old | Shingles vaccine | One injection (live vaccine) Two injections (inactivated vaccine) |

1 Where two or more injections are required at the same time, these should ideally be given in different limbs. Where this is not possible, injections in the same limb should be given at least 2.5cm apart.

2 Where injections can only be given in two limbs, it is recommended that the MMR, as the vaccine least likely to cause local reactions, is given in the same limb as the MenB with the PCV13 and Hib/MenC doses given into the other limb.

The childhood immunisation schedule has been designed to provide early protection against infections that are most dangerous for the very young. This is particularly important for diseases such as whooping cough, rotavirus and those due to pneumococcal, Hib and meningococcal infections. Providing subsequent booster doses as scheduled should ensure continued protection. Further vaccinations are offered throughout life to provide protection against infections when eligible individuals reach an age where they can derive most benefit (such as because of an increased individual risk) or where the programme will provide optimal control of that disease for the whole population.

Recommendations for the age at which vaccines should be administered are informed by the age-specific risk for a disease, the risk of disease complications, the ability to respond to the vaccine and the impact on spread in the population. The schedule should therefore be followed as closely as possible.

Some individuals may be eligible for additional vaccines due to an underlying medical condition or circumstances that put them at increased risk of catching a vaccine-preventable disease or of complications from that disease. These individuals should be vaccinated in accordance with the recommendations in Chapter 7 and the disease specific chapters.

Seasonal influenza

Those eligible for influenza vaccine (on the basis of age or clinical risk) should be vaccinated each winter, usually between October and January, although vaccination may still be of some benefit if given later. The annual letters on the influenza programme should be consulted for age eligibility:

England: www.gov.uk/government/collections/annual-flu-programme

Northern Ireland: www.health-ni.gov.uk/topics/professional-medical-and-environmental-health-advice/hssmd-letters-and-urgent-communications

Scotland: www.sehd.scot.nhs.uk/index.asp

Wales: gweddill.gov.wales/topics/health/nhwales/circulars/public-health/?lang=en

Schedule flexibility

The schedule recommended by the Joint Committee on Vaccination and Immunisation (JCVI) incorporates the minimum intervals between subsequent doses of the same vaccine. As immunological memory from priming dose(s) are likely to be maintained in healthy individuals, increasing that interval will usually lead to a more pronounced response to the later dose. **Therefore, where any course of immunisation is interrupted, there is normally no need to start the course again - it should simply be resumed and completed as soon as possible.** Where vaccination was commenced some time previously however, the product received, or the eligibility may have changed, and the relevant chapter should therefore be consulted.

Immunisations should not be given before the scheduled age unless there is a clear clinical indication for this. The first set of primary immunisations can be given from six weeks of age if required in certain circumstances such as travel to an endemic country. Administering the first set of primary immunisations before 6 weeks of age is not recommended, as it may result in a sub-optimal response to the vaccine which could undermine good control.

MMR vaccine can be given from six months of age, for example during a local outbreak or if travelling to a high incidence country. Any dose of MMR given below the age of one year should be discounted as residual maternal antibodies may reduce the response to the vaccine. Two further doses of MMR will therefore be required at the appropriate ages.

Delaying primary infant immunisations beyond eight weeks risks leaving babies unprotected against serious infections that can be very severe in the very young, such as whooping cough. The six to eight week baby check is not required as part of the assessment for immunisation, and so the eight week primary immunisations should never be delayed because of any delay in carrying out this examination.

Every effort should be made to ensure that all children and adults are immunised, even if they are older than the scheduled age; no opportunity to immunise should be missed. The type of vaccine and number of doses recommended depends on the age of the individual as some vaccines are not indicated after a certain age. In most instances, this is because the ability to benefit from vaccination is reduced because of lower risk (e.g. whooping cough), or lower effectiveness (e.g. for shingles). The exception is rotavirus vaccine, where vaccination at an older age is more likely to be associated with an adverse event (intussusception) (see [Chapter 27b: Rotavirus](#) for more information).

Recording of immunisation

Following immunisation, all the patient's clinical records including the GP held record and, if a child, the record on the Child Health Information System (CHIS) and the Personal Child Health Record (Red Book) should be updated with all the relevant details (see [Chapter 4](#)).

When babies are immunised in special care units, or children and adolescents are immunised opportunistically in accident and emergency units or inpatient facilities, it is important that a record of the immunisation is entered onto the relevant CHIS and sent to the patient's GP for entry onto the practice-held patient record. Details should also be recorded in the child's Personal Child Health Record (Red Book) in a timely manner. Details of vaccines given in other areas, such as schools/maternity services/pharmacies, should also be sent to the patient's GP.

Where possible, records of immunisation should be requested from children and adults arriving from overseas and entered onto the GP held record and other clinical records as appropriate. This will avoid the individual being flagged for vaccination and provide reassurance during local outbreaks.

A toolkit with information on the vaccines used in several other countries can be downloaded to facilitate accurate coding at the following:

<https://www.gov.uk/government/publications/uk-and-international-immunisation-schedules-comparison-tool>

Childhood immunisation programme

When children attend for any vaccination, it is important to also check that they are up-to-date for any vaccines that they should have received previously. The table below gives an example checklist at each key stage; doses of those vaccines that have not been received but are still indicated at that age should be caught up. Catch-up doses should be administered as soon as possible but leaving the appropriate intervals as advised in the relevant chapters.

At a minimum, children's immunisation status should be checked at these key ages, see Table 11.2, and the child offered catch-up for any missing vaccinations.

Table 11.2 Routine immunisation schedule vaccination history at key ages

| Key age | Vaccines child should have had or catch-up with |
|----------------------------------|--|
| At the age of 12 months: | Three doses of diphtheria, tetanus, polio, pertussis, Hib and hepatitis B containing vaccine. A single dose of PCV vaccine. Two doses of MenB vaccine. |
| At the age of 24 months: | Three doses of diphtheria, tetanus, polio, pertussis (and hepatitis B) containing vaccines. A single dose of Hib/MenC and PCV13 vaccines after the age of one year. Either 2 doses of MenB under the age of one and one dose after the age of one year; or 2 doses of MenB after the age of one year. A single dose of MMR vaccine after the age of one year. |
| At school entry: | Four doses of diphtheria, tetanus, pertussis and polio containing vaccine. Two doses of MMR vaccine after the age of one year. A single dose of Hib/MenC conjugate vaccine after the age of one year. |
| At transfer to secondary school: | Four doses of diphtheria, tetanus and polio containing vaccine. Two doses of MMR vaccine after the age of one year. A single dose of Hib/MenC conjugate vaccine after the age of one year. |
| Before leaving school: | Five doses of diphtheria, tetanus, polio containing vaccine. A single dose of MenACWY vaccine after the age of 10 years. Two doses of MMR vaccine. Two doses of HPV vaccine (at least 6 months apart) ¹ |

¹ All Females remain eligible for HPV vaccine up to their twenty-fifth birthday. All males born on/after 1 September 2006 are eligible up to their twenty-fifth birthday

Adult immunisation programme

Five doses of diphtheria, tetanus and polio vaccines at the appropriate interval should ensure long-term protection through adulthood (although additional doses may be indicated for travel or following potential exposure to infection). Individuals who have not completed the five doses should have their remaining doses at the appropriate intervals. Where there is an unclear history of vaccination, adults should be assumed to be unimmunised. A full course of diphtheria, tetanus and polio vaccine should be offered to individuals of any age in line with advice contained in the relevant chapters. It is never too late in life to start a course of vaccination.

Measles, mumps and rubella vaccine should be offered to all young adults who have not received two doses as outlined in [Chapter 21](#), [Chapter 23](#) and [Chapter 28](#). In particular, vaccine status should be checked for all women of child-bearing age who should be offered MMR to prevent rubella in pregnancy. In addition, up to the age of 25 years, MenACWY vaccine should be offered to individuals who have never received a MenC-containing vaccine (see [Chapter 22](#)) and HPV should be offered to eligible unvaccinated individuals (see [Chapter 18a](#) for eligibility).

Older adults (65 years and older) should routinely be offered a single dose of pneumococcal polysaccharide vaccine if they have not previously received it. Annual influenza vaccination should be offered from 65 years of age. Adults aged 70 years become eligible for shingles vaccine and remain eligible until their 80th birthday. More information on shingles vaccine eligibility is available at: <https://www.gov.uk/government/collections/shingles-vaccination-programme>

Vaccination of individuals with unknown or incomplete immunisation status

For a variety of reasons, some individuals may present not having received some or all their immunisations or may have an unknown immunisation history. Where an individual born in the UK presents with an inadequate immunisation history, every effort should be made to clarify what immunisations they may have had. Anyone who has not completed the routine immunisation programme as appropriate for their age should have the outstanding doses as described in the relevant chapters.

If children and adults coming to the UK do not have a documented or reliable verbal history of immunisation, they should be assumed to be unimmunised and a full course of required immunisations should be planned.

Individuals coming from areas of conflict or from population groups who may have been marginalised in their country of origin (such as refugees, gypsy or other nomadic travellers) may not have had good access to immunisation services. In particular, older children and adults may also have been raised during periods before immunisation services were well developed or when vaccine quality was sub-optimal. Where there is no reliable history of previous immunisation, it should be assumed that any undocumented doses are missing and the UK catch-up recommendations for that age should be followed.

An algorithm for vaccinating individuals with uncertain or incomplete immunisation status is available at <https://www.gov.uk/government/publications/vaccination-of-individuals-with-uncertain-or-incomplete-immunisation-status>

Individuals coming to the UK who have a history of completing immunisation in their country of origin may not have been offered protection against all the antigens currently offered in the UK. Most countries have offered protection against diphtheria, tetanus, polio and whooping cough for many years, but do not currently include MenC or MenB in the schedule and may have introduced PCV and Hib vaccine relatively recently. Many countries worldwide only offer single measles vaccines, rather than MMR, or have only recently started to offer a rubella containing vaccine. Measles vaccine is also given below the age of one year in many lower income countries. Doses of measles-containing vaccine given below the age of one should be discounted and two further doses of MMR vaccine given to ensure adequate protection against both measles and rubella.

Current country-specific schedules are available on the WHO website (http://apps.who.int/immunization_monitoring/globalsummary).

Children coming to the UK may have received a fourth dose of a diphtheria/tetanus/pertussis-containing vaccine that is given at around 18 months in many countries. Booster doses given before three years of age should be discounted, as they may not provide continued satisfactory protection until the time of the teenage booster. The routine pre-school and subsequent boosters should be given according to the UK schedule.

Premature infants

It is important that premature infants have their immunisations at the appropriate chronological age (counted from their date of birth), in accordance with the national routine immunisation schedule. As the benefit of vaccination is high in this group of infants, vaccination should not be withheld or delayed.

As the occurrence of apnoea following vaccination is especially increased in infants who were born very prematurely, specific guidance on the immunisation of premature infants in [Chapter 7](#) and the disease specific chapters should be followed.

Selective immunisation programmes

There are a number of selective immunisation programmes that target children and adults at particular risk of serious complications from certain infections, such as hepatitis B, hepatitis A, influenza, Hib, meningococcal and pneumococcal infection. Other vaccines, including BCG, HPV, hepatitis B and hepatitis A, are also recommended for individuals at higher risk of exposure to infection, due to lifestyle factors, close contact or recent outbreaks in their community.

Individuals at risk of exposure through their work should be advised about any required vaccinations by their employer or their occupational health service ([Chapter 12](#)). For more information, please see [Chapter 7](#) and the disease specific chapters.

Vaccination during and after pregnancy

In 2010, routine influenza immunisation of individuals was extended to include all pregnant women. This was based on evidence of the increased risk from influenza to the

mother and to infants in the first few months of life. Vaccination therefore protects the woman herself and provides passive immunity to the infant following birth. Preventing infection in the mother will also reduce the risk of her transmitting influenza to her newborn baby. Inactivated influenza vaccine should therefore be offered to pregnant women at any stage of pregnancy (first, second or third trimesters), ideally before influenza viruses start to circulate. Influenza vaccination is usually carried out between October and January, but clinical judgement should be used to assess whether a pregnant woman should be vaccinated after this period. The current level and severity of influenza activity, the presence of other risk factors and the availability of inactivated influenza vaccine may form part of the consideration for late vaccination.

A programme for the vaccination of pregnant women against pertussis was introduced in October 2012. The purpose of the programme is to boost antibodies in these women so that high levels of passive antibody are transferred from mother to baby. This should protect the infant against pertussis infection until they can be vaccinated at eight weeks of age. Pregnant women should be offered dTaP/IPV vaccine from week 16 of each pregnancy (for operational reasons, vaccination is probably best offered at, or after the foetal anomaly scan at around 20 weeks). This programme is described in more detail in [Chapter 24](#).

Influenza vaccine can be given at the same time as pertussis vaccine, but influenza vaccination should not be delayed in order to administer the two vaccines together. Inactivated influenza vaccines are preferred to the live attenuated vaccine for pregnant women (see [Chapter 19](#)). Pertussis vaccine can be given at the same time as influenza vaccine but, to avoid compromising the passive protection to the infant, this should not be used as a reason to give pertussis vaccination outside of the recommended period.

From 2016, the routine antenatal testing of women for rubella susceptibility ceased. Pregnant women should have their vaccine status checked during or after pregnancy, for example at the post-natal check, and be offered any outstanding doses of MMR soon after delivery. MMR vaccine should not be offered in pregnancy.

Intervals between vaccines

Doses of different inactivated vaccines can be administered at any time before, after, or at the same time as each other. Doses of inactivated vaccines can also be given at any interval before, after, or at the same time as a live vaccine and vice versa.

A minimum four-week interval is normally recommended between successive doses of the same vaccine - for example between each of the three doses of DTaP-containing vaccine in the primary schedule. A better response is made to some vaccines when an eight-week interval is observed between infant doses. Although shorter intervals may be advised to achieve more rapid protection, e.g. for travel or during an outbreak, this may lead to a lower immune response, particularly in infants, and may therefore provide less durable protection. If one of the infant primary immunisation DTaP-containing vaccine doses is inadvertently or deliberately given up to a week early (such as for travel) however, the impact on the final response is minimal. If more than one dose in the three-dose schedule is given early, or one of the doses is given at less than a three week interval, then that dose should be repeated at least four weeks after the final dose. Where an infant dose of MenB is inadvertently given at an interval of less than eight weeks, an additional dose should be administered four weeks after the second dose to ensure adequate protection whilst still at a vulnerable age.

For other multiple dose schedules with inactivated vaccines e.g. hepatitis B, giving subsequent doses at a slightly shorter than the recommended interval is unlikely to be highly detrimental to the overall immune response. However, early vaccination should be avoided unless necessary to ensure rapid protection or to improve compliance, and additional doses may be recommended to ensure longer term protection.

Advice on intervals between different live vaccines is based on existing specific evidence of interference between vaccines. The current advice is detailed in Table 11.3. Recommended intervals between subsequent doses of the same live vaccine will depend upon the specific incubation period of the vaccine virus, and other factors, such as decline in maternally derived antibody. Please refer to the relevant chapters.

Table 11.3 Recommended time intervals when giving more than one live attenuated vaccine

| Vaccine combinations | Recommendations |
|---|---|
| Yellow Fever and MMR | A four week minimum interval period should be observed between the administration of these two vaccines. Yellow Fever and MMR should not be administered on the same day. ¹ |
| Varicella (and zoster) vaccine and MMR | If these vaccines are not administered on the same day, then a four week minimum interval should be observed between vaccines. ² |
| Tuberculin skin testing (Mantoux) and MMR | MMR vaccination and tuberculin skin testing can be performed on the same day (Kroeger <i>et al</i> 2019). However, if a tuberculin skin test has already been initiated, then MMR should be delayed until the skin test has been read unless protection against measles is required urgently. If a child has had a recent MMR, and requires a tuberculin test, then a four week interval should be observed. ³ |
| All currently used live vaccines (BCG, rotavirus, live attenuated influenza vaccine (LAIV), oral typhoid vaccine, yellow fever, varicella, zoster and MMR). | Apart from those combinations listed above, these vaccines can be administered at any time before or after each other. This includes tuberculin (Mantoux) skin testing. ⁴ |

- 1 Co-administration of these two vaccines can lead to sub-optimal antibody responses to yellow fever, mumps and rubella antigens (Nascimento *et. al*, 2011). Where protection is required rapidly then the vaccines should be given at any interval; an additional dose of MMR should be considered.
- 2 A study in the US (Mullooley & Black, 2001) showed a significant increase in breakthrough infections when varicella vaccine was administered within 30 days of MMR vaccine; suggesting that MMR vaccine caused an attenuation of the response to varicella vaccine. When the vaccines are given on the same day, however the responses have been shown to be adequate (Plotkin, 2018.) As the zoster (shingles) vaccine contains the same virus as varicella (chicken pox) vaccine, this recommendation has been extrapolated to MMR and zoster. Where protection from either vaccine is required rapidly then the vaccines can be given at any interval and an additional dose of the vaccine given second should be considered.
- 3 Administering tuberculin (Mantoux) within 28 days of MMR vaccine may result in decreased reactivity of the tuberculin and the false negative reporting of results. If tuberculin testing has already been initiated, MMR should be delayed until the skin test has been read. If protection against measles is urgently required, then the benefit of protection from the vaccine outweighs the potential interference with the tuberculin test. In this circumstance, the individual interpreting the negative tuberculin test should be aware of the recent MMR vaccination when considering how to manage that individual.
- 4 Whilst there is no evidence of decreased reactivity or interference from other live vaccines, those interpreting the results of the tuberculin skin test should be aware of any recently administered live injectable vaccines.

References

- Kroger AT, Duchin J, Vázquez M. General Best Practice Guidelines for Immunization. Best Practices Guidance of the Advisory Committee on Immunization Practices (ACIP). <https://www.cdc.gov/vaccines/hcp/acip-recs/general-recs/index.html>. Accessed on January 10, 2019.
- Mullooly, J and Black, S (2001). Simultaneous administration of varicella vaccine and other recommended childhood vaccines – United States, 1995-1999. *MMWR Weekly*. Nov 30, 2001 / **50**(47); 1058 -1061. <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5047a4.htm>
- Nascimento Silva JR, Camacho LA, Freire Mde S et al (2011). Mutual interference on the immune response to yellow fever vaccine and a combined vaccine against measles, mumps and rubella. *Vaccine* **29**(37): 6327- 6334
- Plotkin SA, Orenstein WA, Offit PA and Edwards KM, (eds) (2018) *Vaccines*, 7th edition. Philadelphia, PA: Elsevier, [2018]