## Antigen Recommendations for Interrupted or Delayed Routine Immunization - Summary of WHO Position Papers

### Recommendations for all immunization programmes

<table>
<thead>
<tr>
<th>Antigen</th>
<th>Age of 1st Dose</th>
<th>Doses in Primary Series (min interval between doses)</th>
<th>Interrupted primary series***</th>
<th>Doses for those who start vaccination late</th>
<th>Booster</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCG 1</td>
<td>As soon as possible after birth</td>
<td>1 dose</td>
<td>NA</td>
<td>1 dose</td>
<td>Not recommended</td>
</tr>
<tr>
<td>Hepatitis B 2</td>
<td>As soon as possible after birth (&lt;24h)</td>
<td>Birth dose &lt;24 hrs plus 2-3 doses with DTP (4 weeks)</td>
<td>Resume without repeating previous dose</td>
<td>3 doses</td>
<td>3 doses</td>
</tr>
<tr>
<td>Polio 3</td>
<td>6 weeks (see footnote for birth dose)</td>
<td>4 doses (IPV dose to be given with bOPV dose from 14 weeks of age) (4 weeks)</td>
<td>Resume without repeating previous dose</td>
<td>4 doses (IPV to be given with 1st dose of bOPV)</td>
<td>4 doses (IPV to be given with 1st dose of bOPV)</td>
</tr>
<tr>
<td>IPV / bOPV Sequential</td>
<td>8 weeks (IPV 1st)</td>
<td>1-2 doses IPV and 2 doses bOPV (4 weeks)</td>
<td>Resume without repeating previous dose</td>
<td>1-2 doses IPV and 2 doses bOPV</td>
<td>1-2 doses IPV and 2 doses bOPV</td>
</tr>
<tr>
<td></td>
<td>8 weeks</td>
<td>3 doses (4 weeks)</td>
<td>Resume without repeating previous dose</td>
<td>3 doses</td>
<td>3 doses</td>
</tr>
<tr>
<td>IPV</td>
<td>8 weeks</td>
<td>3 doses (4 weeks)</td>
<td>Resume without repeating previous dose</td>
<td>3 doses</td>
<td>3 doses</td>
</tr>
<tr>
<td>DTP-containing vaccine 4</td>
<td>6 weeks (min)</td>
<td>3 doses (4 weeks)</td>
<td>Resume without repeating previous dose</td>
<td>3 doses</td>
<td>3 doses</td>
</tr>
<tr>
<td>Haemophilus influenzae type b 5</td>
<td>Option 1</td>
<td>3 doses (4 weeks)</td>
<td>Resume without repeating previous dose</td>
<td>3 doses</td>
<td>3 doses</td>
</tr>
<tr>
<td></td>
<td>Option 2</td>
<td>3 doses (4 weeks)</td>
<td>Resume without repeating previous dose</td>
<td>3 doses</td>
<td>3 doses</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2-3 doses (8 weeks if 2 doses; 4 weeks if 3 doses)</td>
<td>Resume without repeating previous dose</td>
<td>&gt;5 yrs not recommended if healthy</td>
<td>None</td>
</tr>
<tr>
<td>Pneumococcal (Conjugate) 6</td>
<td>6 weeks (min)</td>
<td>3 doses with DTP (4 weeks) or 2 doses (8 weeks)</td>
<td>Resume without repeating previous dose</td>
<td>2-3 doses</td>
<td>1-2 yrs: 2 doses 2-5 yrs at high-risk: 2 doses</td>
</tr>
<tr>
<td>Rotarix</td>
<td>6 weeks (min)</td>
<td>2 doses with DTP (4 weeks)</td>
<td>Resume without repeating previous dose</td>
<td>2 doses</td>
<td>&gt; 24 months limited benefits</td>
</tr>
<tr>
<td>Rota Teq</td>
<td>6 weeks (min)</td>
<td>3 doses with DTP (4 weeks)</td>
<td>Resume without repeating previous dose</td>
<td>3 doses</td>
<td>&gt; 24 months limited benefits</td>
</tr>
<tr>
<td>Measles 8</td>
<td>9 or 12 months (6 months min, see footnote)</td>
<td>2 doses (4 weeks)</td>
<td>Resume without repeating previous dose</td>
<td>2 doses</td>
<td>2 doses</td>
</tr>
<tr>
<td>Rubella 9</td>
<td>9 or 12 months</td>
<td>1 dose with measles containing vaccine</td>
<td>NA</td>
<td>1 dose</td>
<td>1 dose</td>
</tr>
<tr>
<td>HPV 10</td>
<td>As soon as possible from 9 years of age (females)</td>
<td>2 doses (5 months)</td>
<td>If 1st dose given before 15 years of age resume without repeating previous dose</td>
<td>NA</td>
<td>Girls: 9-14 years 2 doses (see footnote)</td>
</tr>
</tbody>
</table>

* For some antigens the WHO position paper does not provide a recommendation on interrupted or delayed schedules at this present time. When the position paper is next revised this will be included. In the meantime, some of the recommendations are based on expert opinion.

** See Table 2: Summary of WHO Position Papers - Recommended Routine Immunizations for Children for full details ([www.who.int/immunization/documents/positionpapers/](http://www.who.int/immunization/documents/positionpapers/)).

*** Same interval as primary series unless otherwise specified.
Table 3: Recommendations* for Interrupted or Delayed Routine Immunization Summary of WHO Position Papers (Updated March 2017)

<table>
<thead>
<tr>
<th>Antigen</th>
<th>Age of 1st Dose</th>
<th>Doses in Primary Series (min interval between doses)**</th>
<th>Interrupted primary series***</th>
<th>Doses for those who start vaccination late If ≤ 12 months of age</th>
<th>Booster Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Recommendations for certain regions</strong></td>
<td></td>
<td></td>
<td></td>
<td>If &gt; 12 months of age</td>
<td></td>
</tr>
<tr>
<td>Japanese Encephalitis 11</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inactivated Vero cell-derived vaccine</td>
<td>6 months</td>
<td>2 (4 weeks) generally</td>
<td>Resume without repeating previous dose</td>
<td>2 doses (generally)</td>
<td>Not recommended</td>
</tr>
<tr>
<td>Live attenuated vaccine</td>
<td>8 months</td>
<td>1</td>
<td>NA</td>
<td>1 dose</td>
<td>1 dose</td>
</tr>
<tr>
<td>Live recombinant vaccine</td>
<td>9 months</td>
<td>1</td>
<td>NA</td>
<td>1 dose</td>
<td>1 dose</td>
</tr>
<tr>
<td>Yellow Fever 12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FSME-Immun &amp; Encepur</td>
<td>≥ 1 yr</td>
<td>3 doses (1st to 2nd 1-3 mos; 2nd to 3rd 12 mos)</td>
<td>Resume without repeating previous dose</td>
<td>3 doses</td>
<td>At least 1 booster</td>
</tr>
<tr>
<td>TBE_Moscow &amp; EnceVir</td>
<td>≥ 3 yr</td>
<td>3 doses (1st to 2nd 1-7 mos; 2nd to 3rd 12 mos)</td>
<td>Resume without repeating previous dose</td>
<td>3 doses</td>
<td>Every 3 years</td>
</tr>
<tr>
<td><strong>Recommendations for some high-risk populations</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Typhoid 14</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vi PS</td>
<td>2 years (min)</td>
<td>1 dose</td>
<td>NA</td>
<td>Not recommended</td>
<td>1 dose</td>
</tr>
<tr>
<td>Ty21a</td>
<td>Capsules 5 years (min) (see footnote)</td>
<td>3-4 doses (1 day) (see footnote)</td>
<td>If interruption between doses is &lt; 21 days resume without repeating previous dose; If &gt; 21 days restart primary series</td>
<td>Not recommended</td>
<td>&gt; 5 yrs: 3-4 doses</td>
</tr>
<tr>
<td>Cholera 15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dukoral (WC-rBS)</td>
<td>2 years (min)</td>
<td>2-5 yrs: 3 doses</td>
<td>If interval since last dose ≥ 6 weeks restart primary series</td>
<td>Not recommended</td>
<td>2-5 yrs: 3 doses</td>
</tr>
<tr>
<td>Shanchol and mORCVAX</td>
<td>1 year (min)</td>
<td>2 doses (2 weeks)</td>
<td>Resume without repeating previous dose</td>
<td>Not recommended</td>
<td>2 doses</td>
</tr>
<tr>
<td>Meningococcal 16</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MenA conjugate (5µg)</td>
<td>9-18 months</td>
<td>1</td>
<td>NA</td>
<td>2 doses if &lt; 9 months with 8 week interval</td>
<td>1 dose of 5µg up to 24 months</td>
</tr>
<tr>
<td>MenC conjugate</td>
<td>2-11 months</td>
<td>2 (8 weeks min)</td>
<td>Resume without repeating previous dose</td>
<td>2 doses</td>
<td>1 dose</td>
</tr>
<tr>
<td>≥ 12 months</td>
<td>1</td>
<td>NA</td>
<td>Resume without repeating previous dose</td>
<td>2 doses</td>
<td>1 dose</td>
</tr>
<tr>
<td>Quadrivalent conjugate</td>
<td>9-23 months</td>
<td>2 (12 weeks min)</td>
<td>Resume without repeating previous dose</td>
<td>2 doses</td>
<td>1 dose</td>
</tr>
<tr>
<td>≥ 2 years</td>
<td>1</td>
<td>NA</td>
<td>Resume without repeating previous dose</td>
<td>2 doses</td>
<td>1 dose</td>
</tr>
<tr>
<td>Hepatitis A 17</td>
<td>1 year (min)</td>
<td>At least 1 dose</td>
<td>At least 1 dose</td>
<td>Not recommended</td>
<td>At least 1 dose</td>
</tr>
<tr>
<td>Rabies 18</td>
<td>As required</td>
<td>3 doses (1st to 2nd 7 days; 2nd to 3rd 14-21 days)</td>
<td>Resume without repeating previous dose; Interval between last two doses should be 14 days minimum</td>
<td>3 doses</td>
<td>3 doses</td>
</tr>
<tr>
<td>Dengue (CYD-TDV) 19</td>
<td>9 years (min)</td>
<td>3 doses (6 months)</td>
<td>Resume without repeating dose</td>
<td>Not recommended</td>
<td>3 doses ≥ 9 years</td>
</tr>
<tr>
<td><strong>Recommendations for immunization programmes with certain characteristics</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mumps 20</td>
<td>12-18 months</td>
<td>2 doses with measles containing vaccine (4 weeks)</td>
<td>Resume without repeating previous dose</td>
<td>Not recommended</td>
<td>2 doses</td>
</tr>
<tr>
<td>Seasonal influenza (inactivated tri- and quadrivalent) 21</td>
<td>6 months (min)</td>
<td>&lt; 9 yrs: 2 doses (4 weeks) ≥ 9 yrs: 1 dose</td>
<td>Resume without repeating previous dose</td>
<td>2 doses</td>
<td>&lt; 9 yrs: 2 doses</td>
</tr>
<tr>
<td>Varicella 22</td>
<td>12-18 months</td>
<td>1-2 (4 weeks – 3 months, depending on manufacturer)</td>
<td>Resume without repeating previous dose</td>
<td>Not recommended</td>
<td>1-2 doses</td>
</tr>
</tbody>
</table>
Summary Table 3 - Notes

- The attached table summarizes the WHO recommendations for interrupted or delayed routine vaccination. Its purpose is to assist national decision-makers and programme managers to develop appropriate policy guidance in relation to their national immunization schedule.

- This table is designed to be used together with two other summary tables - Table 1: Summary of WHO Position Papers - Recommendations for Routine Immunization; and Table 2: Summary of WHO Position Papers - Recommended Routine Immunization for Children.

- Vaccines can generally be co-administered (i.e. more than one vaccine given at different sites during the same visit). Recommendations that explicitly co-administer are indicated in the footnotes. Lack of an explicit co-administration recommendation is often due to a lack of evidence and does not necessarily imply that the vaccine cannot be co-administered. Exceptions to co-administration are stated.

- Refer to http://www.who.int/immunization/positionpapers/ for the most recent version of this table (and Tables 1 and 2) and position papers.

1 BCG
- Expert opinion indicates that vaccination of children older than 12 months of age is usually of limited benefit (although it is not harmful or contraindicated).
- BCG vaccination of adolescents and adults has shown variation in protective efficacy with geographical region, possibly as a consequence of differences in previous exposure to environmental mycobacteria. See position paper for details.
- Infants who are HIV positive or unknown HIV status with symptoms consistent with HIV should not be vaccinated. Reference: *Weekly Epid. Record* (2007, 82: 193-196) [pdf 167kb]

2 Hepatitis B
- In general, the dose for infants and children (aged < 15 years) is half the recommended adult dose.
- Co-administration of HepB vaccine does not interfere with the immune response to any other vaccine and vice versa.
- Data on immunogenicity suggest that in any age group, interruption of the vaccination schedule does not require restarting the vaccine series. If the primary series is interrupted after the first dose, the second dose should be administered as soon as possible and the second and third doses separated by a minimum interval of 4 weeks; if only the third dose is delayed, it should be administered as soon as possible.

3 Polio
- For delayed or interrupted schedules initiate/resume schedule without repeating previous doses.

4 DTP-containing vaccines (Diphtheria, Tetanus and Pertussis)
- Recommended for three doses during the first year of life. In areas where pertussis is of particular risk to young infants, DTP should be started at 6 weeks with 2 subsequent doses at intervals of 4-8 weeks each. The last dose of the primary series should be completed by the age of 6 months.
- The duration of immunological protection will be extended in many instances if an additional booster is given later.
- Diphtheria booster - to compensate for the loss of natural diphtheria boosting in some areas, childhood boosters should be given. The optimal timing of and number of diphtheria-containing booster doses should be based on epidemiological surveillance as well as on immunological and programmatic considerations.
- Tetanus - To ensure lifelong protection against tetanus in all people should receive 6 doses (3 primary plus 3 booster doses) of tetanus toxoid-containing vaccine (TTCV) through routine childhood immunization schedules.
- The 3 TTCV booster doses should be given at: 12–23 months of age; 4–7 years of age; and 9–15 years of age. Ideally, there should be at least 4 years between booster doses.
- National vaccination schedules can be adjusted within the age limits specified above to enable programmes to tailor their schedules based on local epidemiology, the objectives of the immunization programme, any particular programmatic issues and to better align tetanus vaccination with the immunological requirements of other vaccines (particularly for pertussis and diphtheria).
- Opportunities for tetanus vaccination may be taken at the second year of life contacts for alternative PCV schedule 2 + 1, MCV second dose, and meningococcal A-containing vaccines, as well as pre-adolescence and adolescence contacts including for HPV vaccination.
- To provide and sustain both tetanus and diphtheria immunity throughout the life course and for both sexes, age-appropriate combinations of tetanus and diphtheria toxoids should be used. For children <7 years of age DTwP or DTaP combinations may be used. For children aged 4 years and older Td may be used and is preferred.
- From 7 years of age only Td combinations should be used. Age-appropriate combinations containing pertussis vaccine with low-dose diphtheria antigen are also available.
- If tetanus vaccination is started during adolescence or adulthood, a total of only 5 appropriately spaced doses are required to obtain lifelong protection.
- Pregnant women and their newborn infants are protected from birth-associated tetanus if the mother received either 6 TTCV doses during childhood or 5 doses if first vaccinated during adolescence/adulthood (documented by card, immunization registry and/or history) before the time of reproductive age. Vaccination history should be verified in order to determine whether a dose of TTCV is needed in the current pregnancy.
- WHO confirms its earlier recommendation to shift from the use of single-antigen TT to combinations containing diphtheria toxoid, i.e. DT or Td vaccines, which has not yet been implemented in many countries despite the negligible price differential between TT and DT/Td vaccines. Countries and partners are urged to take steps to accelerate this shift.
- TTCVs can be used in immunocompromised persons including HIV-infected individuals, but the immune response may be lower than in fully immunocompetent persons. All HIV-infected children should be vaccinated against tetanus following the vaccine recommendations for the general population.
- Pertussis vaccine: Both aP-containing and wP-containing vaccines have excellent safety records.
- Available evidence indicates that licensed aP and wP vaccines have equivalent initial effectiveness in preventing disease in the first year of life, but that there is more rapid waning of immunity, and possibly a reduced impact on transmission, with aP relative to wP vaccines.
- National programmes currently administering wP vaccination should continue to use wP vaccines for primary vaccination series. Surveillance and modelling data suggest that the use of aP vaccines may result in a resurgence of pertussis after a number of years.
National programmes currently using aP vaccine may continue using this vaccine but should consider the need for additional booster doses and strategies to prevent early childhood mortality such as maternal immunization in case of resurgence of pertussis.

Only aP-containing vaccines should be used for vaccination of persons aged ≥7 years.

Pertussis containing booster - A booster dose is recommended for children aged 1–6 years, preferably during the second year of life (≥6 months after last primary dose), unless otherwise indicated by local epidemiology; the contact could also be used to catch up on any missed doses of other vaccines. This schedule should provide protection for at least 6 years for countries using wP vaccine. For countries using aP vaccine, protection may decline appreciably before 6 years of age.

Vaccinating pregnant women and household contacts -- Vaccination of pregnant women is likely to be the most cost-effective additional strategy for preventing disease in infants too young to be vaccinated and appears to be more effective and favourable thancocooning.

National programmes may consider the vaccination of pregnant women with 1 dose of Tdap (in the 2nd or 3rd trimester and preferably at least 15 days before the end of pregnancy) as a strategy additional to routine primary infant pertussis vaccination in countries or settings with high or increasing infant morbidity/mortality from pertussis.

Delayed or interrupted DTP series - For children whose vaccination series has been interrupted, the series should be resumed without repeating previous doses. Children aged 1 to < 7 years who have not previously been vaccinated should receive 3 doses of vaccine.

Health-care workers should be prioritized as a group to receive pertussis vaccine.

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**Haemophilus influenzae type b (Hib)**


The use of Hib vaccines should be part of a comprehensive strategy to control pneumonia including exclusive breastfeeding for six months, hand washing with soap, improved water supply and sanitation, reduction of household air pollution, and improved case management at community and health facility levels.

WHO recommends that any one of the following Hib immunization schedules may be followed:

- 3 primary doses without a booster (3p);
- 2 primary doses plus a booster (2p+1);
- 3 primary doses with a booster (3p+1).

Because serious Hib disease occurs most commonly in children aged between 4 months and 18 months, immunization should start from 6 weeks of age, or as early as possible thereafter.

The number of primary doses should be set after consideration of the local epidemiology, vaccine presentation (Hib conjugate monovalent vaccine versus Hib conjugate vaccine in combination with other antigens) and how this fits into the overall routine immunization schedule.

In countries where the peak burden of severe Hib disease occurs in young infants, providing 3 doses of vaccine early in life may confer a greater benefit.

In some settings (e.g. where the greatest disease morbidity and mortality occur later, or where rate reductions of disease are not fully sustained after the routine use of Hib vaccine), it might be advantageous to give a booster dose by following either a 2p+1 or 3p+1 schedule.

The interval between doses should be at least 4 weeks if 3 primary doses are given, and at least 8 weeks if 2 primary doses are given. Booster doses should be administered at least six months after completion of the primary series.

If the vaccination course has been interrupted, the schedule should be resumed without repeating the previous dose. Children who start vaccination late, but are aged under 12 months, should complete the vaccination schedule (e.g. have 3 primary doses or 2 primary doses plus a booster).

When a first dose is given to a child older than 12 months of age, only one dose is recommended.

Hib vaccine is not required for healthy children after 5 years of age.

The Hib conjugate vaccine is contraindicated in people with known allergies to any component of the vaccine. There are no other known contraindications or precautions.

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**Pneumococcal (Conjugate)**


Pneumococcal conjugate vaccines (PCVs) are considered safe in all target groups for vaccination, also in immunocompromised individuals. The vaccines are not currently licensed for use in age groups that include women of childbearing age. Although theoretically highly unlikely to be harmful, there is no information on the safety of PCV10 and PCV13 during pregnancy.

Except for very rare anaphylactic reactions that may follow the administration of any medicine, there are no contraindications to the use of these vaccines. However, it is advisable to defer vaccination until after an acute infection with temperature >39 °C.

When injected at different sites, PCVs can be administered concurrently with any other vaccines in infant immunization programmes.

When primary immunization is initiated with one of these vaccines, it is recommended that remaining doses are administered with the same product. Interchangeability between PCV10 and PCV13 has not yet been documented. However, if it is not possible to complete the series with the same type of vaccine, the other PCV product should be used.

For infants, 3 primary doses (the 3p+0 schedule) or, as an alternative, 2 primary doses plus a booster (the 2p+1 schedule).

In choosing between the 3p+0 and 2p+1 schedules, countries should consider locally relevant factors including the epidemiology of pneumococcal disease, the likely coverage, and the timeliness of the vaccine doses.

If disease incidence peaks in young infants (<32 weeks of age), a 2p+1 schedule might not offer optimal individual protection for certain serotypes (e.g. 6B, 23F) compared to a 3p+0 schedule, particularly in the absence of herd protection.

In contrast, higher antibody levels are induced by the third (booster) dose in a 2p+1 schedule compared to the third dose in a 3p+0 schedule. This may be important for duration of protection or effectiveness against some serotypes.

If the 3p+0 schedule is used, vaccination can be initiated as early as 6 weeks of age with an interval between doses of 4–8 weeks, depending on programmatic convenience.

If the 2p+1 schedule is selected, the 2 primary doses should ideally be completed by six months of age, starting as early as 6 weeks of age with a minimum interval of 8 weeks or more between the two doses (for infants aged ≥7 months a minimum interval of 4 weeks between doses is possible). One booster dose should be given between 9–15 months of age.

Previously unvaccinated or incompletely vaccinated children (including those who had laboratory confirmed invasive pneumococcal disease) should be vaccinated using the recommended age-appropriate regimens. Interrupted schedules should be resumed without repeating the previous dose.

HIV-positive infants and pre-term neonates who have received their 3 primary vaccine doses before reaching 12 months of age may benefit from a booster dose in the second year of life.

Catch-up vaccination as part of introduction will accelerate herd protection and therefore the PCV impact on disease and carriage. Maximized protection at the time of introduction of PCV10 or PCV13 can be achieved by providing 2 catch-up dose(s) at an interval of at least 8 weeks to unvaccinated children aged 12–24 months and to children aged 2–5 years who are at high risk of pneumococcal infection.

Further data are needed from different epidemiological settings on the impact of large-scale
PCV vaccination of individuals >50 years of age in order to establish the relative priority of immunization programmes in that age group. However, given the documented effects of herd protection in adult age groups following routine infant immunization with PCV7, higher priority should normally be given to introducing and maintaining high coverage of infants with PCVs.

- The use of pneumococcal vaccine should be seen as complementary to the use of other pneumonia control measures, such as appropriate case management, promotion of exclusive breastfeeding for first 6 months of life, and the reduction of known risk factors, such as indoor pollutants and tobacco smoke.

- For polysaccharide pneumococcal vaccine see position paper: Weekly Epid. Record (2008, 83: 373-384) [pdf 308kb]

- In resource-limited settings where there are many competing health priorities, evidence does not support routine immunization of the elderly and high-risk populations with PPV23. Also, because of the low level of evidence for benefit, routine PPV23 vaccination of HIV-infected adults is not recommended in such settings. In countries that do not routinely administer PPV23 to high-risk populations, data are insufficient to recommend introducing this vaccine to reduce the morbidity and mortality associated with influenza.

### 7 Rotavirus


- Recommended to be included in all national immunization programmes.

- Early immunization is favoured with the first dose of rotavirus vaccine to be administered from 6 weeks of age, however, in order to benefit those who may come late infants can receive doses without age restriction. Because of the typical age distribution of rotavirus gastroenteritis (RVGE), rotavirus vaccination of children >24 months of age is not recommended.

- Rotarix is administered orally in a 2-dose schedule at the time of DTP1/penta and DTP2/penta with an interval of at least 4 weeks between doses.

- RotaTeq vaccine is administered orally in a 3-dose schedule at the time of DTP1/penta, DTP2, and DTP3 contacts, with an interval of at least 4 weeks between doses.

- Rotavirus vaccinations can be administered simultaneously with other vaccines in the infant immunization programme.

- Apart from a low risk of intussusception (about 1-2 per 100 000 infants vaccinated) the current rotavirus vaccines are considered safe and well tolerated.

- Severe allergic reaction (e.g. anaphylaxis) after a previous dose, and severe immunodeficiency including severe combined immunodeficiency, are contraindications for rotavirus vaccination.

- Precautions are necessary if there is a history of intussusception or intestinal malformations, chronic gastrointestinal disease, and severe acute illness. Vaccination should be postponed in case of ongoing acute gastroenteritis or fever with moderate to severe illness.

- The use of rotavirus vaccines should be part of a comprehensive strategy to control diarrhoeal diseases with the scaling up of both prevention (exclusive breastfeeding for 6 months, vitamin A supplementation, safe drinking water, hygiene/handwashing with soap, and sanitation) and treatment (low-osmolarity ORS, zinc and continued feeding).

### 8 Measles


- Reaching all children with 2 doses of measles vaccine should be the standard for all national immunization programmes. In addition to the first routine dose of MCV1, all countries should add a second routine dose of MCV2 to their national immunization schedules regardless of the level of MCV1 coverage.

- In countries with ongoing transmission in which the risk of measles mortality remains high, MCV1 should be given at age 9 months. MCV2 should be given between 15-18 months as providing MCV2 in the 2nd year of life reduces the rate of accumulation of susceptible children and the risk of an outbreak.

- Because many cases of measles occur in children aged >12 months who have not been vaccinated, routine delivery of MCV1 should not be limited to infants aged 9-12 months and routine delivery of MCV2 should not be limited to infants 15 to 18 months of age. Every opportunity (e.g. when children come into contact with health services) should be taken to vaccinate all unvaccinated children that missed one or both MCV routine doses, particularly those under 15 years of age. Policies which prohibit use of vaccine in children >1 year of age, older children and teenagers should be changed to allow these individuals to be vaccinated.

- In countries with low rates of measles transmission (that is, those that are near elimination) and where there is a low risk of measles infection among infants, the first dose may be administered at age 12 months to take advantage of the higher seroconversion rates achieved at this age (63% of children vaccine at age 12 months). In those countries the optimal age for delivering a routine 2nd dose of measles is based on programmatic considerations that achieve the highest coverage and hence the highest population immunity. Administration of the second dose at age 15-18 months ensures early protection of the individual, slows accumulation of susceptible young children and may correspond with other routine immunizations (for example, DTP booster). If first dose coverage is high (>90%) and school enrolment is high (>95%), giving the second dose at school entry may be an effective strategy for achieving high coverage and preventing outbreaks in schools.

- Combined vaccines (Measles and Rubella or Measles, Mumps and Rubella) may not be optimal for use in countries where vaccine coverage for measles vaccine of at least 80% cannot be achieved or maintained.

- Infants from 6 months of age should receive a dose of MCV in the following circumstances: (1) during a measles outbreak as part of intensified service delivery; (2) during SIAs in settings where risk of measles among infants remains high (e.g. in endemic countries experiencing regular outbreaks); (3) for internally displaced populations and refugees, and populations in conflict; (4) for infants born to HIV-infected mothers at high risk of exposure as part of intensified services (e.g. for use in countries where vaccine coverage for measles vaccine of at least 80% cannot be achieved or maintained). This should be considered a supplementary dose and recorded on the child’s vaccination record as “MCV0”.

- Measles vaccination should be routinely administered to potentially susceptible, asymptomatic HIV-positive children and adults. In areas where there is a high incidence of both HIV infection and measles, MCV1 may be offered as early as age 6 months. Two additional doses of measles vaccine should be administered to these children according to the national immunization schedule.

- Mild, concurrent infections are not considered a contraindication to vaccination, but it should be avoided if the patient has a high fever or other signs of serious disease. Theoretically, measles vaccine - alone or in combination with other vaccines - should also be avoided by pregnant women. Furthermore, measles vaccination is contraindicated in people who are severely immunocompromised due to congenital disease; severe HIV infection; advanced leukaemia or lymphoma, etc.

### 9 Rubella


- All countries that have not yet introduced rubella vaccine, and are providing 2 doses of measles vaccine using routine immunization, or SIAs, or both, should consider including rubella components in their immunization programmes. Countries planning to introduce RCVs should review the epidemiology of rubella, including the susceptibility profile of the population; assess the burden of CRS; and establish rubella and CRS prevention as a public health priority.
• Because rubella is not as highly infectious as measles and because the effectiveness of 1 dose of an RCV is > 95% even at 9 months of age, only 1 dose of rubella vaccine is required to achieve rubella elimination if high coverage is achieved. However, when combined with measles vaccination, it may be easier to implement a second dose of RCV's using the same combined MR vaccine or MMR vaccine for both doses.

• RCV's can be administered concurrently with inactivated vaccines. As a general rule, live vaccines should be given either simultaneously with RCV's, or at least 4 weeks apart. An exception to this is oral polio vaccine, which can be given at any time before or after RCV's without interfering in the response to either vaccine.

• Interference may occur between MMR and yellow fever vaccines if they are simultaneously administered to children < 2 years of age.

• Because of a theoretical, but never demonstrated, teratogenic risk rubella vaccination in pregnant women should be avoided in principle, and those planning a pregnancy are advised to avoid pregnancy for 1 month following vaccination.

• Administration of blood or blood products before or shortly after vaccination may interfere with vaccine efficacy. If using only rubella vaccines persons who received blood products should wait at least 3 months before vaccination and, if possible, blood products should be avoided for up to 2 weeks post-vaccination. Vaccinated persons are not eligible to donate blood for 1 month after vaccination.

10 Human Papillomavirus (HPV)


• Recommended target population for the prevention of cervical cancer: females aged 9–14 years, prior to becoming sexually active.

• A 2-dose schedule with an interval of 6 months between doses is recommended for females younger than 15 years. Those females who are ≥15 years at the time of the second dose are also adequately protected by 2 doses.

• The immunization of multiple cohorts of girls aged 9–14 years is recommended when the vaccine is first introduced. If resources are available, the age range could be expanded up to 18 years.

• If the interval between doses is shorter than 5 months, then a third dose should be given at least 6 months after the first dose.

• A 3-dose schedule (0, 1–2, 6 months) is recommended for females aged 15 years and older, prior to becoming sexually active.

• The most effective immunization strategy in JE endemic settings is a one-time campaign in the primary target population, as defined by local epidemiology (typically children aged <15 years), followed by incorporation of JE vaccine into the routine childhood immunization programme.

• The following vaccine dosing schedules and age of administration are recommended. The need for a booster dose in endemic settings has not been clearly established for any of the vaccines listed below:

  • Inactivated Vero cell-derived vaccine: Primary series according to manufacturer’s recommendations (these vary by product), generally 2 doses at 4-week intervals starting the primary series at ≥6 months of age in endemic settings

  • Live attenuated vaccine: Single dose administered at ≥8 months of age

  • Live recombinant vaccine: Single dose administered at ≥9 months of age

• Preferably, inactivated mouse brain-derived vaccines should be replaced by the newer generation JE vaccines discussed in this position paper. Inactivated mouse brain-derived vaccines may continue to play a role in combatting JE in some countries, but overall these products have a less favourable safety profile due to their increased reactogenicity compared to newer JE vaccines. Other disadvantages include the variability of manufacturing, the cost, the higher number of doses required and the need for boosters.

• Despite a lack of comprehensive immunogenicity/effectiveness and safety data for all possible combinations of JE and other routine vaccines, co-administration for programmatic reasons seems acceptable, even in the context of mass campaigns.

• Inactivated JE vaccine can be used in immunocompromised persons including HIV-infected individuals, but the immune response may be lower than in fully immunocompetent persons. Inactivated Vero cell-derived vaccines should be used preferentially over live attenuated or live recombinant vaccines in immunocompromised persons. HIV testing is not a prerequisite for vaccination.

• If the JE risk is sufficient to warrant vaccination of pregnant women, inactivated Vero cell-derived vaccines should be used preferentially over live attenuated or live recombinant vaccines based on the general precautionary principle against using live vaccines in pregnant women especially if alternative types of vaccines are available. Pregnancy testing is not a prerequisite for JE vaccination. Inadverdent administration of live attenuated or live recombinant JE vaccine to a pregnant woman is not an indication for termination of the pregnancy.

11 Yellow Fever


• WHO recommends that all endemic countries should introduce YF vaccine into their routine immunization programmes.

• A single dose of YF vaccine is sufficient to confer sustained life-long protective immunity against YF disease; a booster dose is not necessary.

• It is recommended that YF vaccine be given to children at age 9-12 months at the same time as the measles vaccine.

• The vaccine is contraindicated in children aged <6 months and is not recommended for those aged 6-8 months, except during epidemics when the risk of infection with the YF virus is very high. Other contraindications for YF vaccination are severe hyper-sensitivity to egg antigens and severe immunodeficiency.

• Preventive mass vaccination campaigns are recommended for inhabitants of areas at risk of YF where there is low vaccination coverage. Vaccination should be provided to everyone aged ≥ 9 months, in any area with reported cases. Noting that YF is a live vaccine, a risk-benefit

Table 3: Recommendations for Interrupted or Delayed Routine Immunization (Updated March 2017)
assessment should be undertaken for all pregnant and lactating women.

- Vaccine should be offered to all unvaccinated travelers aged ≥ 9 months, travelling to and from at-risk areas, unless they belong to the group of individuals for whom YF vaccination is contraindicated.

- YF vaccine may be administered simultaneously with other vaccines.

### 13 Tick-Borne Encephalitis (TBE)


- Since the incidence of tick-borne encephalitis may vary considerably between and even within geographical regions, public immunization strategies should be based on risk assessments conducted at country, regional or district level, and they should be appropriate to the local endemic situation. Therefore, establishing case reporting of the disease is essential before deciding on the most appropriate preventive measures to be taken.

- In areas where the disease is highly endemic (that is, where the average prevaccination incidence of clinical disease is ≥5 cases/100 000 population per year), implying that there is a high individual risk of infection, WHO recommends that vaccination be offered to all age groups, including children.

- Because the disease tends to be more serious in individuals aged >50–60 years this age group constitutes an important target for immunization.

- Where the prevaccination incidence of the disease is moderate or low (that is, the annual average during a 5-year period is <5/100 000) or is limited to particular geographical locations or certain outdoor activities, immunization should target individuals in the most severely affected cohorts.

- People travelling from non-endemic areas to endemic areas should be offered vaccination if their visits will include extensive outdoor activities.

- Vaccination against the disease requires a primary series of 3 doses; those who will continue to be at risk should probably have ≥1 booster doses.

- Within the considerable range of acceptable dose intervals, the relevant national authorities should select the most rational primary schedule for their national, regional or district immunization programmes.

- For the vaccines manufactured in Austria and Germany (FSME-Immun and Encepur) that can be given starting from >1 year of age an interval of 1–3 months is recommended between the first 2 doses, and 5–12 months between the second and third doses. When rapid protection is required, for example for people who will be travelling to endemic areas, the interval between the first 2 doses may be reduced to 1–2 weeks.

- With the vaccines manufactured in the Russian Federation (TBE-Moscow and EnceVir) the recommended intervals are 1–7 months between the first 2 doses, and 12 months between the second and third doses. Booster doses are recommended every 3 years for those at continued risk of exposure.

- The currently recommended booster interval should be maintained until more data have been obtained on the duration of protection induced by the Russian vaccines.

- Regardless of the duration of the delay, interrupted schedules should be resumed without repeating previous doses.

### 14 Typhoid


- Recommended for school-age and/or preschool-age children in areas where typhoid fever in these age groups is shown to be a significant public health problem, particularly where antibiotic-resistant S. Typhi is prevalent.

- Vaccine option- Vi polysaccharide typhoid vaccine requires one parenterally administered dose which maybe given after the age of 2 years; the liquid form of Ty21a live oral vaccine (for use in individuals from the age of 2 years) is no longer available; the capsule form of Ty21a (for use in individuals from the age of 5 years) requires 3 or 4 orally administered doses. See position paper for further details.

- If the schedule for Ty21a is interrupted by an interval longer than 21 days, expert opinion indicates that the series should be restarted from the beginning. If the interruption is less than 21 days, resume vaccination without repeating the previous dose.

- Booster- In most endemic settings, a booster dose of the concerned vaccine 3 to 7 years after the primary immunization seems appropriate.
Hepatitis A workers. See position paper for details.

be given to persons considered to be a continued high risk of exposure, including some health

use of meningococcal conjugate vaccines. Polysaccharide vaccines should be administered to

outbreaks in countries where limited economic resources or insufficient supply restrict the

Meningococcal polysaccharide vaccines can be used for those > 2 years of age to control

of age.

Meningococcal polysaccharide vaccines can be used for those > 2 years of age to control

the previous dose.

children 9-23 months of age, and given as a 2-dose series, 3 months apart beginning at age 9

months. If the primary series is interrupted, vaccination should be resumed without repeating

the previous dose.

of HAV infection.

routine childhood vaccines, and should be considered for use in pregnant women at definite risk

contraindication to their use. These vaccines can be co-administered simultaneously with other

HAV vaccines produced by different manufacturers, including combined hepatitis A vaccines,

less expensive and easier to implement. However, in individuals at substantial risk of contracting

consider a 1-dose schedule as this option seems comparable in terms of effectiveness, and is

of age. Severe allergy to components included in the live attenuated hepatitis A vaccine is a

contraindication to their use. As a rule, live vaccines should not be used in pregnancy or in

severely immunocompromised patients. There is no information available on co-administration

of live attenuated hepatitis A vaccines with other routinely used vaccines.

Vaccination against hepatitis A should be part of a comprehensive plan for the prevention and

control of viral hepatitis, including measures to improve hygiene and sanitation and measures for

outbreak control.

18 Rabies


Production and use of nerve-tissue rabies vaccines should be discontinued and replaced with

cell-culture-based vaccines (CCVs).

Recommended for anyone who will be at continual, frequent or increased risk of exposure to

the rabies virus, either as a result of their residence or occupation. Travellers with extensive

outdoor exposure in rural high-risk areas where immediate access to appropriate medical care

may be limited should also be vaccinated regardless of the duration of stay. Where canine

rabies is a public health problem, WHO encourages studies on the feasibility, cost-effectiveness,

and long-term impact of incorporating rabies vaccination into the immunization programme for

infants and children.

The series is given by intramuscular or intradermal injection at 0, 7, and 21 or 28 days.

Intramuscular administration: For adults and children aged ≥2 years, the vaccine should always

be administered in the deltoid area of the arm; for children aged < 2 years, the anterolateral

area of the thigh is recommended. Rabies vaccine should not be administered in the gluteal

area, as the induction of an adequate immune response may be less reliable.

Booster doses of rabies vaccines are not required for individuals living in or travelling to high-

risk areas who have received a complete primary series of pre-exposure or post-exposure

prophylaxis with a cell-culture-based rabies vaccine (CCV).

Periodic booster injections are recommended only for people whose occupation puts them at

continual or frequent risk of exposure. If available, antibody monitoring is preferred to the

administration of routine boosters.

Because vaccine-induced immunity persists in most cases for years, a booster is recommended

only if rabies-virus neutralizing antibody titres fall to <0.5 IU/ml.

Antibody testing should be done every 6 months for people at risk of laboratory exposure to

high concentrations of live rabies virus, and every 2 years for professionals who are not at

continual risk of exposure through their activities, such as certain categories of veterinarians

and animal health officers.

19 Dengue (CYD-TDV)


Countries should consider introduction of the dengue vaccine CYD-TDV only in geographic

settings (national or subnational) where epidemiological data indicate a high burden of disease.

In defining populations to be targeted for vaccination, prior infection with dengue virus of any

serotype, as measured by seroprevalence, should be approximately 70% or greater in the age

group targeted for vaccination in order to maximize public health impact and cost effectiveness.

Vaccination of populations with seroprevalence between 50% and 70% is acceptable but the

impact of the vaccination programme may be lower.

The vaccine is not recommended when seroprevalence is below 50% in the age group targeted

for vaccination.
**Mumps**

**Position paper reference:** Weekly Epid. Record (2007, 82: 49-60) [pdf 311kb]

- Recommended for use in high performing immunization programs with the capacity to maintain coverage over 80% and where mumps reduction is a public health priority.
- If implemented, a combination vaccine of measles, mumps and rubella is recommended.
- As a general rule, live vaccines should be given either simultaneously, or at intervals of 4 weeks.
- Interference may occur between MMR and yellow fever vaccines if they are simultaneously administered to children < 2 years of age.

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**Seasonal Influenza (Inactivated Vaccine)**

**Position paper reference:** Weekly Epid. Record (2012, 87: 461-476) [pdf 1.9 Mb]

- For countries considering the initiation or expansion of programmes for seasonal influenza vaccination, WHO recommends that pregnant women should have the highest priority. Children aged < 6 months are not eligible to receive currently licensed influenza vaccines and should be protected against influenza through vaccination of their mothers during pregnancy and through ensuring vaccination of close contacts.
- Additional risk groups to be considered are children aged 6-59 months, elderly persons ≥ 65 years of age, individuals with specific chronic medical conditions, and health-care workers. Countries with existing influenza vaccination programmes targeting any of these additional groups should continue to do so and should incorporate immunization of pregnant women into such programmes.
- A single dose is appropriate for those ≥ 9 years of age, including pregnant women. Inactivated influenza vaccine is safe to give throughout pregnancy.
- Children aged 6-59 months should receive 2 doses at least 4 weeks apart. Children aged 6-35 months should receive a pediatric dosage.
- Annual vaccination (or re-vaccination, if the vaccine strains are identical) is recommended. Previously vaccinated children 6-59 months require only one-dose.

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**Varicella**


- Countries where varicella is an important public health burden could consider introducing varicella vaccination in the routine childhood immunization programme. However, resources should be sufficient to ensure reaching and sustaining vaccine coverage ≥ 80%. Decision-making on childhood varicella vaccination should also include consideration of the possible impact on herpes zoster.
- Depending on the goal of the vaccination programme, 1-2 doses should be given with the first dose administered at 12-18 months of age. The minimum interval between doses should be as recommended by the manufacturer, ranging from 4 weeks to 3 months.
- Countries with a high average age (≥ 15 years) of acquisition of infection could consider alternative vaccination strategies such as vaccination of adolescents and adults without evidence of varicella immunity. This strategy requires a 2-dose schedule.
- Varicella vaccine is contraindicated during pregnancy and pregnancy should be delayed for 4 weeks after vaccination. Termination of pregnancy is not indicated if vaccination was carried out inadvertently during pregnancy.
- Varicella vaccine can be administered concomitantly with other vaccines. Unless given together with other live viral vaccines (measles, MR, MMR), it should be administered at a minimum interval of 28 days.
- Countries should consider vaccination of potentially susceptible health-care workers (i.e. unvaccinated and with no history of varicella) with 2 doses of varicella vaccine.