Vaccination in Infants

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(updated April 2019)

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Japanese Encephalitis [11]	**Inactivated Vero cell-derived**	6 month	2 generally	4 weeks (generally)				Vaccine options and manufacturer's recommendations; Pregnancy; Immunocompromised
	Live attentuated	8 months	1					
	Live recombinant	9 months	1					
Yellow Fever [12]		9-12 months with measles containing vaccine	1					
Tick-Borne Encephalitis [13]		≥ 1 yr FSME-Immun and Encepur ≥ 3 yrs TBE_Moscow and EnceVir	3	1-3 months FSME-Immun and Encepur 1-7 months TBE-Moscow and EnceVir	5-12 months FSME-Immun and Encepur 12 months TBE-Moscow and EnceVir		At least 1 every 3 years (see notes)	Definition of high-risk Vaccine options Timing of booster
Recommendations for children in some high-risk populations								
Typhoid [14]	**TCV (Typbar)**	>6 months	1					Definition High Risk; Vaccine options
	Vi PS	2 years (min)	1				Every 3 years	Definition of high risk
	Ty21a	Capsules 5 years (min) (see footnote)	3 or 4 (see footnote)	1 day	1 day	1 day	Every 3-7 years	Definition of high risk
Cholera [15]	**Dukoral (WC-rBS)**	2 years (min)	3 (2-5 years) 2 (≥6 years)	≥ 7 days (min) < 6 weeks (max)	≥ 7 days (min) < 6 weeks (max)		Every 6 months Every 2 years	Minimum age Definition of high risk
	Shanchol, Euvchol and mORCVAX	1 year (min)	2	14 days			After 2 years	
Meningococcal [16]	**MenA conjugate**	9-18 months (5µg)	1					Definition of high risk; Vaccine options; 2 doses if < 9 months with 8 week interval
	MenC conjugate	2-11 months	2	8 weeks			After 1 year	Definition of high risk; Vaccine options
		≥12 months	1					
	Quadrivalent conjugate	9-23 months	2	12 weeks				Definition of high risk; Vaccine options
		≥2 years	1					
Hepatitis A [17]		1 year	At least 1					Level of endemicity; Vaccine options; Definition of high risk groups
Rabies [18]		As required	2	7 days			(see footnote)	PrEP vs PEP; Definition of high risk
Dengue (CYD-TDV) [19]		9 years (min)	3	6 months	6 months			Pre-vaccination screening
Recommendations for children receiving vaccinations from immunization programmes with certain characteristics								
Mumps [20]		12-18 months with measles containing vaccine	2	1 month (min) to school entry				Coverage criteria > 80%; Combination vaccine
Seasonal influenza (inactivated tri- and qudri-valent) [21]		6 months (min)	2 (<9 years) 1 (≥ 9 years)	4 weeks			Revaccinate annually: 1 dose only (see footnotes)	Priority risk groups, especially pregnant women Lower dosage for children 6-35 months
Varicella[22]		12-18 months	1-2	4 weeks to 3 months per manufacturer recommendations				Achieve & sustain ≥ 80% coverage Pregnancy Co-admin with other live vaccines

BCG

- Bacillus Calmette-Guérin (BCG) vaccines continue to be the only vaccines in use for prevention of TB
- BCG is a live attenuated bacterial vaccine derived from M. bovis.
- 95% of BCG vaccine recipients experience a reaction at injection site
  - Heals within 2-5 months
  - Leaves a superficial scar, considered normal.

BCG

- Adverse events dependent on:
  - the strain used,
  - number of viable bacilli in the batch
  - variation in injection technique.
- Disseminated BCG disease may occur between 1.56-4.29 cases per million doses
  - incidence of up to 1% of infants and HIV-infected
- A single dose should be given to all healthy neonates at birth

BCG

- Dose is intradermal injection of 0.05 mL of the reconstituted vaccine for infants <1 year
  - 0.1 mL for those >1 year.
- BCG vaccine can be safely co-administered with other routine childhood vaccines including the hepatitis B birth dose

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HEPATITIS B

- **Hepatitis B vaccination is recommended for all children worldwide, and all national programmes should include a monovalent hepatitis B vaccine birth dose, ideally within 24 hours.**
- **If administration within 24 hours is not feasible, a late birth dose has some effectiveness**
  - **Although effectiveness declines progressively in the days after birth**
  - **after 7 days, a late birth dose still effective in preventing horizontal transmission and therefore remains beneficial**
- **WHO recommends that all infants receive the late birth dose during the first contact with health-care providers.**

HEPATITIS B SCHEDULE

- 3-dose schedule: monovalent birth dose, second and third doses given with first and third doses of DTP vaccine
- OR 4-dose schedule: monovalent birth dose, following 3 doses given with other routine infant vaccines at least 4 weeks between doses
- No evidence to support need for booster dose

HEPATITIS B SCHEDULE

- **A birth dose can be given to low birth weight and premature infants.**
  - **The birth dose should not count as part of the primary 3 doses of the standard primary series should still be given afterwards,**

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POLIO

- 1988: World Health Assembly resolved to eradicate polio globally by the year 2000.
- Globally, the last case of poliomyelitis caused by naturally circulating WPV type 2 (WPV2) occurred in India in 1999.
- Global eradication of WPV2 was certified in 2015.
- No case due to WPV type 3 (WPV3) has been detected since 10 November 2012.
- In 2015, Pakistan and Afghanistan remain endemic for
- transmission of WPV type 1 (WPV1).

POLIO

- OPV is administered as 2 drops (~0.1 mL), directly into the mouth
- The eradication of indigenous WPV2 in 1999 led to a coordinated global cessation of use of the type 2 component of OPV and a switch from tOPV to bOPV.
- WHO no longer recommends an OPV-only vaccination schedule
  - For all countries currently using OPV only, at least 1 dose of IPV should be added to the schedule.
- In polio-endemic countries and in countries at high risk for importation and subsequent spread, WHO recommends an bOPV birth dose (a zero dose) followed by a primary series of 3 bOPV doses and at least 1 IPV dose.

World Health Organization

Organisation mondiale de la Santé

Weekly epidemiological record
Relevé épidémiologique hebdomadaire

28 FEBRUARY 2014, 89th YEAR / 28 F
No. 9, 2014, 89, 73–92
http://www.who.int/wer

Polio vaccines: WHO position paper, January 2014

Primary purpose of the IPV dose:

- **To maintain immunity against type 2 polio during and after the global withdrawal of OPV2 and switch from tOPV to $b_{1\&3}$OPV**
- **To reduce VAPP risks (depending on the timing of the IPV administration)**
- **To boost immunity against polio types 1 and 3 → hasten the eradication of these WPVs**

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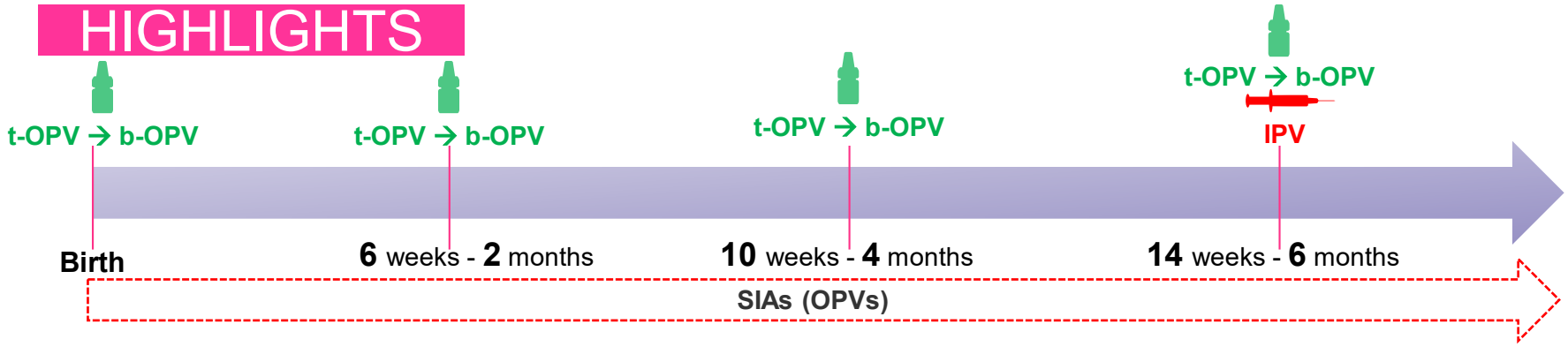
HIGHLIGHTS



- IPV is an additional dose to OPV (not a replacement)
- Minimum interval: 4 weeks
- Single IPV dose at 14 weeks of age with DTP3/OPV3
  - → better immunogenicity of IPV vs earlier administration
- Late schedules (age > 3mos) → may give IPV on 1st visit
- Countries may consider alternative schedules
  - (e.g. VAPP risks)

Sources: WHO WER, 3rd January 2014, 89th year, No. 1, 2014, 89, 1–20

Impact of one dose of IPV

- **Primary role of 1- dose IPV: RISK MITIGATION** strategy
- **Seroconversion against type 2** after one dose of IPV: **32-63%**.
- **Seroconversion rates higher** when vaccine is **administered later in infancy** presumably because of

Author year	Country	Schedule	Type 2 Seroconversion
Intramuscular administration of 1 dose of IPV			
McBean 1988	US	2 mo	**35%**
Simasathien 1994	Thailand	2 mo	**39%**
Resik 2010	Cuba	6 wk	**36%**
Mohammed 2010	Oman	2 mo	**32%**
Resik 2013	Cuba	**4 mo**	**63%**

** Estı´variz CF et al. Lancet 2012; 12(2):128-35*

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PNEUMOCOCCAL CONJUGATE VACCINE

- WHO recommends the inclusion of PCVs in childhood immunization programmes worldwide
- PCV10 and PCV13 have been shown to be safe and effective and to have both direct and indirect effects against pneumococcal disease caused by vaccine serotypes when used in a 3-dose schedule
- For administration of PCV to infants, WHO recommends a 3-dose schedule administered:
  - 2p+1 or as 3p+0, starting as early as 6 weeks of age.

PNEUMOCOCCAL CONJUGATE VACCINE

- Both PCV10 and PCV13 have substantial impacts against pneumonia vaccine-type IPD and nasopharyngeal (NP) carriage.
- No sufficient evidence of a difference in the net impact of the 2 products on overall disease burden
- PCV13 may have additional benefit in settings where disease attributable to serotype 19A or serotype 6C is significant.
- The choice of product to be used in a country should be based on: programmatic characteristics, vaccine supply, vaccine price, the local and regional prevalence of vaccine serotypes and antimicrobial resistance patterns.

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ROTAVIRUS VACCINE

- Currently available vaccines are based on live, oral, attenuated RV strains of human and/or animal origin that replicate in the human gut
- Two RV vaccines are available:
  - Monovalent (RV1) Rotarix™(GlaxoSmithKline Biologicals,Rixensart, Belgium)
  - Pentavalent (RV5)RotaTeq™(Merck & Co. Inc., West Point, PA,USA)
- RV1 originates from a human G1P[8] strain, whereas RV5 contains 5 reassortants developed from human and bovine parent rotavirus strains

ROTAVIRUS VACCINE

- The benefits against severe RV diarrhea and death far exceed the risk of intussusception
- Rotavirus vaccines should be included in all national immunization programmes and considered a priority particularly in countries with high RVGE-associated fatality rates
- Because of the typical age distribution of RVGE, rotavirus vaccination of children >24 months of age is not recommended

ROTAVIRUS VACCINE

- RV1 should be administered orally in a 2-dose schedule at the time of DPT1 and DPT2 with an interval of at least 4 weeks between doses
- RV5 should be administered orally in a 3-dose schedule at the time of the DTP1, DTP2, and DTP3 with an interval of at least 4 weeks between doses
- Can be administered simultaneously with other vaccines

(updated April 2019)

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				1st to 2nd	2nd to 3rd	3rd to 4th		
Recommendations for all children								
BCG [1]		As soon as possible after birth	1					Birth dose and HIV; Universal vs selective vaccination; Co-administration; Vaccination of older age groups; Pregnancy
Hepatitis B [2]	**Option 1**	As soon as possible after birth (<24h)	3	4 weeks (min) with DTPCV1	4 weeks (min) with DTPCV2			Premature and low birth weight Co-administration and combination vaccine High risk groups
	Option 2	As soon as possible after birth (<24h)	4	4 weeks (min) with DTPCV1	4 weeks (min) with DTPCV2	4 weeks (min),with DTPCV3		
Polio [3]	**bOPV + IPV**	6 weeks (see footnote for birth dose)	4 (IPV dose to be given with bOPV dose from 14 weeks)	4 weeks (min) with DTPCV2	4 weeks (min) with DTPCV3			bOPV birth dose Transmission and importation risk criteria
	IPV / bOPV Sequential	8 weeks (IPV 1st)	1-2 IPV 2 bOPV	4-8 weeks	4-8 weeks	4-8 weeks		
	IPV	8 weeks	3	4-8 weeks	4-8 weeks		(see footnote)	IPV booster needed for early schedule (i.e. first dose given <8 weeks)
DTP-containing vaccine [4]		6 weeks (min)	3	4 weeks (min) - 8 weeks	4 weeks (min) - 8 weeks		3 Boosters 12-23 months (DTP-containing vaccine); 4-7 years (Td/DT containing vaccine), see footnotes; and 9-15 yrs (Td)	Delayed/ interrupted schedule Combination vaccine; Maternal immunization
***Haemophilus influenzae* type b** [5]	**Option 1**	6 weeks (min) 59 months (max)	3	4 weeks (min) with DTPCV2	4 weeks (min) with DTPCV3		(see footnote)	Single dose if >12 months of age Not recommended for children > 5 yrs Delayed/ interrupted schedule Co-administration and combination vaccine
	Option 2		2-3	8 weeks (min) if only 2 doses 4 weeks (min) if 3 doses	4 weeks (min) if 3 doses		At least 6 months (min) after last dose	
Pneumococcal (Conjugate) [6]	**Option 1 3p+0**	6 weeks (min)	3	4 weeks (min)	4 weeks			Schedule options Vaccine options HIV+ and preterm neonate booster
	Option 2 2p+1	6 weeks (min)	2	8 weeks (min)			9-18 months	
Rotavirus [7]		6 weeks (min) with DTP1	2 or 3 depending on product	4 weeks (min) with DTPCV2	For three dose series – 4 week (min) with DTPCV3			Vaccine Options Not recommended if >24 months old
Measles [8]		9 or 12 months (6 months min, see footnote)	2	4 weeks (min) (see footnote)				Combination vaccine; HIV early vaccination; Pregnancy
Rubella [9]		9 or 12 months with measles containing vaccine	1					Achieve and sustain 80% coverage Co-administration and combination vaccine; Pregnancy
HPV [10]		As soon as possible from 9 years of age (females only)	2	6 months (min 5 months)				Target 9-14 year old girls; Multi-age cohort vaccination; Pregnancy Older age ≥ 15 years 3 doses HIV and immunocompromised

Refer to http://www.who.int/immunization/documents/positionpapers/ for table & position paper updates.

This table summarizes the WHO vaccination recommendations for children.The ages/intervals cited are for the development of country specific schedules and are not for health workers.

National schedules should be based on local epidemiologic, programmatic, resource & policy considerations. While vaccines are universally recommended, some children may have contraindications to particular vaccines.

MEASLES

- Reaching all children with 2 doses of measles vaccine should be the standard for all NIPS
- In addition to the first routine dose of MCV (MCV1), all countries should include a second routine dose of MCV (MCV2) in their national vaccination schedules
- Where risk of measles mortality among infants remains high, MCV1 should be administered at 9 months of age.
- These countries should administer the routine dose of MCV2 at age 15–18 months
- The minimum interval between MCV1 and MCV2 is 4 weeks.

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Recommendations for children residing in certain regions								
Japanese Encephalitis [11]	**Inactivated Vero cell-derived**	6 month	2 generally	4 weeks (generally)				Vaccine options and manufacturer's recommendations; Pregnancy; Immunocompromised
	Live attentuated	8 months	1					
	Live recombinant	9 months	1					
Yellow Fever [12]		9-12 months with measles containing vaccine	1					
Tick-Borne Encephalitis [13]		≥ 1 yr FSME-Immun and Encepur ≥ 3 yrs TBE_Moscow and EnceVir	3	1-3 months FSME-Immun and Encepur 1-7 months TBE-Moscow and EnceVir	5-12 months FSME-Immun and Encepur 12 months TBE-Moscow and EnceVir		At least 1 every 3 years (see notes)	Definition of high-risk Vaccine options Timing of booster
Recommendations for children in some high-risk populations								
Typhoid [14]	**TCV (Typbar)**	>6 months	1					Definition High Risk; Vaccine options
	Vi PS	2 years (min)	1				Every 3 years	Definition of high risk
	Ty21a	Capsules 5 years (min) (see footnote)	3 or 4 (see footnote)	1 day	1 day	1 day	Every 3-7 years	Definition of high risk
Cholera [15]	**Dukoral (WC-rBS)**	2 years (min)	3 (2-5 years) 2 (≥6 years)	≥ 7 days (min) < 6 weeks (max)	≥ 7 days (min) < 6 weeks (max)		Every 6 months Every 2 years	Minimum age Definition of high risk
	Shanchol, Euvchol and mORCVAX	1 year (min)	2	14 days			After 2 years	
Meningococcal [16]	**MenA conjugate**	9-18 months (5µg)	1					Definition of high risk; Vaccine options; 2 doses if < 9 months with 8 week interval
	MenC conjugate	2-11 months	2	8 weeks			After 1 year	Definition of high risk; Vaccine options
		≥12 months	1					
	Quadrivalent conjugate	9-23 months	2	12 weeks				Definition of high risk; Vaccine options
		≥2 years	1					
Hepatitis A [17]		1 year	At least 1					Level of endemicity; Vaccine options; Definition of high risk groups
Rabies [18]		As required	2	7 days			(see footnote)	PrEP vs PEP; Definition of high risk
Dengue (CYD-TDV) [19]		9 years (min)	3	6 months	6 months			Pre-vaccination screening
Recommendations for children receiving vaccinations from immunization programmes with certain characteristics								
Mumps [20]		12-18 months with measles containing vaccine	2	1 month (min) to school entry				Coverage criteria > 80%; Combination vaccine
Seasonal influenza (inactivated tri- and qudri-valent) [21]		6 months (min)	2 (<9 years) 1 (≥ 9 years)	4 weeks			Revaccinate annually: 1 dose only (see footnotes)	Priority risk groups, especially pregnant women Lower dosage for children 6-35 months
Varicella[22]		12-18 months	1-2	4 weeks to 3 months per manufacturer recommendations				Achieve & sustain ≥ 80% coverage Pregnancy Co-admin with other live vaccines

JAPANESE ENCEPHALITIS

- JE vaccination should be integrated into national immunization schedules in all areas where JE is recognized as a public health priority
- High vaccination coverage should be achieved and sustained in at-risk populations

JAPANESE ENCEPHALITIS

- **Inactivated Vero cell-derived vaccine:**
  - **– Manufacturer's recommendations, which vary by product**
    - **In general, 2 doses at 4-week intervals, starting at ≥6 months of age in endemic settings**
- **Live attenuated vaccine:**
- **– Single dose at ≥8 months of age**
- **Live recombinant vaccine:**
- **– Single dose at ≥9 months of age**
- **Need for booster dose in endemic settings has not yet been clearly established for any of the listed vaccines**

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Varicella[22]		12-18 months	1-2	4 weeks to 3 months per manufacturer recommendations				Achieve & sustain ≥ 80% coverage Pregnancy Co-admin with other live vaccines

YELLOW FEVER

- All current YF vaccines are live attenuated viral vaccines from the 17D lineage
- Single dose (0.5ml) only
  - Injected either SQ or IM
- May be administered simultaneously with other vaccines
- Protection appears to last for life

YELLOW FEVER

- Yellow Fever vaccination is given:
  - Protect populations living in areas subject to endemic and epidemic disease;
  - Protect travelers visiting these areas
  - Prevent international spread by viraemic travelers
- A single dose of YF vaccine is sufficient to confer sustained life-long protective immunity against YF disease
- A booster dose is not necessary.

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TYPHOID FEVER

- **Currently three types of typhoid vaccines are licensed**

  for use:

  1. Parenteral typhoid conjugate vaccine (TCV)

  2. Parenteral unconjugated Vi polysaccharide (ViPS)

  3. Oral live attenuated Ty21a vaccines

TYPHOID FEVER

- **WHO recommends programmatic use of typhoid vaccines for the control of typhoid fever**
  - **Programmes should be implemented in the context of other efforts**
- **TCV is preferred at all ages in view of its improved immunological properties, use in younger children and longer duration of protection.**
- **TCV should be prioritized in countries with high burden of disease or antimicrobial resistance.**
- **Countries may also consider the routine use of ViPS vaccine**
  - **≥ 2 years, and Ty21a vaccine for those > 6 years.**

TYPHOID FEVER

- Typhoid conjugate vaccine
  - a 0.5 mL single dose of TCV in children from 6 months and in adults up to 45 years in endemic regions
  - Administration is encouraged at the same time as other vaccines, at 9 months or in the second year of life
- Vi polysaccharide vaccine
  - a single dose of the vaccine should be administered intramuscularly or subcutaneously from 2 years
- Ty21a vaccine
  - a 3-dose oral immunization schedule, administering the vaccine every second day, recommended above 6 years
- Catch-up vaccination with TCV up to 15 years of age is recommended when feasible and supported by epidemiologic data

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Varicella[22]		12-18 months	1-2	4 weeks to 3 months per manufacturer recommendations				Achieve & sustain ≥ 80% coverage Pregnancy Co-admin with other live vaccines

LET US APPLY WHAT WE HAVE LEARNED.

The Superior doctor, prevents illness

The mediocre doctor, treats impending illness

The inferior doctor, treats actual sickness

" Chinese proverb"

THANK YOU