

## IMMUNISATIONS

Table 1. The Extended Programme for Immunisation (EPI) Schedule. Ministry of Health,

Immunisation	Age (months)						Age (years)			
	0	1	2	3	5	6	12	18	6	12
BCG	1								if no scar	
Hep B	1	2				3			2	
DTaP <sup>1</sup>			1 <sup>1</sup>	2 <sup>1</sup>	3 <sup>1</sup>			4 <sup>1</sup>	DTaP <sup>2</sup>	DTaP <sup>2</sup>
IPV <sup>1</sup>			1 <sup>1</sup>	2 <sup>1</sup>	3 <sup>1</sup>			4 <sup>1</sup>	IPV	
Hib <sup>1</sup>			1 <sup>1</sup>	2 <sup>1</sup>	3 <sup>1</sup>			4 <sup>1</sup>		
Measles							Sabah			
MMR								1	2	

footnote:

1. The combination vaccine used in the primary immunisation schedule is a 5-in-1 DTaP-IPV/Hib.
2. DTaP after primary immunization: for those who had not received primary DTaP in their childhood, replace the booster with Td (adult tetanus-diphtheria) vaccine if they received their last dose of Td > 10 years earlier.

Also:

A child who has been started on DTaP must complete his immunisation with DTaP; it cannot be inter-change with DTP. However a child started on DTP can use DTaP for subsequent doses.

Abbreviations. BCG, Bacille-Calmette-Guerin vaccine; Hep B, Hepatitis B vaccine; DTaP, Diphtheria, tetanus, acellular pertussis vaccine, IPV, inactivated polio vaccine; Hib, Haemophilus influenzae b vaccine; MMR, measles, mumps, rubella vaccine.

### Other vaccines available in Ministry of Health formulary (Blue Book)

- **Pneumococcal polysaccharide vaccine**
  - single dose IM/SC. Booster 3 - 5 years only for high risk persons.
  - protective efficacy 56 - 81%. Immunogenic in children ≥ 2 years.
  - recommended for children with: immunosuppression (including asymptomatic HIV), asplenia, nephrotic syndrome and chronic lung disease
  - for infant < 2 years old, need to consider conjugate vaccine (not in MOH list).
  - category A (specialist prescription)
- **Cholera**
  - oral inactivated vaccine
  - children 2-6 years: 3 doses at 1-6 week interval. Children > 6 years: 2 doses at 1-6 week interval. Booster dose after 2 years.
  - protective efficacy 80-90% after 6 months waning to 60% after 3 years
  - category B (MO prescription)
- **Meningococcal A, C, Y & W-135 vaccine (does not cover B)**
  - single dose IM
  - polysaccharide vaccine. Immunogenic in children ≥ 2 years. Immunity up to 3 years
  - protective efficacy 90-95%
  - conjugate vaccine is not currently available in Malaysia
  - category C (MO prescription)
- **Japanese Encephalitis vaccine**
  - 3 doses SC. Dose 1 and 2 at 2 - 4 weeks interval then dose 3 after 1 year
  - inactivated vaccine. Protective efficacy > 95%.
  - given in Sarawak as part of the EPI at age 9, 10 and 18 months. Booster at 4 years.
  - category B (MO prescription)

- *Rabies vaccine*
  - IM dose
  - pre-exposure immunisation: 3 doses at Day 0, 7 and 28. Boosters every 2-3 years.
  - post-exposure treatment:
    - fully immunised: 2 doses at Day 0, 3. Rabies Immune Globulin (RIG) unnecessary.
    - unimmunised: 5 doses at Day 0, 3, 7, 14 and 28. RIG (20 IU/kg given half around the wound and the rest IM).
  - inactivated vaccine. Available in Malaysia as Purified Vero Cell Rabies Vaccine (PVRV)
  - category B (MO prescription)

- *Typhoid*

Two vaccines available:

1. Vi polysaccharide vaccine

- single dose IM. Boosters every 3 years
- seroconversion in 85-95%; confers 60 – 80% protection 2 weeks after vaccination
- immunogenicity < 2 years of age has not been established.

2. Oral typhoid vaccine (Ty21a vaccine)

- 3 doses 2 days apart. Effective 7 days after last dose. Booster every 3 years.
- live attenuated vaccine
- category B (MO prescription)

- *Varicella zoster*

- Live attenuated vaccine. 70 – 90 % effectiveness.
- SC dose: 12 months - 12 years age: single dose; > 12 years: 2 doses at least 28 days apart.
- 2 vaccines available: Okavax (Sanofi Pasteur) and Varilrix (GSK)
- recommended for:
  - non-immune susceptible health care workers who regularly come in contact with patients with VZV infection
  - asymptomatic or mildly symptomatic HIV infected children (with CD4% > 15%); 2 doses at 3 months interval
  - children with leukaemia and in remission for at least 1 year, have > 700/ml circulating lymphocytes may receive vaccination under supervision of the attending paediatrician (2 doses)
- category A\* (Specialist prescription – special indication)

- *Hepatitis A*

- 2 doses via IM injection. Dose 1 and 2 at 6-12 months apart.
- protective efficacy 94%
- inactivated vaccine. Approved for children age > 1 year.
- category A (Specialist prescription)

### Other Vaccines available in Malaysia but not in MOH list:

- *Influenza vaccine*

- single dose IM. Minimum age is 6 months. Unprimed individuals require a 2nd dose 4 - 6 weeks after the first dose. Yearly re-vaccination for continuing protection
- protective efficacy 70-90%
- recommended for children with:
  - chronic decompensated disorders of respiratory or cardiovascular systems: e.g. cyanotic heart diseases, chronic lung diseases
  - HIV infection. In advanced disease, vaccination may not be effective.

- *Pneumococcal conjugate vaccine (PCV)*
  - 3 dose schedule via IM injection. 4-8 weeks apart. Earliest age is 6 weeks.
  - conjugation to carrier protein enables vaccine to be immunogenic in children < 2 years
  - inactivated vaccine. Protective efficacy against invasive disease 97% for vaccine strains and 89% for all pneumococcal strains.
  - only 1 currently available vaccine: Prevenar (Wyeth) (7-valent vaccine).
  - 10-valent and 13-valent vaccines may be introduced in the near future
- Rotavirus:
  - given orally. 2 vaccines available:
    1. Rotarix (GSK) (monovalent) - 2 dose schedule 4-8 weeks apart
    2. RotaTeq (MSD) (pentavalent) - 3 dose schedule 4-8 weeks apart between doses
  - live-attenuated vaccine.
  - protective efficacy 88-91% for any rotavirus gastroenteritis episode; 63-79% for all causes of gastroenteritis. For both vaccines, the earliest age to vaccinate is 6 weeks.
- Human Papilloma Virus (HPV)
  - 2 vaccines available: Cervarix (GSK): bivalent. Gardasil (MSD): quadrivalent.
  - 3 dose schedule IM (0, 1-2month, 6 month). Requirement for booster uncertain.
  - indicated in females aged 9-45 years.
  - recombinant vaccine. Protective efficacy almost 100% in preventing vaccine type cervical cancer in first 5 years. The vaccine prevents HPV infection and disease but not protective on existing or past HPV infection.

### General Notes

- many vaccines (inactivated or live) can be given together simultaneously (does not impair antibody response or increase adverse effect). But they are to be given at different sites unless given in combined preparations. Many vaccines are now packaged in combinations so that the child is not subjected to multiple injections.
- sites of administration
  - oral – OPV, rotavirus, live typhoid vaccines
  - intradermal (ID) - BCG. Left deltoid area (proximal to insertion deltoid muscle)
  - deep SC, IM injections. (ALL vaccines *except* the above)
    - anterolateral aspect of thigh – preferred site in children
    - upper arm – preferred site in adults
    - upper outer quadrant of buttock - associated with reduced antibody level production
- a person who has been immunised using OPV can subsequently use IPV for booster and vice versa (interchangeable)
- repeat dose of OPV if child vomits soon after administration
- PRP-T (Act Hib) and PRP-OMP (Pedvax) (H. influenzae b vaccines) used in the primary series are interchangeable. Children partially immunized in the private sector with one particular type may be immunized with another type in the MOH schedule.
- MMR can be given despite of previous history of measles, mumps or rubella infection.

### Immunisation : Contraindications

- absolute contraindication for any vaccine: severe anaphylaxis reactions to previous dose of the vaccine or to a component of the vaccine.
- postponement during acute febrile illness. Minor infection without fever or systemic upset is NOT a contraindication.
- relative contraindication: do not give a vaccine within 2 weeks of an elective surgery.

- live vaccines: *Absolute* contraindications
  - immunosuppression - malignancy; irradiation, leukaemia, lymphoma, primary immunodeficiency syndromes (but *not* asymptomatic HIV).
  - on chemotherapy or < 6 months after last dose.
  - high dose steroid: Prednisolone  $\geq 2$  mg/kg/day for > 7 days or low dose systemic > 2 weeks; (delay vaccination for 3 months).
  - if topical or inhaled steroids *or* low dose systemic < 2 weeks or EOD for > 2 weeks can give live vaccine
  - if another *live vaccine* including BCG had been given < 4 weeks ago. (Either give live vaccines simultaneously or if cannot then separately with a 4 week interval)
  - within 3 months following IV Immunoglobulin (11 months if given high dose IVIG e.g. in Kawasaki disease) (except yellow fever or oral polio)
  - pregnancy (live vaccine theoretical risk to foetus) unless there is significant exposure to serious conditions like polio or yellow fever in which case the importance of vaccination may outweigh the possible risk to the foetus.
- killed vaccines are generally safe. The only absolute contraindications are *severe* local (induration > 2/3 of limb) or severe generalised reactions in the previous dose
- Specific Contraindications
  - BCG - Not to be given to symptomatic HIV infected children. Can be given to newborns of HIV infected mother as the infant is usually asymptomatic at birth.
  - Hep B vaccine – Severe hypersensitivity to aluminium. The vaccine is also not indicated for HBV carrier or immuned patient (i.e. HBsAg or Ab positive).
  - Pertussis
    - absolute contraindications: anaphylaxis to previous dose; encephalopathy develops within 7 days of vaccination.
    - precautions: severe reactions to previous dose (fever > 40.5 °C, fits within 72 hours, persistent inconsolable crying, hyporesponsive state, severe local reaction involving 2/3 of limbs) and progressive neurological diseases like infantile spasm, tuberous sclerosis.
    - static neurological diseases, developmental delay, personal or family history of fits are *not* contraindications.
- Diphtheria and Tetanus: Severe hypersensitivity to aluminium and thiomersal
- Oral Polio (OPV)
  - diarrhoea and vomiting (can give the dose but must repeat the dose 1 month later)
  - hypersensitivity to neomycin, streptomycin or polymyxin.
  - within 3 weeks from a tonsillectomy (remote risk of vaccine induced bulbar polio)
- Rubella - contraindicated in pregnancy (even though no reported cases of congenital rubella syndrome due to vaccine).
- Measles - if < 9 months old presence of maternal Ab may decrease immunogenicity. Avoid in persons hypersensitive to neomycin, polymyxin *or* anaphylaxis to egg ingestion.
- MMR and Influenza – severe reaction to hen's eggs or neomycin
- Pneumococcal – children < 2 years age (polysaccharide vaccine); revaccination within 3 years has high risk of adverse reaction; avoid during chemotherapy or radiotherapy and < 10 days prior to starting such therapy – antibody response is poor. Pregnancy.
- Hepatitis A: Severe hypersensitivity to aluminium hydroxide, phenoxyethanol, neomycin
- Japanese B: contraindicated in immunodeficiency and malignancy, diabetes, acute exacerbation of cardiac, hepatic and renal conditions

### The following are *not* contraindications to vaccination

- mild illness without fever e.g. mild diarrhoea, cough, runny nose.
- asthma, eczema, hay fever, impetigo, heat rash (avoid injection in area of skin lesion)
- treatment with antibiotics or locally acting steroids
- child's mother is pregnant
- breastfed child (does not affect polio uptake)
- neonatal jaundice
- underweight or malnourished
- over the recommended age
- past history of pertussis, measles or rubella (unless confirmed medically)
- non progressive, stable neurological conditions like cerebral palsy, Down's syndrome, simple febrile convulsions, controlled epilepsy, mental retardation.
- family history of convulsions
- history of heart disease, acquired or congenital
- prematurity (give immunisation according to schedule irrespective of gestational age)

### Vaccination: Possible Side Effects

- Diphtheria and Tetanus vaccine
  - swelling, redness and pain
  - a small painless nodule may develop at injection site – harmless.
  - transient fever, headaches, malaise, rarely anaphylactic reaction.
  - neurological reactions rare
- DPT
  - local swelling and redness within 24 – 72 hours lasting 1 – 2 weeks.
  - acute encephalopathy (0 – 10.5 per million doses)
  - shock and 'unusual shock-like state' (3.5 to 250 cases per 100 000 doses)
  - anaphylaxis (2 per 100 000 doses)
  - protracted crying (0.1 to 6%)
- OPV
  - Vaccine associated paralytic polio (VAPP):
  - risk at 1 case/ 5.3 million doses
  - highest risk after 1st dose estimated at 1 per 1 million contacts of first dose recipients.
  - risk for subsequent doses is greatly reduced. It is important that contacts of children receiving OPV are themselves fully immunized.
- IPV
  - no serious side effects have been documented, apart from local reaction.
- HiB (Haemophilus influenzae b) vaccine
  - local swelling, redness and pain soon after vaccination and last up to 24 hours in 10% of vaccinees
  - malaise, headaches, fever, irritability, inconsolable crying. Very rarely seizures.
- Measles:
  - transient rash in 5% of cases; URTI symptoms.
  - fever between D5 - D12 post vaccination, for 1-3 days (5 -15% of doses of vaccines).
  - febrile convulsions (D6 - D14) in 1: 1000 - 9000 doses of vaccine. (Natural infection 1:200)
  - encephalopathy within 30 days in 1 : 1,000,000 doses of vaccines. (Natural infection 1:1000 - 5000)
  - long term prospective studies have found no association between measles or MMR vaccine and inflammatory bowel diseases, autism or SSPE.

- Mumps
  - rarely transient rash, pruritis and purpura.
  - parotitis in 1% of vaccinees, 3 or more weeks after vaccination
  - orchitis and retro bulbar neuritis very rare
  - meningoencephalitis is mild (rare) in 1: 800,000 doses. natural infection 1: 400)
- Rubella
  - may have rash, fever, lymphadenopathy, thrombocytopenia, transient peripheral neuritis
  - arthritis and arthralgia occurs in 3% of children and 20% of adults
  - rarely polyneuropathy (e.g. Guillain-Barre syndrome)
- BCG
  - local reaction: a papule at site of vaccination occurs within 2 to 6 weeks. This grows and flattens with scaling and crusting. Occasionally a discharging ulcer may occur. This heals leaving a BCG scar of at least 4 mm in successful vaccination.
  - BCG adenitis may occur.
- Influenza and Rabies
  - transient swelling, redness, pain and induration locally; myalgia, malaise and fever for 1 – 2 days starting within a few hours post vaccination
  - rare: neurological or anaphylactic reaction, Guillain-Barre syndrome, glomerulonephritis, ITP or anaphylaxis.
- Hepatitis A
  - local reactions. Flu-like symptoms lasting 2 days in 10% of recipients.
- Hepatitis B
  - local reactions; fever, flu-like symptoms in 1st 48 hours; Rarely, erythema multiforme or urticaria.
- Typhoid (Typhim Vi):
  - local reactions. Myalgia, malaise, nausea, headaches and fever in 3% of recipients.
- Cholera
  - gastrointestinal upset
- Meningococcus A, C, Y & W-135
  - local reactions. Irritability, fever and rigors for 1 – 2 days. Very rarely, anaphylaxis.

### Vaccination: Special Circumstances

- what to do if a measles case is admitted to the Paediatric Ward?
  - protect all immunocompromised children with immunoglobulin (HNIG) 0.25-0.5 mls/kg (Measles is a major cause of mortality in leukaemia in remission.)
  - check status of other children with regards to measles immunisation. If not immunised then give measles monocomponent vaccine within 24 hours of exposure. Vaccination within 72 hours can abort clinical measles in 75% of contacts.
  - discharge children with uncomplicated measles
  - notify the Public Health Office
- immunisation in HIV infected children (*see Chapter on Paediatric HIV*)
- in patients with past history or family history of fits, neurological or developmental abnormalities that would predispose to febrile fits:-
  - febrile fits can occur 5 – 10 days after measles (or MMR) vaccination or within the first 72 hours following pertussis immunisation.
  - Paracetamol (120 mg, ¼ tablet) prophylaxis after immunisation (esp. DPT) 4-6 hourly for 48 hours regardless of whether the child is febrile or not. This reduces incidence of high fever, febrile convulsions, fretfulness, crying, anorexia, local inflammation
  - rectal Diazepam may need to be considered

- maternal Chicken Pox during perinatal period (*see chapter on Perinatally acquired varicella section*)
- close contacts of immuno-deficient children and adults must be immunized, particularly against measles and polio (use IPV)
- in cases of contact with a patient with invasive Haemophilus influenzae B disease:
  - close contacts in household, nursery, kindergarden < age 4 years should be immunised
  - rifampicin prophylaxis (20 mg/kg once daily (maximum 600 mg) for 4 days) is given to all household contacts at (except pregnant women - one IM dose of ceftriaxone)
  - index case should be immunised irrespective of age
- asplenia (Elective or emergency splenectomy; asplenic syndromes; sickle cell anaemia) – susceptible to encapsulated bacteria and malaria :
  - give Pneumococcal, Meningococcal A, C, Y & W-135, Haemophilus influenza b vaccines
  - for elective splenectomy (also chemotherapy or radiotherapy): give vaccines preferably  $\geq 2$  weeks before procedure. However, they can be given even after the procedure.
  - Penicillin prophylaxis should continue even after vaccination. Ideally for life. If not until 16 years old for children or 5 years post splenectomy in adults.
- babies born to mothers who are HbeAg or HbsAg positive should be given Hepatitis B immunoglobulin (200 IU) and vaccinated with the Hepatitis B vaccine within 12 hours and not later than 48 hours. Given in different syringes and at different sites.
- premature babies may be immunised at the same chronological age as term infants. (*also see Chapter on The Premature Infant for more discussion*)

Table 2. Recommended Immunisation Schedule for Infants and Children with missed immunisations

Time of Immunisation	Age at first visit	
	Between 6 weeks - 12 months	12 months and older
1st visit	BCG, DPT/DTaP, Hib1, Polio1, HBV1	BCG, DPT/DTaP, Hib1, Polio1, HBV1, measles ( <i>see footnote 2</i> ) 6 or 9 mths MMR at 12 months of age
2nd visit (1 mth later)	DPT/DTaP2, Hib2, Polio2, HBV2	DPT/DTaP2, Polio2, HBV2, Hib2
3rd visit (1 mth later)	DPT/DTaP3, Hib3, Polio3,	DPT/DTaP3, Polio3,
4th visit (4 mths after 3rd visit)	HBV3	HBV3, DPT/DTaP4, Polio4,
2-8 mths later	DTaP4, Hib4 & Polio4 (booster)	Polio, DT/DTaP, MMR (at school entry)
	measles in Sabah at 9 months of age	

Notes:

1. For infants aged less than 6 weeks, use "Recommended Immunisation Schedule for Infants & Children".
2. measles vaccine should be given only after 9 months. (exception - given at 6 months in Sabah)
3. For special groups of children with no regular contact with Health Services and with no immunisation records, BCG, HBV, DTaP- Hib-IPV and MMR can be given simultaneously at different sites at first contact.
4. It is not necessary to restart a primary course of immunisation regardless of the period that has elapsed since the last dose was given. Only the subsequent course that has been missed need be given. (Example. An infant who has been given IPV1 and then 9 months later comes for follow-up, the IPV1 need not be repeated. Go on to IPV2.). Only exception is Hepatitis A vaccine.