IMMUNISATION

PRACTICE GUIDELINE ©

DOCUMENT SUMMARY/KEY POINTS

Australian Immunisation Handbook (10th edition, 2013)

Located at: http://www.immunise.health.gov.au

- SCHN follows the recommendations outlined in The Australian Immunisation Handbook (link above). The 10th edition of The Australian Immunisation Handbook (AIH) is also available on the intranet under resources in the Immunisation Department link (Immunisation Resource)
- This document does not replace the information found in the AIH and should be read in conjunction with the handbook.
- Adverse reactions to vaccines (also known as 'vaccine side effects') do sometimes occur. It is usually not possible to predict which individuals may have a mild or, rarely, a serious reaction to a vaccine. The risk of an adverse event occurring can be minimised by thorough pre vaccination assessment and adherence with these guidelines.
- Parent/carer should be informed of the risks and benefits of immunisation. Part of the consent procedure includes the provision of information on what common adverse events are likely and how to manage them (see Immunisation Resource)
- All vaccinations are to be documented on a medication chart, on the PowerChart Vaccination Form (at CHW) and if given to a child under 7 years of age, must be reported to the Australian Childhood Immunisation Register (ACIR).
- Modification of the standard vaccination schedule may be required for patients with certain conditions or have a past history of adverse reaction to a vaccine.
- For further advice contact: Immunisation CNC (at CHW).

FURTHER INFORMATION ABOUT VACCINATION

- The National Centre for Immunisation Research and Surveillance of Vaccine Preventable Diseases(NCIRS): www.ncirs.usyd.edu.au
- Immunise Australia: http://www.immunise.health.gov.au
- NSW Ministry of Health: http://www.health.nsw.gov.au/immunisation/pages/default.aspx

Approved by:	SCHN Policy, Procedure and Guideline Committee	
Date Effective:	1st August 2014	**Review Period**: 3 years
Team Leader:	Clinical Nurse Consultant	**Area/Dept**: National Centre Immunisation Research

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- **Local Public Health Unit (PHU)**
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  - Westmead - Western Sydney PHU - 9840 3603

CHANGE SUMMARY

This document was revised due to expiry of the mandatory review period and the publication of the 10th ed. of The Australian Immunisation Handbook.

- New procedure for notification of vaccination for The Australian Childhood Immunisation Register
- Updated vaccination schedule
- Addition of information for specific risk groups
- For CHW staff - Addition of information on Vaccination Form located in PowerChart

READ ACKNOWLEGEMENT

- At CHW: inservice for all ward staff on new PowerChart Vaccination Form.
- The following staff are to read and acknowledge they understand the contents of this document:
  - Clinical staff dealing with immunisations in Outpatients, Emergency, GCNC, Pharmacy and Ward Areas.
  - Clinical staff dealing with immunocompromised patients requiring immunisation such as oncology, haematology, cardiac, lung and liver transplant patients.

TABLE OF CONTENTS

Australian Immunisation Handbook (AIH)

Note: Given the rapid change in the immunisation recommendations it is anticipated that the ***electronic*** version of the Handbook will be periodically updated to reflect new changes. Handbook updates will be listed on the link below:
http://www.immunise.health.gov.au/internet/immunise/publishing.nsf/Content/Handbook10-home .

Alternatively, the current edition of the Handbook, including updates are available on the Immunisation intranet site under 'Resources' at:
http://chw.schn.health.nsw.gov.au/ou/immunisation/ . The links provided throughout this policy are directed to the CHW intranet site.

This policy is based on the recommendations in the Australian Immunisation Handbook (Australian Technical Advisory Group on Immunisation. *The Australian Immunisation Handbook. 10th ed*. Canberra: Australian Government Department of Health, 2013.)

The Australian Immunisation Handbook (AIH) is divided into 5 parts:

- **Part 1** Introduction to the AIH (Immunisation Resource)
  - How to use the 10th edition handbook
  - What's new
  - Fundamentals of immunisation
- **Part 2** Vaccination Procedures (Immunisation Resource)
  - Pre-vaccination
  - Administration of vaccines
  - Post-vaccination
- **Part 3** Vaccination for Special Risk Groups Immunisation Resource
  - Vaccination for Aboriginal and Torres Strait Islander people
  - Vaccination for international travel
  - Groups with special vaccination requirements including vaccination of:
    - Persons who have had an adverse event following immunisation (AEFI)
    - Pre-term infants,
    - Vaccination of immunocompromised persons including:
      - Immunocompromise associated with corticosteroid administration
      - Use of live vaccines
      - Household contacts of immunocompromised persons
      - Oncology patients
      - Solid organ transplant recipients
      - Haematopoietic stem cell transplant recipients
      - HIV-infected persons
      - Persons with functional or anatomical asplenia
      - Persons with autoimmune diseases and other chronic conditions
    - Recent recipients of normal human immunoglobulin and other blood products
    - Persons with bleeding disorders

- Vaccination before and after anaesthesia/surgery
- Vaccination of migrants to Australia

- **Part 4** Vaccine Preventable Diseases
  - Look under Resources>Australian Immunisation Handbook 10th Ed>Part 4for vaccines listed by disease or Immunisation Resource
- **Part 5** Passive Immunisation Immunisation Resource
  - Includes information on the use of NHIG and specific immunoglobulins such as HRIG (rabies specific immunoglobulin) and ZIG (zoster immunoglobulin)
- Quick reference guides and appendices can also be accessed via the intranet at Immunisation Resource

NSW Immunisation Schedule

Age	Disease	Vaccine	Route
CHILDHOOD VACCINES			
Birth	Hepatitis B	H-B-Vax II	IMI
2 months ***(can be given as early as 6 weeks)***	Diphtheria, Tetanus, Pertussis, *Haemophilus influenzae* type B (Hib), Hepatitis B, Polio Pneumococcal Rotavirus* ***Upper age limit for administration - 14.9 weeks** ***May be given to hospitalised infants as long as standard infection control precautions are maintained**	Infanrix hexa Prevenar13 Rotarix	IMI IMI Oral
4 months	Diphtheria, Tetanus, Pertussis, *Haemophilus influenzae* type B (Hib), Hepatitis B, Polio Pneumococcal Rotavirus* ***Upper age limit for administration - 24.9 weeks** ***DO NOT give if dose 1 not given**	Infanrix hexa Prevenar13 Rotarix	IMI IMI Oral
6 months	Diphtheria, Tetanus, Pertussis, *Haemophilus influenzae* type B (Hib), Hepatitis B, Polio Pneumococcal	Infanrix hexa Prevenar13	IMI IMI
12 months	Haemophilus influenzae type B (Hib) Meningococcal C Measles, Mumps, Rubella	Menitorix Priorix or MMR II	IMI IMI S/C
18 months	Measles, Mumps, Rubella, Varicella	Priorix-tetra	S/C
4 years ***(can be given as early as 3½ years)***	Diphtheria, Tetanus, Pertussis, Polio Measles, Mumps, Rubella **(only if child has not had 2 doses of measles-mumps-rubella containing vaccine)**	Infanrix IPV Priorix or MMR II	IMI IMI S/C
ADOLESCENT VACCINES			
Year 7	Diphtheria, Tetanus, Pertussis Human Papillomavirus Varicella	Boostrix Gardasil Varilrix	IMI IMI IMI or S/C
Year 9	Human Papillomavirus (males only; 2013 & 2014)	Gardasil	IMI

VACCINES PROVIDED FOR AT RISK GROUPS			
• ≥6 months with medical risk conditions • Aboriginal ≥15 years • ≥65 years • Pregnant women	Influenza	Influenza	IMI or S/C
• Aboriginal ≥50 years • Aboriginal - 15-49 years with medical risk factors *(see Influenza chapter of AIH)* • ≥65 years	Pneumococcal	Pneumovax23	IMI

Abbreviations

Abbreviation	Term
ACIR	Australian Childhood Immunisation Register
ACSOM	Australian Council on the Safety Of Medicines
BCG	Bacille Calmette-Guerin vaccine (Tuberculosis vaccine)
CHW	The Children's Hospital at Westmead
DTPa	Diphtheria, Tetanus, Pertussis (acellular) vaccine (childhood dose, <10 years)
Hep B	Hepatitis B vaccine
dTpa	Diphtheria, Tetanus, Pertussis (acellular) vaccine (adult dose, ≥10 years)
Hib	*Haemophilus influenzae* type B vaccine
IPV	Inactivated Poliomyelitis Vaccine
MMR	Measles, Mumps, Rubella vaccine
MMRV	Measles, Mumps, Rubella, Varicella vaccine
NIP	National Immunisation Program
NHMRC	National Health and Medical Research Council

Immunisation across SCHN

- **Goal**: to ensure that all children who attend SCHN are given every opportunity to be appropriately vaccinated and thereby protected against vaccine preventable disease in line with the NSW Immunisation Program.
- **Strategies to achieve goal**: screening, documentation, catch up, reporting and referral
- This guideline should be read in conjunction with the 10th edition of AIH.
- The SCHN will adhere to the immunisation schedule recommended by the National Health and Medical Research Council (NHMRC). The schedule, immunisation technique and further detail about immunisation can be found in the AIH. Links to each section of the AIH can be found on the Immunisation Intranet page under Resources.).
- Details of every child's immunisation status will be checked by the administering staff and recorded as part of each emergency, outpatient and inpatient medical and nursing history
- SCHN practices **catch-up immunisation**. Children who are identified on immunisation history check as being overdue for any scheduled vaccination, and who have no contraindication, should either be vaccinated (after obtaining parental consent) prior to discharge or referred to their general practitioner for vaccination. This applies to children attending the Emergency and Outpatient Departments as well as to children in the wards. Follow-up vaccinations should be arranged if necessary.
- Advice about vaccinations should be included in the discharge letter to the infant/child's General Practitioner and the infant/child's parents should be encouraged to attend for vaccination at the appropriate age (unless contraindicated).
- **Adverse Events Following Immunisation** (AEFI) are not common .They can be distressing for parents/carers, but they do not always contraindicate further vaccination. In the event of an AEFI, the infant/child can be referred to the Adverse Events Following Immunisation Clinic at SCH or CHW for assessment and management of future vaccination doses: http://www.chw.edu.au/prof/clinics/immunisation_adverse_events_clinic.htm
- Multiple vaccines may be administered at the same visit. At CHW, contact the Immunisation CNC (ext 51414 or page 7007) for advice and assistance.
- A family history of allergies is not a contraindication to vaccination.
- The hospital Immunisation CNC and the National Centre for Immunisation Research are available if advice or clarification regarding vaccination is required.
- SCHN will actively promote vaccination in the local health area and the community at large by example, education and research.

SCHN Guidelines

1. Pre-vaccination Assessment (AIH, Section 2.1)

Consent

- A parent or legal guardian must provide consent for ***each*** vaccination encounter for children under the age of 14 years.
- If the child or adolescent refuses a vaccination for which the parent/guardian has consented, the child/adolescent's wishes should be respected and the parent/guardian notified.
- To ensure valid consent is obtained, the person giving consent must be given information on the risks and benefits of the vaccine to be given. Printed information should be provided in addition to verbal explanations (the AIH contains a useful summary that can be used for this purpose Immunisation Resource). Sufficient time to make the decision as well as an opportunity to ask further questions must be provided.
- Consent may be given either in writing or verbally. If given verbally, then a record of this must be documented in the clinical notes e.g. "A discussion was held with patient's father regarding the 2 months vaccinations, including information on the risks and benefits of each vaccine to be given. Parent happy to proceed with vaccinations today".
- There are several further resources available to assist parents in making the decision about vaccination and to assist Immunisation Providers with answers to common questions about vaccination:
    - Understanding Childhood Immunisation
    - Myths and Realities 5th ed.
    - The Science of Immunisation: Questions and Answers)

Pre-vaccination Screening Checklist

- The pre-vaccination screening checklist (Appendix 1 or Immunisation Resource) should be completed for each patient.
- This tool is used to assess whether there are any risk factors that may mean extra vaccines may need to be considered or that some vaccines may need to be delayed. Table 2.1.2 from the AIH '*Responses to relevant conditions or circumstances identified through the pre-vaccination screening tool*' can be referred to for detailed advice (Immunisation Resource).
- It is important to check the patient's previous vaccination status to ensure that the correct vaccines are given at the current visit, specific for the patient's age as well as to ascertain whether any doses have been missed and need to be caught up (see "Catch Up" section below)

Contraindications to Vaccination

- There are only 2 absolute contraindications applicable to *all* vaccines:
    - anaphylaxis following a previous dose of the relevant vaccine*
    - anaphylaxis following any component of the relevant vaccine#

  *Assessment via allergy testing in an Adverse Events Following Immunisation Clinic can assist in identification of the causal vaccine if more than 1 vaccine was given at the time of the reaction

  #Some vaccines, such as the influenza vaccine which contains a small amount of egg protein, can be given to patients with anaphylaxis to a component, however this must be carried out in the Adverse Events Following Immunisation Clinic.
- Live vaccines should not be administered to patients who are significantly immunocompromised. Further information on special circumstances is available in Section 3.3.3 of the AIH 10th ed. (Immunisation Resource)

False Contraindications

- No patient should be denied the benefits of vaccination by withholding vaccines for inappropriate reasons. Table 2.1.4 AIH (Immunisation Resource) lists conditions/situations that are not contraindications for vaccination.

2. Catch-up (AIH, Section 2.1.5)

- Every opportunity should be taken to review a patient's vaccination history and to administer appropriate vaccines that are either due or overdue.
- The AIH provides detailed instructions of how to plan a catch up schedule for children and adolescents who have missed doses for whatever reason (Immunisation Resource)
  - Catch-up worksheet (Appendix 2)
  - Minimum acceptable age for the 1st dose of scheduled vaccines in infants in special circumstances (Immunisation Resource)
  - Number of vaccine doses that should have been administered by the current age of the child
  - Minimum acceptable dose intervals for children <10 years of age (Immunisation Resource)
  - Catch-up schedule for Hib vaccination for children <5 years (Immunisation Resource)
  - Catch-up schedule for Pneumococcal vaccination
    - Pneumococcal vaccination <2yrs at medical risk
    - Pneumococcal vaccination 2-5yrs at medical risk
    - Pneumococcal vaccination <5yrs no risk
- **Some important rules to remember**:
  - Always check the Personal Health Record (Blue/Red Book) against the record on the Australian Childhood Immunisation Register (ACIR). The Immunisation CNC can assist with access to the ACIR. If the record has not been documented in either of these places, contact the Immunisation Provider (GP or Public Vaccination Clinic) who administered the vaccine for confirmation.
  - If documentation of a vaccine dose cannot be confirmed, it should generally be assumed that it has not been given. For the vaccines listed on the NSW Immunisation Schedule adverse events are rarely associated with additional doses if given to an already immune person. Frequent additional doses of diphtheria, tetanus and pertussis containing vaccines and pneumococcal polysaccharide vaccines can cause an increased local reaction, however the benefits of protection may outweigh the risk of an adverse reaction.
  - For incomplete or overdue vaccinations, build on the previous documented doses. In almost every circumstance, there is no need to start the schedule again, regardless of the interval since the last dose.
  - The interval between doses for catch up may be reduced - refer to table 2.1.7 '*Minimum acceptable dose intervals for children <10 years of age*' in the AIH for details (Immunisation Resource)
  - As the child ages, some vaccines may decrease in number of doses required e.g. Hib/Pneumococcal or not be required at all e.g. Rotavirus
  - Some patients will require further doses of antigens that are available only in combination vaccines. In general, the use of combination vaccines is acceptable, even if this means the number of doses of another antigen administered exceeds the required number.

For further assistance in establishing which vaccines to catch up or for calculating appropriate catch up dose intervals, please contact the Immunisation CNC.

3. Storage of Vaccines

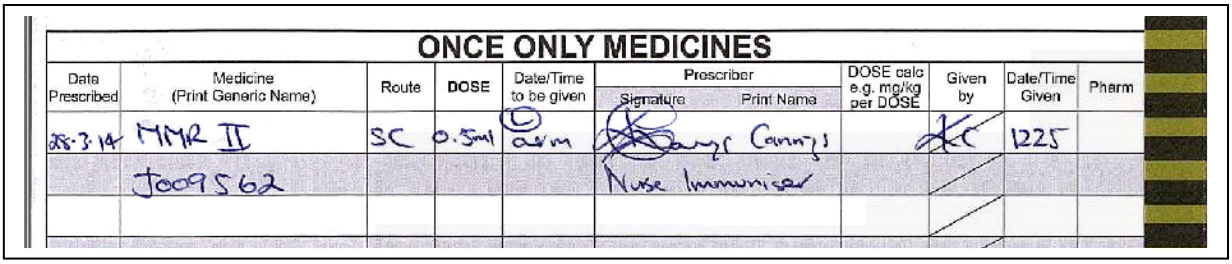
Inactivation or loss of potency of any vaccine will result from improper storage.

- Food or drink **must not** be stored in the refrigerator where the vaccines are stored
- Refrigerator temperature must be maintained between +2 – +8°C for the storage of all vaccines. Contact the Immunisation CNC immediately if your fridge has gone above +8.9°C or below +2.0°C. **Isolate** the affected vaccines within the fridge and **DO NOT** use them until you have received direction from the Immunisation CNC
- Refrigerators used for vaccines MUST have a digital minimum / maximum thermometer placed on the middle shelf. The minimum and maximum temperatures MUST be checked, recorded and reset **twice** a day (at similar times e.g beginning of morning shift and beginning of afternoon shift)
- Ward staff are responsible for checking the fridge temperature and ensuring that the refrigerator is defrosted regularly
- Bar fridges are **NOT** acceptable for the storage of vaccines
- Purpose built vaccine fridges are recommended for reliable storage of vaccines.
- Vaccines should not be stored in the door of the refrigerator but in the middle or top part of the main compartment of the fridge.
- The fridge door should only be opened when necessary, and a sticker placed on the door reading "STOP DO YOU NEED TO OPEN IT?"
- Vaccines **MUST** remain in the refrigerator until they are required and all unused vaccines immediately returned to the refrigerator.
- During "normal hours" vaccines will be ordered on ‘once only’ medication charts and sent to pharmacy to be filled.

4. Administration of Vaccines (AIH, Section 2.2)

Who can give a vaccine?

- Any Registered Nurse or Endorsed Enrolled Nurse as long as the order has been written up by a doctor
  - Valid consent (as per section 1 of this policy) must be obtained by the medical officer writing up the order
- An Authorised Nurse Immuniser (as per PD2008_033)
  - Must check with the medical team that vaccination is appropriate prior to administration
  - Do not require a doctor's order
  - Must identify on the medication chart their authority after their signature (see example below)



ONCE ONLY MEDICINES

Date Prescribed	Medicine (Print Generic Name)	Route	DOSE	Date/Time to be given	Prescriber Signature	Prescriber Print Name	DOSE calc e.g. mg/kg per DOSE	Given by	Date/Time Given	Pharm
28·3·14	MMR II	SC	0.5ml	Ⓛ arm	[illegible]	[illegible]		KC	1225	
	J009562				Nurse Immuniser					

Preparing for vaccination

Depending on the vaccine(s) that are to be administered, and the age and size of the person to be vaccinated, decide on the appropriate injection site and route, and the injection equipment required (e.g. syringe size, needle length and gauge).

The equipment chosen will vary depending on whether the vaccine is a reconstituted vaccine, a vaccine from an ampoule or vial, or a vaccine in a pre-filled syringe.

Equipment may include:

- medical waste (sharps) container
- vaccine, plus diluent if reconstitution is required
- 2 or 3 mL syringe (unless vaccine is in pre-filled syringe)
- appropriate drawing-up needle (19 or 21 gauge needle if required, to draw up through rubber bung and for reconstitution of vaccine)
- appropriate injecting needle (see table below "*Recommended needle size, length and angle for administering vaccines*")
- clean cotton wool and hypoallergenic tape to apply to injection site after vaccination
- sucrose syrup or jelly beans for administration prior to vaccination
- tools for age appropriate distraction e.g. a rattle, noisy toy, bubbles, jelly beans/lollipops for distraction after the injection

Preparing the vaccine

- ensure that the vaccine has been kept in a purpose built vaccine refrigerator that has maintained temperatures within the +2°C to +8°C range before using the vaccine

- ensure that the correct vaccine is taken from the refrigerator and that it is within the expiry date
- check that there is no particulate matter or colour change in the vaccine
- ensure that the diluent container is not damaged and potentially contaminated
- wash hands with soap and water or use a waterless alcohol-based hand rub
- prepare the appropriate injection equipment for the vaccine to be administered

Injectable vaccines that do not require reconstitution

- If the vaccine is in a vial, remove the cap carefully to maintain sterility of the rubber bung. There is no need to wipe the rubber bung of single-dose vials with an alcohol swab if it is visibly clean. If there is visible contamination, the bung should be cleaned with a single-use swab, allowing time to dry before drawing up the contents
- Use a 19 or 21 gauge needle to draw up the recommended dose through the bung (or through the top of the ampoule), if required
- Change the needle after drawing up from a vial with a rubber bung or ampoule, before giving the injection. If using a safety needle system, once the vaccine has been drawn up, draw back on the syringe to ensure as much vaccine as possible is removed from the tip of the needle, and then eliminate any air to the tip of the syringe without re-priming the needle.
- Injectable vaccines that require reconstitution
- Reconstitute the vaccine as needed immediately before administration
- Use a sterile 21 gauge needle for reconstitution and a separate 23 or 25 gauge needle, 25mm in length, for administration of the vaccine in most circumstances.
- Use only the diluent supplied with the vaccine; do not use sterile water for injection instead of a supplied diluent. Ensure that the diluent and vaccine are completely mixed
- Check reconstituted vaccines for signs of deterioration, such as a change in colour or clarity
- Administer reconstituted vaccines as soon as practicable after they have been reconstituted as they may deteriorate rapidly. Refer to individual vaccine product information for recommended times from vaccine reconstitution to administration
- Never freeze a vaccine after it has been reconstituted.
- For all injectable vaccines
- There is no need to expel small air bubbles through the needle for injection. However, in the rare instance of a large air bubble in a pre-filled syringe, first draw back on the needle to ensure no vaccine is expelled along with the air, and then expel the air through the needle, taking care not to prime the needle with any of the vaccine, as this can promote increased local reaction
- **Never** mix other vaccines together in the one syringe (unless that is the manufacturer's registered recommendation, e.g. Infanrix hexa)
- **Never** mix a local anaesthetic with a vaccine

Route of administration

Most vaccines available in Australia are given intramuscularly. Only a few are given subcutaneously, orally or intradermally (see table below).

Route of administration of vaccines used in Australia (AIH, p68-69)

Intramuscular (IM) injection	Subcutaneous (SC) injection	IM or SC injection	Intradermal injection	Oral
Diphtheria-tetanus vaccine (dT)	Inactivated poliomyelitis vaccine (IPV)*	Influenza vaccine†	Influenza vaccine (Intanza only)	Rotavirus vaccine
Diphtheria-tetanus-acellular pertussis vaccine (DTPa and dTpa) and combination vaccines	Quadrivalent meningococcal polysaccharide vaccine (4vMenPV)	Measles-mumps-rubella vaccine (MMR) (Priorix only)	Bacille Calmette-Guérin (BCG) vaccine‡	Cholera vaccine
Hepatitis A vaccine and combination vaccines	Varicella vaccine (VV)	Measles-mumps-rubella-varicella vaccine (MMRV) (Priorix-tetra only)	Q fever skin testing‡	Typhoid vaccine
Hepatitis B vaccine and combination vaccines	Japanese encephalitis vaccine (Imojev)	23-valent pneumococcal polysaccharide vaccine (23vPPV)†		
Haemophilus influenzae type B (Hib) vaccine	Q fever vaccine‡	Rabies vaccine (HDCV)		
Human papillomavirus (HPV) vaccine	Measles-mumps-rubella vaccine (MMR) (M-M-R II only)	Yellow fever vaccine		
IPV-containing combination vaccines*	Measles-mumps-rubella-varicella vaccine (MMRV) (ProQuad only)			
Japanese encephalitis (JEspect)	Zoster vaccine			
10-valent pneumococcal conjugate vaccine (10vPCV)				
13-valent pneumococcal conjugate vaccine (13vPCV)				
Typhoid Vi polysaccharide vaccine				
Meningococcal C conjugate vaccine (MenCCV)				
Quadrivalent meningococcal conjugate vaccine (4vMenCV)				
Rabies vaccine (PCECV)				

* IPV-containing combination vaccines are administered by IM injection; IPV (IPOL) is administered by SC injection.

† The IM route is preferred to the SC route because it causes fewer local adverse events.

‡ Q fever skin testing and BCG vaccine should be administered only by specially trained immunisation service providers.

Recommended needle size, length and angle for administering vaccines (AIH, p72)

Age or size of child/adult	Needle type	Angle of needle insertion
Infant, child or adult for IM vaccines	23 or 25 gauge*, 25mm in length†	90° to skin plane
Preterm babies (<37 weeks gestation) up to 2 months of age; and/or very small infants	23 or 25 gauge*, 16mm in length	90° to skin plane
Very large or obese patient	23 or 25 gauge, 38mm in length	90° to skin plane
Subcutaneous injection in all persons	25 or 26 gauge, 16mm in length	45° to skin plane

* If using a 25 gauge needle for an IM vaccination, ensure the vaccine is injected slowly over a count of 5 seconds to avoid injection pain and muscle trauma.

† The use of short needles for administering IM vaccines may lead to inadvertent SC injection and increase the risk of significant local adverse events, particularly with aluminium-adjuvanted vaccines (e.g. hepatitis B, DTPa-combination or dT vaccines).

Recommended injection sites

Infants <12 months of age:

- The vastus lateralis muscle in the anterolateral thigh is the routinely recommended site.
- The ventrogluteal area is an alternative site only to be used by providers who are familiar with the landmarks used to identify this site.
- The deltoid muscle is not recommended for IM injections in this age group

Children >12 months/adolescents and adults:

- The deltoid muscle is the recommended site for IM injection
- The ventrogluteal area is an alternative site only to be used by providers who are familiar with the landmarks used to identify this site
- The vastus lateralis muscle in the anterolateral thigh may also be used for this age group, however, if this site is used, the less locally reactogenic vaccines (e.g. MMR, hepatitis B) should be given in the thigh.

Children with congenital limb malformation or children in spica casts:

- Give vaccines in an unaffected limb where possible
- The ventrogluteal area can be considered (see previous recommendations for use of this site)
- Administration of vaccines to children in spica casts can be times to occur when the cast is being changed. Parents should be informed of the importance of looking for any signs of swelling that may compromise circulation and to seek advice from their physiotherapist or doctor as soon as possible. The deltoid muscle may considered if timings of cast removal are unsuitable for scheduling vaccines however it is important to be aware of the radial nerve located superficially near the deltoid in children <12 months of age.

Further information on the administration of vaccines including photos and diagrams of sites and how to position a child can be found in Section 2 of the AIH (p67-84, Immunisation Resource)

5. Documentation of vaccination

It is essential that staff ensure there is appropriate documentation of all vaccinations given in the hospital. There are a number of places this needs to be done:

- The medication chart (staff members who order and administer vaccine/s)
- The clinical notes (staff member who administers vaccine/s)
- The Personal Health Record (Blue Book) (staff member who administers vaccine/s)
- The CHW Vaccination Form on PowerChart (staff member who administers vaccine). ***Please ensure a form is completed each time a vaccine is given.*** **Completion ensures that the details are entered onto the Australian Childhood Immunisation Register (ACIR) allowing any childcare payments to continue and admission to childcare.**
- The Australian Childhood Immunisation Register (ACIR) (Immunisation CNC) - details of vaccinations given are obtained through monthly reports of completed Vaccination Forms through PowerChart

The following information should be recorded:

- details of the vaccine given, including brand name, batch number and dose number
- date and time of vaccination
- site of administration
- name of person administering vaccine

The Australian Childhood Immunisation Register (ACIR)

- Records details of vaccinations given to children < 7years of age who live in Australia
- Children enrolled in Medicare are automatically included on the ACIR
- No vaccination information is recorded once the child turns 7 however information logged prior to this time is always retained
- Immunisation History Statements from the ACIR are automatically generated and sent to the address on the Medicare card when the child turns 18 months and 5 years. Parents/carers can request a History Statement at any time via the following methods:
    - online at www.humanservices.gov.au/customer/services/medicare/australian-childhood-immunisation-register
    - from their local DHS Service Centres
    - by calling the ACIR on 1800 653 809 (free call)

6. Adverse Events Following Immunisation (AEFI)

An adverse event following immunisation is any untoward medical occurrence that follows immunisation and does not necessarily have a causal relationship with the usage of the vaccine. The adverse event may be any unfavourable or unintended sign, abnormal laboratory finding, symptom or disease. Such an event may be caused by the vaccine(s) or may occur by chance (i.e. it would have occurred regardless of vaccination).

Vaccines, like other medications can have side effects. Vaccine related side effects are minor and should be anticipated i.e. low-grade fever and pain or redness at the injection site. A list of expected common AEFI can be found in the back cover of the AIH - *Comparison of the effects of diseases and the side effects of NIP vaccines*. A copy is available on the intranet (Immunisation Resource).

Management of an immediate AEFI

After vaccination, the person should remain under observation for at least 15 minutes after they have received any vaccine, regardless of whether it was their first or subsequent dose. Severe anaphylactic reactions usually have a rapid onset; life-threatening reactions are most likely to begin within 15 minutes of vaccination.

Rapid IM administration of adrenaline is the cornerstone of treatment of anaphylaxis. Adrenaline is life saving and must be used promptly.

Staff should follow hospital policy for the management of allergic/anaphylactic reactions.

For further information on AEFI, consult section 2.3 of the AIH (Immunisation Resource).

Reporting AEFI

Any serious or unexpected adverse reaction to a vaccination should be reported to the local Public Health Unit [At CHW: Western Sydney PHU on 9840 3603 and at SCH: South Eastern Sydney PHU on 9382 8333. This is the responsibility of the person who provided the immunisation.

Notifications are entered on the NSW Ministry of Health Notifiable Conditions Information Management System (NCIMS) and forwarded to the TGA for further assessment and classification.

AEFI Clinic

- Specialist clinics are available at SCH and CHW for the assessment and management of a child/adolescent who has either experienced an AEFI or is at risk of experiencing an AEFI due to a risk factor. Referrals are recommended for but not limited to children who have experienced the following:
  - anaphylaxis or allergic reaction
  - encephalopathy
  - prolonged afebrile seizure
  - hypotonic hypo-responsive episode
  - hospitalisation
  - severe injection site reaction

The clinic also provides in depth discussion with parents who have concerns about vaccines, side effects and possible adverse events.

Referrals should be made through the Outpatient Department of each hospital.

7. Parent Information Sheet (AIH, 2013: Front cover)

- See the Immunisation Resource

8. Immunising Special Risk Groups

- Asplenia - functional or anatomical: See Appendix 4
- Cardiac disease: See Appendix 5
- Haematological disorders: See Appendix 6
- High-dose corticosteroid treatment: See Appendix 7
- HIV/AIDS: See Appendix 8
- Neurological disease: See Appendix 9
- Oncology: See Appendix 10
- Preterm infants: See Appendix 11
- Recent recipients of blood products/immunoglobulin: See Appendix 12
- Solid organ transplant recipients: See Appendix 13
- Tetanus prone wound prophylaxis: See Appendix 14

Appendix 1: Pre-vaccination Checklist (AIH, 2013:30)

This checklist helps decide about vaccinating you or your child today. Please fill in the information for your doctor/nurse.

Name of person to be vaccinated: _____

Date of birth: ____ / ____ / _____

Age today: _____

Name of person completing this form: _____

Please indicate if the person to be vaccinated:

- ☐ is unwell today
- ☐ has a disease that lowers immunity (e.g. leukaemia, cancer, HIV/AIDS) or is having treatment that lowers immunity (e.g. oral medicines such as cortisone and prednisone, radiotherapy, chemotherapy)
- ☐ has had a severe reaction following any vaccine
- ☐ has *any* severe allergies (to anything)
- ☐ has had any vaccine in the past month
- ☐ has had an injection of immunoglobulin, or received any blood products or a whole blood transfusion within the past year
- ☐ is pregnant
- ☐ has a past history of Guillain-Barré syndrome
- ☐ was a preterm infant
- ☐ has a chronic illness
- ☐ has a bleeding disorder
- ☐ identifies as Aboriginal or Torres Strait Islander
- ☐ does not have a functioning spleen
- ☐ is planning a pregnancy or anticipating parenthood
- ☐ is a parent, grandparent or carer of a newborn
- ☐ lives with someone who has a disease that lowers immunity (e.g. leukaemia, cancer, HIV/AIDS), or lives with someone who is having treatment that lowers immunity (e.g. oral medicines such as cortisone and prednisone, radiotherapy, chemotherapy)
- ☐ is planning travel
- ☐ has an occupation or lifestyle factor(s) for which vaccination may be needed (discuss with doctor/nurse)
  Please specify: _____

Note: Please discuss this information or any questions you have about vaccination with your doctor/nurse before the vaccines are given.

Before any vaccination takes place, your doctor/nurse should ask you:

- ☐ Did you understand the information provided to you about vaccination?
- ☐ Do you need more information to decide whether to proceed?
- ☐ Did you bring your/your child's vaccination record card with you?

It is important for you to receive a personal record of your or your child's vaccinations. If you do not have a record, ask your doctor/nurse to give you one. Bring this record with you every time you or your child visit for vaccination. Make sure your doctor/nurse records all vaccinations on it.

Appendix 2: Catch-up Worksheet (AIH, 2013:45)

This worksheet can be used in conjunction with catch up tables mentioned in part 2 of this document

Name: **DOB**: **Age**:	**Last dose given** **Dose number and date**	**Number of doses required at *current age****	**Dose number due now**	**Further doses** **Interval or date**	**Comments**
DTPa					
Poliomyelitis (IPV)					
Hepatitis A					
Hepatitis B					
Hib†					
Pneumococcal (13vPCV)‡§					
Pneumococcal (23vPPV)‡					
MenCCV					
MMR					
Rotavirus					DO NOT give after upper age limits for each dose. See Section 4.17 AIH *Rotavirus*, Table 4.17.1
Varicella					

CATCH-UP APPOINTMENTS			
Date	**Vaccines and dose number**	**Interval to next dose**	**Comments**

* Refer to Table 2.1.6 *Number of vaccine doses that should have been administered by the current age of the child* and Table 2.1.7 *Minimum acceptable dose intervals for children<10 years of age*.

† See Table 2.1.8 for Hib vaccine catch-up recommendations

‡ See Tables 2.1.9, 2.1.10 and 2.1.11 for pneumococcal vaccine catch-up recommendations

§ Previous doses of pneumococcal conjugate vaccine may have been given using 7-valent (7vPCV) or 10-valent (10vPCV) vaccine(s).

Tables available on intranet at: Immunisation Resource

Appendix 3: Asplenia - functional or anatomical (i.e. splenectomy)

Patients with an absent or dysfunctional spleen are at life-long increased risk of fulminant bacterial infection, most notably invasive pneumococcal disease. Pneumococcal, meningococcal, Hib and influenza vaccinations are particularly recommended for all patients with asplenia.

For specific recommendations please see the table below.

For patients undergoing elective splenectomy, vaccination should be completed, where possible, 2 weeks prior to the scheduled operation date. If the splenectomy is unplanned, vaccination should occur approximately 1 week after surgery.

Recommendations for vaccination in patients with functional or anatomical asplenia (Table 3.3.5, AIH or Immunisation Resource)

Age	Recommendation
Pneumococcal vaccines	
6 weeks to <2 years	Give a 3-dose primary course of 13vPCV (Prevenar13), with an additional dose of 13vPCV (Prevenar13) at age ≥12 months. See catch up tables 4.13.1 (Pneumococcal chapter of Part 4 AIH) and 2.1.11 for further assistance (Immunisation Resource)
2 to 5 years	If the primary course of 13vPCV (Prevenar13) is incomplete or if the recommended 13vPCV (Prevenar13) dose at age ≥12 months was not received, give 1 or 2 doses of 13v PCV (Prevenar13) as per catch up Table 4.13.2 (Pneumococcal chapter of Part 4 AIH). Give a single dose of 23vPPV (Pneumovax23) at age 4-5 years*.
>5 to <18 years	If a 13vPCV (Prevenar13) dose has not previously been given, give a single dose of 13vPCV (Prevenar13), preferably prior to 23vPPV (Pneumovax23)*. If a dose of 23vPPV (Pneumovax23) was received at age 4-5 years, give another dose of 23vPPV 5 years later (at age 9-10 years). If asplenia is newly diagnosed, give 2 doses of 23vPPV (Pneumovax23), 5 years apart (after 13vPCV (Prevenar13); see above).
Meningococcal vaccines≈	
6 weeks to <6 months	Give 2 doses of MenCCV (Meningitec), 8 weeks apart; then 2 doses of 4vMenCV (Menveo or Menactra), commencing at age ≥12 months (see below)
6 to 11 months	Give a single dose of MenCCV (Meningitec), then 2 doses of 4vMenCV (Menveo or Menactra), commencing at age ≥12 months (see below)
≥12 months	Give 2 doses of 4vMenCV (Menactra or Menveo)‡, 8 weeks apart Give a 4vMenCV (Menactra or Menveo) dose every 5 years thereafter
***Haemophilus influenzae* type B (Hib) vaccine**	
6 weeks to < 5 years	Give the recommended course of Hib-containing vaccine, or catch up vaccination according to table 2.1.8 Additional/repeat doses are not required
≥5 years	If a Hib vaccine dose has not previously been given, or if the primary course of Hib vaccine is incomplete, give a single dose of Hib-containing vaccine. If Hib vaccination is complete (as per children <5 years above), additional/repeat

	doses are not required
Influenza vaccine[§]	
≥6 months to <3 years	Give 2 doses (0.25mL each), 1 month apart, in hthe first year of vaccination Give 1 dose (0.25mL) in subsequent years
3 to 9 years	Give 2 doses (0.5mL) each, 1 month apart, in the first year of vaccination Give 1 dose (0.5mL) in subsequent years
≥10 years	Give 1 dose (0.5mL)

*Whenever possible, 13vPCV (Prevenar13) dose(s) should precede the recommended 23vPPV (Pneumovax23) dose(s). If 13vPCV (Prevenar13) follows 23vPPV (Pneumovax23), a minimum interval of 12 months between 13vPCV (Prevenar13) and the last previous 23vPPV (Pneumovax23) dose is recommended. Th recommended minimum interval between a 13vPCV (Prevenar13) dose and a subsequent 23vPPV (Pneumovax23) dose is 2 months. Also note that the recommended minimum interval between any 2 doses of 23vPPV (Pneumovax23) is 5 years.

[‡]The minimum interval between 4vMenCV (Menactra or Menveo) and any previous MenCCV (Meningitec) dose is 8 weeks.

[§]Influenza vaccination is required annually. Two doses of influenza vaccine are not required in the first year influenza vaccine is given unless the asplenic person also has another immunocompromising condition such as post solid organ transplant or haematopoietic stem cell transplant.

[~]**Consider meningococcal B vaccine - refer to ATAGI recommendations** (Immunisation Resource)

Appendix 4: Cardiac disease

The below recommendations are to avoid the uncertainty of the aetiology of a fever immediately before or after a procedure:

- Children/infants with Congenital Heart Disease (CHD) who are well, should be immunised at the normal times.
- If a child/infant is unwell, the cardiologist will advise when the child can be safely immunised.
- For children/infants for whom a cardiac surgical or catheter procedure is planned, immunisation should not be carried out within two weeks before the procedure.
- For children/infants after cardiac surgery it is advised to wait for one-month post operation if the child is well.
- For those children whose postoperative course has been complicated, it is advisable to consult the cardiologist before immunising.

Factors that influence the timing of vaccines before surgery include:

- The chance of fever in the 2 days following immunisation from many killed vaccines (eg. DTPa, Hib, Hep B).
- The chance of delayed fever and rash up to 2 weeks after MMR.
- The chance of delayed fever and rash up to 4 weeks after varicella vaccine.

Factors that influence the timing of vaccines after surgery include:

- The chance of a vaccine associated fever complicating post-operative management.
- The timing of MMR and varicella vaccine after whole blood transfusions given in surgery.

For information on patients who have received solid organ transplant i.e. heart/lung, see Appendix 13.

For information on vaccination in patients who have recently received immunoglobulin or blood products (live vaccinations need to be delayed by various intervals) see Appendix 12

Appendix 5: Haematological disorders

Immunisations should be discussed with the Consultant Haematologist before administration.

Patients receiving anticoagulant therapy may develop haematomas at the injection site. Vaccination can be delayed if the duration of therapy is only short. Patients on long-term anticoagulation should have their vaccinations given by deep subcutaneous injection, particularly if INR was >3.

In patients with haemophilia, intramuscular (IM) vaccine administration should be avoided because of the risk of intramuscular haematoma. Vaccinations should be given by deep subcutaneous injection. Firm pressure should be applied to the site for 5 - 10 minutes post administration and the site should not be rubbed. Parents/carers and/or patients should be advised of the possibility of haematoma formation. Ice and immobilisation may be used in the case of a small haematoma. Vaccines given SC that are usually recommended to be given IM can have a diminished immune response and additional doses may be required. Hepatitis B surface antibodies (anti-HBs) should be checked. Vaccination at the time of factor administration should be avoided (especially during the first 50 exposure days) because of the risk of inhibitor formation*.

For instruction on vaccination in patients who have recently received immunoglobulin or blood products (live vaccinations need to be delayed by various intervals) see Appendix 12

**This recommendation is local policy at CHW and contradicts the recommendations in the Australian Immunisation Handbook*.

Appendix 6: High-dose corticosteroid treatment

- Before commencement of immunosuppressive therapy i.e. corticosteroids, if time is available, administration of routine vaccines due at this time is recommended. In some cases where prolonged immunosuppressive therapy is anticipated, it may be possible to administer vaccines ahead of the recommended schedule age. In these cases discussion with the immunisation service can assist.
- Significant immunosuppression results from treatment with corticosteroids at a dose equivalent of 2mg/kg/day of prednisolone for more than 1 week or 1mg/kg/day for more than 4 weeks. In such patients, no live vaccines (no MMR, MMR-V, varicella, BCG) should be given for at least 1 month after the completion of the course of corticosteroids. This applies both to ACTH/Synacthen depot and to oral prednisolone.
- Immunisation with DTPa, hepatitis B, pneumococcal and Hib vaccines should occur as per normal protocols.
- Infants on high dose steroids can be given oral rotavirus vaccines at the recommended ages of 2 and 4 months of age. Catch up doses beyond this age are not recommended.
- It is safe and recommended for siblings to receive all immunisations, including live vaccines (MMR, varicella, rotavirus).
- Annual influenza vaccine is recommended for those on high dose steroids or with impaired immunity
- Seroconversion to vaccination is less reliable in children on long term high-dose corticosteroids. It may therefore be appropriate to consider assays of antibody titres in such children subsequent to cessation of immunosuppressive medications and completion of immunisations. In such cases, antibodies to MMR, varicella, tetanus and diphtheria can be analysed. Antibody assays after pertussis vaccination are difficult, expensive and not normally recommended
- Children who are exposed to measles or varicella within six months of completion of therapy with high-dose corticosteroids should be considered for immunoglobulin prophylaxis. The local Public Health Unit can assist with further advice on the appropriate management of these children.

Appendix 7: HIV/AIDS patients

Always consult with the child's Immunologist before giving any vaccines to a child with HIV infection. However, generally speaking, vaccination schedules for HIV-infected patients should be determined by the patient's age, degree of immunocompromise ($CD4^+$ count) and the risk of infection.

The table below (Table 3.3.4, AIH) gives guidance on level of immunocompromise based on age-specific $CD4^+$ counts and percentage of total lymphocytes:

	Age					
	<12 months		1-5 years		≥ 6 years	
Category	$CD4^+$ per microlitre	%	$CD4^+$ per microlitre	%	$CD4^+$ per microlitre	%
No evidence of immunocompromise	≥1500	≥25	≥1000	≥25	≥500	≥25
Moderate immunocompromise	750-1499	15-24	500-999	15-24	200-499	15-24
Severe immunocompromise	<750	<15	<500	<15	<200	<15

Live attenuated vaccines

- Rotavirus vaccines appear to be safe and immunogenic in HIV-infected but clinically stable children, although there is limited data available on its use for these patients.
- MMR vaccine should be routinely given to HIV-infected children in a 2-dsoe schedule at 12 months and 18 months unless the child has a CD4+ count of <750 per microlitre.
- Varicella vaccine may be given to HIV-infected children ≥12 months who are asymptomatic (data on efficacy and safety are limited for these patients). The combination MMRV vaccine is not recommended for use in HIV-infected patients. Give 2 doses, at least 3 months of a monovalent varicella vaccine in children with an age-specific CD4+ count of ≥15%.

Inactivated (non-live) vaccines

- Diphtheria-tetanus-pertussis (DTPa/dTpa), Hib and IPV vaccines can be given according to the routine schedule.
- Pneumococcal disease (respiratory and invasive) is a frequent cause of morbidity in HIV-infected children. Booster doses should be given according to the AIH recommendations (Pneumococcal chapter, Part 4 Immunisation Resource).
- Annual influenza vaccination is recommended in all HIV-infected children (≥6 months of age). In those patients who are immunocompromised and in children <10 years of age, 2 doses, administered a minimum of 4 weeks apart, are recommended the first time influenza vaccine is received.

Appendix 8: Neurological disease

A family history of epilepsy or other familiar neurological disorders is not considered to be a contraindication to immunisation. In some instances it may be advisable not to give vaccines which contain pertussis to infants or children with active or progressive neurological disease as any deterioration in the child's condition may be inappropriately attributed to the vaccine. Pertussis-containing vaccines do not cause infantile spasms or epilepsy, therefore vaccination of children with stable neurological conditions is recommended. .

Immunoglobulin

Intravenous immunoglobulin provides passive immunity to various infections and is not inherently immunosuppressive. However in those patients on regular IVIG responses to live viral vaccines, (i.e. MMR and varicella) may be reduced. Passive immunity to measles is likely to be conferred by IVIG therapy but it may be advisable to assay measles IgG levels three months after the completion of IVIG treatment. It is recommended that MMR, MMRV or varicella vaccines should NOT be given until >9 months after receipt of normal human immunoglobulin (dose: 300-400mg IgG/kg).

Appendix 9: Oncology patients

General Oncology patients

During chemotherapy and for 6 months following completion of chemotherapy, patients can receive ***inactivated*** vaccines according to their normal schedule of vaccination and annual influenza immunisation.

The immune response is likely to be suboptimal however the vaccines are safe to administer.

Vaccines should not be administered during times of severe neutropenia (absolute neutrophil count <0.5 x 10^9/L), to avoid causing an acute febrile episode.

DO NOT give live attenuated vaccines including BCG, MMR, zoster and varicella to patients receiving immunosuppressive therapy and/or have poorly controlled malignant disease.

Household and other close contacts of the immunosuppressed patient should be fully vaccinated according to current recommendations for their age. Annual influenza vaccination is highly recommended for all household contacts (≥6 months of age). The use of live attenuated viral vaccines in contacts of immunosuppressed patients (MMR, MMRV, varicella and rotavirus vaccines, where indicated) is safe and strongly recommended to reduce the likelihood of contacts passing on infection. There is a small risk of transmission of the rotavirus vaccine virus. Hand washing and careful disposal of soiled nappies is recommended to minimise transmission.

Immunisation at completion of chemotherapy for non BMT patients

All patients will benefit from the single booster doses of the vaccines listed below if they are well and in remission 6 months after completion of therapy. For the majority of vaccines listed below, serology testing does not need to be done before or after vaccination, unless there are particular concerns regarding the patient's immune status.

If blood products or immunoglobulins have been administered as part of treatment please refer to Appendix 12 for information on when live attenuated vaccines (MMR, MMRV or varicella vaccines) should be administered.

- Single dose of DTPa-containing vaccine
  - Infanrix hexa (diphtheria/tetanus/pertussis/Hib/polio/hepatitis B) if <10 years of age
  - Boostrix (adult diphtheria/tetanus/pertussis), Boostrix IPV (adult diphtheria/tetanus/pertussis/polio) or ADT booster (adult diphtheria/tetanus) if >10 years of age
- Single dose of MMR*
- Single dose of IPV and hepatitis B (if not given in combination above)
- Single dose of Prevenar13 (if previous age-appropriate dose/s not received)
- Single dose of Pneumovax23 (refer to section 4.13 of AIH Immunisation Resource)
- Single dose of Meningococcal C vaccine (consider Meningococcal B vaccine - refer to ATAGI recommendations Immunisation Resource)
- 2 doses of varicella vaccine, given 4 weeks apart, if seronegative to varicella-zoster virus

**Measles and rubella antibody status should be checked 6 to 8 weeks after vaccination with MMR or MMRV vaccine. Patients who have not seroconverted should receive a further dose.*

Haematopoietic stem cell transplant (peripheral blood, bone marrow or umbilical cord)

Protective immunity to vaccine-preventable diseases is partially or completely lost following either allogenic or autologous haematopoietic stem cell transplantation (HSCT). Immunocompromise following allogenic transplantation is caused by a combination of immunosuppressive therapy given prior to and after transplantation and graft-versus-host disease (GVHD). Immunity is impaired in autologous HSCT recipients due to high-dose chemotherapy and radiotherapy. In most cases HSCT recipients will recover their immunity more quickly than allogenic transplant recipients.

Separate vaccination schedules are not recommended for autologous and allogenic HSCT recipients and is the same regardless of donor source (peripheral blood, bone marrow or umbilical cord), preparative chemotherapy type (ablative or reduced intensity) or transplant type (autologous or allogenic).

Live vaccines should not be given to patients who remain on immunosuppressive therapy for GVHD.

Vaccination pre transplant - Donor

Donor evaluation is an ideal time to ensure sure the donor's immunisations are up to date. It is also an opportunity, where appropriate, to offer booster vaccination (as listed below) prior to stem cell harvesting as this can elicit improved early antibody responses in transplant recipients vaccinated in the post-transplantation period.

- Single dose of DTPa-containing vaccine
  - Infanrix hexa (diphtheria/tetanus/pertussis/Hib/polio/hepatitis B) if <10 years of age
  - Boostrix (adult diphtheria/tetanus/pertussis), Boostrix IPV (adult diphtheria/tetanus/pertussis/polio) or ADT booster (adult diphtheria/tetanus) if >10 years of age
- Single dose of Hib and hepatitis B (if not given in combination above)
- Single dose of Prevenar13

Note:

1. Although dead vaccines could be given at any time pre-donation, compliance with planned TGA guidelines for donors suggests all immunisations should be completed 4 weeks pre-donation. Any live immunisations should be given at least 4 weeks before any planned HPC donation.
2. The donor BMT serology set in PowerChart is a minimum set designed to ensure the safety of the donor to donate. Other serology testing may be indicated depending on the donor's recent or planned vaccinations, or exposure to infections.

Vaccination pre transplant - Recipient

There may be an opportunity to complete standard immunisations, including live vaccines, such as varicella vaccine prior to transplantation (particularly for patients with non-malignant disease). Hepatitis B vaccination is particularly important if the patient will/may receive BM from a Hep B positive donor.

BMT Patient Serology Testing (Order set in PowerChart) includes testing for Hep B, Measles, Rubella and VZ.

The following table (Table 3.3.3, AIH) outlines the recommended schedule for revaccination after transplant, irrespective of previous vaccination history:

Vaccine	Months after HSCT				Comments
	6	8	12	24	
Streptococcus pneumoniae (pneumococcal disease)					
13-valent pneumococcal conjugate vaccine (13vPCV - Prevenar13)	Yes	Yes	Yes	Not needed	See part 4.13 Pneumococcal disease, AIH (Immunisation Resource)
23-valent pneumococcal polysaccharide vaccine (23vPPV - Pneumovax23)	No	No	No	Yes (after 13vPCV)	See part 4.13 Pneumococcal disease, AIH (Immunisation Resource)
Haemophilus influenzae type B					
Hib (Hiberix)	Yes	Yes	Yes	Not needed	
Diphtheria, tetanus, pertussis					
DTPa-containing vaccine for children <10 years (Infanrix hexa or Infanrix IPV) dTpa for those ≥10 years of age	Yes	Yes	Yes	Not needed	For recipients <10 years of age, give all 3 doses as DTPa-containing vaccine For recipients ≥ years of age, give the 1st dose as dTpa, followed by 2 doses of dT. If dT is unavailable, complete vaccination course with dTpa.
Poliomyelitis					
IPV	Yes	Yes	Yes	Not needed	A 3-dose course of inactivated poliomyelitis vaccine is recommended. This can be given as in combination (Infanrix hexa or Infanrix IPV <10 years of age) or dTpa-IPV for >10 year olds
Hepatitis B					
Hepatitis B vaccine	Yes	Yes	Yes	Not needed	
Influenza					
Two doses of influenza vaccine at least 4 weeks apart are recommended for all HSCT recipients receiving influenza vaccine for the first time, with the 1st dose given as early as 6 months after transplant, then a single dose annually thereafter.					

Table continues over page…

Vaccine	Months after HSCT				Comments
	6	8	12	24	
Neisseria meningitidis (meningococcal disease)					
Meningococcal C conjugate vaccine (e.g. Meningitec) (for those <12 months of age)	Yes	No	Yes	Not needed	If HSCT occurred prior to age 12 months, give up to 2 doses of MenCCV, followed by 2 doses of 4vMenCV from 12 months of age (see part 4.10 AIH, Meningococcal disease Immunisation Resource)
Quadrivalent meningococcal conjugate vaccine (4vMenCV - Menactra or Menveo)	Yes	Yes	Not needed	Not needed	Two doses of 4vMenCV are recommended for persons ≥12 months of age (see part 4.10 AIH, Meningococcal disease Immunisation Resource)
Human papillomavirus					
HPV vaccine (Gardasil)			A 3-dose course of 4vHPV vaccine is recommended at intervals of 0, 2 and 6 months. Specific immunogenicity data in this group are not available; better immune responses may be expected at >12 months post transplantation when a greater level of immune reconstitution has been achieved.		Individual recommendations for HPV vaccination in those >9 years of age should be determined by an individual risk assessment (see part 4.6 AIH, Human papillomavirus Immunisation Resource)
Measles, mumps, rubella					
MMR vaccine (Priorix or MMR II)	No	No	No	Yes, 1 or 2 doses separated by a minimum interval of 4 weeks	Give only if the patient is off immunosuppressive therapy, with no cGVHD and with reconstituted cell-mediated immunity. Check serology 4 weeks after 1st vaccine dose. If there is no seroconversion, repeat the dose.
Varicella					
Varicella vaccine (Varilrix)	No	No	No	Yes, 2 doses separated by a minimum interval of 4 weeks	Give to a seronegative patient only if the person is off immunosuppressive therapy, with no cGVHD and with reconstituted cell-mediated immunity.

All staff working with these patients should receive yearly influenza vaccination

Appendix 10: Pre-term Infants

Despite their immunological immaturity, preterm infants generally respond satisfactorily to vaccines. Provided they are medically stable and there are no contraindications to vaccination, preterm infants should be vaccinated according to the recommended schedule at the **usual chronological age, without correction for prematurity**.

The following recommendations are specific for preterm infants depending on their birth weight, precise gestational age and presence of a chronic medical condition(s):

Pneumococcal vaccines

All preterm infants born at <28 weeks gestation are recommended to receive:

- an extra dose of 13vPCV (Prevenar13) at 12 months of age
- a single booster of 23vPPV (Pneumovax23) at 4 - 5 years of age

Hepatitis B vaccine

Low-birth weight preterm newborn infants do not respond as well to hepatitis B-containing vaccines as full term infants. Therefore for low-birth-weight infants (<2000g) and/or infants born at <32 weeks gestation (irrespective of weight) should receive hepatitis B vaccine at birth, 2, 4 and 6 months of age and either:

- measure anti-Hep B at 7 months of age and give a booster at 12 months of age if antibody titre is < 10mLU/mL, or
- give a booster at 12 months of age without measuring the antibody titre

Note: Record in the patient's Personal Health Record ("Blue book") when the next booster is due.

The following precautions and schedule modification should also be considered for preterm infants:

- Immunisation has been associated with an increased risk of apnoea in preterm infants vaccinated in hospital, particularly those still requiring complex medical care and/or with an existing history of apnoea. Although in this setting, apnoea is generally self-limiting, measures should be taken to manage this anticipated AEFI.

Appendix 11: Recent recipients of normal human immunoglobulin (NHIG) and other blood products

The immune responses to live parenteral viral vaccines may be inhibited by normal human immunoglobulin (NHIG). The interval between receipt of NHIG and a live vaccine is dependant on the type and half-life of the immunoglobulin administered (see table below for recommendations).

Patients who have received a blood transfusion, including mass blood transfusions do not need to have any past doses of vaccination repeated. However, following the receipt of ***any*** blood product, including plasma or platelets, an interval of 3 - 11 months should elapse before vaccination with MMR, MMRV or varicella vaccine (see table below). The rationale for this recommendation is that low levels of antibodies present in the blood product may impair the immune response to the live vaccine.

*Recommended intervals between either immunoglobulins or blood products and **measles-mumps-rubella (MMR)**, **measles-mumps-rubella-varicella (MMRV)** or **varicella** vaccination* (Table 3.3.6, AIH Immunisation Resource)

Immunoglobulin/blood product	Route	Dose		Interval (months)
		IU or mL	Estimated mg IgG/kg	
Blood transfusion:				
• Washed RBCs	IV	10mL/kg	Negligible	0
• RBCs, adenine-saline added	IV	10mL/kg	10	3
• Packed RBCs	IV	10mL/kg	20-60	5
• Whole blood	IV	10mL/kg	80-100	6
Cytomegalovirus immunoglobulin	IV	3mL/kg	150	6
HBIG as hepatitis B prophylaxis	IM	100 IU 400 IU	10	3
NHIG (intravenous) for ITP treatment	IV		400	8
NHIG (intravenous) for ITP treatment	IV		1000	10
NHIG (intravenous) for ITP or Kawasaki disease treatment	IV		1600-2000	11
NHIG as hepatitis A prophylaxis	IM	0.5mL (<25kg) 1.0mL (25-50kg) 2.0mL (>50kg)		3
NHIG as measles prophylaxis:		(max. dose 15mL)		
• Standard	IM	0.2mL/kg		5
• Immunocompromised	IM	0.5mL/kg		6
Plasma or platelet products	IV	10mL/kg	160	7
HRIG as rabies prophylaxis	IM	20IU/kg	22	4
Replacement (or therapy) of immune deficiencies (as NHIG [intravenous], various doses)	IV		300-400	9
Rh (D) IG (anti-D)	IM			0
TIG (IM use) for tetanus prophylaxis	IM	250IU (given within 24 hours of injury) 500IU (>24 hours after injury)	10 20	3
ZIG as varicella prophylaxis	IM	200IU (0-10kg) 400IU (11-30kg) 600IU (>30kg)		5

Appendix 12: Solid organ transplant recipients

Vaccination prior to transplant

- Factors that influence the timing of vaccines include:
  - Children with liver or renal disease who require transplantation have major risk factors for the development of a range of infectious diseases. Ideally these children should be immunised prior to transplantation, however due to the young ages at which some of them are transplanted, this may not be possible.
  - The level of immunosuppression induced by pre-transplantation preparation.
  - The chance of fever in the 2 days following immunisation of many killed vaccines (eg. DTPa, Hib, Hep B and for renal patients, IPV)
  - The chance of delayed fever and rash up to 2 weeks after MMR
  - The chance of delayed fever and rash up to 4 weeks after varicella vaccine
- Where possible, children undergoing transplantation should be vaccinated well before surgery however, at the appropriate age, the following may be administered up to:
  - **2 days before surgery**: DTPa, Hep B, IPV, Influenza vaccine, Meningococcal C and Pneumococcal vaccine.
  - **2 weeks before surgery**: MMR
  - **6 weeks before surgery**: Varicella

Vaccination after transplant

- Live vaccines e.g. MMR, MMRV, VZV are contraindicated in transplant patients
- Any vaccination should be delayed for 12 months following liver transplantation
- Routine vaccinations as per the NSW Immunisation Schedule should be given according to age with the addition of hepatitis A vaccine and annual influenza vaccination

The following table (Table 3.3.2 from AIH) contains the recommendations for vaccinations for solid organ transplant recipients:

Vaccine	Vaccines recommended before transplantation		Vaccines recommended after transplantation, if not given beforehand		Comment
	Child (0–18 years)	Adult (≥19 years)	Child (0–18 years)	Adult (≥19 years)	
***Streptococcus pneumoniae* (pneumococcal disease)**					
13-valent pneumococcal conjugate vaccine (13vPCV)	Yes (aged ≥6 weeks)	Yes	Yes (aged ≥6 weeks)	Yes	Recommendations depend on age. See 4.13 *Pneumococcal disease* and Table 2.1.11 *Catch-up schedule for 13vPCV (Prevenar 13) and 23vPPV (Pneumovax 23) in children with a medical condition(s) associated with an increased risk of IPD, presenting at age <2 years.*
23-valent pneumococcal polysaccharide vaccine (23vPPV)	Yes (≥8 weeks after 13vPCV)	Yes (≥8 weeks after 13vPCV)	Yes (≥8 weeks after 13vPCV)	Yes (≥8 weeks after 13vPCV)	Recommendations depend on age. See 4.13 *Pneumococcal disease* and Table 2.1.11 *Catch-up schedule for 13vPCV (Prevenar 13) and 23vPPV (Pneumovax 23) in children with a medical condition(s) associated with an increased risk of IPD, presenting at age <2 years.*
***Haemophilus influenzae* type b**					
Hib vaccine	Yes	Not indicated	Yes	Not indicated	If possible, complete vaccination before transplantation.
Diphtheria, tetanus, pertussis					
DTPa-containing vaccine for children <10 years of age dTpa for those ≥10 years of age	Yes	Yes, provided dTpa has not been given in the last 10 years	Yes, if not previously vaccinated	Yes, provided dTpa has not been given in the last 10 years	The primary schedule should be completed before transplantation. For recipients <10 years of age, not previously vaccinated, give all 3 doses as DTPa-containing vaccine. For recipients ≥10 years of age, not previously vaccinated, give the 1st dose as dTpa, followed by 2 doses of dT. If dT is unavailable, complete vaccination course with dTpa. See also catch-up tables for children and adults in 2.1.5 *Catch-up*.
Influenza					
Influenza vaccine	Annual vaccination starting before transplantation for those ≥6 months of age. Two doses of influenza vaccine at least 4 weeks apart are recommended for all SOT recipients receiving influenza vaccine for the first time. Influenza vaccine should be given annually thereafter.				
Poliomyelitis					
IPV	Yes	Yes (see comments)	Yes	Yes (see comments)	Adults who have received a routine course of polio vaccination in childhood are recommended to receive a booster every 10 years if they plan to travel to a polio endemic area or have an occupational risk of polio exposure (e.g. laboratory workers).

Hepatitis B					
Hepatitis B vaccine	Yes	Yes	Yes	Not needed	A high-dose formulation (H-B-Vax II dialysis formulation) is preferred. Alternatively, give single strength Hep B vaccine in each arm at each dosing interval *OR* administer a standard vaccination course, then check HBsAb titres 4–8 weeks following the last vaccine dose. If titres are <10 mIU/mL, repeat the vaccination course.
Influenza					
Two doses of influenza vaccine at least 4 weeks apart are recommended for all HSCT recipients receiving influenza vaccine for the first time, with the 1st dose given as early as 6 months after transplant (see also in the introduction of 3.3.3 *Vaccination of immunocompromised persons* above), then a single dose annually thereafter.					
***Neisseria meningitidis* (meningococcal disease)**					
Meningococcal C conjugate vaccine (MenCCV) (for those <12 months of age)	Yes	No	Yes	Not needed	If HSCT occurred prior to age 12 months, give up to 2 doses of MenCCV, followed by 2 doses of 4vMenCV from 12 months of age (see 4.10 *Meningococcal disease*).
Quadrivalent meningococcal conjugate vaccine (4vMenCV)* (for those ≥12 months of age)	Yes	Yes	Not needed	Not needed	Two doses of 4vMenCV are recommended for persons ≥12 months of age (see 4.10 *Meningococcal disease*).
Human papillomavirus					
HPV vaccine			A 3-dose course of 4vHPV is recommended at intervals of 0, 2 and 6 months. Specific immunogenicity data in this group are not available; better immune responses may be expected at >12 months post transplantation when a greater level of immune reconstitution has been achieved.		Individual recommendations for HPV vaccination in those >9 years of age should be determined by an individual risk assessment (see 4.6 *Human papillomavirus*).
Measles, mumps and rubella					
MMR vaccine	No	No	No	Yes, 1 or 2 doses separated by a minimum interval of 4 weeks (see comments)	Give only if the person is off immunosuppressive therapy, with no cGVHD and with reconstituted cell-mediated immunity. Check serology 4 weeks after 1st vaccine dose. If there is no seroconversion, repeat the dose.
Varicella					
Varicella vaccine	No	No	No	Yes, 2 doses separated by a minimum interval of 4 weeks (see comments)	Give to a seronegative recipient only if the person is off immunosuppressive therapy, with no cGVHD and with reconstituted cell-mediated immunity.

* Any transplant recipient who anticipates travelling may require additional vaccination, such as for meningococcal and hepatitis A disease (see also 3.2 *Vaccination for international travel*).

Appendix 13: Tetanus-prone wound prophylaxis

The definition of a tetanus-prone injury is not straightforward, as tetanus may occur after apparently trivial injury i.e. rose thorn or even with no history of injury. Therefore, all wounds other than clean, minor cuts are to be considered 'tetanus-prone'.

Some wounds are more likely to favour the growth of tetanus organisms: compound fractures, bite wounds, deep penetrating wounds, wounds containing foreign bodies (especially wood splinters), wounds complicated by pyogenic infections, wounds with extensive tissue damage (e.g. contusions or burns) and any superficial wound obviously contaminated with soil, dust or horse manure (especially if topical disinfection is delayed more than 4 hours).

Re-implantation of an avulsed tooth is also considered to be tetanus-prone.

Please refer to the table on the following page for the appropriate prophylaxis recommended for tetanus-prone wound management according previous vaccination and age.

Further information is available in Part 4 of The Australian Immunisation Handbook (Immunisation Resource).

VACCINE RECOMMENDATIONS FOR TETANUS-PRONE WOUNDS IN EMERGENCY DEPARTMENTS

The aim of management is to prevent tetanus and complete a primary course of vaccination if required

For further information and advice refer to the Australian Immunisation Handbook (AIH), pages 402-404 or contact the Immunisation CNC on 51414 or pg 7007

<10 years - recommended primary vaccination course is with Infanrix hexa® at 6 weeks, 4 & 6 months of age plus a booster dose of Infanrix IPV® at 4 years of age

≥10 years - recommended primary vaccination course is 3 tetanus containing vaccines (at least 1 month apart) plus a booster dose at 10 & 20 years after the primary course

STEPS

1. Check *documented* history (parental recall is **not** reliable) of tetanus containing vaccinations
2. Manage as per table 1 - if primary course remains incomplete refer patient to immunisation provider e.g. local GP
3. Administer age appropriate vaccines as per table 2

Table 1: Management of tetanus-prone wounds

History of tetanus containing vaccines	Time since last dose	Type of wound	DTPa-combinations, dT, dTpa as appropriate	Tetanus immunoglobulin (TIG) Obtain from pharmacy or the Australian Red Cross ph: 9229 4444
≥ 3 doses	< 5 yrs	All wounds	**NO**	**NO**
≥ 3 doses	5 - 10 yrs	Clean minor wounds	**NO**	**NO**
≥ 3 doses	5 - 10 yrs	All other wounds	**YES**	**NO**
≥ 3 doses	> 10 yrs	All wounds	**YES**	**NO**
< 3 doses or uncertain	N/A	Clean minor wounds	**YES**	**NO**
< 3 doses or uncertain	N/A	All other wounds	**YES**	**YES** TIG dose = 250 units, give IMI, 21g needle, ASAP after injury. If ≥ 24h have elapsed, give 500 units

Table 2: Age appropriate vaccines available - note that the dose of tetanus vaccine for children <8 years is **higher** than in adult vaccines

Age group	**Infanrix hexa®** **DTPa-hepB-IPV-Hib** 	**Infanrix IPV®** **DTPa-IPV** 	**Boostrix®** **dTpa**	**ADT Booster®** **dT**
	Diphtheria, tetanus, pertussis, hepatitis B, poliomyelitis, Haemophilus influenzae type b	Diphtheria, tetanus, pertussis, poliomyelitis	Diphtheria, tetanus, pertussis	Diphtheria, tetanus
<10 years	✓	✓	✗	✗
≥ 10 years	✗	✗	✓	✓

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