

<b>Section 6:</b>	Vaccine Administration Standards	<b>Standard #:</b> 06.100
<b>Created by:</b>	Province-wide Immunization Program Standards and Quality	
<b>Approved by:</b>	Province-wide Immunization Program Standards and Quality	
<b>Approval Date:</b>	July 1, 2013	<b>Revised:</b> January 1, 2020

### ***Preamble***

Alberta Health Services (AHS) Province-wide Immunization Program Standards and Quality, Population, Public and Indigenous Health provides Public Health and other partners who administer provincially funded vaccines with ongoing and timely information relating to province-wide immunization program standards and quality. These standards are based on currently available evidence based information, Alberta Health (AH) policy, and provincial and national guidelines. Immunizers must be knowledgeable about the specific vaccines they administer.

### ***Background***

Proper vaccine administration is a key element to ensuring the optimal safety and effectiveness of vaccines. Vaccine administration practices are based on clinical trials that determine the dose, route and schedule for each vaccine to optimize vaccine effectiveness and reduce the risk of local reactions or other adverse events.<sup>17</sup> There may be situations where vaccine administration decisions need to be reviewed and assessed on a case by case basis.

Immunizers should receive educational and competency based training on vaccine administration before immunizing. Professional standards for medication and vaccine administration and federal/provincial/territorial policies and procedures also guide immunization practices.<sup>17</sup> It is the individual immunizer's professional responsibility to ensure they are following these standards.

There are many components in the immunization process including counselling and risk communication, informed consent, assessing if the individual is fit to immunize, reporting of adverse events following immunization, recognition and management of anaphylaxis, immunization documentation etc. These topics will be addressed in detail in other sections of the manual.

### ***Purpose***

The purpose of this Standard is to provide principles and guidelines for the consistent administration of vaccines and biologicals.

### ***Applicability***

This standard applies to all AHS staff providing provincially funded vaccines and biologicals.

## Competency

In November 2008 the Public Health Agency of Canada published the Immunization Competencies for Health Professionals with a goal of promoting safe and competent practices for immunization providers. The following competencies outlined in that document are applicable to this standard:

- Types of Immunizing Agents and Their Composition - Prepares and administers immunization agents correctly.
- Administration of immunizing agents - Prepares and administers immunization agents correctly. This includes knowledge and understanding of techniques to reduce the pain associated with immunization.

## Definitions

**Beyond-use-date** – new expiry date after opening a multi-dose vial. A beyond-use date must never extend beyond the manufacturer's expiry date.

**Manufacturer's expiration date** – expiry date printed on the vaccine/biological by manufacturer. If the expiry date is only a month and year, the last day of the month would be used as the expiry date.

**Infant:** birth up to 12 months of age

**Toddler:** children 1 year of age up to and including 3 years of age

**Preschooler:** children 4 years of age up to and including 6 years of age

**School Age:** children in grade 1 up to the end of grade 12

**Adolescent:** 12 years up to and including 17 years of age

**Adult:** 18 years of age and older

## Section 1: Preparation for Administration of Vaccine and Biological Products

### Standard Precautions:

- Biological products, syringes and needles are considered sterile once manufactured. Aseptic technique must be practiced when preparing these products. All vaccine vial stoppers are to be swabbed prior to use whether they are single dose or multi dose vials. Vial stoppers are not considered to be sterile even if the protective caps are in place.<sup>3</sup>
- Wash hands well using soap and water, or a waterless hand cleaner prior to preparing biological products and between clients.
- Glove use is NOT necessary, unless the immunizer will come in contact with body fluids or the skin on their hands is not intact. Gloves must be changed between clients and hands cleaned before donning new gloves.
- Use separate, sterile safety engineered sharp devices (SEDS) for each injection.
- Engage the safety mechanism on needles immediately following administration of the biological product.
- Immediately discard the syringe/needle into a sharps container that is within arm's reach and easy view of the immunizer, but placed safely away from clients (and children).
- Never recap needles or empty used needles/syringes from one sharps container to another. Discard cotton balls into the regular garbage. If saturated with blood, dispose into sharps container.
- Sharps containers should be locked and changed when 2/3 full to avoid overfilling/packing of contents.
- When transporting sharps containers that are less than 2/3 full (either within the clinic setting or when using for off-site clinics), snap them closed securely. They can be reopened later for continued use. Excess pressure on containers should be avoided during transport.

## **Product Preparation:**

- If immunizing more than one individual at the same clinic appointment, it is recommended to draw up and administer all the immunizations for the one individual before proceeding to the next.
- Check the expiry date of all products being administered, including diluent. Expired vaccine and diluent should never be administered. If only the month and year are provided for the expiry date, the vaccine can be used to the end of that month.
- Vaccine should be withdrawn from the vial by the immunizer administering the vaccine.
- Different vaccines must never be combined in the same syringe.
- Disposable syringes are not meant for storage of vaccines and biologicals. With the exception of vaccines or biologicals supplied preloaded by the manufacturer, syringes should not be preloaded due to uncertainty of vaccine stability in disposable syringes, the risk of contamination, an increased potential for vaccine administration errors and vaccine wastage.<sup>1</sup>
- Live vaccines should be reconstituted and drawn up just prior to administration, as they are unstable and begin to deteriorate immediately after reconstitution. Refer to the product monograph for specific instructions.
- The needle should only be changed between drawing up and administering the vaccine/biological if the needle is:
  - bent
  - damaged
  - contaminated
- For viscous products it may be necessary to use blunt fill or larger bore needles. In this situation, it is necessary to change the needle as blunt fill or large bore needles should not be used to administer vaccines.
- Express air only until a drop of fluid is visible on tip of needle.

## ***Section 2 - Preparation Instructions***

### **General:**

- When preparing any biological product, consider the “7 Rights” of immunization:
  - Right product (e.g., biological, vaccine and diluents)<sup>5,17,39</sup>
  - Right client
  - Right dose
  - Right time (date and interval)
  - Right route, needle length and technique
  - Right reason (e.g., meet vaccine eligibility criteria)
  - Right documentation
- Thoroughly clean hands using soap and water or a waterless hand cleaner.
- Prepare necessary materials (e.g. single use, disposable sterile syringe/needle, vaccine, diluent if required, 70% isopropyl alcohol, sharps container, supplies for the management of anaphylaxis)
- Check the name, dosage and expiry date of the vaccine/biological and diluent three times in relation to the assessment of the client and their immunization history<sup>5</sup>
  - When removing from the fridge or biological cooler
  - When drawing up/reconstituting the product
  - Before administration
- Visually inspect the vaccine/biological to ensure it appears as expected, per monograph, and there is no particulate. Do not administer if there is particulate that does not dissolve.
- Shake or roll container (according to manufacturer’s instructions) before loading syringe and administering.
- Only use diluent supplied by the manufacturer for the same manufacturer’s vaccine product.<sup>10</sup>
  - Not all diluents are just sterile water and may contain a variety of components: stabilizers, bactericides, pH buffers, or chemicals to assist in dissolving the vaccine.
  - Diluent supplied for a vaccine may be a specific volume.

## **Vials:**

- Thoroughly clean hands using soap and water or a waterless hand cleaner.
- Remove the cap from a single dose vial only after the vaccine has been confirmed and a fit to immunize assessment has been completed. If the cap has been removed from a single dose vial, the vaccine must be used by the end of the day or it is to be discarded.
- For a new vial, uncap the vaccine vial, clean the rubber stopper of the vial with an alcohol swab and allow to dry as some vaccine can be inactivated by alcohol.
- For a previously opened multi-dose vial, wipe off the rubber stopper with an alcohol swab and allow to dry before subsequent uses.
- Gently shake or roll the vial immediately before removing each dose to ensure that the contents are fully dispersed.
- For products that do not require reconstitution, draw into the syringe a volume of air equal to the quantity of biological product to be removed and inject into the vial.
  - The exception to this would be purified protein derivative (PPD) – it is not recommended to inject air into the vial prior to drawing up as this can cause oxidation of the biological and leakage from the vial stopper.
- For lyophilized products that require reconstitution, inject air equal to the volume of diluent into the diluent vial. Draw up the diluent, and introduce it down the side of the vaccine vial, not directly into the vaccine powder, to avoid foaming or potential denaturing of the vaccine protein. Mix the reconstituted vaccine with a careful swirling motion until a uniform suspension is achieved prior to administration, unless otherwise instructed by the manufacturer. There is no need to add air to the vial containing the lyophilized product.
- Place the vial right side up and insert the needle through the centre of the rubber stopper.
- Slowly inject air or diluent from the syringe, except for PPD.<sup>11</sup>
- Hold the vial upside down and withdraw the required quantity of biological product into the syringe. Refer to vaccine specific biological page for required volume.
- To assist with withdrawal of product from inverted vials, ensure end of the needle is below fluid level and situated in the groove of the vial stopper.<sup>5,6,7,12</sup>
- Remove the needle from the vial and expel the air bubble(s).
- Never detach the needle from the syringe and never leave the needle in a multi-dose vial to draw up further doses.
- Once vaccine has been withdrawn from a vial, it cannot be returned into the vial.
- For situations where the vaccine/biological dose required necessitates using more than one vial (e.g., rabies immune globulin) multiple vials can be combined into the same syringe as long as the lot number is the same. If lot numbers are different then different syringes and different injection sites must be used. This does not apply to multi-dose vials (e.g., influenza vaccine) where vaccine/biological will be administered to multiple individuals.
- If entering a multi-dose vial for the first time, record the day opened on the vial using yyyy= 4 digit year, Mon= 3 letter month, dd= 2 digit date.
- Once vaccine has been withdrawn from a multi-dose vial, immediately return it to temperature controlled storage container.
- Record on client health record. Use the lot number on box.

### **Ampoules:**

- Thoroughly clean hands using soap and water or a waterless hand cleaner.
- Tap the ampoule lightly to ensure that the contents are in the lower part of the ampoule.
- Wrap an alcohol swab around the neck of the ampoule. Snap the top off by breaking it away from your body.<sup>12</sup>
- Discard the neck of the ampoule in the sharps container.
- Withdraw the contents of the ampoule with a sterile syringe and needle.
- Filter needles are not indicated routinely for drawing up biological products or epinephrine from glass ampoules<sup>5</sup>. The reasons are as follows:
  - Vaccines and biologicals are supplied in small ampoules and fewer glass shards are introduced into the ampoule contents when opening this size of ampoule.<sup>6, 7</sup>
  - **Exception-** Ampoules larger than 1 mL have an increased risk of producing glass shards; therefore filter needles are recommended in these situations (e.g., Synagis®)
  - Fewer shards will potentially be drawn into smaller bore needles used for immunization<sup>6</sup> (e.g., needles 23 G, 25 G, 27 G)
  - Using an alcohol swab when opening the ampoule will reduce the risk of glass shards entering the ampoule contents
  - Filter needles could potentially filter out particulate matter such as adjuvants or other active ingredients, making a vaccine less effective.<sup>5</sup>
- Do not add air to the ampoule.
- Expel air bubble(s) from the syringe.
- Discard the ampoule in a sharps container.
- Record on client health record. Use the lot number on box.

### **Prefilled Syringe:**

- Thoroughly clean hands using soap and water or a waterless hand cleaner.
- Ensure lot number on syringe and box match as syringe is discarded after administering vaccine.
- Shake or rotate syringe according to biological product monograph instructions.
- Grasp needle-cap firmly near end where needle attaches to syringe.
- For syringes with needle attached, rotate rubber needle-cap slowly until loosened. Slowly slide off the cap.
- For separate needles and syringes, firmly attach the needle onto the syringe with a push and clockwise twist.
- Use caution with products that have special safety engineered shields.
- Slowly eject the air bubble. If plunger is hard to push, hold syringe in one hand, and slowly rotate plunger clockwise (looking down on end of plunger) while pushing it into the barrel. (NOTE: Rotating plunger counter-clockwise may cause plunger to detach).
- If a needle has been placed on a preloaded syringe, the sterile seal has been broken and the vaccine must be used or discarded in the time noted in the product monograph.
- Discard syringe and the attached needle in sharps container.
- Record on client health record. Use the lot number on box.

### **Oral Applicator:**

- Thoroughly clean hands using soap and water or a waterless hand cleaner.
- Ensure lot number on syringe and box match as syringe is discarded after administering vaccine.
- Shake or rotate oral applicator according to biological product monograph instructions.
- Remove protective cap from oral applicator.
- Once the oral vaccine has been administered discard the applicator in the sharps container.
- Record on client health record. Use lot number on box.

## **Section 3: Injection Site, Volume and Equipment**

### **Choose an injection site:**

Use clinical judgment to select an appropriate injection site and needle size. This assessment is based upon:

- Individual's age
- Volume of biological product to be administered
- Viscosity of biological product
- Adequacy of muscle mass
- Recommended route of administration for the biological
- Individual's unique characteristics e.g., mastectomy, available limbs
- Number of products to be administered

After selecting the appropriate injection site, inspect the skin's surface over the site.

- Do not inject vaccine where there are bruises, scars, inflammation, masses, edema or tenderness as there might be interference with absorption of the biological.
- Both intramuscular (IM) and subcutaneous (SC) vaccines may be given through a tattoo.

The literature contains varying recommendations regarding the maximum number of injections and maximum volume of all injections to be given into one muscle. The decision regarding number of injections and maximum volume to be administered should be based on the age and assessed muscle mass of the individual.<sup>5</sup>

If multiple parenteral injections are required, use separate anatomic injection sites (different limbs) whenever possible. If multiple injections in the same limb are required, separate the injection sites by at least 2.5 cm (1 inch). In individuals where there is insufficient deltoid muscle mass, use the anterolateral thigh muscle.<sup>17</sup> Use of separate limbs or adequate separation assists in differentiation of local adverse events following immunization.<sup>5</sup>

Do not administer active immunizing agents into the gluteal muscles due to the risk of reduced immunogenicity from poor absorption if the injection does not reach the muscle.<sup>17</sup>

### **Choose a Route:**

Vaccines should be given by the route recommended by the manufacturer because data regarding safety and efficacy of alternate routes are limited.

- When a vaccine monograph notes an immunization can be given by either SC or IM, the IM route is preferred.<sup>13, 14</sup>
- Alternate routes may be considered in special circumstances. Consultation with an MOH or designate is required.
- If a vaccine has been inadvertently given by a route other than that recommended by the manufacturer, contact the MOH or designate for recommendations for follow-up.

An appropriate gauge and length of needle must be chosen to ensure that the vaccine is deposited within the proper tissue layer to decrease the chance of local adverse events and ensure efficacy.

In general, vaccines containing adjuvant are administered IM to avoid irritation, induration, skin discoloration, inflammation, and granuloma formation. Most inactivated vaccines are given via the IM route, with a few exceptions.

Needle length should be sufficient to reach the largest part of the muscle for IM injections to prevent the biological from being deposited into subcutaneous tissue and reduce the risk of abscess formation. Use of longer needles has been associated with less redness and swelling at the immunization site than occurs with shorter needles.<sup>5</sup>

**Table 1:** Injection Site, Age, Volume, and Equipment Guidelines <sup>5, 15, 16, 17, 18</sup>

Route	Site	Age	Needle Size/Length <sup>a</sup>		Volume per Muscle <sup>b</sup>
Intramuscular (IM)	Vastus Lateralis	Younger than 12 months	25G	1"	0.5 – 1.0 mL
		12 months to preschool	25G	1"	0.5 – 1.5 mL
		School age to 15 years	25G	1" – 1½"	0.5 – 4.0 mL
		15 years and older	25G	1" – 1½"	Up – 5.0 mL
	Deltoid	12 months and older	25G	5/8" – 1"	0.5 – 1.0 mL
		School age to 15 years	25G	1"	0.5 – 1.5 mL
		15 years and older	25G	1" – 1½"	0.5 – 2.0 mL
	Ventrogluteal <sup>c</sup> (immunoglobulin products only)	Preschool age and younger <sup>d</sup>	22G	1"	0.5 – 1.5 mL
		School age to 15 yrs	22G	1" – 1½"	0.5 – 2.5 mL
		15 yrs. and older	22G	1½"	2.0 – 5.0 mL
Subcutaneous (SC)	Usually given into the subcutaneous tissue of the upper outer triceps area of the arm. Other sites may be used if needed (e.g., antero-lateral thigh). <sup>e</sup>	All ages	25G	5/8"	0.5 – 1.0 mL
Intradermal (ID)	Usually the flexor surface of the forearm, although mid-deltoid (e.g., for rabies vaccine given ID) may be used.	All ages	26G - 27G	3/8" - 5/8"	0.1 mL

<sup>a.</sup> Needle length may need to be adjusted based on nurse assessment of muscle size and subcutaneous tissue present. The following technique may help assess needle length for IM injections for clients who fall outside of the average range for weight and height or muscle mass.

- If using the deltoid or vastus lateralis muscle grasp the muscle between thumb and index finger.
- One half the distance between the thumb and index finger will be the approximate length of the needle required to penetrate that muscle.<sup>5</sup>
- Make sure to also take the thickness of the adipose tissue into account.

- b. Adjust maximum volume according to muscle size.
- c. The dorsogluteal site is only recommended in adolescents and adults when the deltoid, vastus lateralis and ventrogluteal sites bilaterally have had maximum volume of an immune globulin preparation injected and an additional volume still needs to be administered. This is due to the possibility of sciatic nerve injuries when the injection is done in the dorsogluteal site. Gluteal muscles should never be used for active vaccine administration.
- d. For the majority of infants the vastus lateralis is the recommended site for injection because it provides a large muscle mass. In extremely rare situations where the gluteal muscle must be used, care should be taken to define the anatomic landmarks for the ventrogluteal site to avoid injury of the sciatic nerve.
- e. For infants under 12 months of age, the usual site for SC administration of vaccine is the subcutaneous tissue of the anterolateral thigh.

### **Special Considerations:**

#### **Limb Integrity:**

Do not administer an immunizing agent in a limb that is likely to be affected by a lymphatic system problem, such as lymphedema or mastectomy with lymph node curettage. Vastus lateralis is an alternative site for all ages. Individuals who present with A-V fistula (vascular shunt for hemodialysis) and those who have had mastectomies with lymph node curettage, axilla lymphadenectomies, limb paralysis and upper limb amputations may have short term or long term circulatory (e.g., lymphatic systems) implications that may impair vaccine absorption and antibody production.

#### **Bleeding Disorders:**

Individuals with a bleeding disorder or who are receiving anticoagulant therapy may develop hematomas in IM injection sites. When any intramuscularly administered vaccine is indicated for a patient with a bleeding disorder:

- Only one injection per muscle mass should be administered at each visit.
- A 23-gauge or finer needle should be used and the vaccine should be injected slowly.
- Apply firm pressure to the site for at least 5 to 10 minutes after injection.
- Stabilization of the limb is of utmost importance and will reduce the risk of a hematoma.
- The site should not be rubbed or massaged.
- Instruct client/parent to monitor limb and to report any concerns to their hematologist immediately.
- Individuals receiving long-term anticoagulation with either warfarin or heparin are not considered to be at higher risk of bleeding complications following immunization.
  - They may be safely immunized through either the IM or subcutaneous (SC) route as recommended for the vaccine product, without discontinuation of their anticoagulation therapy.
  - Give IM vaccines using a small gauge needle (23 gauge or smaller) and ask the client to apply firm pressure to the injection site for 5 to 10 minutes.
  - There is a lack of evidence on whether there is an increased risk of bleeding complications following immunization with the newer types of anticoagulants, such as antiplatelet agents, but there is no reason to expect that there is a greater risk of bleeding complications than with other anticoagulants.



## Section 4: Injection Technique

Vaccines and biologicals are injected by intradermal (ID), intramuscular (IM) or subcutaneous (SC) routes. The following are guidelines for each injection route.

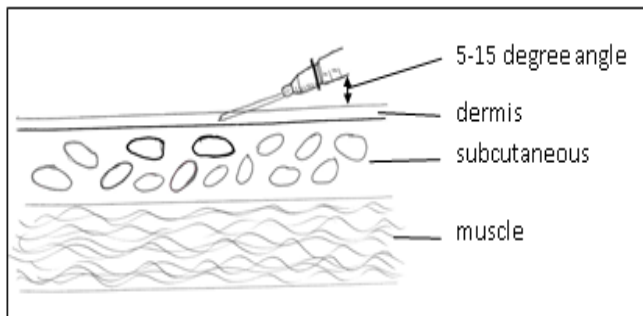
Do not massage the area after injection, as this can damage the underlying tissue or force vaccine up the needle track.

Application of “band-aids” is not routinely recommended and may pose potential risks such as pain when band-aid is removed, and may be a potential choking hazard for young children. Reactions to band-aids may also be confused as a reaction to the vaccine. Parents requesting band-aids may be accommodated.

### Intradermal Injection Technique <sup>2, 15, 19</sup>

- Thoroughly clean hands using soap and water or a waterless hand cleaner.
- Choose an area of skin that is intact with good integrity.
  - Inspect for any pre-existing lumps, sebaceous cysts or scars<sup>16</sup>.
  - EMLA cream is not to be used for tuberculin testing.<sup>19</sup>
- Thoroughly clean hands using soap and water or a waterless hand cleaner again.
- Draw up vaccine or biological per product instructions.
- Cleanse the injection site with new alcohol swab by circling from the centre of the site outward for 1-2 inches. Let dry.
- Ensure the safety activator is on the same side of the syringe as the needle bevel.
- Stretch the selected area of skin taut between the thumb and forefinger.
- Hold the syringe with the needle bevel facing up and parallel to the site.
- Slowly insert the needle, in-between your thumb and forefinger, at a 5 – 15 degree angle

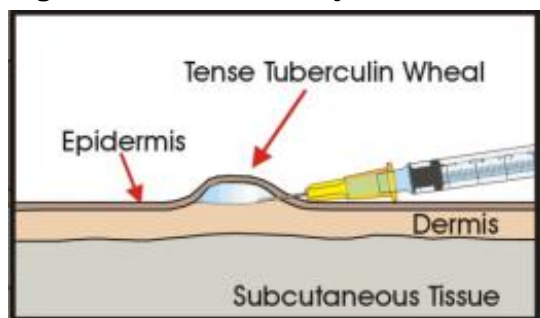
**Figure 1: Intradermal Injection**<sup>33</sup>



Alberta Health Services: Public Health Central Zone.  
“Administration of Biological Products”. Revised 06-Jul-2010.

- Release the stretched skin and hold the syringe in place with your thumb and forefinger. Maintain stability of limb and needle at all times.
- Grip the flange of the syringe between the first and middle fingers. Slowly depress the plunger. **No aspiration.**
  - You should feel fairly firm resistance during depression
  - A tense, pale wheal or “bleb” should be seen. If not, re-administer immediately in opposite arm site.

**Figure 2: Intradermal Injection**



Taken from  
[http://www.cdc.gov/nchs/data/nhanes/nhanes\\_11\\_12/TBSkinTestManual.pdf](http://www.cdc.gov/nchs/data/nhanes/nhanes_11_12/TBSkinTestManual.pdf)

**Figure 3: Image of Tuberculin Wheal**



Image retrieved from Saskatchewan Immunization Manual  
May 10, 2013 <http://www.health.gov.sk.ca/sim-chapter8>

- Remove the needle, activate the safety mechanism, and discard into sharps container.
- Use a cotton ball to lightly blot any blood. Do not press down or massage area. Bandages should not be used.
- Once all documentation is complete, discard all empty vials into the sharps container.

### **Intramuscular Injection Technique** <sup>1, 13, 16, 20, 28</sup>

- Thoroughly clean hands using soap and water or a waterless hand cleaner.
- Expose the area for injection to be able to landmark properly.
- Thoroughly wash hands using soap and water or a waterless hand cleaner.
- Select the appropriate syringe and needle for the IM site chosen.
- Draw up vaccine or biological per product instruction.
- Cleanse the injection site with new alcohol swab by circling from the centre of the site outward for 1-2 inches. Let dry.
- Bunch or squeeze the muscle between the non-dominant thumb and forefinger before injection to increase muscle mass and minimize the chance of striking bone. This bunching method is most commonly used for pediatric and geriatric or emaciated clients with reduced muscle mass when using a 1" needle.<sup>7</sup>
- Alternatively place your thumb and forefinger on either side of the site of injection and press the area flat. This method is recommended when nursing judgement has deemed a 5/8" needle appropriate for use based on client assessment.
- Insert the needle at an angle of 90° to the skin to the desired depth.<sup>1, 9, 11, 16, 18, 20, 21</sup>

- Aspiration is not necessary; however, if blood is noticed in the hub of the syringe, the needle should be withdrawn immediately and the needle and syringe including vaccine contents discarded. A new needle and syringe with vaccine will need to be prepared.<sup>1, 7, 11, 16, 17, 29, 30</sup>
- Administer the vaccine<sup>29</sup> while maintaining stability of the limb and needle at all times.
- Rapid injection is not recommended for more viscous biological products such as immune globulin products.
- Remove the needle quickly.
- Activate the safety mechanism and discard into sharps container.
- Use a cotton ball and apply pressure to the injection site.
- Use of adhesive bandages is not routinely recommended.
- Once all documentation is complete, discard all empty vials into the sharps container.

**Landmarking:**

**1. Vastus lateralis – medial lateral portion of the thigh<sup>21</sup>**

- Draw an imaginary line from the greater trochanter to the lateral femoral condyle of the knee. (Figure 4)<sup>22</sup>
- The middle third portion is a safe area for injection (Figure 4).
- This site is recommended for infants up to 12 months of age and older when necessary (immune globulin products under 3 years of age or multiple injections for any age)<sup>1</sup>
- Needle is to be inserted at a 90° to the skin (toward the bone) (Figure 5)<sup>23</sup>

**Figure 4: Landmarking for Vastus lateralis**

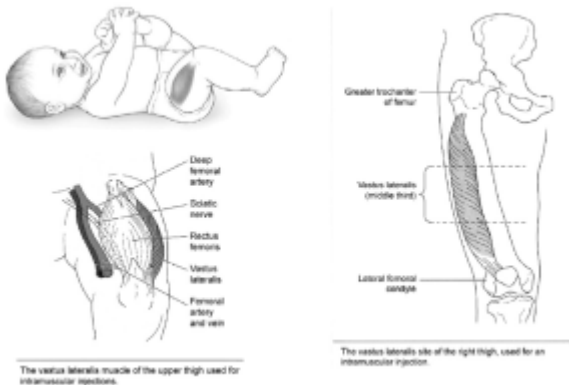


Image retrieved May 10, 2013 from <http://www.cdc.gov/vaccines/pubs/pinkbook/downloads/appendices/D/vacc.admin.pdf>

**Figure 5: IM Injection Needle Position**

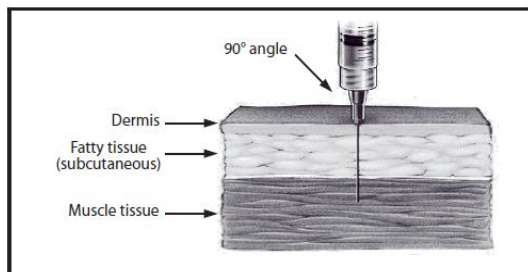


Image retrieved from CDC May 10, 2013 <http://www.cdc.gov/mmwr/pdf/rr/rr6002.pdf>

## 2. Deltoid – mid-portion of the deltoid muscle

- Locate the lower edge of the acromion process (bony prominence where the clavicle and scapula join)
- Identify the insertion of the deltoid. The injection site is the centre of the upside down triangle between these two points. (Figure 6)
- The needle is to be inserted at an almost 90° angle to the muscle

**Figure 6: Landmarking for Deltoid**

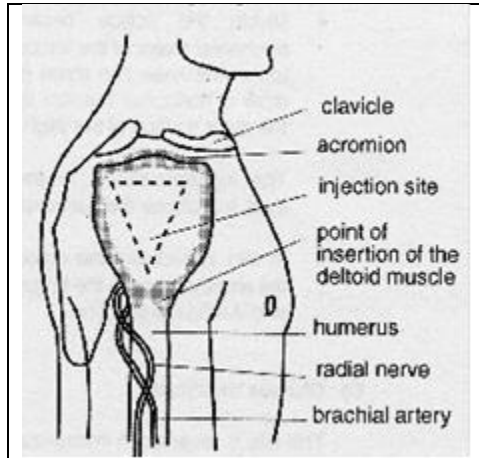


Image retrieved from BC CDC Immunization Manual May 10, 2013 [http://www.bccdc.ca/NR/rdonlyres/24C36473-261A-4FBD-8A41-444B3520DB64/0/SectionIV\\_AdministrationofBiologicalProducts\\_June2012\\_.pdf](http://www.bccdc.ca/NR/rdonlyres/24C36473-261A-4FBD-8A41-444B3520DB64/0/SectionIV_AdministrationofBiologicalProducts_June2012_.pdf)

## 3. Ventrogluteal –

- Position patient lateral (side-lying) with the upper leg flexed and slightly in front of the lower leg. If the prone or supine position is preferred, the client should “toe-in” to relax the muscle.
- Place the heel of your hand over the greater trochanter of the femur. Use whichever hand so your thumb is pointing to the client’s front.
- Palpate anterior superior iliac spine with index finger, then move your middle finger across the iliac crest to form a “V”. (Figure 7).

**Figure 7: Landmarking for Ventrogluteal**

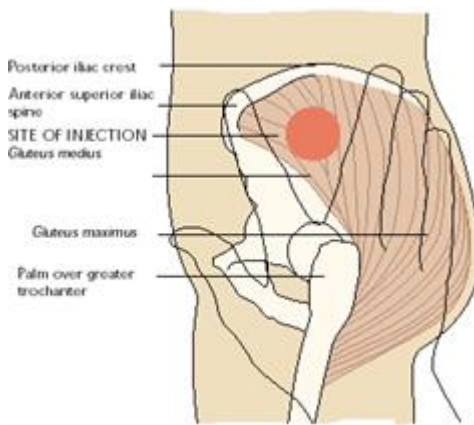


Image retrieved from BC CDC Immunization Manual May 10, 2013 [http://www.bccdc.ca/NR/rdonlyres/24C36473-261A-4FBD-8A41-444B3520DB64/0/SectionIV\\_AdministrationofBiologicalProducts\\_June2012\\_.pdf](http://www.bccdc.ca/NR/rdonlyres/24C36473-261A-4FBD-8A41-444B3520DB64/0/SectionIV_AdministrationofBiologicalProducts_June2012_.pdf)

- The center of the formed triangle or “V” is the ventrogluteal site.
- The needle is to be inserted at an almost 90° angle to the muscle but pointed slightly up toward the iliac crest.
- Dorsogluteal site is not recommended as it is not developed in infants, there is a risk of injection injury to the superior gluteal artery or sciatic nerve, the thickness of the subcutaneous layer varies greatly, and immunogenicity is lower with some immunizations.<sup>13, 17, 24, 25, 26, 27</sup>

### **Subcutaneous Injection Technique** <sup>1, 7, 13, 31, 32</sup>

- Thoroughly clean hands using soap and water or a waterless hand cleaner.
- Expose the area for injection to be able to landmark properly.
- Thoroughly clean hands using soap and water or a waterless hand cleaner again.
- Select the appropriate syringe and needle.
- Draw up vaccine or biological per product instruction.
- Cleanse the injection site with new alcohol swab by circling from the centre of the site outward for 1-2 inches. Let dry.
- Pinch the skin at the injection site using the thumb and forefinger.

**Figure 8: Landmarking for SC Injection for Deltoid and Thigh**



Images retrieved from CDC May 10, 2013  
<http://www.cdc.gov/mmwr/pdf/rr/rr6002.pdf>

- Dart the needle in at an angle of 40 to 60 degrees (Figure 9).

**Figure 9: SC Injection Needle Position**

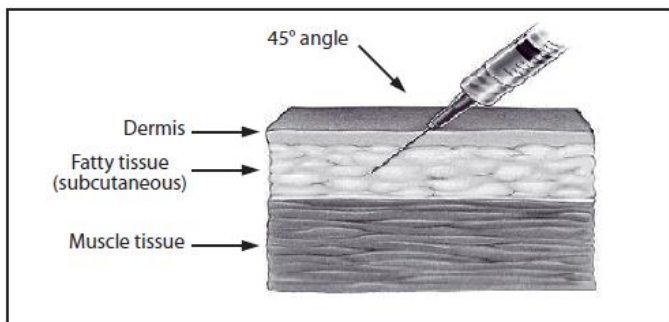


Image retrieved from CDC May 10, 2013  
<http://www.cdc.gov/mmwr/pdf/rr/rr6002.pdf>

- Release the skin and administer the vaccine while maintaining stability of the limb and needle at all times.
- Remove the needle quickly.
- Activate the safety mechanism and discard into sharps container.
- Use a cotton ball and apply pressure to the injection site.
- Use of adhesive bandages is not routinely recommended.
- Once all documentation is complete, discard all empty vials into the sharps container.

### **Intranasal Administration Technique**<sup>35</sup>

- Thoroughly clean hands using soap and water or a waterless hand cleaner.
- Remove rubber tip protector.
- DO NOT remove dose divider clip on plunger rod.
- Client should be sitting upright with head tilted slightly backwards. Client should not be standing, as there is a risk they may faint and fall.
- Place tip just inside nostril and angle syringe parallel to the bridge of the nose (Figure 10).

**Figure 10: Positioning for Intranasal Administration**






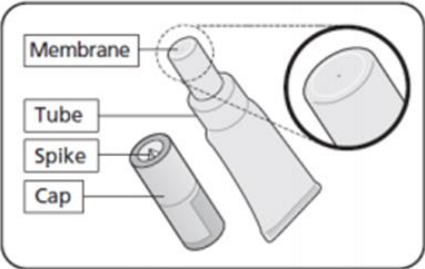
Image retrieved from [http://www.viloniaschools.org/public/userfiles/RECURRING\\_EVENT\\_I\\_TEMS/FLU\\_Season/nasal-spray-flu-vaccine-picture.jpg](http://www.viloniaschools.org/public/userfiles/RECURRING_EVENT_I_TEMS/FLU_Season/nasal-spray-flu-vaccine-picture.jpg) - January 3, 2013.

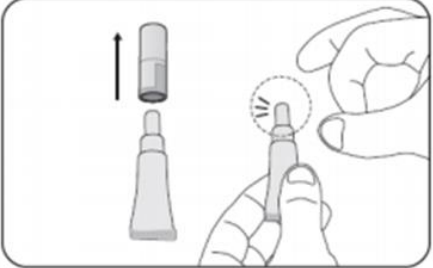
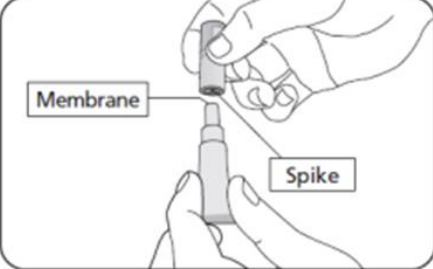

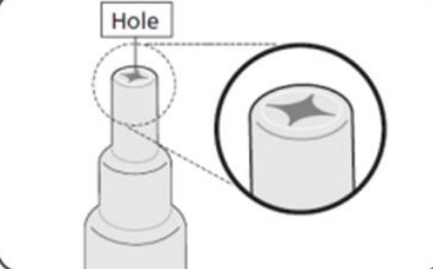
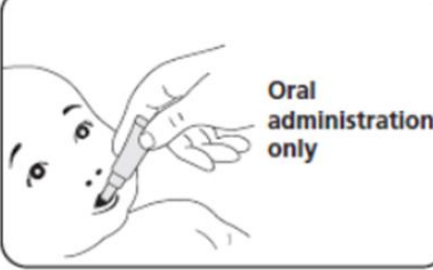
- As rapidly as possible depress plunger until the dose-divider clip prevents you from going further.
- DO NOT have the client actively inhale the mist.
- Pinch and remove the dose-divider clip from plunger.
- Repeat steps above for the other nostril.
- Once all documentation is complete, discard empty applicator into the sharps container.

**Oral Administration Technique**

- Thoroughly clean hands using soap and water or a waterless hand cleaner.

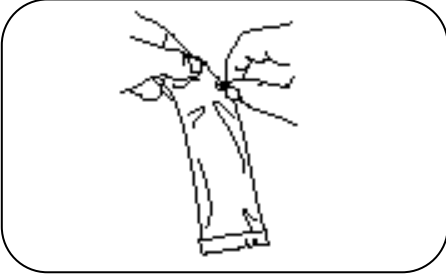

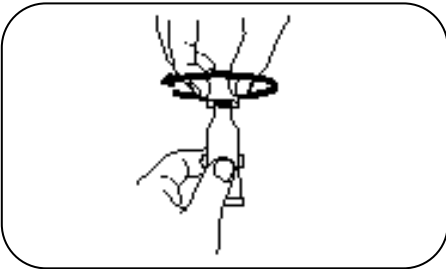
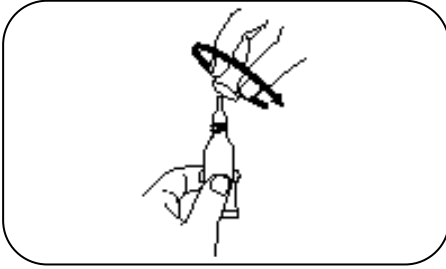
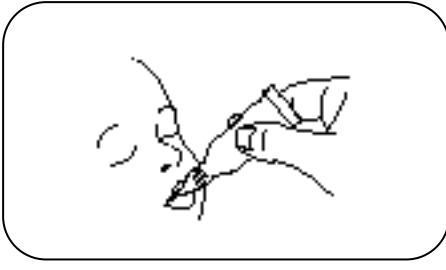
**Figure 11: Rotarix® vaccine comes in two different packages – oral applicator or vaccine tube.** Images retrieved from Rotarix® Product monograph May 2, 2017.

<b>Administration of Rotarix® vaccine in an oral applicator</b>	
<ul style="list-style-type: none"> <li>• Remove protective tip from applicator</li> </ul>	
<ul style="list-style-type: none"> <li>• Vaccine is for oral administration only. Client should be seated in a reclining position with head tilted slightly backwards. Administer entire contents of the oral applicator orally into the infant's mouth towards the inner cheek.</li> </ul>	
<ul style="list-style-type: none"> <li>• DO NOT INJECT</li> </ul>	
<b>Administration of Rotarix® vaccine tube</b>	
<ul style="list-style-type: none"> <li>• Check the tube has not been damaged or previously opened.</li> <li>• Liquid should be clear and colourless without any particles in it. If you notice anything abnormal, do not use vaccine.</li> <li>• Vaccine is given orally - straight from the tube, no mixing is necessary.</li> </ul>	

<p>Get the tube ready:</p> <ul style="list-style-type: none"> <li>• Pull cap off and keep cap – you need cap to pierce the membrane.</li> <li>• Repeatedly flick the top of the tube just below the membrane until it is clear of liquid.</li> </ul>	
<ul style="list-style-type: none"> <li>• Turn cap upside down (180°) and position to open tube (there is a small spike inside the centre of the cap).</li> <li>• Keep the tube upright</li> <li>• Hold the sides of the tube.</li> </ul>	
<ul style="list-style-type: none"> <li>• Press the cap down to pierce the membrane then lift off cap. You do not need to twist.</li> </ul>	
<ul style="list-style-type: none"> <li>• Check that the membrane has been pierced – there should be a hole at the top of the tube.</li> <li>• If the membrane has not been pierced repeat steps.</li> </ul>	
<ul style="list-style-type: none"> <li>• Administer vaccine immediately after opening:</li> <li>• Position child leaning slightly backwards</li> <li>• Squeeze liquid gently into the side of the child's mouth towards the inside of the cheek.</li> <li>• Tube may need to be squeezed a few times to get all of vaccine out. It is okay if a drop remains in the tip of the tube.</li> <li>• Once documentation is complete, discard the empty tube and cap in approved biological waste containers according to local regulations.</li> </ul>	



**Figure 12: RotaTeq® vaccine** – each dose is supplied in a container consisting of a squeezable plastic, latex-free dosing tube with a twist-off cap, allowing for direct oral administration. The dosing tube is contained in a pouch. Images retrieved from RotaTeq® Product monograph March 20, 2018.

Administration of RotaTeq® vaccine	
<ul style="list-style-type: none"> <li>Tear open the pouch and remove the dosing tube.</li> </ul>	
<ul style="list-style-type: none"> <li>Clear the fluid from the dispensing tip by holding tube vertically and tapping cap.</li> </ul>	
<ul style="list-style-type: none"> <li>Open the dosing tube in 2 easy motions:               <ol style="list-style-type: none"> <li>Puncture the dispensing tip by screwing cap <b>clockwise</b> until it becomes tight.</li> </ol> </li> </ul>	
<ol style="list-style-type: none"> <li>Remove cap by turning it <b>counterclockwise</b>.</li> </ol>	
<ul style="list-style-type: none"> <li>Administer dose by gently squeezing liquid into infant's mouth toward the inner cheek until dosing tube is empty (a residual drop may remain in the tip of the tube.)</li> <li>Once documentation is complete, discard the empty tube and cap in approved biological waste containers according to local regulations.</li> </ul>	

## **Oral Administration through a Nasogastric or Nasojejunal Tube**

Rotavirus vaccine can be administered via a nasogastric tube (NG) or a nasojejunal (NJ) tube. Parent/caregiver should be engaged in ensuring appropriate tube placement and flushing of tube pre and post administration of vaccine. It is the responsibility of the health care provider to administer the vaccine. For additional information related to oral vaccine administration via NG tube see link. <https://insite.albertahealthservices.ca/Main/assets/tms/phc/tms-phc-vs-oral-vaccine-administration-through-a-ng-tube-instructions.pdf>

### **Section 5: Client Position and Stabilization**

Stabilization measures are necessary to protect the child/client, minimize discomfort, and provide for client and nurse safety during the immunization procedure. The nurse should never assume that a particular child/client will be able to remain still during immunization. The immunization procedure along with the stabilization guidelines should be carefully explained to the accompanying parent/guardian prior to administering the injection and the parent/guardian should always be involved in holding the child. It is essential that the parent/guardian be aware that their role in holding the child is to stabilize the child and the limb while the nurse's role is to administer the injection. The nurse must be able to maintain control of the site and the needle during immunization. Assistance from another nurse should be sought when necessary to ensure adequate stabilization.

In circumstances where excessive restraint would be necessary in order to ensure stability of the site (such as with an extremely combative older child or handicapped individual), the nurse should defer the immunization until such time that the immunization can be accomplished with the use of normal stabilization measures. Consultation with MOH/MOH designate may be required under special circumstances.

When immunizing in the school, every effort should be made to enlist the child's cooperation; with some children this will require extra time and explanation. Occasionally, assistance from another nurse or staff member may be required to help distract and/or comfort the child. It is acceptable, with the child's permission, to hold the child's hand or arm to avoid sudden movement. Excessive restraint (i.e. physical restraint, or holding child against their will) should not be used. If the child's cooperation cannot be obtained, the parent/guardian should be notified and alternate arrangements for immunization should be made.

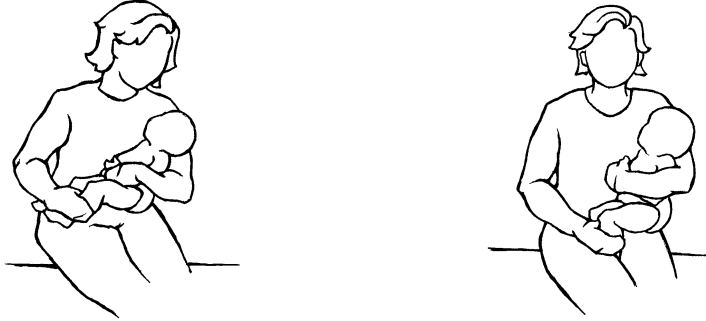
Choice of stabilization method depends on type of injection, site and age of child.

### **Infants and Toddlers**

#### **1. Vastus lateralis**

- Ask the parent/guardian to hold the child on their lap in a seated or semi-recumbent position so that the vastus lateralis site is clearly visible, with the child's arm tucked behind the parent.
- The child's head should rest on the parent/guardian's arm with the outside arm being held.
- Instruct the parent/guardian to hold the child's outside leg around the calf or knee. Alternately, the parent/guardian may place the child's feet between their legs and secure the child's legs with their hand. If using this method, ensure parent/guardian sits forward in chair so the child cannot push their feet against the chair.
- The immunizer should hold the thigh to ensure proper stability of the site.

**Figure 12: Stabilization Technique for Vastus lateralis**

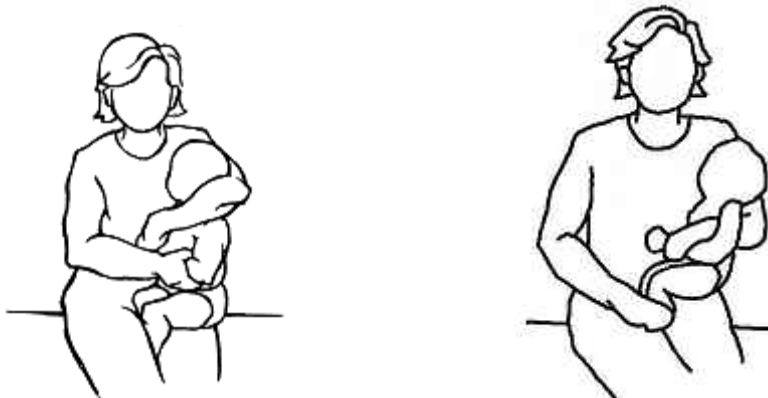


- Ensure the child's arm that is positioned closest to the caregiver, is tucked into the parent/guardian's side or placed behind the caregiver's back. The child's other arm is controlled with the parent/guardian's arm and hand placed over it. In the case of children under 1 year of age, the caregiver can control both arms with one hand.
- Instruct and guide the caregiver to firmly hold the child's legs and feet between his or her thighs and control them with their free hand. The caregiver's hand may be placed over the child's knee to prevent the leg from being raised by the child during the immunization above in Figure 11.

## 2. Deltoid

- Ask the parent/guardian to hold the child so that the deltoid site is clearly visible and the child is firmly restrained to prevent movement during the immunization.
- Ask the parent/guardian to fully uncover/unclothe the child's arm and hold the child in a seated or semi-recumbent position on their lap as in the Figure 12 below.

**Figure 13: Stabilization Technique for Deltoid**

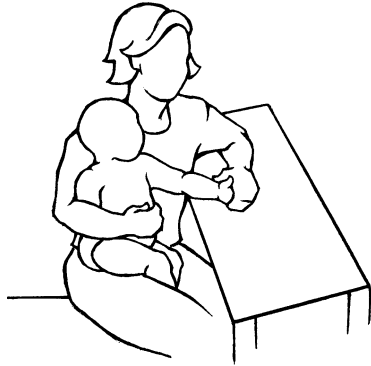


- Ensure the child's arm that is positioned closest to the caregiver is tucked into the parent/guardian's side or placed behind their back. The child's other arm is controlled with the parent/guardian's arm and hand placed over it as pictured above.
- Ask the parent/guardian to firmly hold the child's legs and feet between his or her thighs, and control them with their free hand, if necessary.

### 3. Intradermal Injection

- Ask the parent/guardian to sit the child sideways on their lap with the child's legs between the parent/guardian's legs.
- The parent/guardian should hold the child snugly by wrapping their arm around the child's body.
- The parent/guardian can hold the child's left hand with their left hand and extend the child's arm so the flexor area of the forearm is exposed. If possible, rest the child's arm on a firm surface.
- The nurse will hold the forearm to ensure proper stability of the site.

**Figure 14: Stabilization for Intradermal Injection**



### **School Aged and Older Children**

#### **Deltoid**

- Verbally instruct and physically guide the caregiver to hold the child so that the deltoid site is clearly visible and the child is firmly restrained to prevent movement during the immunization.
- Ask the caregiver to fully uncover/unclothe the child's arm and seat the child on parent's lap or have the child stand in front of the seated caregiver.
- Ensure the child's arm that is positioned closest to the caregiver is placed behind the caregiver's back. The child's other arm is held close to the child's body with the caregiver's arm and hand placed over it as pictured above.

## Section 6: Client Observation

Advise recipients of any biological product to remain under observation for at least 15 minutes following the immunization regardless of whether or not they have had the biological product previously.

Extend the observation period to 30 minutes when a person has a history of anaphylactic reaction to any agent (vaccines, biological, drugs, food, bee stings, etc.).<sup>15</sup>

## Section 7: Management of Pain and Anxiety

The purpose of this section is to provide strategies and interventions that health care providers and parents can use to reduce and/or prevent anxiety before and during administration of vaccines. Pain management is often based on a “5-P” approach<sup>54</sup>:

- Physical
- Procedural
- Psychological
- Pharmacological
- Process

The strategies included in this section incorporate interventions from each approach. Wherever possible it is recommended that public health incorporate pain management activities into their immunization clinic routines. For infection control reasons, fabric products and items that will be touched by the client (e.g., distraction toys, pinwheels, and sweet tasting solutions) should be brought by the client/parent and not supplied by public health.

### Physical:

- **Position of client:**
  - Children three years of age and younger - sitting upright and being held by a parent before, during and after the procedure are associated with reduced pain during immunization as compared to supine (lying down). For infants 0 to 1 month of age that may be immunized in the hospital setting, skin-to-skin (kangaroo care) can be considered. This involves placing a diaper-clad infant prone on the mother’s chest before, during and after vaccine administration.
  - Children three years of age and older (including adults) - sitting upright promotes a sense of control which can have a positive impact on their experience of pain. The only exception would be if the client prefers to lie supine, or there is a history of fainting.
- **Breastfeeding in children 0 to 2 years of age before, during and after procedure** - this has been shown to have analgesic effects by combining a number of interventions to reduce pain in infants – presence of a comforting person, holding the child, skin to skin contact (physical sensation), feelings of satiety, the act of sucking (diversion) and sweet-tasting milk and other chemicals in the milk that produce analgesia and relaxation. Research indicates that infants who are breastfed during immunization do not experience aspiration, vomiting, cyanosis or respiratory changes during the procedure. Alternatively, a baby can be held and bottle-fed with expressed breast milk or formula throughout the procedure which simulates aspects of breastfeeding and may confer benefit.
- **Sucking / pacifier before, during and after injection in children 0 to 2 years of age** - non-nutritive sucking (e.g. pacifier or engaging in thumb sucking) before, during and after vaccine administration, has been shown to have analgesic effects. Sweet tasting solutions can be combined with non-nutritive sucking in children 0 to 2 years of age.

- **Individuals greater than or equal to 7 years of age with history of fainting** - The individual should be screened for prior episodes of fainting and appropriate interventions should be considered prior to immunization (e.g., the client can be immunized lying down).

#### **Procedural:**

- **Aspiration** - aspiration before injection can increase the length of time the needle is in the tissue and potentiate the shearing action of the needle. Aspiration is not deemed necessary when immunizing because the sites recommended for immunization do not have large blood vessels.
- **Order of vaccines** - Research indicates that giving the most painful vaccine last decreases overall pain from injections. This strategy is recommended for all age groups. If an infant is getting rotavirus vaccine it is recommended to provide this vaccine first as rotavirus has a high concentration of sucrose (see Pharmacological section for more information on sweet-tasting solutions).
- **NOTE** - simultaneous injections (immunizing with two nurses at the same time) are not recommended due to a lack of strong evidence of effectiveness and lack of feasibility.

#### **Psychological:**

- **Provide a verbal signal of impending procedure** – this will help decrease the chance of sudden movements in individuals being immunized. Some suggestions include: “*Here I go...*” or “*On three...one, two three...*” Be cognizant of those who have indicated they would prefer to disengage, or they are so distressed that providing a prompt will increase their stress.
- **Neutral language / watch non-verbals** – instead of warning about the painful aspects of the procedure, use neutral language. Some suggestions include: “*You will feel some pressure / squeezing / a twinge...*” versus “*You will feel a sting / stab / ache*”. Avoid negative facial expressions (grimaces etc.).
- **Parent Coaching** – parent behaviours that can decrease children’s pain-related distress include remaining calm, being matter-of-fact, including humour, and redirecting the child’s attention.
- **Distraction** – involves taking attention away from the procedure. Involve parents and children in helping to select the best distraction strategies by offering a variety of suggestions. Choose age-appropriate strategies (for example - parent supplied toys and iPods, breathing with a toy, (pinwheels, bubbles). Adults and adolescents can use breathing interventions (blowing, cough or deep breathing).

**Note:** If sites choose to allow the use of bubbles (supplied by the client) as a distraction, soap residue on the floor should be wiped up with a paper towel immediately to avoid a slip hazard. Cleaning staff should be notified so proper cleaning products can be used in areas where soap residue may have accumulated on the floor.

- **Environment** – Establish an environment that facilitates trust and respect. Immunize the most anxious children first. Ensure the limb is stabilized just prior to vaccine administration. When possible, provide a private room for immunization.

**NOTE – It is not the expectation for the PHN to provide counselling regarding severe needle phobia.**

## **Pharmacological:**

- **Sweet tasting solution (sugar water):**

- Is an analgesic in infants. Proposed mechanism of analgesia involves release of endogenous opioids and distraction.
- It is recommended that parents be supported if they choose to use sweet-tasting solutions for children 2 years of age and younger who are not breastfed or bottle-fed during immunization.
- Sweet tasting solutions are indicated for the management of painful procedures, not for general comfort or as a food supplement.
- Administration should take place 1 to 2 minutes before vaccine administration and the analgesic effect may last for up to 5 minutes.
- For children receiving rotavirus vaccine the use of sweet tasting solutions may not be necessary as there is indication that rotavirus vaccine could have a similar affect. If a child is getting rotavirus vaccine it is recommended to provide this vaccine first.
- The use of sweet tasting solutions is not necessary for infants 0 to 2 years of age. If the infant is breastfed or bottle-fed, this is the preferred pain relieving intervention for this age group. Sweet tasting solutions can be combined with non-nutritive sucking in children 0 to 2 years of age

- **Topical anesthetic creams and gels** can reduce pain from cutaneous needle procedures. If parents wish to use topical anesthetic creams/gels they should be referred to their physician or pharmacist for product recommendations and instructions for use. The Public Health Nurse can educate the individuals/parent about the exact site or sites of vaccine administration.

- **Strategies NOT currently recommended:**

- **Skin-cooling techniques** (vapo-coolants (e.g. Buzzy, *Pain Ease*<sup>™</sup>) and ice packs): There is insufficient evidence to recommend for or against the use of skin-cooling techniques to reduce pain at the time of injection in children and adolescents.
- **Oral analgesics** (acetaminophen/ibuprofen): There is no demonstrated benefit of administering an oral analgesic to reduce injection pain at the time of immunization.

## **Process (education and implementation):**

- All vaccine administrators should be educated in pain management techniques.
- Pain management strategies can be put into practice via various methods – verbal instruction, pamphlet, videos.
- Resources for Parents Related to Pain Management Strategies:
  - Tips To Make Immunization Easier for Children (AHS Parent Resource)
  - Pain Management During Immunization – pamphlets and videos. Immunize Canada website <https://www.immunize.ca/pain-management-children> Available in English and French.
  - HELPinKids&Adults <http://phm.utoronto.ca/helpinkids/> (videos).

## References

1. Advisory Committee on Immunization Practices (ACIP). "General Recommendations on Immunization". Morbidity & Mortality Weekly Report, Vol.60, No RR02; 2011.
2. American Academy of Pediatrics, (2009) The Red Book, 28<sup>th</sup> edition.
3. Immunization Action Coalition, Ask the Experts, Vol.15, No 1; January 2011. <http://www.immunize.org/va/va30.pdf> (accessed 23 Oct 2011)
4. Public Health Agency of Canada (PHAC). "National Vaccine Storage and Handling Guidelines for Immunization Providers (2015)". <http://healthycanadians.gc.ca/publications/healthy-living-vie-saine/vaccine-storage-entreposage-vaccins/index-eng.php> (accessed 15 June 2016)
5. BC CDC Immunization Manual (2012) <http://www.bccdc.ca/dis-cond/comm-manual/CDManualChap2.htm> (accessed 15 June 2016)
6. Zahir, A.F., Choy, C.Y., Rushdan, R. (2008). Glass particle contamination of parenteral preparations of intravenous drugs in anaesthetic practice. Southern African Journal of Anaesthesia Analgesia, 14(3):17-19.
7. Carbone-Traber, K., Shanks, C. (1986). Glass particle contamination in single-dose ampoules. Anesthesia and Analgesia Journal: 65:1361-3.
8. CDC Atlanta,(2015) The Pink Book, 13<sup>th</sup> edition accessed at: <http://www.cdc.gov/vaccines/pubs/pinkbook/index.html> (accessed 15 June 2016)
9. Kozier & Erb. Fundamentals of Nursing, 8<sup>th</sup> edition, Vol. 1, pp. 848-850
10. World Health Organization (2000). Vaccines and biologicals update, Vol. 34, December 2000.
11. CDC Atlanta, Mantoux Tuberculosis Skin Test Facilitator Guide (2003). <http://www.cdc.gov/tb/education/Mantoux/guide.htm> (accessed 18 May 2011)
12. Alberta Health Services. Professional Practice & Development: Intravenous (IV) Medication Administration. Calgary & Area, August 2009. 59.
13. Immunisation against infectious disease-Green Book (2006) (updated 07 Nov 2011). [http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH\\_079917](http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_079917) (accessed 25 Feb 2012)
14. Diggle, L., Deeks, J., Pollard, A. J.(2006) Effect of needle size on immunogenicity and reactogenicity of vaccines in infants: randomized controlled trial. British Medical Journal, 38906.704549.7C (published 4 Aug 2006).
15. Alberta Health & Wellness, Alberta Immunization Manual (2007).
16. Diggle, L., Injection technique for immunization. Practice Nurse, Vol.33, No.1; January 2007. 34-7.
17. National Advisory Committee on Immunization. (2012). *Canadian immunization guide (Evergreen Edition)*. Ottawa, ON: Public Health Agency of Canada. <http://www.phac-aspc.gc.ca/publicat/cig-gci/>
18. Koster, M.P., Stellato, N., Kohn, N., Rubin, L.G. Needle length for immunization of early adolescents as determined by ultrasound. Pediatrics, August 2009, Vol.124, No. 2; 667-672.
19. Public Health Agency of Canada. Canadian Tuberculosis Standards, 6<sup>th</sup> edition. (2007).
20. Hunter, J. Intramuscular injection techniques. Nursing Standard, Vol.22, No.24, February 2008.
21. University of Auckland. Immunisation Advisory Centre. Vaccine Administration (2004). <http://www.immune.org.nz/?T=922>
22. Australian Government. The Australian Immunisation Handbook, 9<sup>th</sup> edition. (2009).
23. Australian Government. The Australian Immunisation Handbook, 8<sup>th</sup> edition. (2003).
24. Pazarci, N.K., Orken, D.N., Celik, M.G., Celebi, L.G. Post-injection sciatic neuropathy: clinical and electrophysiological findings. Archives of Neuropsychiatry. September 2010, Vol.47, No.3; 207-12.
25. Mishra, P., Stringer, M.D. Sciatic nerve injury from intramuscular injection: a persistent and global problem. International Journal of Clinical Practice. November 2010, Vol.64, No.11; 1573-9.
26. Malkin, B. Are techniques used for intramuscular injection based on research evidence? Nursing Times.net. 16 December 2008, 104: 50/51, 48-51. <http://www.nursingtimes.net/nursing-practice/1952004.article> (accessed 12 May 2011)



27. Royal Collage of Paediatrics and Child Health. Position Statement on Injection Technique. March 2002. [http://www.rcn.org.uk/data/assets/pdf\\_file/0010/78535/001753.pdf](http://www.rcn.org.uk/data/assets/pdf_file/0010/78535/001753.pdf) (accessed 31 May 2011)
28. Cook, I.F., Murtagh, J. Optimal technique for intramuscular injection of infants and toddlers: a randomized trial. *The Medical Journal of Australia*. 18 July 2005, Vol.183, No.2; 60-63. [http://www.mja.com.au/public/issues/183\\_02\\_180705/coo10229\\_fm.html](http://www.mja.com.au/public/issues/183_02_180705/coo10229_fm.html) (accessed 12 May 2011)
29. Ipp, M., Taddio, A., Sam, J., Goldbach, M., Parkin, P.C. Vaccine-related pain: randomized controlled trial of two injection techniques. *Archives of Disease in Childhood*. 2007;92:1105-1108 doi:10.1136/adc.2007.118695.
30. Taddio, A. et al. Help Eliminate Pain in Kids: Clinical Practice Guidelines for Pain Management during Childhood Immunizations -Technical Report.
31. Workman, B. Safe injection techniques. *Nursing Standard*. 16 June 1999, Vol.13, No.39; 47-53.
32. Hunter, J. Subcutaneous injection technique. *Nursing Standard*. 30 January 2008, Vol.22, No.21; 41-44.
33. Alberta Health Services: Public Health Central Zone. "Administration of Biological Products". Revised 06-Jul-2010.
34. [http://www.cdc.gov/nchs/data/nhanes/nhanes\\_11\\_12/TBSkinTestManual.pdf](http://www.cdc.gov/nchs/data/nhanes/nhanes_11_12/TBSkinTestManual.pdf) (Accessed 27 Aug/12)
35. AstraZeneca Canada. (April 19, 2012). FluMist® Influenza Vaccine, live attenuated, intranasal spray. *Product Monograph*
36. [http://www.viloniaschools.org/public/userfiles/RECURRING\\_EVENT\\_ITEMS/FLU\\_Season/nasal-spray-flu-vaccine-picture.jpg](http://www.viloniaschools.org/public/userfiles/RECURRING_EVENT_ITEMS/FLU_Season/nasal-spray-flu-vaccine-picture.jpg) (accessed on 03 Jan/13).
37. <http://www.sciencebuzz.org/sites/default/files/images/flumist.jpg> (accessed on 03 Jan/13).
38. [http://www.examiner.com/images/blog/EXID24244/images/resized\\_flu\\_mist\\_kaleb\\_nissley.jpg](http://www.examiner.com/images/blog/EXID24244/images/resized_flu_mist_kaleb_nissley.jpg) (accessed on 03 Jan/13).
39. Saskatchewan Immunization Manual (March 2013) <http://www.health.gov.sk.ca/sim-chapter8> (accessed on 6 May 2013)
40. Shah P.S., Herbozo C., Aliwalas, L.L, & Shah V.S. Breastfeeding or breast milk for procedural pain in neonates. *Cochrane Reviews* (2012).
41. Razek, A.A. & El-Dein, N.A. Effect of breast-feeding on pain relief during infant immunization injections. *International Journal of Nursing Practice* (2009). <http://www.philadelphia.edu.jo/academics/aalrazek/uploads/Effect%20of%20breast-feeding.pdf>
42. British Columbia Centre for Disease Control. (2012). *Communicable Disease Control Manual: Immunization Section IV-B – Reducing Immunization Injection Pain*.
43. Hatfield, L.A. et al. Analgesic Properties of Oral sucrose during routine immunizations at 2 and 4 months of age. *Pediatrics* (2008) <http://pediatrics.aappublications.org/cgi/reprint/121/2/e327>
44. Taddio, A. et al. Reducing the pain of childhood vaccination: an evidence-based clinical practice guideline. *CMAJ* (2010). doi: 10.1503/cmaj.101720. *CMAJ* December 14, 2010 vol. 182 no. 18 First published November 22, 2010, doi: 10.1503/cmaj.101720
45. Lewindon, P.J., Harkness, L., & Lewindon, N. Randomised controlled trial of sucrose by mouth for the relief of infant crying after immunization. *Archives of Disease in Childhood* (1998). <http://adc.bmj.com/content/78/5/453.full>
46. Reis, E.C. et al. Effective pain reduction for multiple immunization injections in young infants. *Archives of Pediatrics & Adolescent Medicine* (2003). <http://archpedi.ama-assn.org/cgi/content/abstract/157/11/1115>
47. Moshe, I, Taddio, A., Sam, J., Gladbach, M. & Parkin, P.C. Vaccine-related pain: randomized controlled trial of two injection techniques. *Archives of Disease in Children* (2007). doi: 10.1136/adc.2007.118695
48. Ipp, M., et al. Order of vaccine injection and infant pain response. *Archives of Pediatric Adolescent Medicine* (2009).
49. Melzack, R. & Wall, P.D. Pain mechanisms: a new theory. *Science* (1965).

50. Barnhill, B.J. et al. Using pressure to decrease the pain of intramuscular injections. *Journal of Pain and Symptom Management* (1996).  
<http://download.journals.elsevierhealth.com/pdfs/journals/0885-3924/PII0885392496000498.pdf>  
(unable to open)
51. Cohen, L.L. Reducing infant immunization distress through distraction. *Health Psychology* (2002). <http://psycnet.apa.org/journals/hea/21/2/207/>
52. Taddio, A et al. Routine immunization practices: use of topical anesthetics and oral analgesics. *Pediatrics* (2007). <http://pediatrics.aappublications.org/cgi/reprint/120/3/e637>
53. Toronto Public Health (2010). Immunization and Vaccines - How to reduce your child's pain from immunization.  
<http://www1.toronto.ca/wps/portal/contentonly?vgnextoid=45b22f763c322410VgnVCM10000071d60f89RCRD&vgnnextchannel=696b2f763c322410VgnVCM10000071d60f89RCRD>
54. GlaxoSmithKline Inc. (January 14, 2016). ROTARIX®: Human Rotavirus, live, attenuated, oral vaccine. *Product Monograph*.
55. Taddio, A et al. Clinical Practice Guideline for Reducing Pain during Vaccine injections in Children and Adults. *CMAJ* 24 August 2015 <http://www.cmaj.ca/content/early/2015/08/24/cmaj.150391>
56. Oral Vaccine Administration Through A Nasogastric (NG) Tube Instructions. Public Health Calgary Zone Immunization Program Manual (2 May 2019)  
<https://insite.albertahealthservices.ca/Main/assets/tms/phc/tms-phc-vs-oral-vaccine-administration-through-a-ng-tube-instructions.pdf#search=Calgary%20NG%20Tube%20feeding%20for%20children>