Vaccination Guidelines For Swine

'How to get the maximum benefit when vaccinating your swine herd'

This document is available at
www.vido.org

This report is based on the VIDO Beef Technical Group report *Vaccination Guidelines: How to get the maximum benefits when vaccinating your beef cattle herd.* It has been modified by the VIDO Swine Technical Group for application to swine production.

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TABLE OF CONTENTS

I VIDO Swine Technical Group

The Vaccine and Infectious Disease Organization (VIDO) was established in 1975 at the University of Saskatchewan as a financially self-reliant national organization of the University. VIDO receives funding from governments, charitable foundations, the livestock and poultry industries, federal and provincial granting agencies, contracts and other private sources. VIDO is fulfilling its mandate to serve both livestock producers and consumers by developing safe and effective animal health and performance products, preventive medicine programs, improved livestock management techniques, and information materials to help producers achieve their goals of increased productivity.

The VIDO Swine Technical Group (VSTG) is a unique association of people directly involved in the swine industry who voluntarily give their time and expertise in a wide variety of specialty disciplines. The members of the group change from time to time, and have included pork producers, veterinarians, agricultural economists, agricultural engineers, nutritionists, farm extension workers and VIDO research scientists.

The objective of the Swine Technical Group is to investigate and discuss some of the disease problems of pigs that relate to management and affect the profitability of pork production. These discussions have led to targeted research projects and development of a variety of education materials for swine producers.

Technology transfer becomes ever more important as production expands and the demand for quality and accountability increases. The VIDO Swine Tech Group is helping producers stay up to date on industry trends that affect profitability, animal health, animal welfare, food safety, the environment and public awareness of many aspects of the pork supply chain.

The VSTG Mandate

1. Provide relevant and current information to benefit swine producers.
2. Bring the animal health concerns of pork producers to VIDO for consideration.

'How to get the maximum benefit when vaccinating your swine herd'

This document is a starting point for understanding the proper storage, handling and use of vaccines. Future projects will discuss vaccination strategies.

II CONSIDERATIONS FOR VACCINATION

One of the management tools a producer can use to reduce and prevent disease is vaccination. Vaccines can be a valuable tool, but much of their effectiveness depends upon proper usage. Pork producers will be able to use vaccines more effectively if they understand their limitations and incorporate other best management practices to assist in preventing or reducing disease.

Timing of vaccine delivery should take into account both the length of time for protective immunity to develop post-vaccination as well as the predicted time of disease challenge. For best performance of vaccines, swine producers should follow the manufacturer's directions on the label for vaccine delivery (e.g. prebreeding, prefarrowing or at specific periods during the growing pig's life), unless otherwise directed by a veterinarian.

The effectiveness of vaccine programs can be affected by the following factors:

a) Vaccine handling and storage
b) Age of animal
c) Interference of passive maternal antibodies
d) Timing of vaccination vs. exposure
e) Nutrition
f) Disease load levels
g) Environment (i.e. chilling, ammonia)
h) Concurrent disease (i.e. parasitism)
i) Vaccine type and quality including quality of vaccine delivery
j) Individual animal response
k) Prevention of response due to antimicrobial interference (i.e. live avirulent bacterins)

III Proper Storage and Handling of Vaccines

Transport, store and handle vaccines according to the manufacturer's recommendations. Vaccines that are exposed to temperatures above or below those recommended by the manufacturer will have a reduced shelf life.

It is important not to break the *'cold chain'*, a phrase used to describe the manner in which a vaccine should be transported and stored – at an optimum temperature that avoids temperature extremes. From the time of purchase to the time of use, vaccines should be kept at the recommended storage temperature (see label on bottle), also avoiding exposure to ultra-violet light. For example, use a Styrofoam box with a tight-fitting lid. Transport the vaccine securely in this box on cold packs. Your veterinarian should provide a box with an ice pack until you get home, at which time the vaccines should be immediately stored in the refrigerator until they are ready for use. Care should be taken to ensure that the vaccine does not freeze, because this can render many vaccines ineffective. In addition, freezing may release harmful endotoxins that may increase the risk of adverse effects such as abortion or loss of appetite in the animal.

If a group of animals is to be processed, or if several vaccines are to be administered, keep vaccines in a cool, insulated container and remove them only as needed. Plan vaccine purchases in quantities that can be used up according to the manufacturer's recommendations.

Vaccines need to be used prior to expiry. Follow the label and the manufacturer's recommendations. It is also important to gently remix the vaccines before injection by inverting the bottle several times. WARNING: Do not shake harshly as it may negatively affect the quality of some vaccines.

Most modified live vaccines (MLV) must be re-hydrated by adding a sterile diluent to a vacuum-packed, freeze-dried material.

This can be mixed in one of two ways:

a) The vacuum in the vaccine bottle will easily draw the fluid from the diluent bottle through a transfer needle (sharp on both ends)**.** To maintain the vacuum, first put one end of the needle into the diluent bottle, then holding the diluent bottle upside down, put the other end of the needle into the freeze-dried bottle.

b) If you are using a syringe and needle to transfer diluent, use a clean syringe to avoid contamination of the entire vial with residual material in the syringe.

The effectiveness of modified live vaccines will be significantly reduced within hours of re-hydration. Exposure to sunlight and heat will kill the virus very quickly

and render the vaccine ineffective. Alcohol or any disinfectant applied to the needle between animals can kill a modified live vaccine. Change needles every time you refill the syringe if using a 30 or 50 cc automatic syringe; otherwise every 10 to 15 head or when the needle is dull, bent, burred or dirty. If vaccinating in the face of an outbreak of viral disease you may wish to change the needle between each animal in order to prevent the spread of the disease via the needle. Use syringes that have **not** been previously cleaned with disinfectant (example: Hibitane or Betadine or soap). Mark your automatic syringes so that syringes used for killed vaccines are not subsequently used for modified live vaccines.

You should also use a clean needle for withdrawing vaccine from the vial, as a used needle can contaminate the vaccine.

Proper handling and storage of vaccines will ensure that the vaccine retains optimal effectiveness.

IV Combining Vaccines

Always read the label directions on the vaccine and follow them. Vaccines must not be mixed unless the manufacturer has specifically provided information saying that they can be mixed. Vaccines contain proteins that have very specific shapes that are recognized by the body. These complex shapes may become altered when the vaccine is affected by the chemical nature of another product. (i.e. pH).

V Preparation

i) Read the label

The label contains very specific information with respect to the use of the vaccine. Failure to follow these instructions may lead to vaccination failure. There are eight different types of information on the label that you must become familiar with.

a. Dosage
b. Route of administration
c. Injection location
d. Indications for use
e. Warnings and cautions
f. Storage conditions
g. Expiry date
h. Withdrawal time

ii) Syringes and Needles

Cleanliness, correct dose, syringe working properly, needle size

iii) Labour Skills

Technique briefing and demonstration

iv) Animal Handling Equipment

Equipment function – ensure crowding gates are in good working condition

Eliminate hazards – including sharp objects that may cause bruising or puncture wounds.

Proper restraint – securely restrain pigs. Sows may be vaccinated in group housing systems at feeding time when they are less aware of the operator. Pigs do not have to be individually restrained. Crowding of pigs is a very effective and safe way to restrict the movement of pigs at the time of vaccination.

Personnel safety – provide proper workplace safety for the operator, e.g. non-slip floors, proper lighting, hearing protectors etc.

v) Vaccine Preparation

Do not prepare more MLV vaccine than can be used within the time recommended by the manufacturer. It may be good practice to refrain from premixing all MLV vaccines prior to starting processing in case there is an interruption of the vaccination process. In this way the vaccine is less likely to be wasted if it becomes necessary to stop vaccinating.

Stored, open killed vaccines may become contaminated; therefore manufacturers recommend using all vaccine after the bottle has been opened.

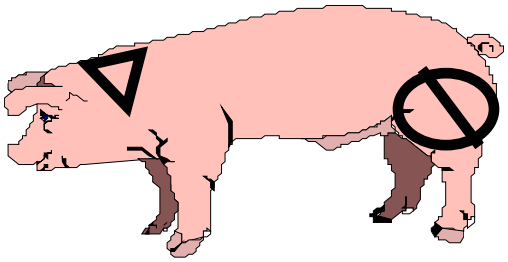
VI Injection Techniques

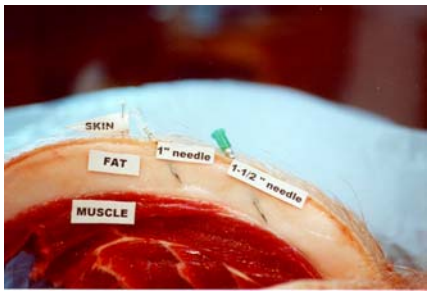
Use only sharp and straight needles (discard dull, bent or burred needles).

i) **Use the correct needle, spacing and order of vaccination**

Size of Animal	Needles for IM Injections		Needles for SQ Injections		Max ml per Injection Site
	Length	Gauge*	Length	Gauge*	
Sows and Boars	**1 ½"**	**16 -18**	**1 "**	**16 - 18**	**12**
60 - 250 lbs. 27 – 113 kg	**1"**	**16 - 18**	**3/4 "**	**16 - 18**	**8**
10 - 60 lbs. 4.5 – 27 kg	**5/8 - 3/4 "**	**18**	**½ - ¾"**	**18**	**5**
under 10 lbs. under 4.5 kg	**½ - 5/8"**	**20**	**½"**	**20**	**2**

- **Gauge of needle depends partly on the thickness or viscosity of the vaccine given. For thicker material a larger gauge will be needed.**





The ideal location for intramuscular vaccines is in the neck muscle

NEVER inject in the ham, regardless of the age of the animal. The ham is one of the most valuable prime cuts in the pig. Because the ham is often sold as a large volume cut, it is difficult to detect physical hazards such as broken needles, tissue scarring or abscesses prior to sale. Tissue scarring persists for the life of the animal; thus, even injections in the ham of piglets will create tough pork at market 5 to 6 months later. The detection by consumers of physical hazards such as a needle or abscess will have far-reaching effects, as the consumer will affect the opinions of a great number of other potential buyers of pork. If a product label indicates that you can give the vaccine either intramuscular (IM) or subcutaneously (SC) and staff have been properly trained to give SC injections, then give the product SC.

Space multiple injections in the neck of mature animals greater than 3 finger-widths apart. In younger growing pigs where the neck is small, the second vaccine should be given in the opposite side of the neck.

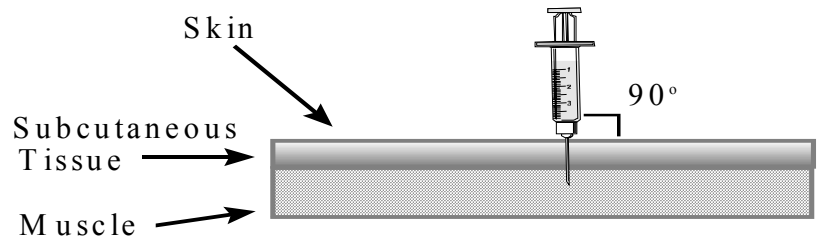
Visually inspect the needle upon withdrawal to ensure it is intact. Never straighten or reuse a bent needle as it is more at risk of breaking off in the pig. This will reduce the risk of broken needles which pose a food safety hazard.

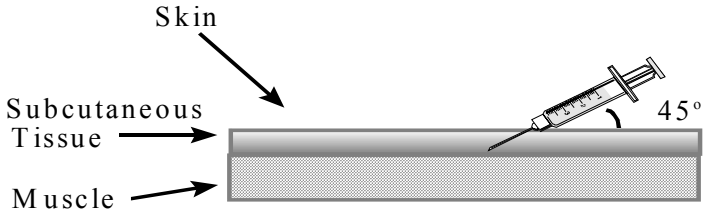
ii) Select the best route of administration

Follow label instructions for route of administration.

- Give SC injections using the 'tent' method. The tent method involves grasping a loose flap of skin and pulling it away from the body. This makes a small tent and the vaccine is injected into the base of the tent under the skin. In the pig these loose areas of skin are located behind the elbow of the front leg and in front of the knee and adjacent to the belly.

- Give IM injections in the neck, with the needle angled perpendicular to the skin.





iii) Dealing with broken and bent needles

When a needle breaks during injection:

- Feel the injection site. You MIGHT find the needle for removal.
- If the needle cannot be removed, immediately and permanently identify the suspect animal, record animal's tag number on processing or treatment records and inform the next buyer on shipment of animal that it may have a broken needle in its neck (identify the location).

In order to ensure compliance with quality assurance protocols, identify processed and treated animals on your records. Keep processing and treatment records.

VII Post-Vaccination Procedures

i) Adverse Reactions

Animals should be observed after vaccination for evidence of adverse reactions. Life-threatening anaphylactic or allergic responses can occur. Pigs should be observed for at least one hour post-vaccination. Itching, swelling and redness of the skin may indicate signs of an anaphylactic reaction that is affecting the pig's entire body. In this case, the allergic response is not limited to the injection area and is often seen around the nose, anus and vulva. Severe reactions are those of anaphylactic shock and may include rapid breathing, trembling, salivation, high fever, anxiety, diarrhea and sudden collapse. Treatment with Epinephrine is indicated.

Observe remaining animals previously treated that are not immediately affected. Consult with your veterinarian for further instructions.

iii) Reporting Adverse Reactions

All adverse reactions should be reported to your veterinarian. Ask your veterinarian to forward information on adverse reactions to the Veterinary Biologics section of the Canadian Food Inspection Agency (CFIA). The following information is required to report suspected adverse reactions:

- Trade and assigned name of product
- Manufacturer
- Serial or lot number
- Expiration date
- Owner's name and address
- Name, address and telephone number of vaccine supplier
- History and symptoms

VIII Waste Disposal

i) Disposal of Sharps

Sharps include needles and scalpel blades. There is a risk of needlestick injuries or cuts when these sharps are not handled or disposed of properly.

Drugs, vaccines or blood may cause reactions or infections if they are present on broken glass or used needles.

To safely dispose of sharps, use a rigid plastic or metal puncture-proof container with a sealed lid, such as a used plastic disinfectant bottle with a narrow mouth or a 20-litre pail with a narrow opening in the lid. In some regions, local landfill sites will accept these containers. Label clearly as *'Sharps Container'* and *'Not for Recycling'.* Specialized sharps containers and disposal services are available from medical waste disposal companies. Sharps containers can also usually be obtained from local veterinary clinics. **Note:** Do not burn sharps containers because you lose the identification of the hazard.

ii) Disposal of Vaccines and Vaccine Containers

Regularly check all vaccines for the expiry date. All vaccines past the expiry date should be discarded according to provincial environmental regulations.

On some vaccines, the label states 'use entire contents when first opened.' The manufacturer normally will recommend disposal of any remaining vaccine after vaccination has been completed, as sterility of the product can no longer be guaranteed. Consult with your veterinarian if you have significant quantities of left-over vaccine.

There are two classes of expired vaccines – unused (unopened) and used (opened). Unused expired vaccine can be returned to the point-of-purchase, such as the veterinary clinic. Many manufacturers will accept them for disposal. Used vaccines may be returned to a veterinary clinic for disposal through a medical waste company.

Modified-live virus vaccines should be rendered noninfectious before disposal in order to prevent the virus from potentially infecting workers or animals. This can be accomplished by various methods including freezing, autoclaving, burning or adding bleach to the bottle. Consult with your vaccine supplier for a disposal plan for your product.

IX Sanitation of Vaccine Syringes

If multiple dose syringes are reused, the following syringe cleaning and care points will help you avoid injection site infections:

- Clean the external syringe surface with soap, water and a brush.
- Rinse the inside components of the vaccine syringe, including tubes and connectors, with distilled or de-ionized water that is near the boiling point

(greater than 180º F). This is accomplished by repeatedly drawing water that is greater than 180º F into the syringe and squirting it out. Three to five rinses should be adequate. An alternate technique is to boil for five minutes. Remove as much water from inside the syringe as can be squirted out and let the syringe cool before using. Heat kills modified live vaccine products.

Note: You should not use a soap or disinfectant on internal components. Soap or disinfectant residues may kill MLV vaccines.

- Store the vaccine syringe in a dust-free, dry (low humidity) environment. It is best if the newly cleaned vaccine syringe is stored in a new zip-lock bag and placed in the freezer.

- Vaccine transfer needles should be boiled in water and allowed to cool before using. Transfer needles should be stored in a new zip-lock bag in the freezer.

X Human Health Risks

Accidental injection of vaccines for livestock into humans can potentially cause serious health problems. If an accident occurs, consult with your family doctor or the provincial poison control centre and be prepared to describe the vaccine and the location of the injection accident, and how much vaccine was injected. The vaccine manufacturer is often a very good source of human safety information.

Take the bottle of vaccine along with you if you are instructed to go to the hospital to receive medical attention.

The following is a list of Main Poison Control Centres in Canada:

British Columbia -	1-800-567-8911
Alberta -	1-800-332-1414
Saskatchewan -	1-866-454-1212
Manitoba -	1-204-787-2591
Ontario -	1-800-267-1373
Quebec -	1-800-463-5060
New Brunswick -	1-800-244-8353
Newfoundland -	1-709-722-1110
Nova Scotia -	1-902-428-8161
PEI -	1-800-565-8161

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Appendix A

How Vaccines Are Licensed

The Veterinary Biologics Section of the Canadian Food Inspection Agency (CFIA) is responsible for the licensing of veterinary vaccines in Canada. Biologics are licensed to ensure they are safe and efficient in animals and pose no threat to humans or the environment. Biologic regulations are part of the Health of Animals Act.

Manufacturers and importers are required to notify the Veterinary Biologics Section (VBS) of suspected adverse reactions.

Individual animal owners or veterinarians are encouraged to report suspected adverse reactions to the Veterinary Biologics Section of the CFIA.

Label Claims: All vaccines are registered with one or more of the following labeling claims:

a) Prevention of infection – prevents all colonization or replication of the organism in vaccinated animals.
b) Prevention of disease – at least 80% effective in preventing clinical disease.
c) Aid in the prevention of disease – prevents disease by a clinically significant amount.
d) Aid in disease control – alleviates disease severity, reduces disease duration or delays disease onset.
e) Other claims – effects other than direct disease control, such as the control of infectiousness through the reduction of pathogen shedding, if there is a clinically significant effect.

General Criteria for Product Acceptability

a) The product must be pure, safe, potent and efficacious. Purity and safety (consistency of product) are regarded as being the most important.
b) The product must be licensed or approved in the country where it originates.
c) Each biologically active component must be relevant to Canadian disease conditions.
d) The product must be produced and tested in accordance with generally accepted 'good manufacturing practices' and 'current state-of-the-art'.

Use vaccines for which there is published evidence that the vaccine is efficacious.

Appendix B

Special care points for metal syringes:

Metal syringes can be taken apart and boiled in hot water.

a. Clean work area ... don't try to work in an area subject to blowing dust
b. Wash external surface of syringes
c. Operator needs to wash his or her hands for 2 minutes
d. Cover clean work area with new, clean paper towels
e. Disassemble syringes
f. Wash syringe parts with clean, hot tap water (do not wash the internal parts with soap or disinfectant)
g. Boil all internal syringe parts in boiling de-ionized or distilled water for five minutes
h. Reassemble while hot
i. Use a small amount of CLEAN vegetable oil spray to lubricate rubbers
j. After assembly is completed, rinse the internal parts three to five times with water hotter than 180º F
k. Allow the syringe to cool for 10 minutes before using
l. If storing the syringe, place the syringe in a new zip-lock bag
m. Store the syringe in a freezer
n. Prior to using the syringe after storage, rinse the internal syringe with water hotter than 180º F. Boil 2 cups of water in microwave and pull boiled water into syringe three to five times
o. Let syringe cool for five to ten minutes before using

Special care points for plastic automatic syringes:

Plastic syringes can be heat-sterilized in a microwave oven. Note that this is another method of heat sterilization; there is nothing special about microwaves in this instance. The plastic automatic syringe must be covered in water while being heated in a microwave oven.

a. Wash the external parts of the plastic automatic syringe in soap and water
b. Rinse the internal parts with hot tap water (do not use soap or disinfectant) by drawing water up though the intake tube while repeatedly depressing the syringe plunger
c. Completely fill the plastic automatic syringe with de-ionized or distilled water (draw-off tube and syringe should be full of water)
d. Wrap the plastic automatic syringe in five to ten layers of wet paper towels
e. Place the wet-paper-towel-wrapped syringe in a zip-lock bag
f. Leave zip-lock bag open and place in a microwave oven

g. Set microwave oven on high setting and microwave each plastic automatic syringe individually for five minutes
h. Check moistness of paper towel wrapping half way thorough the process and remoisten if paper towels appear to be drying out
    a. If paper towels become too dry while in the microwave they can burn
i. Remove the plastic automatic syringe from the zip-lock bag and unwrap. Most of the water that was filling the plastic automatic syringe will have boiled off; if not, squirt out all remaining water.
j. Allow syringe to cool for ten minutes before using
k. If storing, remove zip-lock bag containing the plastic automatic syringe from the microwave oven and place directly in the freezer

Microwave oven sterilization of vaccine transfer needles:
Vaccine transfer needles can be heat-sterilized in a microwave oven. The transfer needle must be covered in water while being heated in the microwave oven.

Two methods are available:

1. Clean the transfer needle in hot tap water (**no soap or disinfectant**) and place the cleaned transfer needle in clean cup. Completely cover with six to eight ounces of de-ionized or distilled water. Microwave using the high setting to bring the water to a boil and continue to boil for one additional minute. Never allow the water level to evaporate to the level of the transfer needle. It must remain completely covered during the process.
   OR

2. Clean the transfer needle in hot tap water (no soap or disinfectant) and wrap in several layers of paper towels. Soak the towels and transfer needle in water and place in a zip-lock bag. Place the zip-lock bag in a microwave oven and leave the top of the bag open. Microwave using the high setting for two minutes. Do not let the paper towels dry out while being heated in the microwave oven.

Quality Control:
Ask your veterinarian to review your vaccine syringe preparation technique. If you think you are having a problem with syringe sterility, ask your veterinarian to test the sterility of your vaccine syringe. **Note:** heat without pressure will not kill spores, therefore autoclaving or the use of a pressurized canner is required to achieve sterilization at a level adequate to kill spores.

Reference: Excerpt from Dr. Dee Griffin, Great Plains Veterinary Educational Center, NE

Appendix C

Needle Free Vaccine Delivery ***(A VIDO technical report written by Dr. Phil Willson)***

Researchers at the University of Saskatchewan's Vaccine and Infectious Disease Organization (VIDO) have found that disease protection through vaccination with a low-pressure needle-free jet injector was as good as or better than protection of pigs immunized with a syringe and needle. This study confirmed similar results achieved by researchers using other drugs or vaccines and the results may extend to other kinds of livestock.

Although some level of infection can occur even after vaccination, animals immunized with the needle-free jet injector experienced milder clinical disease than the other group when exposed to the pathogen, implying a stronger immune response.

Vaccination of livestock is crucial to developing specific immune resistance to diseases otherwise costing producers billions of dollars. Vaccination of livestock with needles – intra-muscular and subcutaneous – can incur costs through animal stress, vaccine residues, injection site lesions and broken needles – with consequences for food safety.

Needle-free injection offers several benefits over traditional syringe-and-needle delivery. Vaccine is dispersed as tiny particles in skin and other tissue, greatly increasing the rate of uptake of the vaccine by the immune system. Entry points are minute, minimizing tissue damage at the injection site. The injector can be loaded for multiple injections and needle stick injuries are eliminated.

In this study, piglets of six and nine weeks of age were vaccinated with Pleurostar-APP® either by needle-free jet injector (NF) or conventional intra-muscular (IM) routes (eight piglets each).

Vaccine was delivered to the same surface location in each group. All vaccinated pigs had at least a four-fold increase in antibody concentration before protection from disease was tested under experimental conditions.

Measurement of two indicators of the pigs' immune response (antibodies IgG1 and IgG2) showed similar immune responses to *A. pleuropneumoniae* (antigens OmlA and ApxII) for both groups (NF and IM). More importantly, evidence of clinical disease was significantly lower in the needle-free group.

Since a smaller volume of vaccine went into the pigs using the needle-free method, this indicated that future studies could lead to establishment of much smaller effective doses with this system.

We do not currently know whether needle free injection hurts pigs more or less than needles, but avoiding the needle may avoid some of the stress.

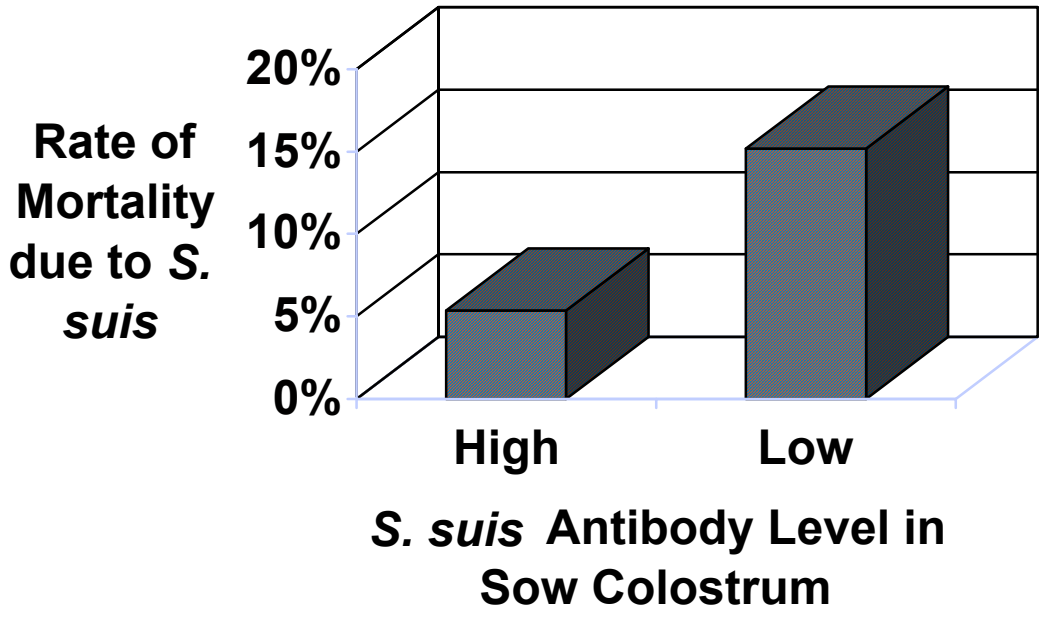
Appendix D

Importance of Maximizing Passive Maternal Immunity ***(A VIDO technical report written by Dr. Phil Willson)***

The importance of passively acquired immunity with respect to several diseases should not be underestimated. These passively acquired immunoglobulins are taken up by the pig from colostrum. These antibodies persist in the pig for variable amounts of time depending on the concentration of immunoglobulins in the colostrum and the amount of Colostrol uptake by the piglet. These antibodies provide an important bridge of protection as the piglet gradually activates its own immune system.

Research has demonstrated that the level of passively acquired antibodies provides a demonstrable difference in protection of the growing pig for *Strep. suis* Figure 1.

Figure 1 Antibody in sow colostrum protects piglets from death caused by *S. suis*.



Appendix E

PRODUCER DEFINITIONS

A. VACCINE TARGET

Microorganism ***An organism that is not visible to the naked eye.***

Pathogen ***A microorganism that causes disease. This can include viruses, bacteria, fungi and multicellular parasites.***

Examples of bacteria	**Diseases**
Actinobacillus pleuropneumoniae (App)	Fibrinous pneumonia
Clostridia perfringens type C	Baby pig scours
Erysipelothrix rhusiopathiae	Septicaemiae, arthritis, valvular endocarditis
E. coli (*Escherichia coli*)	Baby pig scours
Haemophilus parasuis (Glassers)	Polyserositis
Lawsonia intracellularis	Porcine Proliferative enteritis " Ileitis"
Leptospira interogans sp	Reproductive failure
Mycoplasma hyopneumoniae	Mycoplasma pneumonia
Pasteurella multocida type D	Chronic Progressive Atrophic Rhinitis
Salmonella cholerasuis	Salmonellosis
Streptococcus suis	Meningitis, Polyserositis

Examples of viruses	**Diseases**
Porcine Parvovirus	Reproductive failure
Porcine Reproductive and Respiratory	Reproductive failure, respiratory disease
Rotavirus	Piglet scours
Transmissable Gastroenteritis	TGE scours
Examples of fungi	
Examples of multicellular parasites	

B. TYPES OF VACCINES

Vaccine ***A suspension of microorganisms or parts of microorganisms administered to an animal for the prevention of infectious disease.***

Autogenous vaccine
A vaccine prepared with a pathogen isolated directly from an individual animal or herd for use in the same animal or herd.

Bacterin
A suspension of killed bacteria**.** For example: a combination *Mycoplasma hyopneumoniae* and *Pasteurella multocida* type D vaccine.

Killed vaccine

A vaccine that contains no living pathogen or pathogen fragments. The killed pathogen (bacteria/virus/protozoa, etc.) is used in the vaccine.

Modified live vaccine

A vaccine that contains a live pathogen that has been altered so it no longer causes clinical disease, although it may cause mild clinical symptoms.

Monovalent vaccine
A vaccine against a single pathogen

Multivalent vaccine
A vaccine against several pathogens

Recombinant vaccine
A pathogen or a protein that has been genetically manipulated (i.e. genes have been inserted or deleted to improve the safety or the effectiveness of a vaccine)

Subunit vaccine
A single protein or part of a protein from a pathogen that is incorporated in a vaccine

Toxoid
A toxin that has been structurally altered to destroy its harmful properties without destroying its ability to induce formation of antibodies upon injection (e.g. tetanus toxoid)

Vectored vaccine
A microorganism that does not cause disease and is modified to contain genetic material from a pathogen - when the vectored vaccine is administered, the animal reacts by mounting a specific immune response against the pathogen.

C. VACCINE COMPONENTS

Adjuvant ***A vaccine component that improves the immune response to the antigen***

Antigen ***The active component of a vaccine which is recognized as foreign by the animal and induces an acquired immune response. Antigens may include substances such as bacteria, viruses, toxins or foreign proteins.***

Diluent ***With respect to vaccines, the fluid that one uses to suspend a freeze-dried (powdered) vaccine***

D. RESPONSES TO VACCINES

Antibodies ***A class of proteins also called immunoglobulins produced by specialized lymphatic cells -plasma cells (from B cells). These immunoglobulins bind to a specific antigen of the infecting agent or vaccine.***

Immunoglobulins (Igs) are classified according to their mode of action and are labeled:

IgG - The most abundant; protects against bacteria, viruses and toxins in the blood

IgM - The first circulating antibody to appear

IgA - Found in many body secretions such as nasal secretions, saliva and milk (helps piglets).

IgE - Causes certain cells to release histamines (as happens with allergies).

Immunity ***The state of being protected against the effects of a pathogen (e.g. A microorganism or its toxins)***

Immune System ***Those tissues, cells and body secretions that function to protect the animal from infection by foreign organisms and other harmful substances.***

Types of Immunity:

Acquired immunity
Immunity resulting from prior exposure to a pathogen or vaccine. This immunity is characterized by memory, specificity for a single pathogen or foreign protein and an accelerated secondary response. Acquired immunity is also called active immunity or adaptive immunity and can be divided into 2 responses:

Cellular Immunity (Cell Mediated)
Immune responses mediated by cells that can destroy pathogens. An example would be white blood cells that destroy **virus-infected** cells.

Humoral immunity
Immune response characterized by the formation of antibodies, which are proteins secreted by specific cells (B cells and plasma cells). The antibodies decrease the growth and/or harmful effects of a microorganism or its products.

Maternal immunity
This is a type of immunity of the newborn acquired from the mother's blood supply before birth or through colostrum and milk after birth. This is also passive immunity.

Natural (Innate) Immunity
Disease resistance that exists without prior exposure to a pathogen. The skin itself provides a protective barrier to infection.

Passive immunity
Immune protection acquired from another animal. (e.g. Colostrol or milk antibodies from dam or injection of immune serum)

Immune Response	***The response of the immune system following exposure to a pathogen, vaccine or foreign protein***
Onset of Immunity	***The length of time from vaccination until a protective immune response is present***
Duration of Immunity	***The period of time during which a protective immune response is present after vaccination. This can determine the frequency of revaccination or the time of vaccination relative to disease risk.***
Anamnestic Response	***An immune response to an antigen or pathogen to which the animal was previously exposed. This immune response occurs more quickly and is often stronger than the response induced by the first injection or vaccination, also called the secondary response.***
Anaphylactic Shock	***An adverse response to a foreign protein (e.g. a vaccine) to which the animal has previously been exposed. For example, this is occasionally seen with administration of a blackleg vaccine. In pigs, signs of anaphylactic shock include swelling of the nose, rectum or vulva, rapid breathing and difficulty breathing (appear to be choking) trembling, and may fall down, anxiety, salivation, and possible sudden death. Treatment with the drug Epinephrine can counteract the above effects.***
Serological Response	***A measure of antigen-specific antibody present in blood. This response may also be called an antibody Titer and expressed in quantitative units.***
Tissue Reaction	***Heat, pain, swelling or even an abscess at the site of an injection or vaccination. This is also referred to as a local vaccine reaction.***
Withdrawal Time	***The length of time following the administration of a vaccine that an animal must not be sold for human food consumption.***

E. VACCINE DELIVERY

Vaccination ***The administration of a vaccine to an animal. This term is often used interchangeably with immunization and inoculation (the administration of a microorganism to an animal).***

Routes of Vaccination:

IM:	Intramuscular (into the muscle)
SC:	Subcutaneous (under the skin)
IN:	Intranasal (into the nostrils)
ID:	Intradermal (within the skin)
Oral:	Into the mouth
Mucosal:	The administration of a vaccine to a mucosal surface such as the digestive tract, the respiratory tract, the reproductive tract or the inner surface of the eyelid.

Primary vaccination ***The first time an animal is vaccinated for a particular antigen.***

Revaccination ***The second or subsequent vaccination. This is often referred to as a "BOOSTER SHOT."***

Vaccine dose ***The amount of vaccine injected is usually measured in milliliters (ml) or cubic centimeters (cc) which are equivalent terms. Syringes used for vaccination are usually calibrated in these units.***

F. VACCINATION PROTOCOL

Label Directions ***Manufacturer's instructions on appropriate use of vaccine. This involves disease protection, vaccination schedules, dosage, route of delivery, species for use, warnings, cautions, and withdrawal times.***

Off Label Usage ***Product applications not specified by the manufacturer. When used in this manner the manufacturer assumes no liability for efficacy, withdrawal times and safety. A veterinary prescription under a valid vet-client-patient relationship is required prior to off-label use of a drug.***

Lot Number ***This is a number, assigned by the manufacturer, which uniquely identifies when and where a product was made. All bottles of a vaccine that were produced at the same time will be assigned an identical lot number.***

Expiration Date ***The date, printed on the bottle of vaccine, which the manufacturer***

(Shelf Life) ***guarantees the product, is stable if handled and stored properly. The effectiveness or quality of the product is not guaranteed after this date.***

G. OTHER TERMS

Purity ***Vaccine contains specified material only and is free of other micro-organisms.***

Safety ***This indicates that the commercial vaccine has been tested to determine if there are either systemic or local reactions following vaccination.***

Efficacy ***Demonstration that the vaccine induces a defined biological outcome (i.e. - reduced clinical disease, reduced shedding of a pathogen, reduced transmission of a disease agent) that is relevant to the label claim on the vaccine.***

Potency ***Potency is linked to efficacy and for vaccines is a measure of the amount of vaccine antigen required to induce a defined immune response.***

H. VETERINARIAN / CLIENT/ PATIENT RELATIONSHIP

A legal definition of the relationship between a veterinarian and a client. The Canadian Veterinary Medical Association has defined this as follows:

A Veterinarian / Client/Patient Relationship (VCPR) exists when all of the following conditions have been met:

- **The veterinarian has assumed the responsibility for making clinical judgments regarding the health of the animal(s) and the need for medical treatment, and the client has agreed to follow the veterinarian's instructions.**
- **The veterinarian has sufficient knowledge of the animal(s) to initiate at least a general or preliminary diagnosis of the medical condition of the animal(s). This means that the veterinarian has recently seen and is personally acquainted with the keeping and care of the animal(s) by virtue of an examination of the animal(s) or by medically appropriate and timely visits to the premises where the animal(s) are kept.**
- **The veterinarian is readily available for follow-up evaluation, or has arranged for emergency coverage, in the event of adverse reactions or failure of the treatment regimen.**
- **A valid Veterinarian/ Client / Patient Relationship is needed for dispensing prescription labeled products and off-label use of drugs.**