Improving Protection Against Swine Influenza A Virus

Swine influenza A viruses continue to cause significant direct economic losses for the pig industry. Pigs can also serve as 'mixing vessels' generating novel influenza viruses that could infect humans—as occurred with the H1N1 virus in 2009, variant H3N2 viruses, and the human infection with swine influenza virus in Alberta in 2020.

Vaccination is the main method to protect against swine influenza and reducing the risk of generating novel viruses. Swine influenza A vaccines are based on inactivated virus and efficacy depends on achieving a match between circulating strains and those that are in the vaccine. This match is often difficult to achieve due to antigenic drift (evolutionary changes in the viral genome).

DISEASE TRANSMISSION HISTORY

Pigs became ill during the 1918 flu pandemic, but it was not until the 1930s that the influenza virus was identified as the cause of the disease in pigs. Swine influenza is now common in North and South America, Europe, and in Asia.

Surveillance work conducted at the University of Saskatchewan found virus populations in the USA and Canada are different, possibly due to antigenic drift.

Commercial vaccines formulated for US swine herds may not provide protection in Canada. Furthermore, vaccine-associated enhanced respiratory disease has been reported in research studies when pigs, vaccinated with commercial vaccine, are challenged with antigenic drifted virus. This could indicate current commercial vaccines enhance rather than protect against drifted swine influenza virus infection.

Whether the current vaccine options reflect a lack of protection or enhanced disease, the need for continued swine influenza virus vaccine research is clear.

The Vaccine and Infectious Disease Organization (VIDO) is a world leader in infectious disease research and vaccine development.

Collaborating with national and international partners from government, academia, and industry, we aim to improve animal health, protect Canadian herds and ensure food safety by:

- Understanding how pathogens cause disease;
- Developing novel vaccines and therapeutics;
- Improving vaccine formulations and delivery methods.

Our work has resulted in vaccines for porcine epidemic diarrhea virus and *Actinobacillus pleuropneumoniae*, as well as several others for cattle and poultry.

We have also developed more potent adjuvants that enhance the immune response of vaccines, and novel approaches for needle-free delivery.

VIDO

OUR RESEARCH

H1N1, H1N2 and H3N2 are the dominant influenza subtypes that cause disease in western Canadian swine. We previously developed an H1N1 based live attenuated vaccine that provided protection in young piglets even in the presence of maternal antibodies.

To broaden protection, we developed a novel bivalent vaccine derived from two swine influenza viruses isolated from Saskatchewan and Alberta farms:

- SD69 (H3N2), a representative strain for a newly recognized antigenic group (swine cluster IV-E) found in western Canada for which there is no current commercial vaccine coverage; and
- SD191 (H1N2), a representative strain for the newly recognized antigenic group (Alpha3) which started in Manitoba and spread across Canada and the United states over the last 6 years.

Our data showed this vaccine candidate induced strong immune responses and is protective against similar viruses.

WHAT'S NEXT

Our goal is to develop an effective vaccine with broader protection against the swine influenza viruses impacting Canadian pork producers.

We are investigating the vaccine protection, optimizing the vaccination route and dose, and further characterizing the safety of our novel vaccine candidates.

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