International

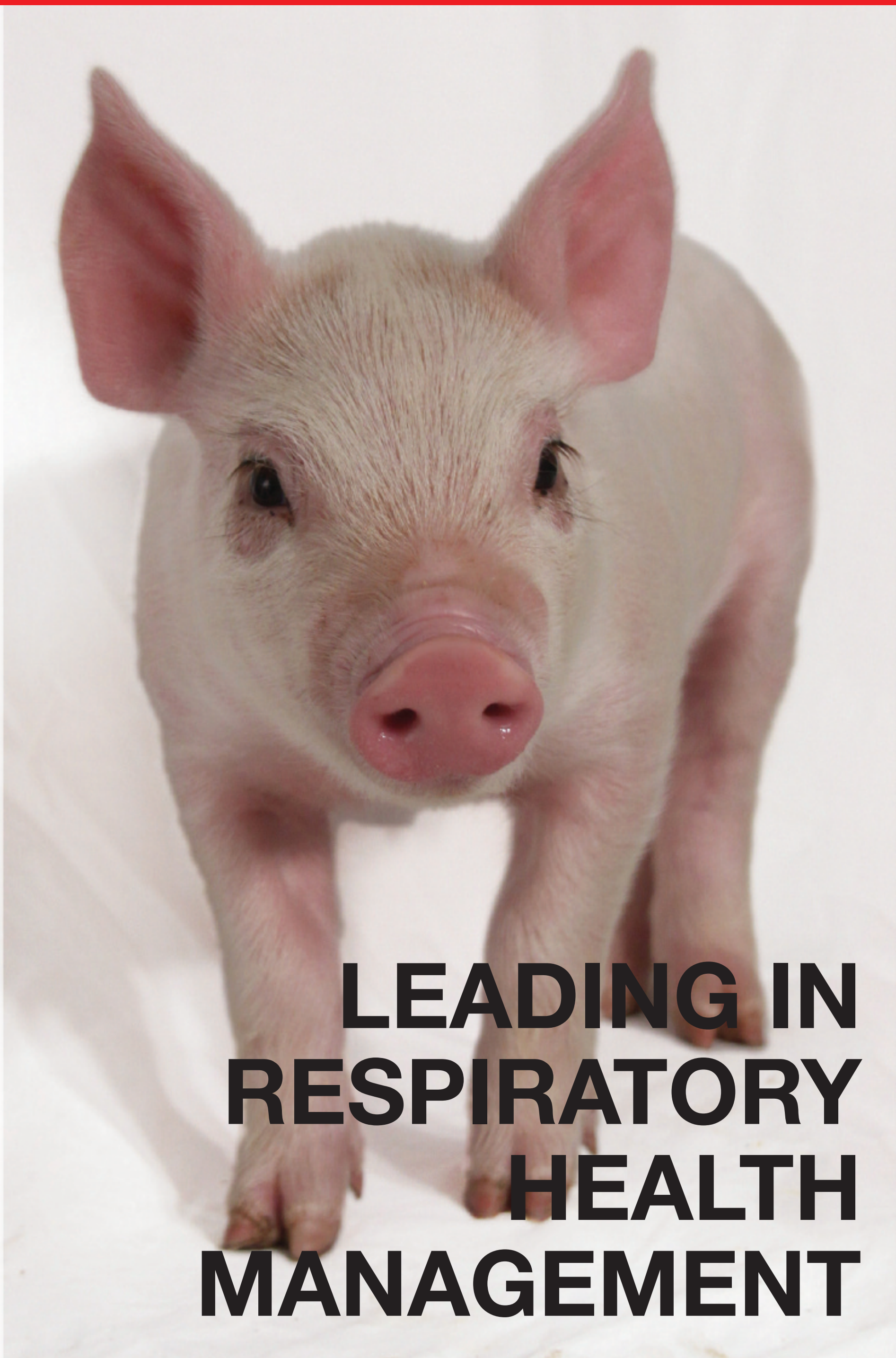
Pig Topics

October 2014

A Special Edition from MSD Animal Health

MSD Animal Health

MSD Animal Health's ResPig program helps to make every operation as efficient, productive, predictable and profitable as possible



LEADING IN RESPIRATORY HEALTH MANAGEMENT

ResPig
Management System

Get customized PRDC control and prevention strategies

MSD
Animal Health

EDITORIAL

Leading the swine industry in respiratory health management

Pork demand will continue to increase in the coming years, driven by a worldwide growing population and a rising middle-class. To be able to cope with this increasing demand, the swine industry must optimize pork meat production, both in quantity and in quality, at an affordable price, while ensuring sustainability and an efficient cost.

Porcine Respiratory Disease Complex (PRDC) continues to be a major economic problem around the world, negatively impacting production and, due to its complexity, the cause is often difficult to establish, while control solutions vary depending on the production system.

Merck Animal Health (MSD Animal Health) is dedicated to Porcine Respiratory Disease Complex (PRDC) prevention and control, not only through providing highly effective vaccines and pharmaceuticals specialties, but also via expert-level technical support, specific tools and diagnostic services.

The ResPig Management System is the platform developed by Merck Animal Health (MSD Animal Health) that combines all our services and solutions in swine respiratory health. The mission of ResPig is to provide a full range of services and products that help veterinarians and pig-production professionals to improve their farm's performance, by better managing PRDC. With the ResPig tools, our partners will be able to systematically audit their farms, evaluate and benchmark KPIs, define and implement tailor-made solutions, as well as customize training programs.

The ResPig site also includes technical information about PRDC and Merck Animal Health's (MSD Animal Health's) respiratory vaccines.

Furthermore, we are pleased to bring you this special edition of International Pig Topics, focused on state-of-the-art respiratory health management.

Count on ResPig to bring your farm's respiratory management to the next level and enjoy the reading!

Narciso Bento
Head of Global Swine Business Unit, Merck / MSD Animal Health.

THE SWINE RESPIRATORY IMMUNE SYSTEM

Chris Chase, Professor at South Dakota State University, Department of Veterinary Science, PO Box 2175, Brookings, SD 57007.

The swine respiratory immune system is a dynamic system that uses a variety of defense mechanisms including the epithelial and mucous barriers of the respiratory tract, innate immunity and adaptive immunity (Fig. 1).

The upper respiratory tract (URT) is the first line of defense and consists of epithelial lined airways of the nares, sinuses and turbinates whose mucosa and submucosa are part of the common mucosal immune system.

The airways of the trachea and lower airways of the lung are lined with ciliated epithelium with their tight junctions to prevent breach of the barrier by pathogens.

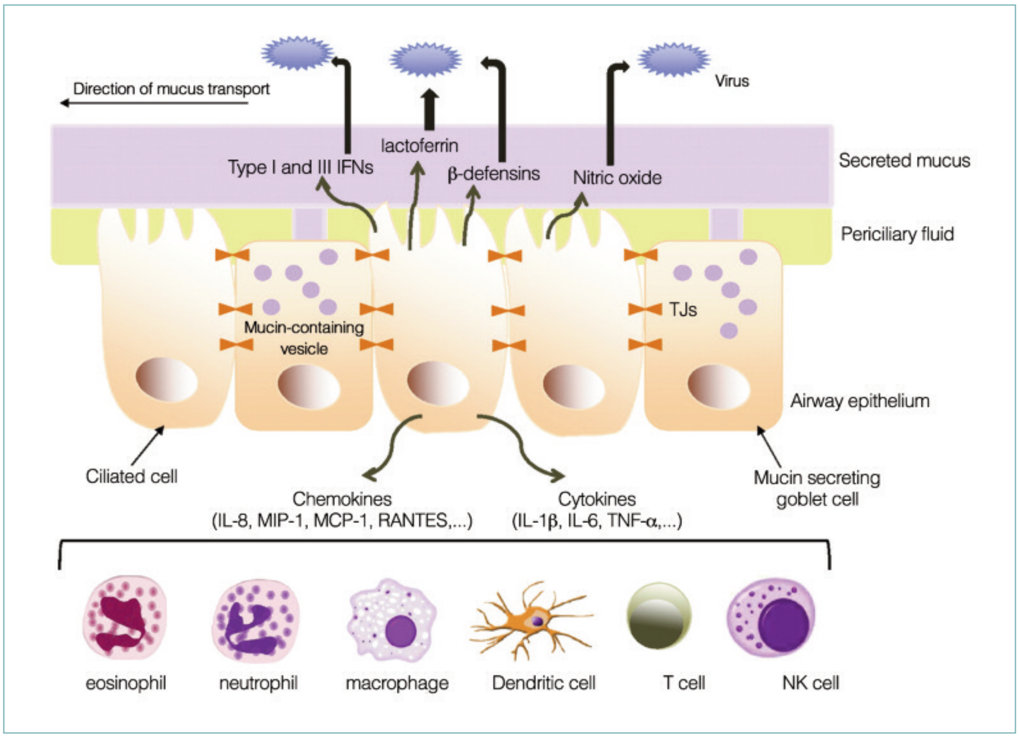
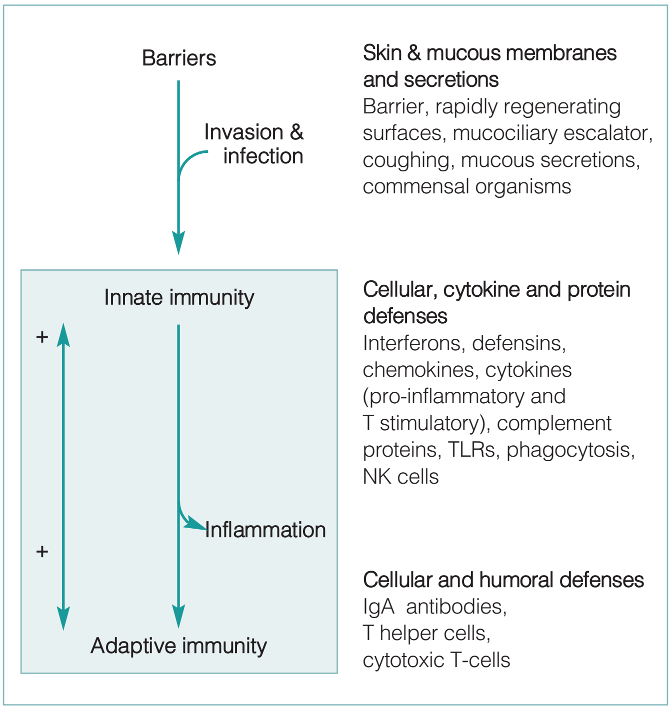


Fig. 2. Defenses of the healthy epithelium (the healthy soldier). Epithelial cells act as a barrier against respiratory viruses. The mucociliary apparatus (ciliary movement of mucus) and tight junctions (TJs) add mechanical, biological, and chemical protection. The airway epithelium also regulates both innate and adaptive immune responses, through production of antiviral substances such as IFNs, lactoferrin, β-defensins, and nitric oxide (NO) in the mucus layer and production of cytokines and chemokines which recruit and activate immune cells in the submucosa (Vareille M. et al. Clin. Microbiol. Rev. 2011:24:210-229).

All respiratory epithelium produces mucous and the epithelial cells form tight junctions (Fig. 2). These cells also have important immune functions for both the innate and adaptive immune response. The cilia of the epithelial cells of the respiratory tract provide the movement necessary to move the mucous produced by goblet cells to be transported up the mucociliary elevator where it is swallowed and cleared through the digestive tract.

The mucociliary elevator is important for the entrapment and clearance of pathogens and particulate material. Dehydration thickens the mucous and irritants like ammonia as well as pathogens like Mycoplasma hyopneumoniae and swine influenza depress cilia movement.

Fig. 1. Respiratory immune responses (adapted from David J. Topham, Introduction to Viral Immunology: Part I).



Innate immunity

The second line of defense is the innate immune response, which is location specific- in the URT, the innate defenders are predominately respiratory epithelial cells while in the lower respiratory tract particularly in the lung, alveolar and interstitial macrophages are the defenders.

This response starts where pathogens interact directly with epithelium or macrophages and engage the immune system.

The epithelium produces interferon, defensin, nitric oxide and lactoferrin that, not only provide antimicrobial protection in the lumen of the respiratory tract, but they also recruit cells from the circulation with chemokines and cytokines through the inflammatory process and activate more of the innate response (neutrophils, eosinophils, macrophages and natural killer cells).

Natural killer (NK) cells, like many cellular components of the innate immune system, have a dual function: an innate response to attack virus-infected cells and cytokine production for assisting in the activation of the acquired immunity. This activation of the innate immune system then activates T-cells of the acquired immune response (Fig. 2).

Alveolar macrophages phagocytize inhaled particles or pathogens, including low numbers of bacteria that they may encounter. After ingesting particles, they leave the alveolus by one of two pathways: through the airways and then moving up the mucociliary escalator, or between alveolar epithelial cells to enter the lymph. Alveolar macrophages activate T-lymphocytes to initiate an immune response.

Alveolar macrophages are a major target of Porcine Respiratory and Reproductive Syndrome virus (PRRSV), preventing effective antiviral responses and leading to secondary bacterial infections.

Pulmonary intravascular macrophages are found in the lungs. They are prominent in pigs and are primarily involved in defense against septicemia rather than protection from respiratory disease.

Pulmonary intravascular macrophages that are actively clearing bacteria (especially gram negative bacteria) from the bloodstream may release cytokines and inflammatory mediators that contribute significantly to respiratory disease.

Acquired immunity

The acquired immune response, the third line of defense, with its myriad of B-cells, T-cells, cytokines, and antibodies provides the pathogen-specific memory with continued duration of protective immunity.

The acquired response is the target for vaccines to generate memory and protection. In the mucosal lymphoid tissues (Fig. 3), mature T-cells and B-cells that have been stimulated by antigen and produce IgA will leave the submucosal lymphoid tissue and re-enter the bloodstream.

These lymphocytes will exit the bloodstream into the submucosa of other mucosal associated lymphoid tissue (MALT), many that are associated with the respiratory tract.

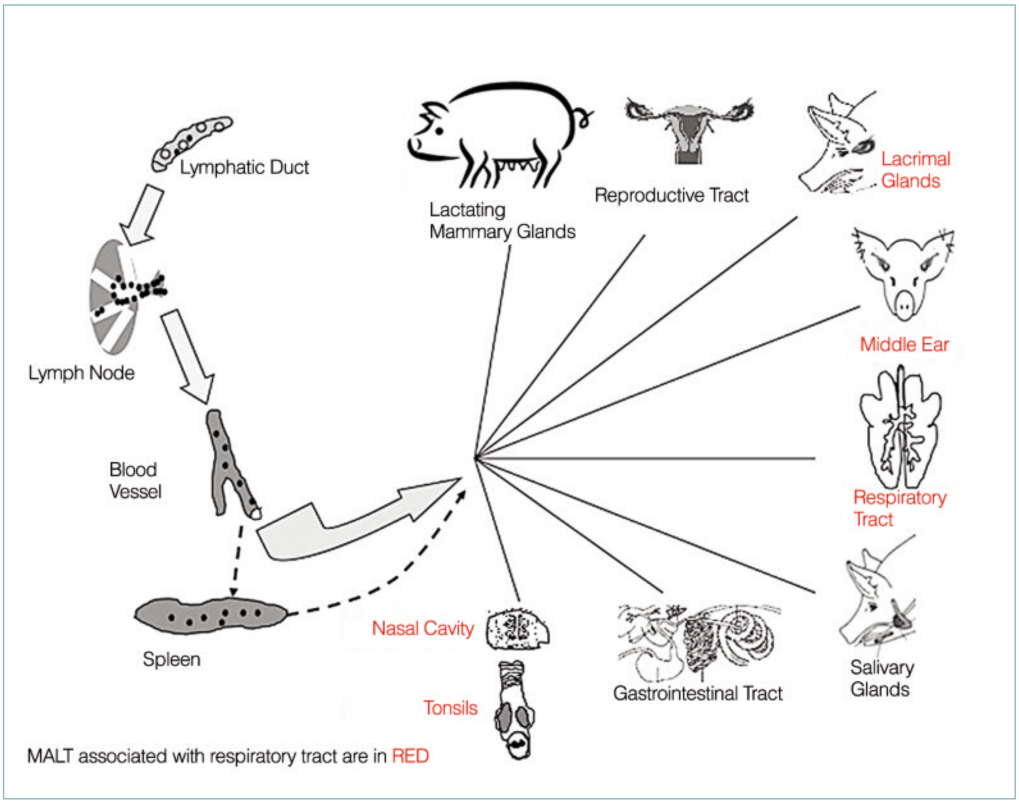
Many of these cells will return to the same mucosal surface from which they originated but others will be found at different mucosal surfaces throughout the body.

This homing of lymphocytes to other MALT sites throughout the body is referred to as the 'common immune system' (Fig. 3). The predominant Ig secreted by the mucosal immune system is IgA. IgA is secreted by plasma cells in the submucosa and is transported to the mucosal surface of the epithelial cell.

The epithelial cells add a secretory component to IgA that is important for protecting the IgA molecule from proteolytic enzymes and also serves to anchor the IgA into the mucous layer forming a protective coating on the mucosal surface.

IgA plays an important role in immunity by making infectious agents clump together, preventing attachment of infectious agents to epithelial cells, and neutralizing toxins. Intraepithelial T lymphocytes are important mediators of immunity at mucosal surfaces. This is especially true for respiratory infections. Pigs have high numbers of intraepithelial lymphocytes that are predominantly T-cells (many are cytotoxic T-cells that kill virus-infected cells).

Fig. 3. The common mucosal immune system (Adapted from Mucosal Immunology and Vaccine Development).



Final thoughts

Maximizing the immune response against respiratory pathogens requires a concerted effort to make sure the immune system can respond adequately to respiratory vaccines. Vaccines need to be applied strategically at those times that will result in an adequate immune response prior to pathogen exposure.

For the acquired immune response to perform optimally, pigs need to have a proper nutrition plan [energy, protein, immune minerals (copper, zinc, selenium)], low stress (proper density, minimize co-mingling, thermal neutral temperature) and a clean, dry comfortable environment.

THE DERMIS AS A PRIME SITE OF VACCINE DELIVERY

Professor Artur Summerfield, Chair of Veterinary Immunology, University of Bern, Switzerland.

The skin is most exposed to the environment and thus represents a major physical and immunological protection against injury and infection. Therefore, similar to the mucosal immune system, the skin has a coordinated system in which epithelial cells, resident immune cells, lymph and blood vessels operate very efficiently if the epidermal barrier is disrupted.

This is the basis for using the skin as a site of vaccine delivery. The skin comprises three main layers. The avascular epidermis composed of several layers of cornifying squamous keratinocytes is, similar to humans, 30-140 µm thick in pigs and represents the main barrier of the skin. The dorsal epidermis in the neck region is generally thicker than the ventral site, with a particular thin inguinal area. With age, there is a slight decrease in epidermal thickness, which is however not relevant for pig farming. In addition to keratinocytes, the epidermis contains a type of antigen-presenting cell similar to dendritic cells (DC), called Langerhans cells.

The dermis in pigs is 10-13 times thicker than the epidermis and is composed of collagen and elastin fibres with many lymph and blood vessels as well as resident dermal DC, mast cells and fibrocytes. The subcutis as third layer represents a fatty layer, which is approximately 12mm thick in pigs (Fig. 1).

Dendritic cells represent a specialized cell type of the immune system which play a major role in inducing and orchestrating immune responses. Therefore, it is essential to target this cell type for efficacious vaccines. DC are equipped with many receptors that are able to sense invading pathogens, such as Toll-like receptors which recognize pathogen-associated molecular patterns like viral nucleic acids or bacterial cell wall components. Triggering DC activation by such alarm signals is essential for induction of adaptive immune responses, including vaccines. Therefore, vaccines can be supplemented with immunostimulatory components triggering this process. After taking up invading pathogens or vaccine antigens, activated DC migrate through lymphatic vessels to the draining lymph nodes where immune responses are induced (Fig. 1).

Within the skin, the dermal layer is best equipped to mount immune responses as it contains many resident DC, as well as many lymphatic and blood vessels. After intradermal vaccine deposition, resident DC will react and fulfill their functions as sentinels and antigen-presenting cells as described above.

In contrast to dermal DC, Langerhans cells present in the epidermis are less efficient at stimulating immune responses. Inflammatory signals induced by immunostimulatory vaccine components will also trigger the extravasation of monocytes from the blood capillaries present in the dermis. Monocytes will then differentiate into inflammatory DC and macrophages, thereby creating a large pool of innate immune cells participating in the induction of immune responses. Importantly, the dermis is rich in lymphatic vessels through which antigen-loaded DC and free antigen will be transported to the lymph nodes where adaptive immune responses are induced. Dermal DC are particularly efficient at activating T lymphocytes, which are activated only by processing antigenic peptides presented in Major histocompatibility complex molecules expressed at high levels on DC. In contrast, B lymphocytes are activated by unprocessed free antigen.

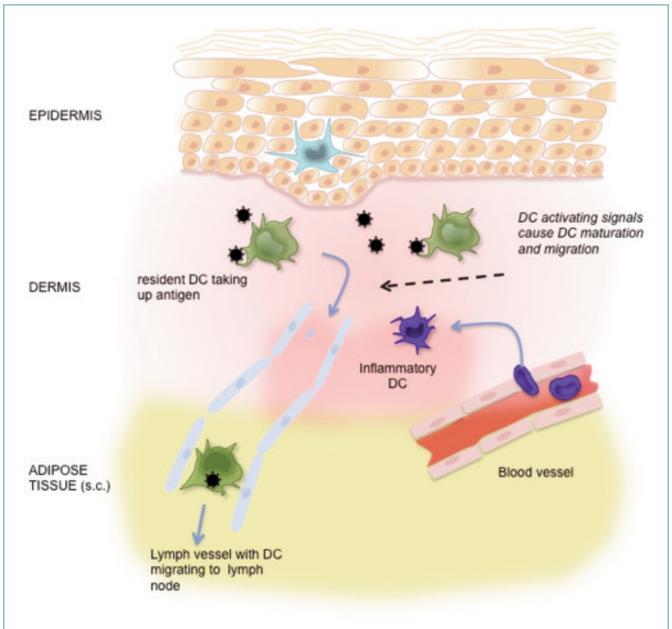
T and B lymphocytes will reciprocally activate each other, a process required for the induction of immunological memory.

These anatomical and immunological conditions represent the basis for targeting the dermis as a site of vaccine delivery. A review of published literature on the experimental comparison of intradermal (i.d.) to intramuscular/subcutaneous (i.m./s.c.) vaccine injection in various animals and human demonstrate that while all parenteral vaccination routes are highly immunogenic with good vaccines, much lower antigen doses are necessary for i.d. vaccination.

It can be expected that improved adjuvants, specifically developed for i.d. vaccines, will further favour this route of vaccine delivery.

In addition, a most important advantage of i.d. delivery is the possibility to employ needle-free safe vaccination devices such as pressure injection. Furthermore, i.d. in contrast to i.m. injection does not damage pig carcasses and, is considered to be less painful and more animal friendly.

Fig. 1. The dermis represents an excellent site for vaccine delivery being rich in resident dendritic cells (DC), lymph vessels and blood capillaries. Dermal DC act as sentinels of the immune system in the skin. They take up antigens or pathogen, and after activation migrate through the lymph vessels to the draining lymph node where immune responses are induced. Local inflammation induced by immunostimmulatory vaccine components not only activate resident DC but also cause an infiltration of inflammatory cells, including monocytes. These differentiate into DC and macrophages, which participate in the induction of immune responses.



In conclusion, i.d. vaccine delivery has a clear advantage or i.m./s.c. injections.

In both human and veterinary medicine, several devices have been developed for this purpose, the main ones being pressure-based liquid jet injection, microneedles, and particle based injection principles.

Although significant work is also invested in human medicine in less invasive transcutaneous immunization techniques, such approaches will be less immunogenic due to the barrier function of the epidermal stratum corneum and less efficient delivery to immunogenic dermal DC.

In pigs, pressure devices, such as IDAL (MSD Animal Health) have proven to be very effective and safe for delivery of 0.2 mL of a formally registered i.d. vaccine.

Based on the immunological benefits of i.d. vaccination, this delivery route should become a consideration for the modern pig producer. ■

GET PRDC CONTROL AND PREVENTION STRATEGIES CUSTOMIZED TO YOUR FARM

Porcine Respiratory Disease Complex (PRDC), recognized by various respiratory signs also resulting in reduced feed efficiency and poor growth, remains a major economic concern in pig farms around the world.

The etiology of PRDC tends to be a complex mixture of pathogens, environmental and management factors, host immune system weakness and genetics. Some of the pathogens commonly involved in PRDC include Porcine Reproductive and Respiratory Syndrome virus, Swine Influenza virus, Porcine Circovirus, Mycoplasma hyopneumoniae and a variety of bacteria, such as Haemophilus parasuis, Actinobaccillus pleuropneumoniae and Streptococcus suis.

Considering this complexity, identification of the primary cause of the disease is often difficult and prevention and control strategies may vary widely within and between production sites. Therefore, veterinarians and producers need to have access to appropriate tools to identify, not only the cause of PRDC, but also the risk factors so that long-term effective solutions can be attained.

Nearly a decade ago, the ResPig Management System was developed to provide veterinarians and pig producers with a systematic problem solving method for respiratory disease. All the important risk factors are checked so the most effective plans of action can be formulated and monitored over time.

Because of its continued dedication to PRDC prevention and control and the increased need for swine veterinarians and producers to make effective and profitable treatment decisions, Merck/MSD Animal Health recently updated and expanded the existing ResPig Management System. The tool is now even more user-friendly, flexible and solutions oriented.

The new ResPig Management system will include 4 different sections that can either be used separately or in combination:

1. Audits.
2. Slaughter Check Tool.
3. Economic simulator.
4. Information resources.

Each of these sections is briefly reviewed here.

Audits: The audits are questionnaires that analyze management, health, vaccination protocols and biosecurity status of the production system. The user can opt to fill out one or more pending on the farm. Via a scoring system, risk factors are highlighted and indicators are identified which point to specific possible PRDC causative agents.Pending on the audit findings, additional laboratory analysis may be needed to establish a severity score for each pathogen audited including an estimation of the timing of infection of the different pathogens. Upon completion of the audit, the results are summarized in an easy to read, dashboard style, report.

Slaughter Check Tool: Slaughter checks are an excellent tool to determine chronic lung lesions and/or respiratory diseases that are still active at the end of production. The slaughter check results (pneumonia, pleuritis and rhinitis scores) can be entered and analyzed in this tool. The outcome of this analysis further refines the specific pathogen score.

Economic Simulator: This is a modeling tool to support the decisions around intervention strategies for the control/ reduction of respiratory problems in the farm.

The Economic Simulator compares production and economic parameters before and after introduction of an intervention strategy and estimates the impact of the intervention on profitability. The Economic Simulator allows the user to simulate predicted performance and compare the economic impact of various intervention combinations.

Information resources: This section is an educational database with information about PRDC, various trainings about disease management and vaccination techniques, as well as Merck/MSD respiratory solutions.

The various tools in the renewed ResPig Management System make this a one stop PRDC resource and decision-making tool for the veterinarian and swine producer. The audits allow the veterinarian together with the producer to do a consistent and standardized review of various health and management aspects, ensuring that nothing is overlooked time after time.

The economic simulators serve to run “what-if” scenarios that lead into effective decision making about farm specific PRDC interventions. As scenarios can be saved in the database, benchmarking can be done to ensure that goals are being met. Throughout this process, the veterinarian works and communicates closely with the producer, creating a true partnership between them.

The ResPig Management System is a key tool in the improvement of overall health, production results and profitability of swine production systems around the world. ■

ResPig Management System

THE ECONOMICS OF RESPIRATORY DISEASE

Derald Holtkamp MS, DVM, Associate Professor in the Department of Veterinary Diagnostic and Production Animal Medicine, Iowa State University College of Veterinary Medicine.

Dates	Flow	Number of groups	Vaccine
Period 1			
August 2011 to April 2012	Terminal	29	Vaccine A
	Maternal	25	Circumvent PCV
Period 2			
May 2012 to December 2013	Terminal	30	Vaccine B
	Maternal	20	Circumvent PCV

Table 1. Vaccine strategies compared.

Understanding the economics of respiratory disease in growing pigs is necessary for making informed decisions related to animal health. How much is disease costing the operation? Should more resources be allocated to improve pig health? Will implementation of a particular animal health intervention yield a positive return? If multiple animal health interventions are available which will yield a better return?

Evaluating the cost of disease and the value of interventions

The benefit of any animal health intervention is derived from a reduction in the cost of disease targeted by the intervention.

Therefore, estimating the benefit of an animal health intervention can be thought of as the negative of estimating the cost of disease. As a first step toward estimating the cost of disease, or the value of an animal health intervention, swine veterinarians and producers must understand how the disease and intervention impacts the profitability of the producers operation.

This is challenging and requires a fundamental understanding of:

1) How the recommendation impacts pig productivity. Reasonably accurate estimates of productivity impacts attributed to animal health interventions can be very difficult to make and defend. Arguably the best source of information comes from well-designed and executed field studies conducted by the producer or others under the same conditions in which his or her pigs are raised. Other good sources of information come from the producer's historical production data and the clinical experience of their veterinarians.

The literature and studies conducted by the vendors selling animal health products are also good sources of data.

2) How the productivity impacts translate into revenues, costs and profitability. Animal health recommendations have a cost, a potential improvement in productivity and increases or decreases in revenue and other costs that will affect the profitability of the farm or production system.

The cost of the recommendation is nearly always known with a high level of certainty. For example, the cost of a recommendation to vaccinate pigs with a single dose of a vaccine would be the price of the vaccine per dose times the number of pigs vaccinated plus labor and some material costs; all of which are nearly perfectly predictable.

The benefit, on the other hand, depends on the improvement in productivity and increases or decreases in revenue and other costs that are realized.

Here is where it gets complicated since the realized benefit depends on many variables; season of the year, health challenges, level of management, etc., and is not nearly as predictable and much more difficult to quantify.

Furthermore, the changes in productivity must be converted into dollars (or other local currency).

This can be complicated and a basic understanding of the concepts of how revenue and costs change as productivity changes is required.

The tool of choice for dealing with the complexities is an enterprise budgeting model, like the economic simulator in MSD Animal Health's ResPig Management System.

Table 2. Summary of productivity metrics for Circumvent PCV vs. Vaccine A in period 1.

	Vaccine A	Circumvent	Difference
Flow	Terminal	Maternal	
Number of groups/head placed	29/56,830	25/66,611	
Mortality rate (%)	2.68[a]	1.45[b]	-1.23
Cull rate (%)	1.61[a]	0.87[b]	-0.74
ADG – Actual (g/day)	866[a]	857[a]	-9
ADG – W/ Adjustment for maternal genetics (+0.029)		885	19
FCR – Actual	2.742[a]	2.737[a]	-0.005
FCR – W/ Adjustment for maternal genetics (-0.1)		2.637	-0.105

[a,b] Values with different superscripts within a row were significantly different (P <0.05).

Table 3. Summary of productivity metrics for Circumvent PCV vs. Vaccine B in period 2.

	Vaccine B	Circumvent	Difference
Flow	Terminal	Maternal	
Number of groups/head placed	30/60,847	20/54,202	
Mortality rate (%)	3.01[a]	1.55[b]	-1.46
Cull rate (%)	1.31[a]	0.76[b]	-0.55
ADG – Actual (g/day)	893[a]	866[a]	-27
ADG – W/Adjustment for maternal genetics (+0.029)		894	1
FCR – Actual	2.627[a]	2.635[a]	-0.008
FCR – W/ Adjustment for maternal genetics (-0.1)		2.535	-0.092

[a,b] Values with different superscripts within a row were significantly different (P <0.05).

ResPig Economic Simulator

The economic simulator in the ResPig Management System is an enterprise budgeting model that projects costs and revenues for growing pigs, for a period of time or group(s) of pigs. Producer specific values are entered for facilities and pig flow; productivity metrics (e.g. average daily gain, mortality and feed-to-gain ratio); input prices and costs; and market hog prices.

The economic simulator captures the major relationships between the entered values and calculates the total cost and revenue for the growing pig enterprise. Information about animal health interventions is also entered which is used to calculate a direct cost of the intervention.

The economic simulator can be used to evaluate if an animal health intervention will yield a positive return or to evaluate multiple animal health interventions to project which will yield a better return.

Using the ResPig Management System

As an example, the economic performance of alternative PCV2 vaccines was compared in the ResPig® Management System using retrospective production data from a single production system (Thacker et.al., 2014). The production system was divided into a maternal and terminal flow that produced replacement gilts and slaughter pigs, respectively. All of the pigs were fed by gender. Facilities consisted of separate nursery and finishing facilities and pigs flowed all-in-all-out by site. For this analysis, only finishing performance data was compared. The entire production system was negative for Mycoplasma hyopneumoniae and Porcine Reproductive and Respiratory Syndrome virus (PRRSV).

The historical porcine circovirus type 2 (PCV2) vaccine choices made by this production system created a natural experiment that facilitated head-to-head vaccine comparisons in two time periods (Table 1). Pigs were vaccinated with Circumvent PCV in the maternal flow in both time periods, while Vaccine A and Vaccine B were used in the terminal flow in each period 1 and 2, respectively. Per label recommendations, a single dose of Vaccine A and Vaccine B was given at 3 weeks of age and 2 doses of Circumvent PCV at 3 and 6 weeks of age.

Productivity differences were estimated using production data that was collected as each group of pigs was closed-out and the site was emptied. Productivity metrics analyzed included 1) average daily gain (ADG), 2) feed conversion ratio (FCR), 3) group mortality rate (MORT) and 4) group cull rate (CULL).

Differences in productivity metrics between vaccines within each time period were analyzed by ANOVA with pig group as the experimental unit. An important confounder in the vaccine comparison in each time period was that the productivity of the maternal genetics is typically lower than for terminal genetics. Based on personal communication with the genetic supplier, on average the maternal line would be expected to have a 0.029kg lower ADG and increased FCR by 0.100kg feed per kg of gain. To deal with this potential confounder, the analysis was done with and without adjustments made for the expected genetic differences. The results are summarized for period 1 in Table 2 and for period 2 in Table 3.

In both time periods the differences in mortality and cull rate between the two vaccines were statistically significant, with the advantage to Circumvent PCV, but the differences in ADG and FCR were not.

To estimate the economic value of the productivity differences between vaccines in each time period, the values for the productivity metrics in Tables 2 and 3 were entered into the economic simulator in the ResPig Management System. Values entered for facilities and pig flow; input prices and costs; and market hog prices were the same for both vaccines and were representative for the period covered by the analysis. Three analyses, each including a different set of productivity metrics, were done for each time period (Table 4).

Productivity metrics included	Value (US$)	
Period 1 (Circumvent® vs Vaccine A)		
Mortality and culls only	2.20	Only productivity metrics for which differences were significant ($p<0.05$)
All	1.74	All productivity metrics regardless of significance
All with adjustment for maternal genetics	6.57	All productivity metrics regardless of significance; after adjustments for maternal genetics
Period 2 (Circumvent® vs Vaccine B)		
Mortality and culls only	2.49	Only productivity metrics for which differences were significant ($p<0.05$)
All	0.33	All productivity metrics regardless of significance
All with adjustment for maternal genetics	5.29	All productivity metrics regardless of significance; after adjustments for maternal genetics

Table 4. Value of differences between vaccines on a US$ per pig marketed basis.

The first analysis included only those metrics for which the differences were statistically significant, mortality and cull rates. Values for ADG and FCR were set equal for both vaccines. The second analysis included the observed values for all of the metrics regardless of whether the differences were significant or not.

Because the differences for ADG and FCR were not statistically significant at $P<0.05$ we have less confidence, but not zero, that the differences were real and not simply due to random chance.

No adjustments were made to any of the metrics for genetic differences. The third analysis is the same as the second; except the genetic adjustments were made for ADG and FCR.

The results of the analysis on a US$ per pig marketed basis are in Table 4. For every analysis in both time periods, the advantage went to Circumvent PCV. In period, 1 the advantage ranged from US$1.74 to US$6.57 per pig marketed. In both periods the analysis which is on firmest footing is the one that included only differences in mortality and cull rates.

For this analysis the advantage to Circumvent PCV in both period 1 (US$2.20) and period 2 (US$2.49) was between the results for the other two analyses. It would, however, be unwise to simply ignore the genetic confounder and differences observed in productivity metrics simply because the differences were not significant at $p<0.05$.

Higher p-values simply mean that there is a greater chance that any differences observed are due to random chance but there is still a chance the differences were real.

As pork production consolidates and farms become bigger, the stakes of making good decisions get much larger. As the stakes increase, the amount of effort and rigor in evaluating animal health interventions increases as well. Tools like the economic simulator in the ResPig Management System add to the necessary rigor for making good decisions. ■

DUTCH EXPERIENCE WITH THE RESPIG MANAGEMENT SYSTEM

Victor Geurts, DVM, LL.Mm
MSD Technical Services, The Netherlands.

In The Netherlands, respiratory disease, such as PRDC resulting in poor technical-, slaughterhouse results and significant economical losses, is also a major concern for the pig industry.

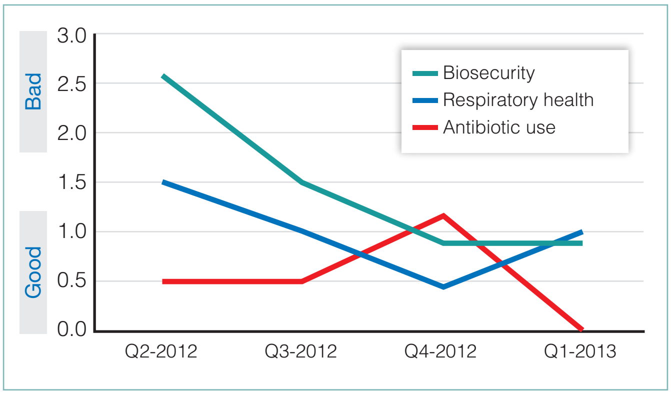
An incomplete diagnosis of the causative pathogens and a poor understanding of the other risk factors for infectious diseases often explains the suboptimal effects of preventive treatments, such as vaccination, on technical, slaughterhouse and economic performance.

MSD-Animal Health provides the pig industry not only with high quality products, such as vaccines, that are technically supported by an experienced group of veterinarians, but also with advise on diagnostic investigation of PRDC, including:

Table 1. Audit report for a multiplying farm.

	Score
Biosecurity	2.6
Management	1.0
Technical	1.4
Respiratory health	1.5
Non-respiratory health	0.2

Fig. 1. ResPig success.



1. identification of the causative infections
2. identification of non-infectious risk factors.
3. a plan of action including structural preventive measurements such as vaccination.
4. regular monitoring and evaluation of the results.

Evaluation of economic losses due to respiratory diseases and calculation of the return on investment (ROI) are the basis of intervention decisions and are important to have an economically healthy pig industry. This approach is formalized in ResPig.

The ResPig management system

The veterinarian can subscribe to the ResPig program which includes a regular cross-sectional serological and saliva (PCR) investigation of the different animal groups in the farm and a biosecurity, technical, clinical, management/ housing audit.

There are tailor made audits for all types of pig farms (multiplying, fattening, breeding, closed).

The diagnostic investigations focus on the respiratory pathogens that are present in The Netherlands; i.e. PRRSV, PCV2, Actinobacillus pleuropneumoniae, Mycoplasma hyopneumoniae, Influenza, AR and Haemophilus parasuis.

Upon completion of the diagnostic investigation, audit reports are generated and an intervention plan is discussed. With the convenient ‘traffic light’ system, the strong and weak points in a farm can easily be addressed (Fig. 1). A display of the scores over time can be made to visualize the effects of the interventions on those parameters. (example in Fig. 1: scores from 0 up to 3. 0 = perfect, 3 = bad).

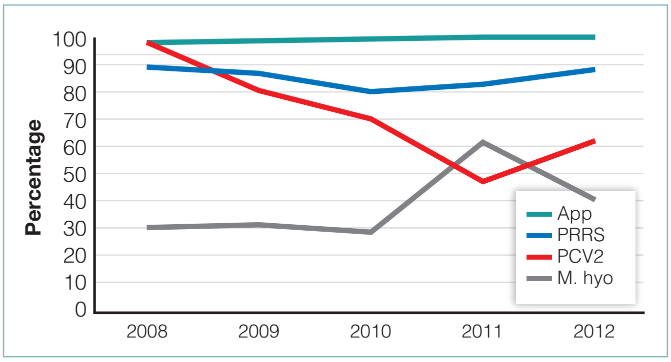


Fig. 2. Seroprevalence finishers 22 weeks.

Value ResPig for pig farms, veterinarians, advisors and pig traders

The ResPig management system generates valuable information on various aspects of the pig farm to establish a healthy and economic efficient business via:

- Complete diagnosis of respiratory problems including the influence of non-infectious factors.
- Clinical, technical and economical evaluation of the interventions such as vaccination.
- Consistent view of the health and infection status of the farm/pigs.
- Rapid detection of the origin of health problems of older or sold pigs.

Farm exceeding possibilities of ResPig

Because of the high number of participating farms, standardized sampling protocols and the presence of a clinical, technical, slaughterhouse and vaccination anamneses, a large data base can be formed on different levels (within: vet practice, farm types, country).

This data base provides a lot of (benchmark/comparative) information that can serve the individual farms and veterinarians. With this information it is possible to:

- Evaluate the efficacy of vaccination strategies.
- Determine influence of infections on technical, slaughterhouse and economic performance.
- Identify risk factors for higher antibiotic use.
- Epidemiological evaluation: presence (prevalence) of infections in farms/regions and the possible explanations (Fig. 2).

Long term experience with ResPig

ResPig was introduced in The Netherlands in 2008. Nowadays, more than 10% of the industrialized farms are using ResPig which is reflected in the amount of audits/investigations (Fig. 3).

MSD-AH The Netherlands commissioned a survey of 292 ResPig and non-ResPig farms with the following results:

All farms:

- 50% does a regular audit/ serological monitoring.
- 78% of 'non-ResPig users' is very interested to know what ResPig is.
- 14% does a regular economic analysis of the effect of interventions → 90% is interested.

ResPig using farms:

- 76% → ResPig results can be used as a 'farm passport': certificate of status.
- 43% saved extra money due to ResPig.
- 38% used less antibiotics due to ResPig.
- 82% is willing to pay the advisor for evaluating the results and for his advice.

Summary

With ResPig, the Dutch veterinarian now has a problem solving tool to successfully conquer respiratory problems in farms.

The tool is highly appreciated by the farmers especially when all features (investigations, audit and economic calculation) are used.

Besides a systematic approach of clinical problems, ResPig also provides a consistent view of the farm health status so that the origin of possible problems can easily be determined.

When ResPig is used on a large scale, it generates a lot of benchmark and epidemiological information beneficial for the individual pig farm and veterinarian.

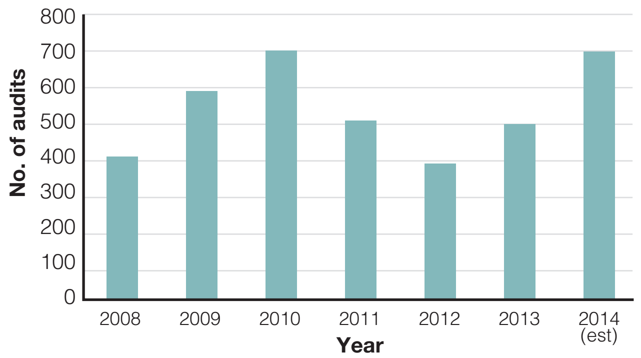


Fig. 3. Audits/investigations.

THE ADVANTAGES OF A NEEDLE-FREE INTRADERMAL INJECTION SYSTEM

Dr Rika Jolie

In the modern swine industry, producers are managing larger specialized units, where vaccination has become a necessary tool to maintain the farm's health status.

The majority of vaccines are delivered with a standard needle and syringe, which tend to be inexpensive and easily adaptable. However, this conventional vaccination method has many disadvantages, including broken needles, negative impact on pork quality, significant risk of self-injection, bio-hazards, and transfer of infection to other pigs.

Therefore producers are interested in effective, convenient, operator and animal friendly, vaccination tools that also address the consumers' demand for safe and high quality pork.

As a result, needle-free injectors are being considered more and more as an alternate technology to the conventional needle and syringe.

The basic principle of needle free injectors is that a high pressure stream of fluid is forced through the skin via mechanical pressure in a fraction of a second.

Needle-free injectors have many known advantages.

They result in the elimination of broken needles and associated carcass trim, improve employee safety by avoidance of the accidental needle stick, and reduce the biological waste.

They also reduce the risk of spreading viremic diseases like PRRSV, which occurs when re-using the same needle-syringe on multiple animals, and cause less stress and pain for the animal.

Needle-free injection tends to be more precise and reliable, with the dose being virtually identical every time, compared to needle-syringe vaccination, which relies more on equipment (e.g. needle length and gauge) and technique. All these advantages definitely outweigh a higher equipment cost and required maintenance

Needle free injectors can be divided into various types based on their power source (spring, battery or compressed gas).

In contrast with the more compact battery operated injectors, compressed gas injectors tend to be more cumbersome for the user due to the multiple components and their reliance on an exhaustible energy source.

Location of vaccine delivery also differs between needle free injectors and can be either transdermal or primarily intradermal.

The transdermal delivery deposits a standard vaccine dose (2 mL) subcutaneously or intramuscularly, resulting in an immune response that is comparable to traditional needle-syringe vaccination.

In contrast, the intradermal route delivers a small volume (<0.5 mL) of a formally registered vaccine formulation primarily in the skin and dermis.

As the skin is rich in dendritic cells, a powerful antigen presenting cell, intradermal vaccination induces a strong humoral and cellular immune response.

The IDAL injector, developed by Merck/MSD Animal Health, is an example of a battery powered, intradermal injector that delivers a 0.2 mL vaccine volume.

Those vaccines used with IDAL have specific regulatory approval for intradermal administration.

Compared to other needle-free injectors, the IDAL is easier to handle and more convenient, as it is battery operated, comes in one piece without any additional components, is robust and easy to clean.

IDAL, which is produced in partnership with Henke-Sass Wolfe, combines not only the mentioned advantages of a reliable needle-free delivering system, but also the ones resulting from an intradermal injection.

In recent years, needle-free injectors have become technologically more sophisticated and, considering the many advantages over needle and syringe, they should become a consideration for the modern swine producer.

Effective, safe and animal friendly in a single dose

Porcilis M Hyo ID Once

Take the leap forward with easy-to-use needle free vaccinations

Porcilis® M Hyo ID Once
Fewer lesions, more profit

Intervet International bv
P.O. Box 31, 5830 AA Boxmeer
The Netherlands
Phone +31 (0)485 587600
Fax +31 (0)485 577333
Email info@merck.com
www.msd-animal-health.com

MSD
Animal Health