SWINEPRESS

Biosicurezza: scatta l'ora del fare anche ai Congressi Veterinari

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Ormai da qualche anno in suinicoltura si sono registrati notevoli progressi sul fronte dei presidi immunizzanti per molte delle patologie più diffuse negli allevamenti intensivi: tuttavia le recenti necessità ed imposizioni in materia di riduzione dell'**uso di antibiotici e chemioterapici** obbligano a guardare alla "protezione" del suino su tutti i fronti, anche quelli per cui le vaccinazioni non sono disponibili.

Come non cercare quindi di impedire ogni possibile **contagio dall'esterno,** sia che esso viaggi con i beni che con le persone dirette agli allevamenti? Inoltre, come non tentare anche di limitare ogni possibile **circolazione di patogeni e contaminazione interna** all'allevamento?

Queste sono state le "**patate bollenti**" su cui si è concentrata l'attenzione dei veterinari convenuti ai due grandi e recenti convegni mondiali di patologia e management del suino, che si sono succeduti a maggio e giugno 2018.

E.S.P.H.M. a Barcellona e **I.P.V.S.** a Chongqing hanno infatti definitivamente (ri)portato sotto la luce dei "riflettori globali" un focus ormai non più rinviabile o rinunciabile: le pratiche di corretta gestione della protezione interna ed esterna degli allevamenti suini... insomma, la **BIOSICUREZZA.**

Il **10° E.S.P.H.M.** ha presentato in rassegna a **Barcellona dal 9 all'11 maggio** scorso il "fior fiore" della produzione scientifica europea (e non solo) nel campo della ricerca in suinicoltura.

Rispetto alle prime edizioni, si stanno affermando, negli ultimi anni, moltissime attenzioni ai temi di recente acquisizione nell'ambito delle produzioni industriali, come appunto le **strategie di prevenzione**.

Ad esempio, l'irrimandabile questione della riduzione dell'uso di antibiotici, unitamente alla ricerca di una sempre maggior applicazione delle normative sul benessere dei suini allevati, stanno proiettando in primissimo piano alcuni approcci, acquisiti da anni, ma ormai integralmente complementari alle buone prassi di allevamento: **prevenzione delle malattie, interruzione della catena di contagio, riduzione delle contaminazioni ambientali e comportamenti "virtuosi" del personale** addetto alla cura dei suini, sono oggi le uniche strade per giungere efficacemente al futuro bando d'uso di molti antibiotici.

In tale contesto, assume un forte impatto sulla suinicoltura europea moderna, l'attenzione a ridurre l'**amputazione della coda** ai soli casi di cannibalismo non diversamente risolvibili perchè *de facto* costringe a mettere il controllo degli infettanti ambientali sotto stretta sorveglianza.

Infatti, le piccole infezioni (ancorché aspecifiche) delle ferite cutanee dovute alle lotte di gerarchizzazione dei gruppi di suini neo-formati, sono deleterie quando si cerca di spostare l'attenzione dei suini dai propri simili con cui "litigarsi un posto in società" all'arricchimento ambientale preparato per farli abituare ai cambi di sito. Ambienti biologicamente sotto controllo e ricchi dal punto di vista manipolativo sono quanto di meglio si possa creare per provare ad allevare suinetti non caudectomizzati. Lo stesso dicasi per minimizzare le contaminazioni delle ferite da castrazione; anestesia ed analgesia per la castrazione sono di certo completate da ambienti (es. gabbie parto) ben disinfettati in sui condurre la prima convalescenza post-castrazione per i maschietti: la strada per ridurre l'uso dell'antibiotico è anche questa (Direttiva CE 120/2008 e successive Linee Guida MINSAL)

La biosicurezza diventa sempre più viatico prioritario e strumento indispensabile per raggiungere le mete ambite dalla comunità internazionale, che pone oggi una notevole attenzione alle mille sfaccettature in tema di riduzione anche dei contagi esogeni.

Riferimento 1 ◀
Riferimento 2 ◀
Riferimento 3 ◀

La biosicurezza all'esterno delle aziende produttrici di suini è l'unica vera barriera al diffondersi di patologie banali e non solo: i recenti focolai di **PED** hanno dimostrato quale facilità d'ingresso abbia il suo agente, viaggiando con automezzi ed alcune matrici organiche (mangimi).

Ormai la biosicurezza è la "trave portante" delle buone pratiche di allevamento: lo dimostra anche il **crescente interesse di "stakeholders" non direttamente coinvolti** nella produzione e nella commercializzazione di biocidi.

Riferimento 4 ◀
Riferimento 5 ◀
Riferimento 6 ◀

Alcune aziende farmaceutiche hanno prodotto negli ultimi anni degli **strumenti software** (vere e proprie applicazioni), in grado di funzionare sia on-line che su dispositivi off-line, che si prefiggono il compito di analizzare, schedare e misurare, i comportamenti correnti del personale di allevamento, le procedure attive e perfino le disponibilità tecniche delle misure di biosicurezza.

La motivazione di tutto ciò è la necessità per alcuni *grandi marchi del farmaco* di supportare alcune dei propri prodotti immunizzanti, con un servizio post-vendita adatto a creare in allevamento condizioni ottimali per il funzionamento e la "tenuta" dei vaccini: infatti, è ormai assodato che - **al ridursi della pressione infettiva** - corrisponde sempre e comunque una **maggiore efficacia della profilassi vaccinale.**

Si sono dunque moltiplicati i percorsi e le applicazioni per audit di Biosicurezza "software assistiti": *nulla di nuovo sotto il sole*, ma tuttavia un plauso va fatto per il concreto passo in avanti *conquistato* dalle strategie di prevenzione ambientale, se anche chi ha sempre avuto un approccio più indiretto (es. i produttori di vaccini) ha abbracciato la Biosicurezza come baluardo finale e irrinunciabile.

Se fino ad oggi abbiamo fatto conto che fra gli anti-infettivi fossero gli antibiotici a fare il lavoro di contenimento di quanto sfuggisse agli immunizzanti (fosse questo dovuto ad incomplete risposte vaccinali od all'irruzione di infezioni concomitanti o secondarie), ora invece ci si rivolge a biocidi e disinfettanti, per la loro acclarata capacità di contrastare la pressione infettiva ambientale.

Riferimento 7 ◄

Riferimento 8 ◄

In un'ottica più "scolastica", un ottimo compendio a tutto campo di quello che la Biosicurezza può garantire in termini di riduzione dei contagi, si rispecchia nel lavoro di ricerca del'Università di Ghent, mentre ulteriori spunti di riflessione sono rappresentati dalla **visione "sociologica" della biosicurezza** di matrice ispano-australiana offerta nella ricerca di Marta Hernández-Jover.

Infatti, risultano assai interessanti le valutazioni che si possono al livello di "biosicurezza percepita" in corso di sopralluoghi ad aziende a carattere "industriale", piuttosto che a quelle a conduzione "familiare", o addirittura di tipo "ricreativo".

Indubbiamente, in tutti questi ambiti le differenze di approccio sono ampie e che questa prospettiva possa aiutare chi è più *indietro* su certi temi a recuperare il tempo perduto: in fondo la legge non fa differenza fra chi alleva suini con lo scopo di immetterne le carni sul mercato e chi invece li detiene solo per il piacere della loro "compagnia" perché riduzione ed uso responsabile degli antibiotici, sono prescritti in tutte le specie zootecniche e la trasmissione di antibiotico-resistenza è un rischio sia per i consumatori di derrate alimentari che per chi vive anche solo a contatto con gli animali in genere.

Tra la gente "comune" (il cosidetto *grande pubblico*), il rischio di identificare la produzione intensiva con l'unico problema impattante sul territorio (l'antibiotico-resistenza è solo un primo esempio!), fa da contraltare alla convinzione di poter ritenere sicura la piccola produzione familiare, micro-diffusa a livello locale ed idealizzata quasi fosse una zona franca per i patogeni e per gli errori manageriali.

Il *capitolo manodopera* ha fatto la parte del leone in sede congressuale, per l'opinione prevalente in tutti i presenti – ricercatori, autori, delegati e veterinari – che **la formazione e la motivazione** (es. comprensione delle istruzioni, condivisione di obbiettivi e incombenze individuali) degli addetti all'allevamento e/o agli animali siano momenti chiave per la corretta applicazione delle procedure di Biosicurezza e dei presidi disinfettanti, senza dimenticare il coinvolgimento di terzi nella biosicurezza esterna alle aziende (es. tecnici, veterinari, autisti dei numerosi mezzi diretti negli allevamenti).

Riferimento 9 ◀

Tecnologie disponibili a basso costo rendono oggi possibili **monitoraggi in tempo reale** degli spostamenti dei diversi addetti all'interno delle strutture e fra le stesse, in modo da verificarne l'osservanza dei divieti di transito da zone infette a zone a minor livello di contaminazione (come esempio passaggi diretti ingrasso<>sala parto) e appositi rilevatori del passaggio del personale (e soprattutto del suo smartphone!), possono registrarne le sequenze di movimento, i tempi, il rispetto dei cambi di indumenti e calzari laddove previsto, le precauzioni in uscita dalle zone infette e successivo ritorno a quelle più "pulite": applicate, su più vasta scala, anche al personale in ingresso agli allevamenti (camionisti, tecnici, veterinari, visitatori) e permetterebbe una conoscenza vera e dettagliata di ciò che si muove attorno e dentro gli allevamenti .... patogeni compresi!

Nel successivo mese di giugno, il XXV I.P.V.S. a Chongqing (CINA) è stato un congresso rivolto ad un immenso "Continente Nuovo" di operatori (veterinari, allevatori, produttori e tecnici), parzialmente ancora vergini rispetto ad istanze da anni coltivate nei vecchi mercati suinicoli dell'Europa e del Nord America), in cui la linea editoriale della biosicurezza è stato a tratti inevitabilmente "scolastica".

In una delle "*Lectures*" generali dedicate al *Healthy & Safe pork*, si è comunque potuto approffittare di un ottimo compendio a 360 gradi sulle pratiche di controllo ambientale della pressione infettiva in due specifiche relazioni di due autori statunitensi come Thomas Gillespie e Satoshi Otake.

Riferimento 10 ◀
Riferimento 11 ◀

Una nota di colore a margine dell'impegno congressuale .... per i delegati europei è stato davvero quasi irreale invece sentire parlare di Peste Suina, come di un fatto epidemiologicamente "normale" per le produzioni suinicole dei paesi dell'Estremo Oriente: tuttavia succede anche questo ad un congresso in Asia e fa davvero bene sentir citata la biosicurezza in casi così drammatici di circolazione di patogeni convincendo una volta di più a ri-posizionare, la profilassi diretta (ovvero la biosicurezza, come si usa dire oggi), tra le “leve” di maggior calibro nella gestione ambientale della salute animale.

In conclusione tutto il mondo è paese, sia che si tratti di fare il “lavoro di fino” nei confronti di infezioni complicanti o secondarie (fino a proporre l’abbandono del taglio coda?), sia che fronteggino infezioni radicate ed enzootiche (es. PRRS) piuttosto che patologie di più grave impatto (PSA nell’Est Europa o in Asia).

Le procedure di biosicurezza sono davvero ormai assurte a **conditio sine qua non** per veterinari e produttori zootecnici in tutto il mondo, sia in termini di esiti sanitari che di rapporto costo/beneficio!

Fabio Persico
Medico Veterinario

VIRAL DISEASES

ORAL

VVD-OP-03

EVALUATION OF THE SURVIVAL OF VIRAL PATHOGENS IN CONTAMINATED FEED INGREDIENTS USING TRANSBOUNDARY SHIPMENT MODELS

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Introduction

This study evaluated survival of important viral pathogens of swine or their surrogates in contaminated feed ingredients during simulated transboundary transportation. Based on global significance, 11 viruses were selected, including Foot and Mouth Disease Virus (FMDV), Classical Swine Fever Virus (CSFV), African Swine Fever Virus (ASFV), Influenza A Virus of Swine (IAV-S), Pseudorabies virus (PRV), Nipah Virus (NiV), Porcine Reproductive and Respiratory Syndrome Virus (PRRSV), Swine Vesicular Disease Virus (SVDV), Vesicular Stomatitis Virus (VSV), Porcine Circovirus type 2 (PCV2) and Vesicular Exanthema of Swine Virus (VESV).

Materials and Methods

To model the survival of FMDV, CSFV, PRV, NiV, SVDV and VESV, surrogate viruses with similar physical properties and stability were used, and those consisted of Seneca Virus A (SVA) for FMDV, Bovine Viral Diarrhea Virus (BVDV) for CSFV, Bovine Herpesvirus Type 1 (BHV-1) for PRV, Canine Distemper Virus (CDV) for NiV, Porcine Sapelovirus (PSV) for SVDV and Feline Calicivirus (FCV) for VESV. Remaining assessments involved the actual pathogen. Controls included complete feed (positive and negative controls) and stock virus positive controls (virus only, no feed matrix). Virus survival was evaluated using either a Trans-Pacific or Trans-Atlantic transboundary model, involving representative feed ingredients, transport times and environmental conditions, with samples tested by PCR, VI and/or swine bioassay.

Results

Select viruses (SVA, FCV, BHV-1, PRRSV, PSV, ASFV and PCV2) maintained infectivity during transport, while others (BVDV, VSV, CDV and IAV-S) did not. Survival was maximized in ingredients including conventional soybean meal, lysine hydrochloride, choline chloride, and vitamin D.

Discussion and Conclusions

These results demonstrate survival of certain viruses in specific feed ingredients ("high-risk combinations") under conditions simulating transport between countries. This work supports previously published data on the survival of PEDV in feed and provides further evidence indicating that contaminated feed ingredients may serve as risk factors for foreign animal diseases.

VIRAL DISEASES

VVD-023

NORTHERN IRISH PORCINE REPRODUCTIVE AND RESPIRATORY SYNDROME VIRUS (PRRSV) TYPE 1 ISOLATES EVIDENCE CONSIDERABLE VARIABILITY IN THE OPEN READING FRAME 5 (ORF5)

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POSTER

Introduction

PRRSv is widely spread around Northern Ireland infecting most breeding and growing pig farms. PRRSv vaccines are used in 90 to 95% of infected sow herds, while less than 15% of weaning-growing pigs receive vaccines. PRRSv is frequently involved in porcine respiratory disease complex. PRRSv infection rarely causes severe clinical signs, and a remarkable number of famers reject the use of vaccines, arguing the perceived very mild-to-nill contribution of PRRSv to respiratory problems and performance drops.

Material & methods

Between 2016 and 2017, we gathered PRRSv isolates from clinical cases of mild-to-severe respiratory disease in Northern Ireland, from which 8 samples from different farms were selected. The ORF5 gene was sequenced (Anicon, Germany). The Animal and Plant Health Agency (APHA) provided additional historical sequences from Irish samples to compare the homology between them. We built a Neighbour-joining phylogenetic tree with an additional 687 nucleotide sequences from the UK and compared the nucleotide identity.

Results

Northern Irish samples were PRRSv type 1 with >85% similar nucleotide identity with the Lelystad strain.

Variability between Northern Irish strains was noticeable with nucleotide identities as low as 84%. These strains were widely spread in the phylogenetic tree (see poster) among other British, Irish and reference isolates.

Discussion & conclusion

PRRSv from these Northern Irish cases did not belong to any single cluster based on ORF5 analysis, contrary to the beliefs of many Norther Irish producers regarding the mildness of the disease and the lack of necessity to vaccinate against PRRSv in Northern Ireland.

Predictions of disease severity and vaccine effectiveness based on ORF5 sequence are not possible. Northern Irish farms are infected by a wide range ofPRRSv-1 viruses, and clinical cases do need a proper investigation to elicit the best control measures – with or without vaccines.

HERD HEALTH MANAGEMENT & ECONOMY

HHM-077

APPLICATION OF A RISK ASSESSMENT TOOL TO ASSESS THE EXTERNAL BIOSECURITY OF PIG FARMS

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Currently, the generation of knowledge and implementation of biosecurity on farms is essential in pig production. The development of tools to identify where to focus efforts for improving biosecurity and objectively compare the level of biosecurity among farms is an important component.

The aim of this study was to evaluate the external biosecurity of pig farms in Argentina by adapting a previously developed tool (Allepuz et al. 2017). It was applied in the context of a hypothetical porcine epidemic diarrhea (PED) outbreak were PED herd prevalence was obtained from Beam et al. (2015). We considered six possible routes of disease introduction: i) replacement animals; ii) vehicles transporting replacement; iii) vehicles to the slaughter; iv) vehicles transporting feed; v) visits of people and vi) neighborhood (i.e. from farm, slaughterhouse, road). The importance of the different biosecurity measures aimed at reducing the probability of virus introduction and the probability of transmission given a certain contact were obtain in an expert opinion workshop with 18 veterinarians and researchers following the guidelines described in OIE (2014). Then, we estimated the percentage of risk reduction and the score of the probability of PEDV introduction by the different routes and the overall probability of introduction. In total 192 farms were analyzed. The results showed that there is high margin for improvement the biosecurity of the above farms. The percentage of risk reduction was 42% (range: 5-90%) and the routes with the great margin of improvement were replacement animals, both replacement and food vehicles and finally visits. Besides, for most of the farms, the risk of PEDV introduction was high, especially through the food vehicle, the replacement animals and the visits. This study also showed that in the case of entry of PED a most farms would be infected as happened in North America.

HERD HEALTH MANAGEMENT & ECONOMY

HHM-OP-03

B-ESECURE: ELECTRONIC SYSTEM TO MEASURE AND IMPROVE BIOSECURITY ON PIG FARMS

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Introduction

Biosecurity procedures impact diseases such as PRRS, but applying and following biosecurity rules is often difficult. B-eSecure is an electronic system that besides external biosecurity, tracks and reports correct and wrong movements of people on farms and visualizes effects of biosecurity improvement on health status and production results. This PigChamp EU program is being piloted by MSD-AH in farms around the world and implementation in 2 Dutch farms is described.

Materials and method

Via installed tracking-devices, movements of people who wear personalized beacons are reported. The PRRSv status of sows, gilts, farrowing-, nursery- and finishing unit was determined and groups with circulating PRRSv defined as red vs groups without as grey. Movements from grey to red were defined as safe and from red to grey and between red as risk respectively unsafe unless a hygiene-lock was used between them (checked by locker devices). The % of correct and risk/unsafe movements per farm and person were reported monthly. Training and reports were implemented to reduce the amount of wrong movements. The effects on PRRSv prevalence and production parameter are monitored via regular diagnostics and management system.

Results

Farm (multiplying) 900 sows: PRRSv+ farrowing, nursery and rearing gilts. Risk/unsafe movements were reduced: September 27% vs October 23%. PRRSv prevalence in the farrowing units decreased by 50% and the amount of detected virus dropped 99% in nursery and farrowing.

Farm (breeding) 700 sows: PRRSv+ rearing gilts unit. Amount of wrong movements remained low at 7% in Oct. Extensive PRRSv monitor will be done every 4 months and 2 groups of mature-gilts tested monthly. No PRRSv was detected in October.

Conclusion

B-eSecure is very helpful for visualization, implementation and improvement of biosecurity procedures. Linking the program with PRRSv prevalence data and production results helps to reach and maintain a high level of biosecurity.

HERD HEALTH MANAGEMENT & ECONOMY

HHM-051

COMBAT A NEW TOOL FOR FAST EVALUATION AND BENCHMARKING OF BIOSECURITY, PIG FLOW AND MANAGEMENT

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Introduction

COMBAT (Comprehensive Online Management and Biosecurity Assessment Tool) is a new app developed by Boehringer Ingelheim Vetmedica to help farmers and veterinarians to evaluate and improve the level of biosecurity, pig flow and management procedures and benchmark against other farms. COMBAT is based on a detailed set of 55 questions to be answered directly in the application.

Material & Methods

This study is based on more than 1000 COMBAT's (questionnaires) from 46 different countries globally. The relative risk of not being able to prevent, control or manage a PRRSV infection is calculated in 4 categories: Internal risks, External risks, Location risk, Management and pig flow. Feedback is given to each category and categorized as very high, high, medium and low risk, to facilitate discussion of behaviors and prioritize fields of importance.

Results

Very high risky behaviours (percentage in brackets) were identified regarding; -external biosecurity; poor or no restrictions to vehicles for animal and feed transportation, pick up dead animals, (cleaning and disinfection) (38,45% - 64,51%) . -Internal biosecurity; persons (61,08%), clothes and boots (51,4%), nurse sows being moved unrestricted between areas of production (47,06%) and Incoming gilts in contact with PRRSv infected animals before introduction (54,81%). –Location; Unstable PRRSV or unknown status of nearest neighbouring farm (72,44%). –Management and pigflow; Holding pigs back for weaning quality (77,10 %), weaned pigs in farrowing room (58,55%), continuous flow after weaning (48,23%) and risky gilt introduction (74,29%).

Discussion & Conclusion

COMBAT facilitates improved biosecurity, pig flow and management practices, by highlighting the most important risk areas related to PRRS incidence. Successful PRRS control must incorporate measures to reduce the risk of new virus introduction (external risks) and improve the ability to control PRRSV internally on a farm/site/area. Immediate feedback encourages and veterinary advisers to address risky behaviors on the actual production site.

HERD HEALTH MANAGEMENT & ECONOMY

HHM-053

USE OF COMBAT-COMPREHENSIVE ONLINE MANAGEMENT AND BIOSECURITY ASSESSMENT TOOL- IN 21 FARMS IN SPAIN

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One of the pillars of the prevention, control and eradication of Porcine Reproductive and Respiratory Syndrome is the biosecurity. Boehringer Ingelheim has developed COMBAT (Comprehensive Online Management and Biosecurity Assessment Tool) that allows pig producers to identify areas of improvement and to correct high risk practices.

Materials and Methods

COMBAT is based on a set of 58 questions. The relative risks are calculated in 4 categories: Internal risks, External risks, Location risks and management risks. 21 Spanish farms completed COMBAT on-line between August 17th and November 17th.

Results

The most important findings are:

Internal Risks:

- 43% of farms don´t have boots and clothes restrictions on people moving between production areas.
- 10% of farms don´t clean and disinfect farrowing, nursery or finishing rooms.
- 10% of producers don´t use commercial modified live vaccine.

External risks:

- 67% of producers don´t have requirements on drying time following the washing of the vehicles used to transport animals.
- 62% of producers don´t mark flow restrictions on vehicles used to transport animals.
- 22% of farms receive gilts from a ELISA positive farm.
- 77% of farms have their dead animals managed by another company.

Location risks:

- 45% of farms are located in an area with at least one more farm within 3 km radius.
- In 72% of the farms the nearest neighboring pig farm is PRRS positive.

Management risks:

- 30% of farms don´t follow a strict all in all out system.
- 42% of farms leave sometimes weaned piglets in the farrowing room.
- 35% of farms mix piglets from different age groups.

Conclusions and Discussion

A successful PRRS control must include taking actions to reduce the risk of new virus introduction, spreading, shedding and transmission. COMBAT is a tool that allows producers to measure risks and benchmark against other production sites.

◀ Ritorna all'articolo

KEYNOTE ADDRESS: Biosecurity from theory to practise

KEYNOTE

KL-06

HOW TO ASSESS BIOSECURITY ON-FARM?

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Introduction

Pigs are susceptible to a wide range of endemic and epidemic diseases, including zoonotic infections, which can affect health, welfare and productivity, and thereby have a major economic impact. The implementation of biosecurity measures along the production chain presents itself as one of the major solutions to minimize the risk of introduction of these diseases into a farm, as well as their spread within the farm (Anon., 2010a). Biosecurity is a term used to describe management measures for the prevention of pathogens entering a farm (external biosecurity) or the spreading of pathogens within the farm (internal biosecurity) (Amass and Clark, 1999; Vangroenweghe et al., 2009).

The present manuscript will discuss the importance of biosecurity and how biosecurity can be scored in pig herds. In a third part, the results of scoring biosecurity in pig herds from different European countries (Prohealth project) will be presented.

Importance of biosecurity

Different studies have shown positive associations between biosecurity and some production parameters (Laanen et al., 2013; Postma et al., 2016) and between biosecurity and farm profitability (Corrégé et al., 2012; Siekkinen et al., 2012; Rojo-Gimeno et al., 2016; Collineau et al., 2017). In addition, a higher biosecurity level had a positive impact on reducing the amount of antimicrobials used in Belgian pig production (Laanen et al., 2013; Postma et al., 2016). This is promising considering that antimicrobial use in pig production has been identified as one of the highest among livestock sectors in the EU (Filippitzi et al., 2014; Carmo et al., 2017).

Despite these documented positive effects and the recognized importance of biosecurity measures, there are still major shortcomings in the implementation of these measures among European pig farms (Laanen et al., 2013; Backhans et al., 2015; Filippitzi et al., 2017). There are several examples of spread of diseases due to insufficient implementation of biosecurity measures, such as the porcine epidemic diarrhea (PED) (Scott et al., 2016), African Swine Fever and the highly pathogenic strain of porcine reproductive and respiratory syndrome (HP-PRRS) (Brookes et al., 2015). Thus, it is highly needed to continue emphasizing the importance of biosecurity in disease prevention.

Assessing biosecurity in pig herds in an objective and quantitative way is a necessary first step to create and/or increase the awareness of the farmer. It also allows the farmer to benchmark his/her farm and to implement proper changes to improve the biosecurity level.

Scoring system

A web-based tool based on a questionnaire Biocheck.ugent® has been developed by Ghent University (Laanen et al., 2010) and been used in over 5000 pig herds in 40 different countries. For the PROHEALTH project, some minor revisions were made by the different consortium members. The on-line tool can be accessed by the following web-addresses and is free for use:

https://www.survey.ugent.be/lime/index.php/691653/lang-en

The questionnaire is divided into a number of subcategories, each containing questions related to specific items of management and biosecurity. There are six subcategories for external biosecurity and six for internal biosecurity.

The subcategories within external biosecurity include purchase policy, vermin and bird control, location and environment, removal of carcasses and waste, access check, and equipment. The subcategories of the internal biosecurity are management of diseases, farrowing and suckling period, nursery period, fattening period, cleaning and disinfection, and compartmentalization, working lines and equipment. Detailed information about the questionnaire is described by Laanen et al. (2010). Each subcategory and each question within a subcategory has a weight based on information from scientific literature, expert opinion and general knowledge of management and infection risks *e.g.* purchase of breeding animals implies a higher risk for disease transmission than not purchasing breeding animals. Depending on the response to a question, a higher or lower score is obtained for that question, for that subcategory and finally for the entire questionnaire. The final score for management and biosecurity for a herd may vary between 0 (absence of any measure) and 100 (presence of all biosecurity measures). The questionnaire and scoring tool is applicable for every type of pig herd e.g. sow herds and fattening herds. In the case of a fattening pig farm, the tool will adapt and calculate the score for fatteners, without showing questions for sows and piglets. The questionnaire has been pretested in farms from different countries.

After completing the questionnaire, a general score is obtained and provided to the farmer. In addition, the results for external and internal biosecurity as well as the score for each subcategory are provided. The scores are visualized by a spider chart which immediately compares the farmer's result with the average results of his country and the average results throughout the world. This allows the farmer to identify those items related to biosecurity requiring further improvement.

Results of biosecurity scoring in pig herds in the prohealth project

The biosecurity was scored in sow herds from 6 different European countries: Belgium, Denmark, Finland, Germany, The Netherlands and Spain. The farms are considered to be fairly representative for the pig farms in the different countries. However, as they were not randomly selected, a full representation cannot be guaranteed.

A total of 236 sow farms completed the questionnaire. The aim of the project was to include 50 herds in the six participating countries. For different reasons this number of farms could not be met in every country. The number of farms where the biosecurity was assessed are shown in the table below. In every country the same questionnaire was used, the way in which data was collected differed slightly per country.

Table 1. Number of sow farms in different EU countries where biosecurity was scored

Country	Data were collected through...	Number of participating farms
A	farm visit	52
B	telephone interview	27
C	farm veterinarians	51
D	farm visit	29
E	the integration	50
F	telephone interview	27
Total number of farms		**236**

An overview of the general characteristics of the sow farms is provided in Table 2.

Table 2. General characteristics of the sow farms in the six participating countries

Country	Average number of sow places	Average years of experience	Average FTE (full time equivalents) per farm	Sow per FTE
A	363	23	1.7	214
B	914	14	5.2	176
C	382	21	2.7	141
D	918	26	3.7	248
E	971	19	5.2	187
F	237	26	2.2	108
Average	**613**	**21**	**3.4**	**180**

The farms could be classified arbitrarily into three types of farms: farms where piglets left the farm at weaning or at the end of the nursery, or farrow-to-finish pig herds where the pigs remained on site until slaughter age (Table 3).

Table 3. Type of farms with sows that participated in the study in the 6 EU countries

Country	Type of farm: pigs until ...			
	weaning (3-4 weeks)	end of nursery (9-12 weeks)	end of fattening (6-7 months)	Total
A	1	9	42	52
B	0	27	0	27
C	4	18	29	51
D	2	12	15	29
E	11	15	24	50
F	3	8	16	27
Total	**21**	**89**	**126**	**236**

To compare the external biosecurity scores between countries, analysis of variance was performed (ANOVA, post hoc Bonferroni, IBM SPSS®) between the participating countries (Table 4). The overall external biosecurity score was highest in country B (87.5) and lowest in country A (67.3) ($p < 0.05$). Country C and D did not significantly differ from each other regarding overall external biosecurity score ($p > 0.05$).

Table 4. External biosecurity scores and subcategories in farms of the 6 EU countries.

Country		Subcategory within external biosecurity						External Biosecurity
		1	2	3	4	5	6	Score
A		86.5	66.1	42.8	70.4	61.6	59.0	67.3
B		95.9	84.7	73.0	94.5	89.0	80.4	87.5
C		92.2	75.6	57.4	86.5	74.9	49.4	76.3
D		93.7	78.1	57.2	78.1	79.4	40.7	75.4
E		94.2	70.1	68.3	88.7	75.0	76.0	80.0
F		82.3	58.6	56.1	75.7	73.1	88.1	71.4
Average	**Scores**	**90.8**	**71.8**	**58.1**	**82.1**	**74.0**	**64.1**	**75.7**
	SD	10.3	14.0	18.7	14.8	20.8	32.2	10.2
	min - max	49.9 – 99.8	31.2 – 95.7	0.0 - 100	32.3 - 100	0.0 - 100	0.0 - 100	41.0 – 96.0

The same was done for the internal biosecurity scores. In table 5, the countries are ranked according to the overall internal biosecurity scores. Country B had a significantly higher internal biosecurity (64.6) compared to countries A and C (55.0 and 51.2, respectively) ($p < 0.05$). Country F had the lowest overall internal biosecurity score (46.4) compared to countries B, E and D (64.6, 60.1 and 57.6 respectively) ($p < 0.05$).

Table 5. Internal biosecurity scores and subcategories in farms of the 6 EU countries.

Country		Subcategory within internal biosecurity						Internal Biosecurity
		7	8	9	10	11	12	
A		59.8	58.2	58.9	62.2	45.9	50.2	55.0
B		100.0	46.1	57.6	0.0	46.8	90.3	64.6
C		59.7	47.7	55.0	41.0	39.9	58.5	51.2
D		71.6	52.4	69.8	45.2	55.8	41.9	57.6
E		79.3	55.3	56.8	50.7	47.8	69.8	60.1
F		81.7	45.9	38.3	49.4	44.8	31.3	46.4
Average	**Scores**	**72.5**	**51.8**	**56.8**	**44.1**	**46.2**	**57.5**	**55.7**
	SD	22.0	20.0	17.7	38.6	19.7	25.0	13.5
	min - max	15.0 - 100	0.0 - 100	7.1 – 89.3	0.0 - 100	7.1 - 100	0.0 - 100	13.0 – 91.6

The following conclusions and implication can be made:

- The external biosecurity category that had the highest average score was "purchase of animals and semen" (90.8), the one with the internal biosecurity lowest average score was "weaning period" (44.1).
- The external biosecurity category that had the lowest average score was "feed, water and equipment supply" (58.1). Where most farms do take measures concerning the animals they purchase, a lot of farms fail to do this for other things that enter the farm. For example, feed trucks cannot fill the feed bins without entering the clean road, water quality is not checked annually and/or no measures are taken for material supply, like disinfection or quarantine. In some countries however, an annual check of the water quality is imposed by quality labels.

KEYNOTE

- The internal biosecurity category that had the highest score was "Disease management" (72.5). Many participating farms were regularly visited by their farm veterinarian and stick to predetermined vaccination and medication protocols.
- The overall scores for external biosecurity were higher than the scores for internal biosecurity meaning it is easier for farmers to implement management measures for the prevention of pathogens entering a farm rather than to implement measures to prevent the spreading of pathogens within the farm.
- There was a large variation between countries, likely due to differences in farm and country characteristics and other factors.
- There was a large variation in scores between farms, meaning that there is still room for improvement in many pig farms.
- The results of the online biosecurity scoring tool can serve as an instrument to introduce and evaluate improvement strategies. They are currently used in ongoing research aiming to find risk and protective factors for production diseases in pig farms in Europe.

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KEYNOTE ADDRESS: Biosecurity: from theory to practise

KEYNOTE

KL-07

IMPLEMENTATION OF BIOSECURITY IN THE PIG INDUSTRY: SOCIAL AND INSTITUTIONAL FACTORS

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Spread and establishment of infectious diseases is a challenge for the livestock industries, as it can significantly affect animal and public health, on-farm productivity and trade arrangements. Implementation of biosecurity pre-border, at the border and post-border is crucial for the prevention of disease introduction and spread at a farm, region or country level and to minimize the impact of disease outbreaks. International and national organizations have developed and implemented biosecurity policies to prevent the spread of emergency animal diseases from infected to non-infected countries or regions within a country; however, at a farm level biosecurity implementation is in most cases responsibility of the industry and the individual farmers (Enticott et al. 2012; Higgins et al. 2016; Hernández-Jover et al., 2016).

Farm biosecurity is defined as a set of measures to prevent properties from the entry and spread of pests and diseases, with the level of farmer engagement with farm biosecurity being affected by a diverse range of factors. Biosecurity is important for all type of livestock enterprises; however, intensive production systems, such as pig production, where transmission of disease is more likely due to higher animal density and contacts, appropriate implementation of biosecurity plays a significant role in preventing disease spread.

There is a significant number of studies that have investigated biosecurity implementation at a farm level among different types of livestock producers, including commercial and non-commercial enterprises and different animal species (e.g. Boklundet al., 2004; Barclay, 2005; Casal et al., 2007; Brennan and Christley, 2012; Garforth et al., 2013; Lambert et al., 2012; Sahlström et al., 2014; Schembri et al., 2015; Hernández-Jover et al., 2016). Some of these studies have gone a step further and investigated not only the level of implementation of biosecurity but also the institutional and social factors influencing producers' engagement with and attitudes towards biosecurity. In general, findings from these studies indicate that livestock producers are highly committed to the health of their animals; however, their knowledge and implementation of biosecurity and their understanding of their responsibility as part of the biosecurity system is limited, with the perception that biosecurity risk originates externally and as such, should be managed by government.

On-farm biosecurity implementation is not solely influenced by economics and rational judgements, but rather by a multitude of influences and factors, including internal and external factors and socio-economics and demographic factors. This is true for all livestock production systems. For example, some of the internal factors identified are the level of knowledge of principles of disease transmission, the perceptions of the potential risks and the perceptions of responsibility in preventing disease. These factors are in turn affected by external factors, such as the level of available information and support for producers (e.g. industry, government), the regulatory context, the producer networks, the media, etc. Furthermore, impacting on these factors and perceptions, there are demographic characteristics and economic drivers that will have a strong influence on what producers do and believe.

Research in biosecurity within the pig industry confirms pig producers have similar drivers than other livestock producers for decision-making in relation to biosecurity. Some key farm characteristics influencing producer biosecurity engagement is herd size and the motivations for keeping pigs. In general, pig farms with bigger herd sizes, which would also be considered commercial, have better biosecurity than small-scale pig properties (Norémark et al., 2010, Lambert et al., 2012, Sahlström et al., 2014, Schembri et al., 2015). In relation to motivations for keeping pigs, those producers identifying income as a reason for raising pigs, mainly among non-commercial producers, are more likely to follow biosecurity principles in their property than those who keep pigs for other reasons, such as family tradition or home consumption (Schembri et al., 2105). However, more complex factors or drivers such as trust in those providing advice on biosecurity have also been identified as crucial for practice adoption in the pig industry (Hernández-Jover et al., 2012).

The reasons for adopting biosecurity practices is complex, with producer knowledge on biosecurity and diseases, perception of risk, attitudes in relation to animal health and trust all playing a significant role, and any program to improve biosecurity engagement need to consider this complexity (Hernández-Jover et al., 2014).

The current paper will explore the findings from some these studies and discuss them in the context of pig production, identifying key social and institutional factors to consider for improving engagement of producers with biosecurity.

HERD HEALTH MANAGEMENT & ECONOMY

HHM-027

ASSESSMENT OF KNOWLEDGE, COMPLIANCE, AND ATTITUDES OF ENGLISH AND SPANISH SPEAKING EMPLOYEES TOWARDS BIOSECURITY PRACTICES

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Introduction

For biosecurity to be effective, employees must follow all protocols. For employees to follow all protocols, they must have good knowledge, compliance and attitudes of the protocols. The purpose of this study was to assess knowledge, compliance, and attitudes of English and Spanish speaking farm employees towards biosecurity Standard Operating Procedures (SOPs).

Materials and Methods

14 sow farms in the Carthage System having a minimum of 3 English speaking employees and 3 Spanish speaking employees were selected. A survey was given to each employee in English or Spanish according to the employee's first language. The survey contained 8 knowledge based questions about farm biosecurity SOPs. An open ended knowledge question required participants to mention all key points to receive credit on primary attempt. If participants failed to address all points, leading questions allowed participants to receive points in a secondary attempt. Questions were asked to assess self vs peer compliance and overall importance to biosecurity.

Results

Biosecurity practices were considered by most employees as highly important procedures. There was a difference reported in self vs peer compliance with self-reported compliance always being higher than peer reported. In the knowledge portion, both language groups recieved a total score of around 90%. Spanish speaking employees answered more questions on the primary attempt than English speaking employees. Farm managers scored higher on primary attempt than other groups. Employees who have been on the farm >36 months scored higher than employees with <36 months experience.

Discussion

Surveys serve as a valuable model to identify gaps in protocols and training programs. Our results identified which groups training should be focused toward as well as which protocols need to be improved to improve overall compliance. By understanding our biosecurity gaps, production systems can focus training, reduce training time and cost and improve interventions in deficient areas.

Herd health management through prevention and control of pathogens
Prevention starting with biosecurity

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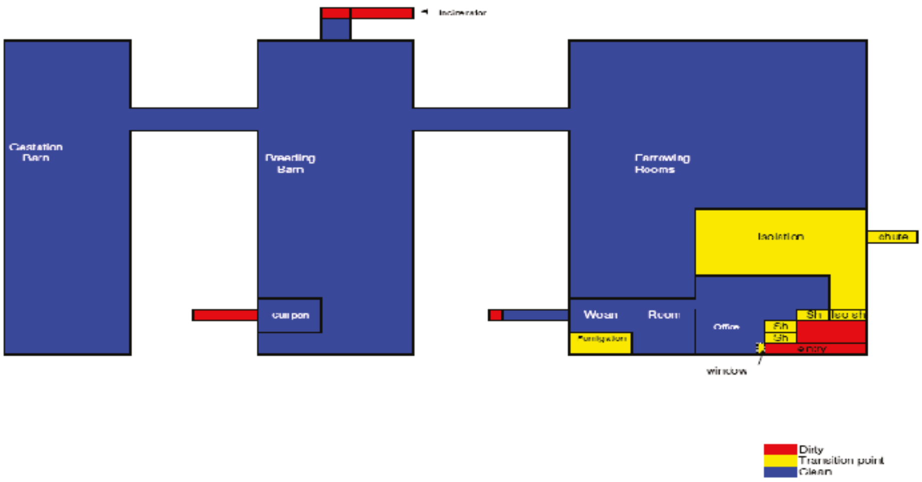
Biosecurity is a top concern in the livestock industry since it affects performance, economic results and can even close markets for trading when catastrophic disease occur. Excellent examples are African Swine Fever (ASF), Classical Swine Fever (CSF), and Foot & Mouth Disease (FMD) that will dramatically affect export sales of a country. Biosecurity in its simplest sense is how one reduces the risk of pathogens from entering the site which is called bioexclusion. Another aspect of biosecurity is called biocontainment which is how one controls the transmission of a pathogen within the production site. Biomanagement is the combined activities of both bioexclusion and biocontainment. All biosecurity programs need to be practical; thereby encouraging implementation of the plans. The most difficult aspect to implementation is ensuring that the individuals performing the daily biosecurity procedures completely understand the importance of their actions. Additionality the individuals need to know that it is a team approach by everyone on the staff and commitment to doing the correct procedures each and every day. The understanding of the procedures is usually easily adopted but the motivation to perform the proper procedures each and every instance can be lacking at times. Every employee must embrace all aspects of the biosecurity program for successful implementation.
In years past biosecurity programs were approached by an organized educational sessions similar to a classroom approach. A disease break creates the need for all employees to immediately assist in the necessary activities. The new disease break creates a "crash course" which increases awareness and seriousness of the situation. The "crash course" methodology does not generate alignment through all departments of the farm's staff or a system-wide sustainable program on biosecurity. Any biosecurity program begins with fundamental practices, plus an attitude of continuous learning as new information develops.
The complexity of small farms has given way to far more multifaceted programs on larger farms. The entire array of potential threats has also been heightened due to multiple strains of a pathogen such as, Influenza type A Virus, where more than one strain commonly persists in a large population at the same time.[1] The variation of pathogenicity is another factor that often creates increased economic damage once it enters a site (PRRSV is a great example of this variability across strains). Today management level employees are skilled and knowledgeable about the following: an awareness of all current processes on the site that can impact biomanagement; understanding the economic harm that occurs when health of the site changes; knowledge on how to reduce risk to the farm; and, having open communications for questions and instructions for all employees.

The different levels of bioexclusion: developing the clean – dirty line
The Secure Pork Supply (SPS) Continuity of Business Plan in the US was developed to provide opportunities to voluntarily prepare before an outbreak like FMD, CSF, and ASF.[2] By participating in the SPS program the unit establishes a premise where the animals are not exhibiting or infected with a foreign animal disease. This allows the unit to:
- Move animals to processing or another pork production premises under a movement permit issued by Regulatory Officials, and
- Maintain business continuity for the swine unit enrolled into the SPS program, including producers, haulers, and packers during an FMD, CSF, and ASF outbreak.

The participation in SPS establishes different levels of bioexclusion starting with a perimeter fence that includes an entry gate. The fence or first layer is meant to make a statement about passing through or beyond this point requires that one needs permission before entering. This can be considered the first layer in developing a clean – dirty line. This layer is used globally as observed by the author. There are variations with a double wire fence of different heights to a solid concrete wall. The entry gate also varies on the complexity for both vehicle and people entering. The obvious goal is to reduce entry to only those that need to come inside which is the major reason for a clean – dirty line in any biosecurity program.

The second layer of the clean – dirty line is the point of entering the structure for supplies, people, animals, and everything that is needed inside the unit. This clean – dirty line is illustrated by using different colors. The structure's shape is color coded by using red color to illustrate dirty and blue illustrating clean areas of the structure. The yellow color is used to illustrate a transition from dirty into the clean area. Some units have chosen to implement different levels even with the entry process. The simple approach is to enter into the unit with only a clothing change. Most units will have people enter with a complete clothing change, shower and put on clean clothes before entering. A few units have added a bench entry system plus the clothing change, shower and the use of clothes that stay on the clean side. The physical bench is the reminder for the person entering that a "change" is about to occur. A properly managed clean – dirty line within all structures is lacking in units throughout the world. A clean – dirty line for entering any unit needs to be correctly administered to provide further "insurance" against pathogen entry into modern units.



Other potential vectors and additional layers for bioexclusion

The list of what comes into a modern swine unit is daunting when one begins to write everything down. Very simplistically, try the exercise of listing everything that enters a unit sometime. One needs to begin with the obvious things on the list that enters by underground, surface and airborne routes. The list will include necessary objects like water, feed, trucks, trailers, people, mobile phones, supplies of all sorts which includes vaccines, bottles of antibiotics, equipment, bedding material, bags of drying dust, food items for employees, and many more. porcine epidemic virus (PEDV) outbreaks in 2013 - 2014 in North America caused a massive upscaling of biosecurity programs especially for sow farms. Creep feed quickly became a focus for improved control, requiring a minimum two weeks prior to being used in farrowing rooms for example. Recent research has shown extended infectivity of some viruses for up to 37 days with the help of plant products like soy proteins.[3] Bio-shed (a small structure for housing supplies, semen, etc.) were purchased or constructed and placed near the road so non-essential vehicles did not need to enter as far as the unit. Bio-shed management requires a person from inside the unit to exit through the shower and put outside clothing on to collect the supplies. This person then re-enters the unit by showering and using the unit's clothes again. Fumigation rooms were another addition. Supplies, equipment, tools, bags of products, boxes are placed on shelves within the fumigation room. Fumigation rooms were constructed with one outside door for the outside person to unload the supplies into the racks within the fumigation room. The boxes and items were allowed to set for an adequate period of time before someone inside the unit was allowed to enter and unpackaged the products.

Potential vectors influencing biocontainment: people transmit pathogens around a unit

Several years ago a study was conducted to look at how people transmitted hemolytic *E. coli* around a unit.[4] In this study, people mechanically transmitted *E. coli* without extraordinary measures to enhance caretaker contact with pig excretions and secretions beyond that which would occur in a typical pork production unit. Hand washing and donning clean outerwear did not prevent *E. coli* transmission. However, showering and donning clean outerwear did prevent transmission.

The author’s understanding of people transmitting pathogens promoted the use of another aspect of the clean – dirty line when performing partial depopulations in the early days of PRRSV elimination programs. Implementation of a clothing and boot change with sanitizing of the hands, i.e. a clean – dirty line, was established in the hallway of the finishers. The clean – dirty line in this situation is to separate the PRRSV infected rooms from the rooms containing non-infected animals. The nursery is depopulated after establishing sow herd stability as defined by American Association of Swine Veterinarians (AASV) PRRS categories. Infected animals were separated from non-infected animals by an empty finisher room in-between the rooms housing infected and non-infected animals with a temporary curtain in the hallway. A complete change of outer clothes, gloves and boots with a disinfectant containing boot dip pan was made as one walked through the curtain. The curtain was moved down the hallway as the next infected finisher was marketed, cleaned and disinfected. This allowed the empty finisher to be filled with non-infected animals with a cleaned disinfected room maintained in-between.

A summary of a proper entry program for people with the use of a clean – dirty line includes at least the following considerations:

- Comply with “days” away from pigs not associated with the unit you are entering. Example: one night after being in a sow unit with a shower, complete change of clothes, and re-showering into the nursery – finisher is sufficient. A two night time period away from one unit before going into a completely different unit with showers and clothing changes to add sufficient security to not transmit a pathogen between units.
- Leave personal effects, including digital mobile devices in a secure area or your vehicle.
- Walk through disinfectant sprays which is common in Asian countries.
- Remove footwear and all clothing in an outer changing room, leave clothing in the outer room, pass through the shower and put on unit provided clothing. The past thorough shower is another example of the clean – dirty line.
- Thoroughly shower and wash hair using soap and shampoo. The exception to the shower is the entry into down flow sites from the sow unit, i.e. nursery, wean-to-finisher or finisher sites that sometimes only require a bench entry system, i.e. complete clothing change, washing of the hands and using the unit’s boots.
- Dry yourself and dress in unit provided clothing and footwear.
- Sanitize hands with alcohol or disinfectant gel.

To ensure compliance of your staff requiring a shower, the facilities must provide:

✓ A shower that is kept clean and mold free.
✓ A good ambient air temperature for the people during the shower.
✓ Plenty of hot water and a shower head with a generous spray.
✓ People friendly soaps and shampoos.
✓ Clean towels.
✓ Clean clothing available at all times to properly fit staff and visitors

Other biocontainment aspects for consideration

Additional efforts are being implemented to control insects within the unit since studies have shown transmission by insect or arthropod as a fomite, i.e. mosquito, different species of flies and cockroaches.[5,6,7] Rodent control has been encourage with the same consideration of being either a fomite or vector for transmission of pathogens around a unit. The author’s observations support rodent control measures due to a continual *Lawsonia intracellularis* outbreaks when mice populations are high. *Brachyspira hampsonii* infections have been found in wild water birds and speculated as a possible source of infecting a naïve farm when the water birds used the unit's lagoon for an extended stay.[8]

Animal monitoring and transportation biosecurity

The most obvious method of bringing a pathogen into a unit is through the animals themselves. Routine profiling of the replacement animals has historically been serology, i.e. blood collected from a random number of animals. The more recent use of oral fluid samples have provided additional knowledge on the population and shedding. The behavior of the pig is such that whatever is in the environment of the animal is in the animal's mouth. Saliva samples have enlightened the industry on persistence of Influenza virus in a population long after the original break.[9] Even more recent work with *Mycoplasma hyopneumoniae* elimination program have driven the use of laryngeal and or tracheal swabs since the serological samples have presented a delay in the animals immune response.[10] The multiplier level units in North America are now using both serology and laryngeal swabs to monitor the replacement animals to protect sow farms that are naïve to *Mycoplasma*.

The activities of monitoring of animals prior to movement, such as replacement animals to be placed into a sow unit, has dramatically changed in the past couple of years. The implementation of using oral fluid samples, i.e. ropes, has enlightened the industry on shedding of pathogens. The sample collection itself has increased the number of animals being monitored since the rope is tied so two pens of animals can chew on the rope. Thereby, expanding the number of animals monitored from when 30 were serologically profiled to two pens has improved detection of pathogens. The goal is to match health or provide replacement animals with better health then the sow population. Recently laryngeal swabbing of replacement gilts to determine *Mycoplasma hyopneumoniae* infection has been driven by the need to detect infection more quickly than the use of serology. The activities of monitoring a population will continue to evolve as better understanding of transmission of pathogens become recognized.

Another method of transmitting disease is with dirty trucks and trailers. Numerous studies have shown and provided knowledge on what it means to have a clean trailer. The author asked a local trucking firm what percentage of producers asked and paid for a clean truck and trailer before porcine epidemic disease virus (PEDV) challenge vs after the massive spread across the hog producing states. The percentage prior to 2014 outbreaks of PEDV was estimated to be around 50% to 60% of the producers wanting a clean truck and trailer. The percentage quickly moved to 95+% of the time producers wanted a clean truck and trailer. A key study suggested that collection points, such as harvest facilities and livestock auction markets, can be an efficient source of contamination of transport vehicles that return to pig farms and likely played a role in rapidly disseminating PEDV across vast geographic regions shortly after PEDV was first identified in the United States.[11] This data also suggests that the contamination of transport vehicles leaving the harvest facilities increased as the prevalence of PEDV–positive transport vehicles and virus load coming into the facility increased. Trucking firms have installed modified forms of "thermal assisted drying" by blowing heat into the trailer after a proper cleaning and disinfecting. Although this additional practice is not entirely necessary, the addition of heat has added value of providing a clean trailer to the producer. The following list was a combined effort of American Association of Swine Veterinarians (AASV) and National Pork Producers Council (NPPC) personnel to provide proper instructions for both producers and truckers to prevent pathogen entry into the unit. A form of the clean – dirty line is also illustrated in these instructions since live animals cross over this "line" when entering the transport trailer but people do not cross.

Ensure you are Prepared for Swine Transportation

1. The market truck must be prepared for hauling market hogs.

a. The cab of the truck, including floor-boards, pedals, steering wheel, gear shift handle, door handles, etc., must be cleaned and disinfected between loads.

b. The trailer must be

• Washed clean and free of any visible manure or shavings,

• Disinfected with an appropriate disinfectant, at the correct rate, for the proper contact time, and applied so that all surfaces are covered, and

• Allowed to dry completely (Thermal assisted drying speed this process greatly).

c. All equipment, including sort-boards, rattle paddles, electric prods, etc. need to be thoroughly cleaned, disinfected, and

dried.
d. Clean boots, coveralls, gloves, knee pads, etc. must be used for each load and stored in a designated clean area. A separate area for storage must be used for these articles after they are used and until they can be cleaned and disinfected for future use.
2. The Production Site must be ready for animal movement.
a. All load out equipment must be clean and in good working order
b. The load out area and chute must be clean, disinfected and ready to market pigs
c. Communicate where the clean – dirty line is located. This marks the separation between the production facilities, its animals and its workers from trucks, trailers and people outside of the production facility.
• An effective clean – dirty line is the back of the trailer but may be at the barn door, the chute or gate.
• Be sure it is clearly marked and visible to all.
• Provide plastic disposable footwear and a place to dispose of the footwear for the driver if they must to cross the clean – dirty line.
d. An amp supply of trained farm personnel available to help load pigs from the site.
• The truck driver should never cross the clean – dirty line to help move pigs from the barn.
3. Communication between the livestock hauler and livestock owner or site manager must be open and complete. Expectations for loading and unloading animals must be communicated prior to arrival.
a. A clear clean – dirty line must be identified and communicated.
• No human foot traffic is allowed to cross the clean – dirty line from either direction.

Responsibilities for compliance by the different parties during the Loading Process
1. Livestock haulers
a. Must stay on the out-bound side of the clean – dirty line at all times for load out.
b. No driver equipment may cross the clean – dirty line or be used in the barn.
c. No pigs should be allowed to exit the truck to re-enter the unit during the load out process.
d. The driver must remove all boots and clothing on the truck side of the clean – dirty line.
• All dirty boots and coveralls should be placed in a designated area, outside the cab (for example in a dirty boot box).
e. Hand paperwork to farm load-out personnel away from the truck and barn.
2. Loading crew or farm personnel
a. The farm load crew must observe the clean – dirty line at all times.
• If the clean – dirty line is crossed, farm personnel MUST follow re-entry biosecurity measures (such as shower in/out or change of clothes/boots and wash of hands) before they can resume the loading process.
• Dirty coveralls or gloves must be placed in a container or directly into a washer.
• Dirty boots must be placed where they can be washed and disinfected away from farm clothing. Do not place them where everyday foot traffic occurs.
• Do not share loading equipment with livestock haulers.
b. Do not cross foot traffic at any time with livestock haulers including after pigs are loaded.
c. No farm equipment should be shared with the livestock haulers.
d. Do not allow drivers to help load pigs out of the barn.
e. Do not allow drivers to fill out paperwork in the office.

Responsibilities after the Loading Process
1. Farm personnel must clean and disinfect the load out area immediately after the transport vehicle has been loaded and pulled away.
2. Farm personnel that cross the clean – dirty line to clean the chute or load out area must follow the biosecurity protocols of the site, such as shower in/out or change of clothes and boots and wash hands.

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Control of a pathogen using Porcine Reproductive and Respiratory Virus (PRRSV) as the example

Porcine reproductive and respiratory syndrome (PRRS) despite decades of intense research and vast amounts of resources, remains the most costly production disease throughout the world. Progress continues to be made in controlling this pathogen, but the estimate that PRRS costs the US swine producers every year is more than US$580 million.[12] The cost to a producer is both in the sow unit and in the nursery finisher flows. Economic losses are significantly larger in naïve herds post-infection of PRRSV then compared to herds that are antibody positive at the time of the PRRSV infection.[13] PRRSV can be consider a "tariff" or a demand on the unit's resources that must be paid as long as the virus is active and causing damage to the production of the animals.

PRRSV continues to find its way into modern swine units even when tremendous resources have been implemented to impede the virus's ability to enter. The majority of PRRSV impact occurs during the acute outbreak especially in naïve populations, but this is also the time when the management can focus on minimizing the death loss of the sows, piglets and growing pigs that became infected during farrowing. A second goal is to minimize the length of time the sow populations shed virus. Two metrics for measuring both goals have been developed to help capture the impact of a PRRSV break.

1. Time to stability (TTS): TTS measure the duration of the piglet infection. The calculation is the number of weeks post-closure of the sow herd (replacement gilts are loaded into the sow herd with no additional entries until after shedding stops) until four consecutive negative serologic results, i.e. usually serum from 30 individual piglets near weaning age and sampled as one piglet per litter, have been documented.
2. Time to baseline production (TTBP): TTBP measures the volume or number of piglets that dies. The calculation is the number of weeks it takes for the sow herd to return to producing the same volume of weaned piglets per week that it averaged prior to the PRRS outbreak.

PRRSV acclimation programs' main focus is to minimize both the duration of infection and the volume of mortality during an acute outbreak. Thereby improving both TTS and TTBP which ultimately reduces the economic impact of the outbreak. Proper acclimatization will not prevent future infection, but prior exposure minimizes clinical disease when wild-type PRRS exposure occurs. All acclimatization programs are similar since the focus is to take a susceptible population to a state of immune competence that minimizes clinical disease. This process is called immune management of that population.

The biomanagement of PRRSV once it has entered a population also impacts the TTS and TTBP. The author has experienced elongated TTS when mistakes by the employees occur. One example is when a unit weaning one time per week, did not have a focus on controlling internal transmission during a PRRSV elimination program. The employees returned to their daily routines immediately after the weaning task was accomplished. The lack of not cleaning and disinfecting the common hallway, not changing clothes, washing hands or changing gloves, and not using disinfectant boot dips carried virus into the recently farrowed piglets. This was determined by serologically profiling the recently farrowed piglets which determined that they were being born naïve to PRRSV. This established that the sow herd was stable and not shedding virus. Several changes were implemented as suggested previously and immediately the near wean pigs went PRRSV negative and stayed negative to present.

Another example is when strict "management changes to reduce exposure to bacteria to eliminate losses" or also called McREBEL is practiced during a PRRSV elimination program.[14] Strict McREBEL mean that no cross fostering is performed. When strict McREBEL is practiced more starve-out piglets will need to be timely euthanized. The act of euthanizing the piglets is again in the common hallway where entry into the farrowing rooms occur. The hallway was not sanitized properly immediately after euthanizing the piglets; therefore, the employees carried the virus into the farrowing rooms with the youngest piglets. The transmission of virus in this manner caused an elongation of the elimination program.

Herd health management with a goal of preventing or at least controlling pathogen activity so economic harm is reduced, first starts with a detailed plan for all departments. This aspect is called the unit's biosecurity program. Bioexclusion is the portion of the unit's plan to keep pathogens out of the facilities. Biocontainment is the portion of the biosecurity program that minimizes or controls the economic damage from the infection. Biomanagement is both bioexclusion and biocontainment working together to achieve the unit's goals on pathogen prevention and or control. One approach is to have routine staff meetings where biosecurity is discussed. The following discussion topics can be used as a guideline:

1. List and define all biosecurity practices by department.
2. Develop biosecurity gap or "hole" in each department.
3. Define solutions for each respective gap.
4. Empower one person in each department or at least one person per unit to be the champion of biosecurity who looks at each practice to determine is a change is needed or if the practice is sufficient.
5. Build interdepartmental relationships so alignment and collaboration occurs for the overall health programs.

At the end of the day biosecurity is never stagnant but a dynamic ongoing program that needs monitored and often discussed. The science on pathogen transmission is ever evolving which causes the person who is the champion of biosecurity for each unit to re-examine the programs. The key is to develop a culture for the employees that empowers them to come along side and work together for the best health of the unit.

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Prevention and control of swine diseases through biosecurity

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Introduction

Prevention and control of swine diseases have to be comprehensive approach, which should include the components as below:

1) Pig flow
2) Herd immunity (vaccination, etc.)
3) Medication
4) Husbandry / management
5) Testing
6) Biosecurity

The objective of this paper is to focus on the importance of biosecurity in particular. Topics we discuss are as follows:

- What is biosecurity?
- How is an infectious agent transmitted?
- What can we do to reduce a risk of each transmission route?
- How can we audit and measure biosecurity?
- Conclusions & summary

What is biosecurity?

Definition of biosecurity is "the protection/security of susceptible animal herds from the introduction and transmission of infectious pathogens" (*Saunder's Veterinary Dictionary, 1999*).

Biosecurity has to be:

1) Science based
2) Practically feasible (simple, organized)
3) Effective (cost vs. benefit)
4) Committed to continue (execution)
5) Measurable

Components of biosecurity include as follows:

1) Internal biosecurity (within-farm)
- To minimize the transmission of pathogens that already exist within a farm

2) External biosecurity (Between-farms)
- To prevent new introduction of pathogens into a farm

3) Monitoring, auditing, and education

Transmission routes of infectious agents

Transmission routes of infectious agents are classified as below:

1) Direct transmission (porcine vectors)
- Live animals
- Semen

2) Indirect transmission (non-porcine vectors)
- Needles

- Personnel
- Coverall and boots
- Fomites
- Transport
- Carcass disposal
- Birds
- Rodents
- Wild animals
- Insects
- Manure processing
- Water
- Air
- Feed

Measure biosecurity risks on your farms

Biosecurity should be numerically measurable. Here are some examples of tools that are able to asses biosecurity risks on farms:

- PADRAP (AASV: American Association of Swine Veterinarians, North America) (1)
- BioCHECK (Ghent University, EU) (2)
- BioAsseT (P-JET: PRRS-Japan Elimination Team, Japan) (3)

Transboundary risk of swine disease transmission

Most recently, Dee et. al. has developed a transboundary model to prove the risk of transmission of certain swine pathogens such as PEDV, PRRSV, Seneca Valley virus (as a surrogate of FMDV) and ASFV via selected feed ingredients (4).

Area regional approach and global collaboration

In some regions, economical significance of particular swine diseases such as PRRS and PED has let producers and veterinarians to initiate area regional approach in order to control or eliminate such diseases. Recent research has shown that a risk of transmission of certain swine pathogens is transboundary (4). Global collaboration is required for sustainable success of biosecurity in each country.

Conclusions & summary

Biosecurity is an only way of the "true" proactive approach of disease prevention. Biosecurity should be comprehensive approach. Execution is the key of prevention/control of swine diseases through successful biosecurity. Because the risk of swine disease transmission is transboundary, sustainable success of biosecurity requires area regional approach and global collaboration.

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