

## Production, Management, and the Environment VI

**839 Associations between management practices and reproductive performance in Canadian dairy herds.** José Denis-Robichaud\*<sup>1</sup>, Ronaldo L. A. Cerri<sup>2</sup>, Andria Jones-Bitton<sup>1</sup>, and Stephen J. LeBlanc<sup>1</sup>, <sup>1</sup>Department of Population Medicine, University of Guelph, Guelph, Ontario, Canada, <sup>2</sup>Faculty of Land and Food Systems, University of British Columbia, Vancouver, British Columbia, Canada.

The objective of this study was to identify management practices associated with reproductive performance on Canadian dairy farms. A questionnaire was distributed online and by mail to Canadian dairy farmers from March to May 2014 to assess reproduction management. From 833 responses, reproduction management was categorized as mainly visual heat detection ( $n = 415$  herds), timed artificial insemination (TAI;  $n = 175$ ), automated activity monitoring (AAM;  $n = 85$ ) where each represented  $>50\%$  of AI, or “combined” practices ( $n = 131$ ). Pregnancy rate (PR), insemination rate (IR), and conception risk (CR) per 21 d for 2013 were extracted from dairy herd information (DHI) files of 346 farms. Univariable linear regression models adjusted for region were used to identify associations of these reproduction performance measures with farms’ characteristics and management practices. The average ( $\pm$ SD) PR, IR, and CR were  $17 \pm 4.7\%$ ,  $43 \pm 11.3\%$ , and  $40 \pm 8.5\%$ , respectively. Pregnancy rate was lower in tiestall barns ( $15.2\%$  CI =  $14.4$ – $16.0$ ) than in freestall barns ( $17.9\%$  CI =  $17.2$ – $18.6$ ), in herds inseminating once per day ( $15.7\%$  CI =  $14.9$ – $16.6$ ) than in herds inseminating twice per day ( $17.8\%$  CI =  $16.8$ – $18.7$ ), and in herds with  $<100$  lactating cows ( $16.2\%$  CI =  $15.5$ – $16.8$ ) than in herds with more than 250 lactating cows ( $20.1\%$  CI =  $17.2$ – $22.9$ ). Pregnancy rates were not significantly different by main reproduction management practice: visual heat detection ( $15.9\%$  CI =  $15.0$ – $16.8$ ), TAI ( $16.7\%$  CI =  $15.4$ – $18.0$ ), AAM ( $17.4\%$  CI =  $16.0$ – $18.9$ ), or combined practices ( $18.2\%$  CI =  $16.6$ – $19.9$ ). Insemination rates were lower in herds using visual heat detection ( $40.0\%$  CI =  $37.3$ – $42.6$ ) than in herds using TAI ( $47.4\%$  CI =  $43.8$ – $50.9$ ), or combined practices ( $46.7\%$  CI =  $42.6$ – $50.7$ ), but not significantly different from herds using AAM ( $44.0\%$  CI =  $40.3$ – $47.7$ ). Conception risks were higher in herds using visual heat detection ( $40.7\%$  CI =  $37.2$ – $44.1$ ) than in herds using TAI ( $36.8\%$  CI =  $33.0$ – $40.3$ ), but not significantly different from herds using AAM ( $40.0\%$  CI =  $36.1$ – $43.9$ ), or combined practices ( $39.8\%$  CI =  $35.8$ – $43.9$ ). Performance was influenced by factors other than the reproductive management program.

**Key Words:** dairy cow, management, reproduction

**840 Evaluation of Ovsynch and CIDR inserted concurrently with or two days after initiation of Ovsynch protocol to improve reproductive performance in lactating dairy cows with low estrus detection efficiency.** Abid Hussain Shahzad\*<sup>1</sup>, Abdul Sattar<sup>1</sup>, Nasim Ahmad<sup>1</sup>, Ijaz Ahmad<sup>1</sup>, Deniz Nak<sup>2</sup>, and Yavuz Nak<sup>2</sup>, <sup>1</sup>University of Veterinary and Animal Sciences, Lahore, Lahore, Punjab, Pakistan, <sup>2</sup>Uludag University, Bursa, Bursa, Turkey.

To assess the efficiency of 3 synchronization methods as postpartum reproductive management tools in dairy cattle on a commercial dairy farm. Cyclic Holstein lactating cows ( $n = 167$ ), 55–90 DIM, were randomly allotted to 1 of 3 treatments. First group was (Ovsynch;  $n = 58$ ) given a 2-mL i.m. injection of synthetic GnRH on d 0. After 7 d, PGF<sub>2a</sub> (2 mL i.m.) was injected. A second injection of GnRH was administered 48 h after the PGF<sub>2a</sub> injection and all cows were bred by timed AI 16 h after the second GnRH injection. Cows in second group (Ovsynch+P7:

$n = 55$ ) were introduced a modified Ovsynch TAI treatment similar to Ovsynch but CIDR was inserted for a 7-d period (CIDR was inserted with GnRH and removed on PG Shot). In third group (Ovsynch+P5;  $n = 54$ ), cows were subjected to Ovsynch protocol in addition to CIDR insertion for 5 d (CIDR was inserted after 2 d of GnRH and removed with PG shot). P4 conc. was measured on d 30 and 60. Pregnancy diagnosis was carried out at d 30, 60, 90 post insemination in all 3 groups. Progesterone profile was significantly higher ( $P < 0.05$ ) for Ovsynch + P5 ( $7.75 \pm 0.38$  ng/mL) and Ovsynch + P7 ( $7.58 \pm 0.26$  ng/mL) compared with Ovsynch ( $6.52 \pm 0.32$  ng/mL) on d 30 PTAI but nonsignificant among all 3 synchronization treatments (i.e.,  $6.37 \pm 0.49$  in Ovsynch,  $6.75 \pm 0.36$  in Ovsynch+P5 and  $6.80 \pm 0.41$  in Ovsynch+P7 group). Pregnancy rate in Control group was 39.7, 36.2, and 32.80 on d 30, 60 and 90 post insemination. In second modified Ovsynch group with 7d CIDR (Ovsynch+P7) insertion pregnancy rate was 42.6% on d 30, 37% on d 60 and 90 PAI. In third group pregnancy rate was 45.5, 43.6 and 41.8 on corresponding 30, 60, 90 d PAI. Although pregnancy rate were statistically not significant but, by percentage points, improved pregnancy rate was observed on all 3 time points in Ovsynch+P5 group.

**Key Words:** modified Ovsynch, postpartum lactating cow, progesterone

**841 Reproductive outcomes following presynchronization of dairy heifers with a 14-d CIDR and prostaglandin F<sub>2a</sub>.** Courtney K. Claypool\*<sup>1</sup>, Jennifer A. Spencer<sup>1</sup>, Saulo Menegatti Zoca<sup>3</sup>, Bahman Shafiqi<sup>1</sup>, William J. Price<sup>1</sup>, Amin Ahmadzadeh<sup>1</sup>, Neil R. Rimbey<sup>2</sup>, and Joseph C. Dalton<sup>2</sup>, <sup>1</sup>University of Idaho, Moscow, ID, <sup>2</sup>University of Idaho, Caldwell, ID, <sup>3</sup>UNESP, Botucatu, Sao Paulo, Brazil.

Efficient pregnancy production in heifers provides an earlier return on investment for dairy producers. The research hypotheses were that presynchronization would result in a faster insemination rate following entry to the breeding program, and an increased proportion of pregnant heifers within the first week of entry into the breeding program compared with no presynchronization. Heifers were assigned to 1 of 3 groups: (1) 14-d CIDR, (2) prostaglandin F<sub>2a</sub> (2 $\times$  PG), or control (1 $\times$  PG). The 14-d CIDR group ( $n = 119$ ) received a CIDR on d -30, which was removed on d -16. The 14-d CIDR group received an injection of PG (25 mg i.m.) upon entry to the breeding program (d 0). The 2 $\times$  PG group ( $n = 118$ ) received an initial injection of PG on d -11, and a second injection of PG on d 0. The 1 $\times$  PG group ( $n = 121$ ) received an injection of PG on d 0. Data were analyzed using ANOVA procedures within the generalized linear mixed models in SAS (9.4). All animals received tail paint and were observed for behavioral estrus daily. Pre-synchronization affected ( $P < 0.05$ ) the proportion of heifers observed in estrus and inseminated in the first week: 95.8% (14-d CIDR), 74.5% (2 $\times$  PG), 66.9% (1 $\times$  PG). Days to AI (LSM  $\pm$  SEM) following entry to the breeding program were also affected ( $P < 0.05$ ) by treatment:  $3.6 \pm 0.4$  d (14-d CIDR),  $4.9 \pm 0.4$  d (2 $\times$  PG),  $6.8 \pm 0.5$  d (1 $\times$  PG). Proportion of heifers pregnant in the first week of the breeding program also differed ( $P < 0.05$ ): 68% (14-d CIDR), 43% (2 $\times$  PG), 41% (1 $\times$  PG). Conception rates to AI in the first week were 71.9% (14-d CIDR), 57.9% (2 $\times$  PG), and 61.7% (1 $\times$  PG), and were different ( $P < 0.05$ ) between 14-d CIDR and 2 $\times$  PG heifers. Days on feed from entrance to the breeding program to projected calving date were calculated for all heifers:  $295 \pm 2.6$  d (14-d CIDR),  $302 \pm 2.6$  d (2 $\times$  PG), and  $305 \pm 2.5$  d (1 $\times$  PG), and were different ( $P < 0.05$ ) between 14-d CIDR and 1 $\times$  PG heifers. Pre-synchronization with a 14-d CIDR and PG appears to be an effective strategy to increase the

proportion of heifers identified in estrus, inseminated, and pregnant within the first week upon entry to the breeding pen.

**Key Words:** dairy heifer, presynchronization, CIDR

#### **842 Effects of expression of estrus measured by activity monitors on ovarian dynamics and conception risk in Holstein cows.**

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The objective of this study was to determine intensity of physical activity as a result of estrus expression and its relationship with ovarian dynamics and fertility. Estrus events were recorded at 2 commercial dairies. A collar-mounted accelerometer (Collar; SCR Heatime) and a leg-mounted pedometer (Leg1; Boumatic Heat-seeker-TX) were used in farm 1. A second leg-mounted pedometer (Leg2; AfiMilk Pedometer Plus) was used in farm 2. Only spontaneous estrus (SE) events were registered at farm 1 (collar and Leg1; 1,099 events; 318 cows). Cows with Leg2-tags were induced to ovulate (IO; 1,411 events; 1,040 cows) with an E2/P4-based TAI protocol. Blood samples and ovarian ultrasonography were done at detection of activity increase (SE), or at the moment of AI and 10 d after AI (IO). IO cows were scanned on d 7 after AI to assess CL presence. Pregnancy diagnosis was performed at 42 ± 7 d. Data were analyzed with ANOVA, logistic regression, proc MIXED. Peak estrus activity (PA) for Collar was 71.6 ± 20.7 index value, and for Leg1 and Leg2, 334.3 ± 155.7% and 286.18 ± 163.3% relative increase. Pre-ovulatory follicle diameter was 18.8 ± 0.3 mm (SE) and 13.3 ± 3.5mm (IO). Follicle diameter was not correlated with AAM measurements ( $r = 0.007$ ). Cows with high PA had greater E2 concentration (9.5 ± 0.3 vs. 8.2 ± 0.2 ng/mL [Collar]; 8.9 ± 0.2 vs. 8.1 ± 0.2ng/mL [Leg1]). P4 concentration at d of AI was not correlated with relative increase (Leg2), but it was higher on d 10 for cows that had more intense estrus (3.17 ± 0.11 ng/mL vs. 3.73 ± 0.21 ng/mL). Cows with greater PA had greater P/AI than those with lower PA (36.5% vs. 24.6% [Collar], 33.5% vs. 21.4% [Leg1] and 42.9% vs. 28.9% [Leg2]). Likelihood of ovulation was greater for high vs. low relative increase (94.6% vs. 86.2%). Greater estrus intensity improved ovulation and P/AI. Data from AAM might be used to survey and predict fertility measures in dairy cows. More studies are needed to determine management and selection tools to improve estrus expression, detection, and fertility.

**Key Words:** pedometer, follicle, pregnancy

#### **843 Vitality and morphology of Boer buck spermatozoa stored fresh for 72 hours.** Olumide A. Ajao\*, Daniel M. Barry, and Kow K. Benyi, *University of Venda, Thohoyandou, Limpopo Province, South Africa.*

The study was aimed at evaluating the effects Biladyl and Triladyl extenders on the percentage live proportion and morphological status of the Boer buck spermatozoa when stored at 5°C, 12°C and 17°C in programmable refrigerators for 72 h. Four (n = 4) healthy Boer bucks aged 3.12 ± 0.55 years were ejaculated using an artificial vagina (AV) once every 4 d for 6 replicates. Semen was extended at ratio 1: 5 v/v (semen to extender). All smears were duplicated. Semen samples were evaluated for percentage live spermatozoa and morphological status after every 12 h in 72 h of storage. Data were analyzed by ANOVA using the GLM procedure of Minitab. Spermatozoa viability and morphological correlations between extender type and temperature were assessed using the principal component analysis (PCA). The

interaction between extender type and storage temperature indicated no significant difference ( $P > 0.05$ ) on the proportion of live spermatozoa. The percentage live spermatozoa in Biladyl stored at 12°C was 76.6% compared with the higher percentage of live spermatozoa in Triladyl (80.0%) which were kept at 12°C. Among the conditions storage tested, temperature 12°C kept the least number of spermatozoa alive after the 72 h of storage with 69% of live spermatozoa. The percentage of live spermatozoa found in Triladyl after 72 h at 17°C was highest (86.3%). Spermatozoa kept in Biladyl at 12°C and in Triladyl at 12°C statistically produced higher morphological abnormality with ( $P < 0.05$ ) effect than the morphological abnormality discovered in Biladyl 17°C and Triladyl 17°C. Temperature 12°C had the highest percentage of morphologically abnormal spermatozoa (23.33%) in Biladyl, followed by the Triladyl extender (22.46%) stored at 12°C, followed by the percentage found in Biladyl stored at 12°C (18.68%) and lastly by the 17.46% of sperm found in semen extended with Triladyl stored at 17°C. With appropriate protocol, Biladyl and Triladyl extenders can keep acceptable percentage of goat spermatozoa alive when stored at 5°C, 12°C and 17°C up to 72 h.

**Key Words:** extender, vitality, morphology

#### **845 Environmental and economic consequences of subclinical ketosis and related diseases in dairy farming.** P. F. Mostert\*, E.

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Subclinical ketosis (SCK) in dairy cattle is a metabolic disease that occurs around the calving period and increases the risk on other diseases. SCK and other diseases result in, e.g., milk losses, reduced pregnancy rate, culling, and therefore have environmental and economic consequences. This study aimed to estimate the environmental and economic consequences of SCK and related diseases in dairy farming. A dynamic stochastic simulation model at cow level was developed and combined with a life cycle assessment and partial budget analysis. The model was divided into 4 parts. In part one, cows receive a parity (1–5+) and a potential milk production. Cows subsequently have a risk on getting retained placenta or milk fever (part 2), SCK (part 3), and metritis, displaced abomasum, clinical ketosis, lameness or mastitis (part 4). The risk on diseases depends on parity and previous diseases. The model was parameterized using literature. Inputs are the number of dairy cows, prevalence of diseases and culling rate, outputs are the change in global warming potential (GWP) and profit per case of SCK. Outputs were divided in direct (SCK) and indirect (other diseases due to SCK) consequences, that were estimated with the attributional risk of SCK. Cows with (a combination of) diseases had: a reduced daily milk yield, discarded milk if treated, an increased calving interval, and risk of culling. Monte Carlo simulation was performed to find the variation in the output. Preliminary results showed that the costs increased from €33.0 (±31.3) to €55.2 (±58.3) and GWP increased from 1.3 (±1.3) to 1.8 (±2.0) % CO<sub>2</sub>-e/unit milk per parity based on milk losses per case of SCK. Results differ per parity ( $P < 0.001$ ) due to differences in milk yield and risk on diseases. The highest contribution came from SCK (68%). Other diseases particularly had an effect on the variation of the output. Future calculations will be extended by including reproduction and culling, and by performing sensitivity analyses. In conclusion, SCK has an effect on the environmental and economic performance of dairy farming.

**Key Words:** greenhouse gas emissions, costs, health

#### 846 Characterizing the temporal pattern of leaky gut biomarkers in healthy and ketotic cows during the transition period.

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The dairy cow transition period is associated with increased incidence of metabolic disorders. Ketosis is the most prevalent metabolic disease and approximately 10–25% of cows experience clinical ketosis following calving. We hypothesize that a compromised gastrointestinal barrier (a.k.a. leaky gut) and subsequent lipopolysaccharide (LPS) infiltration may play a key-role in ketosis etiology. Study objectives were to retrospectively characterize biomarkers of leaky gut during the transition period in healthy and clinically diagnosed ketotic (urine acetoacetic acid >15 mg/dL) cows. Blood samples from lactating Holstein cows (n = 164, parity 2–7; from a commercial herd) were obtained at 21, 14, and 7 d antepartum ( $\pm 3$  d) and 3, 7, 10, and 14 d postpartum ( $\pm 1$  d). Cows were retrospectively categorized into one of 2 treatments: healthy (H; n = 24; no diagnosed health disorder) and ketotic (KET; n = 22; cows diagnosed only with ketosis). KET cows had reduced milk production compared with H (10%;  $P < 0.01$ ). Antepartum circulating LPS in KET cows was increased (129%;  $P = 0.02$ ) compared with H, and they tended to have increased NEFA (70%;  $P = 0.08$ ) when compared with H. Postpartum KET cows had increased NEFA (49%;  $P < 0.01$ ), BHBA (16%;  $P = 0.01$ ), SAA (75%;  $P = 0.04$ ), haptoglobin (273%;  $P = 0.03$ ), and L-lactate on d 3 (74%;  $P = 0.02$ ) and tended to have higher LPS binding protein (LBP; 4854 vs. 3569 ng/mL;  $P = 0.07$ ), when compared with H. Postpartum circulating insulin was decreased (11%;  $P = 0.02$ ) in KET cows compared with the H. The postpartum LPS area under the curve (a measure of total LPS exposure over time) tended to be decreased in KET cows ( $P = 0.06$ ), which may be explained by treatment differences in LBP and its role in LPS removal. In summary, blood bioenergetics and gut integrity biomarkers indicate that ketosis may be closely associated with biomarkers of leaky gut during the transition period.

**Key Words:** ketosis, intestine, lipopolysaccharide

#### 847 A randomized clinical trial assessing the use of a single injection of dexamethasone combined with oral propylene glycol therapy for the treatment of hyperketonemia.

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The treatment of hyperketonemia [HK, blood  $\beta$ -hydroxybutyrate (BHBA)  $\geq 1.2$  mmol/L] with oral propylene glycol has proven benefits. Parenteral administration of glucocorticoids has been suggested as an adjunctive therapy, however it has not been assessed in a randomized field trial setting. The objective of this research was to evaluate the effect on cure rate of a one-time intramuscular injection of dexamethasone as an adjunctive therapy for hyperketonemia. A randomized control trial was conducted from May to August 2014 on 4 dairy farms in New York State. Cows were tested from 3 to 16 d in milk, once weekly, for blood BHBA using the Precision Xtra device. All cows testing positive for HK were randomly assigned to receive a single intramuscular injection of 20 mg dexamethasone (DX) or an equivalent volume of sterile saline placebo (PB). Both groups received 4 d of oral propylene glycol therapy. Cure risk was determined by blood BHBA obtained the week following enrollment. A multivariable multi-level logistic regression model was constructed for the outcome of being ketotic at first follow-up. Herd was controlled as a random effect. A total of 498 cows were enrolled,

248 treated with DX and 250 receiving PB. At first follow-up, 250 individuals (50.2%) remained HK. Of those, 131 (52.4%) were from the DX group and 115 (46.0%) from the PB group ( $P = 0.26$ ). Lactation number and BHBA at enrollment modified the effect of treatment. The odds of recovering were higher in first lactation animals treated with DX compared with PB treated first-lactation animals (OR: 3.59 CI: 1.29–10.03). Cows enrolled with BHBA at 1.2 and 1.4 mmol/L and treated with DX had odds of recovering 2–3 times higher (OR: 3.09, CI: 1.65–5.75, OR: 2.31, CI: 1.39–3.83, respectively) than those treated with the PB. There is no significant association between treatment and cure risk at higher BHBA at enrollment. Adding DX to HK treatment protocols was beneficial for cows in first lactation or had a blood BHBA at enrollment of 1.2 or 1.4 mmol/L.

**Key Words:** ketosis, treatment, dexamethasone

#### 848 Effects of prepartum digital dermatitis on first-lactation performance.

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The objective of this study was to describe and quantify the effect of prepartum digital dermatitis (DD) on first-lactation performance. A cohort of 719 pregnant heifers was monitored for DD for a period of 6 mo before calving. The heifers were classified by the number of DD events diagnosed as Type I, Type II and Type III (no DD, one DD event, and multiple DD events, respectively) during this period. After calving, health during initial 60 d in milk (DIM), reproductive and hoof health outcomes, and milk production were compared among the 3 group types. Multivariable logistic and linear models were adjusted for age, height, and girth circumference at enrollment, as well as type of trace mineral supplementation during the pre-partum period. Overall, cows experiencing DD during the rearing period showed inferior production and health outcomes compared with healthy heifers during the first lactation. A numerical difference was found on the percentages of assisted calvings, stillbirths, culls before 60 DIM, and diseased cows during the fresh period between Type III and Type I cows. Significantly lower conception risk at first service (OR [95% CI] = 0.55 [0.33, 0.89]) and increased number of days open (mean [95% CI] = 24 d [5.2, 43]) were observed in Type III compared with Type I cows. In relation to hoof health, a significantly increased risk of DD during first lactation was found in Type II and III cows (OR = 5.16 [3.23, 8.29] and 12.5 [7.52, 21.1], respectively), as well as the earlier occurrence of DD post-calving (mean [95% CI] = 59 d [20, 96], and 74 d [37, 109]). Compared with Type I cows, decreased milk production during initial 305 DIM was estimated at 199 and 335 kg for Type II and III cows, respectively. This difference was due to a greater decline in rate of production (less persistence) after peak yield ( $P < 0.01$ ). Given the long-term effects of DD on health, reproduction, and production, priority should be given to efficient DD prevention and control programs during the rearing period of dairy heifers. Intensive intervention programs are expected to increase overall well-being and farm profitability, based on active long-term DD surveillance, mitigation of risk factors, and prompt treatment.

**Key Words:** digital dermatitis, heifer, milk production

#### 849 Identification of the most likely classical swine fever outbreak scenarios in the swine industry of Indiana.

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The objectives of this study were to develop metrics using empirical data for the identification of the most likely outbreak scenarios of classical swine fever (CSF) in Indiana and to describe the characteristics of the outbreaks. Three types of CSF outbreak scenarios were considered: single, multiple, and outbreak due to delay in detection. The data sources included Indiana premise identification database, feral hog population, and US census data. The attributes included in the metrics were distribution of swine premises and operation types, import frequencies (domestic and international), import origins, number of imported pigs, proximity to feral hogs, and immigrant population. Different weights were assigned to each of the attributes based on their importance. The metrics were used to identify the top 10 Indiana's counties that were most likely to initiate a CSF outbreak; premises with high risk of outbreak were identified within the top 10 counties. Each of the identified swine premises represented a single outbreak scenario. The swine import data of the identified premises were used for identifying the multiple

outbreak scenarios while the export data for identifying the outbreak due to delay in detection scenarios. These identified outbreak scenarios were simulated to derive the outbreak-related measures. In 2012, there were 8589 swine premises in Indiana. A total of 3,145 import shipments from 27 US states and 3 Canadian provinces were received. Similarly, 3,154 export shipments of live pigs were sent to 41 US states. Nineteen single and 15 multiple outbreak scenarios were identified, while no outbreak due to delay in detection was identified. The median number of premises in the multiple outbreak scenarios was 17 (range: 4–32). The estimated median epidemic durations (days) for single and multiple CSF outbreak scenarios in Indiana were 57 and 121, respectively. The identified most likely CSF outbreak scenarios can be used to estimate epidemic duration and magnitude of an outbreak and provide guidance for developing a risk-based surveillance for the CSF in Indiana.

**Key Words:** classical swine fever, epidemic, risk assessment