A retrospective analysis of a high health commercial pig production system showing improved production and reduced antibiotic use after implementation of a PCV2 vaccination.

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Abstract
Increasingly, the varied usage of antibiotics in food producing animals has come under greater regulatory and retail scrutiny. Consumer attitudes towards the use of antibiotics in the food supply chain continue to drive this increased scrutiny. The delivery of immune stimulating antigens through vaccination is well documented as a mechanism for the prevention and control of disease causing agents. Through proper application, vaccination can play a vital role in the reduction of antibiotic use without compromising animal welfare. In that context the challenge is to provide economic returns to primary producers through reduced production costs and/or increased returns following a vaccine implementation. Production data from a 2,800-sow unit and its three site production in Western Canada was retrospectively reviewed for the time period beginning April of 2007 through to March of 2009. At the time porcine Circovirus type 2 (PCV2) vaccination was initiated, the system did not perceive porcine Circovirus type 2 associated disease (PCVAD) to be the leading clinical concern. The herd is PRRS and Mycoplasma hyopneumoniae negative. Six production batches prior to the introduction of Ingelvac CircoFLEX\textsuperscript{©} vaccination and six batches from after the onset of vaccination were analyzed. Improvements in attrition (6.6\% vs. 2.7\%) \(p=0.004\) were achieved through vaccination. Average daily gain was improved by 68 g (845 g vs. 913 g) \(p=0.04\). Mortality was reduced by more than half from 5.39\% to 2.05\% (\(p=0.009\)) on average. At the same time as these improved production parameters were observed, the antibiotic costs per pig dropped from CDN\$1.20 to CDN\$0.42 as a direct reflection of reduced and more prudent use in the system. This reduction in antibiotic use reflects current consumer demands for our food production systems. Overall, the six production batches that received vaccination for PCV2 had a yearly ROI of CDN\$6.60 for each CDN\$1 invested in vaccine versus the six production batches that were not vaccinated for PCV2.

Introduction
Reducing the varied usage and reliance of antimicrobials in food producing animals is consistent with current consumer expectations! Once considered a discussion point amongst regulatory and special interest groups, the specifics of on-farm antimicrobial usage and resistance are now viewed as mainstream issues within social dialogues.\textsuperscript{1} The intricate nature of understanding the multi-factorial role and outcomes with respect to antimicrobial use has created inherent polarization within private and public professional fields as well as within a range of lay person and consumer groups.\textsuperscript{2}

The use of timed vaccination as a biological tool to assist in the prevention of specific diseases and by extension, minimize on-farm antimicrobial usage is a valid animal health management strategy. The delivery of immune stimulating antigens through vaccination has been widely validated as a mechanism for the prevention and control of disease causing agents. The efficacy of specific vaccines to prevent losses from bacterial and viral associated diseases has been well documented for both agents within swine populations.\textsuperscript{3,4} Through proper application, vaccination can play a vital role in the reduction of on-farm antibiotic use without compromising animal welfare and operational productivity. In that context, the challenge is to provide economic returns to primary producers through reduced production costs and/or increased returns following a vaccination implementation strategy.

Production System
Performance and financial data from a high health commercial 2,800-sow pig production system and its three site production in Western Canada was chosen for this retrospective analysis. The time period for this investigation spanned from the beginning of April 2007 through to March of 2009. The system was Porcine Reproductive and Respiratory Syndrome (PRRS) negative and Mycoplasma hyopneumoniae negative for this time period. At the beginning of the study period the system was perceived to have a low prevalence of clinical porcine Circovirus associated disease (PCVAD). Initially, clinical cases of a highly pathogenic “Streptococcus suis type 2” (PCV2 was later recognized as a cofactor) were noted by the herd veterinarian in October of 2006 in the grower stages between 15 – 18 weeks of age. At that time porcine Circovirus type 2 (PCV2) vaccination was initiated, the system did not perceive PCV2 to be a significant clinical or economic concern. Piglets were vaccinated at an average of 20 days of
age (weaning) with a single dose PCV2 subunit vaccine (Ingelvac CircoFLEX®; Boehringer Ingelheim Vetmedica Inc, Burlington, Ontario). The performance and health of the sow herd (27.7 pigs per sow per year) was considered excellent. The sows and breeding gilts were not vaccinated for PCV2.

Production Analysis
Six production batches prior to the introduction of PCV2 vaccination and six production batches from after the onset of vaccination were analyzed. Batches prior to vaccination and batches following vaccination were compared for the same grow-finish barns. A production batch was defined as the time period from weaning (20 days of age) through to marketing.

Improvements in a multiple of performance and financial metrics occurred within the subsequent six batches following the initiation of the PCV2 vaccination protocol. Group comparisons were analyzed using the Mann-Whitney U test in SPSS v. 15, SPSS Inc.

Total culls prior to market were reduced markedly from an average of 6.6% to 2.7% (p=0.004) following introduction of PCV2 vaccination to the system.

Temporally, nursery grow finish (NGF) mortality had risen noticeably over the multiple periods leading up to the introduction of piglet vaccination. For the six production batches prior to our introduction of the PCV2 piglet vaccine, Streptococcus suis type 2 was the leading bacterial pathogen and was considered the primary cause of the increased mortality issues within the system. The positive response to PCV2 vaccination changed that working hypothesis by demonstrating a pronounced and rapid reduction in overall NGF mortality (Figure 1). In the six production batches after the introduction of PCV2 vaccination mortality was reduced by more than half from 5.39% to 2.05% (p=0.009). Average daily gain was improved throughout the system overall by an average of 68 g per day from 845 g to 913 g (p=0.04) (Figure 2).

The reduction in mortality and attrition (increased full value markets) and advances in other performance and productivity metrics translated into system wide progress in terms of on-going improvements in herd and individual health as well as a decrease in overall medication usage. By extension this resulted in a decline in antibiotic/treatment cost for the entire system. Figure 3 shows a marked reduction in the use of medication by the year in quarters. This declining trend that we see in overall medication use was mirrored in feed, water, and injectable medication usage charts. Moreover, this trend is in line with current consumer and retail demands.
Return over investment (ROI) was calculated using the performance and financial records provided to us for analysis by the system. Using average values for market price and input costs the six production batches that received vaccination for PCV2 had a yearly ROI of $6.60 for each $1 invested in vaccine versus the six production batches that were not vaccinated for PCV2.

Figure 3: Overall medication costs by quarter for six production batches prior to PCV2 vaccination & six production batches after PCV2 vaccination.

Conclusion
This retrospective analysis of a large three site production system in Western Canada demonstrates that the use of a one dose PCV2 vaccine at the time of weaning can control PCVAD, improve performance, reduce antibiotic cost and improve animal welfare while returning a greater return to the producer. Swine vaccines can contribute to more prudent use of antimicrobials in food producing animals.

References