Discussion

This longitudinal study provides the first direct evidence of the emergence and persistence of a new multi-drug resistant Salmonella strain (mSTM193) in an Australian pig herd, with clinical significance to both pigs and humans. Further, the identical MLVA profiles (A, B, C, E, and F) have been seen in an increasing number of human infections, with the result that pigs cannot be excluded as a possible source (Anon 2014a; Anon 2014b). Previous Salmonella farm studies conducted in Australia have largely been cross sectional and have generally isolated a variety of serovars, particularly when multiple colony picks are tested. A surprising finding in this study was the absence of isolates other than mSTM193 over the 13 months, despite the increased rigor of characterising 10 colonies per positive sample, in comparison to the common investigating laboratory practice of characterising only 1. The emergence of mSTM193 in Australia, a decade after its rise to prominence in Europe, raises questions as to its mode of entry, particularly considering Australia’s strict quarantine restrictions and the failure of STm DT104 to appear at all. The resistance profile, ASSuT, reflects that seen in Europe (Hopkins et al., 2010). MLVA is a powerful and sensitive technique for strain differentiation in this setting. How long do they persist within a herd to inform human illness attribution studies? What is clear from the study so far is that in order to answer the question ‘when are different MLVA profiles different’, possibly related; closely related? or the same? It is critical to gain both experience in the technique and an understanding of the context in which it is used.

References


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Food and Medicines Agency, 2015). Inspired by the public debate, the present project was initiated with the purpose to increase the knowledge of what it takes to produce pigs for slaughter without use of antibiotics. The strategy for production of piglets without antibiotics was to keep the piglets strong enough to face infections without need for antibiotic treatment. This primary focus points were increased attention on the piglets in the first weeks after birth and vaccination against common diseases. Furthermore, the hygiene in the barns was increased in order to decrease the infection pressure on the pigs. Monitoring ensured that animal welfare was not compromised and that sick animals received treatment.

Material and Methods

The project herd is a typical Danish sow herd with 500 sows, weaning piglets to separate barns on the same site. At approximately 30 kg live weight, 2/3 of the pigs are sold to local finishing producers, and the remaining 1/3 of the pigs are kept for fattening on a neighbouring farm. The goal with the project was to deliver 50% or more of the pigs for slaughter without any antibiotic treatment from birth to slaughter,
Antimicrobials in swine production, antimicrobial resistance, alternative strategies to antimicrobial use

Epidemiology and control of hazards in pork production chain – SAFEPORK
One health approach under a concept of farm to fork

Antimicrobials in swine production, antimicrobial resistance, alternative strategies to antimicrobial use

Figure

In the weaned pigs, consumption of antibiotics was reduced by 50% due to a lower frequency of treatments against intestinal disorders. Even with this low consumption of antibiotics, the productivity was increased, possibly due to the implementation of vaccination against *Lawsonia intracellularis*.

Vaccination against *Lawsonia intracellularis* controls the disease and improves production parameters in infected herds (Hardge et al., 2004), but vaccinated herds also use less antibiotics than non-vaccinated herds (Bak and Rathkjen, 2009; Bundgaard et al., 2012).

![Figure 1](image1.png)

**Figure 1**: Average prescription of antibiotics (9 month average) measured as ADD/100 pigs/day before and after initiation of project with production of antibiotic free pigs. Source: Vetstat database.

![Figure 2](image2.png)

**Figure 2**: Production figures in the sow herd in the first quarter after initiation of the project with production of antibiotic free pigs, compared to the average productivity in the previous year.

Six months after initiating of the project, the results regarding reduced use of antibiotics are promising. The overall antibiotic consumption in the sow herd decreased by 14% from a monthly average prescription of 2.15 ADD/100 pigs/day to 1.86 ADD/100 pigs/day. In the weaned pigs, the monthly average prescriptions have decreased by 50%, from a monthly average of 8.30 ADD/100 pigs/day to 4.19 ADD/100 pigs/day, mainly due to a reduction in prescription of antibiotics for treatment of intestinal disorders. The reductions have resulted in a steady decrease of the 9 month average of antibiotic consumption (figure 1). Data from finishers are not yet available.

In the sow herd, production figures were at the same level or higher than the average of the previous year (figure 2). In the weaned pigs, the average daily weight gain was increased, and the feed consumption was decreased (table 1). The prewean mortality was lowered by 2.5%, but the postwean mortality was increased by 0.4% in the same period. Hence, the overall piglet mortality decreased by 2.1%. The optimized management procedures and hygienic precautions resulted in an increased workload, with approximately 12 extra working hours spent per week.

### Discussion

During the first 6 months of the project, the farmer successfully reduced the consumption of antibiotics for both sows and weaned pigs without compromising the productivity. In the sow herd, most production figures were actually slightly better than in the previous year (figure 2). The improvement was probably caused by the optimized management procedures with extra care for the piglets and focus on sow feeding, thereby providing the best possible milk production for the piglets. This assumption is supported by the drop in prewean mortality, which also can be used as a parameter for the quality of the management in the farrowing unit. There was a slight increase in postwean mortality but still, more pigs survived from birth to
thereby decreasing the overall consumption of antibiotics, mainly in the weaned pigs. The amount of antibiotics prescribed in the herd was surveyed using data from the Danish Vetstat database, where all antibiotics are registered on a monthly basis as Animal Daily Doses (ADD) per 100 pigs per day. The development of antibiotic use in a herd is given as an average of the prescribed ADDs for the past 9 months. To identify the pigs that were raised without antibiotics, all piglets were given an ear tag at 3 days of age. If an antibiotic treatment had to be given, the ear tag was removed. The management procedures in the herd were changed to maximize the immunity and minimize the infection pressure. For a maximal immunity, the daily care was intensified, especially in the farrowing unit. The production system was changed from weekly batch farrowing to production of one larger batch every second week, and the weaning age of the piglets was slightly increased. Already before initiation of the project, all piglets were vaccinated against PCV2 and Mycoplasma hyopneumoniae, but on top of that, a vaccination program against Lawsonia intracellularis was implemented, because this infection was diagnosed in the weaned pigs. After weaning, the weakest pigs were taken out of the project, collected in separate pens and medicated to minimize the infection pressure and to make sure that animal welfare was not compromised. To reduce the overall infection pressure and the spread of infection between the pigs, extra hygienic procedures were implemented, including change of boots between sections and disinfection of boots. The pigs were not comingled between batches, and sick pigs were removed from the healthy pigs. The success of the project was measured by the antibiotic consumption and the productivity in the sow herd and in the weaned pigs. Quarterly efficacy reports were used for evaluation of productivity.

Results

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The combination of lowered antibiotic consumption with improved production figures highlights the advantage of prophylaxis compared to treatment. Vaccination protects the pigs from onset of disease, thereby preventing damage to the intestinal mucosa, resulting in an increased growth rate of the vaccinated pigs compared to non-vaccinates (Bak and Rathkjen, 2009). Hence, vaccinated pigs perform better compared to non-vaccinated pigs, even if the non-vaccinated pigs receive antibiotic treatments after an outbreak of diarrhea.

Conclusion

Preliminary results from the project are positive, indicating that it will be possible to produce at least 50% of the pigs without use of antibiotics. This is possible with herd relevant vaccination programs, including PCV2, Mycoplasma hyopneumoniae and Lawsonia intracellularis, and with continuous focus on caretaking and hygiene.

References

- DANMAP (2013): Use of antimicrobial agents and occurrence of antimicrobial resistance in bacteria from food animals, food and humans in Denmark. ISSN 1600-2032, p 92.