EMIDA MINAPIG Evaluation of alternative strategies for raising pigs with minimal antimicrobial usage: Opportunities and constraints [Bewertung von alternativen Strategien zur Schweineproduktion mit minimalem Antibiotikaeinsatz: Möglichkeiten und Grenzen]

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Key words
Antibiotikaeinsatz, Kosten, Risikofaktoren, Europa, EMIDA

Aim of the study
The aim of MINAPIG research was to evaluate strategies in pig production that will reduce the usage of antimicrobials while assuring the health and welfare of pigs and offering sustainable solutions for farmers.
The objectives of the project were 1) to investigate the efficacy and effectiveness of specific and unspecific technical alternatives to antimicrobial usage in pig production, 2) to identify drivers impacting on choices of farmers and veterinarians between alternative strategies, and 3) to transfer obtained knowledge to different target groups including veterinarians and farmers to promote sustainable pig production. In this report, we will focus on work conducted with input from SAFOSO as a consortium partner. The total consortium consisted of 9 partners, out of which SAFOSO acted as the coordinator. SAFOSO was also involved in activities led by ETHZ (Dr Visschers) and included in their separate report (below).

Part 1

Material and methods
A cross-sectional study was conducted on the antimicrobial use in 227 pig herds in four European countries (Belgium, France, Germany, Sweden) and the association of usage with animal health, production, biosecurity and other disease prevention measures. Data were collected between December 2012 and December 2013 in farrow-to-finish pig farms. Each farm was visited once to collect detailed information on the antimicrobial consumption over the past year. These data were used to quantify the antimicrobial usage measured as the "treatment incidence" (=number of treatment days per 1000 days). Additionally, data was collected on the internal and external biosecurity, technical performance, health characteristics and vaccination practices. A causal pathway was designed to study associations between biosecurity status, antimicrobial usage, and production parameters. All data collection was performed according to standardized methodologies allowing for comparison of results between herds and countries.
In the prospective study, 70 farms located in Belgium, France, Germany and Sweden were recruited to implement reduction measures. The choice of intervention was based on individual farmers' preference and agreed in collaboration with the attending veterinarians. The performance of pigs in these farms was monitored and economic assessment was conducted taking into account the costs of interventions and the impact on performance over several production cycles.

Results and significance
The results of the cross-sectional study revealed huge differences in antimicrobial use between farms, ranging from excessively high to remarkably low. Differences were observed within and between countries with an average treatment incidence from birth till slaughter. As far as the biosecurity was concerned, Sweden had on average the highest total biosecurity score, followed by Germany, France and Belgium. In all countries, our results confirmed that measures taken to prevent disease introduction (i.e. external biosecurity) scored higher compared to measures taken to prevent within herd disease transmission (i.e. internal biosecurity). Higher antimicrobial usage from birth till slaughter was associated with a shorter farrowing rhythm and a younger weaning age, whereas a better external biosecurity was related with lower antimicrobial usage. A higher external biosecurity was associated with more weaned piglets per sow per year. The negative association observed between the biosecurity level and the estimated frequency of treatment against certain clinical signs of disease, used as a proxy for disease incidence, is consistent with the hypothesis that a higher biosecurity level results in healthier animals. Based upon the available data "top farmers" were identified that managed to

combine both below-national-average usage of antimicrobials and above-national-average technical performance. These farmers were characterized by higher internal biosecurity status and were generally located in a more favorable environment (lower pig density and limited contact with wildlife). Overall, the study showed high variation both in antimicrobial usage, biosecurity and management practices indicated substantial room for improvement.

Alternative measures in the prospective study included the improvement of the external or internal biosecurity (n=21 herds), vaccination (n=32 herds), changes made to the feed or water schemes (e.g. zinc oxide, water quality) (n=42 herds) and improved herd management (e.g. reduced density) (n=42 herds). The compliance with the initial intervention plan was high (86% on average). It means that farmers did apply the measures initially defined together with their veterinarian. Antimicrobial usage was significantly reduced following the implementation of the intervention; in the median herd of the four countries, pigs were treated before intervention during 50 days from their birth to their slaughter (i.e. 25% of their lifespan), and after intervention during 29 days (i.e. 15% of their lifespan). In particular, the treatment incidence of suckling pigs and weaners significantly decreased. The usage of critically important antimicrobials (i.e. fluoroquinolons and cephalosprins of third and fourth generations) also reduced, although the reduction was not significant; this is because the usage of these antimicrobial classes was already low in most participating countries. The reduction of antimicrobial usage was positively correlated with the antimicrobial usage before intervention; it means that herds using a lot of antimicrobials before intervention could achieve bigger reduction. Thus, high antimicrobial users should be targeted with priority. No link was found between the type or the number of measures implemented and the success in reducing antimicrobial usage. Although bigger sample size could have helped in identifying such links, it appears that no single intervention can be recommended for all herds. On the contrary, interventions aiming at reducing antimicrobial use should be herd-specific and adapted to the sanitary and technical context of the herd.

The results of the economic analysis demonstrated that reductions in usage were achievable and did – on average – not come at the cost of reduced productivity or health. The savings due to reduced antimicrobial expenditures compensated the costs associated with the intervention in half of the herds. Further economic analysis is needed to specify recommendations for individual herds.

In conclusion, the MINAPIG work showed that reduction of antimicrobial usage is achievable and that economic losses can be prevented.

Part 2

Farmers' and veterinarians' perceptions of antimicrobial use in pig farming

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Key words

Antimicrobials, Pig farmers, Veterinarians, Perceptions, Europe, EMIDA

Aim of the study

In the second work package of the MINAPIG project, the following research questions were addressed: 1) How do farmers and veterinarians perceive antimicrobial usage in pig farming and policy measures to reduce antimicrobial usage? Do these perceptions differ between European countries? 2) Which psychosocial factors, external characteristics and demographic characteristics determine the application of antimicrobials by pig farmers? 3) Which psychosocial, external and demographic factors determine farmers' and veterinarians' willingness to reduce the antimicrobial usage in pig farming?

Material and methods

First, in-depth interviews with 14 German and Swiss pig farmers and with six German and Swiss veterinarians were conducted to get better insights into the psychosocial factors that may determine their perception of antimicrobials and their antimicrobial usage or prescription behaviour, respectively. Based on the interviews and a review of the literature, two surveys were developed. The first survey was sent to farmers only and combined with the cross-sectional survey of WP1 so that the farmers' perceptions could be related to their actual antimicrobial usage. They survey was conducted in Belgium, Germany, France, Sweden and Switzerland (N = 281). Data collection took place between November 2012 and December 2013. In the second survey, both pig farmers (N = 1309) and veterinarians (N = 334) were investigated in all six participating

countries. The farmers again received a paper-and-pencil questionnaire of seven pages. Veterinarians completed an online survey that lasted about 10 minutes to complete. Data were collected between November 2013 and March 2014.

Results and significance

Results of both surveys showed that farmers estimated their own antimicrobial usage as lower than that of other pig farmers in their own country as well as compared to most of the other participating countries. Farmers in all countries were generally not very worried about antimicrobial resistance and its consequences compared to financial or legal issues related to pig farming. Moreover, they estimated the benefits of antimicrobials as relatively high and the risks of antimicrobials as moderate. More specifically, Danish farmers perceived more benefits and fewer risks of antimicrobials than their colleagues from France, Germany, Sweden and Switzerland. Farmers only showed moderate intention to reduce the antimicrobial usage at their farms. The collaboration and contact with their veterinarians was perceived as good.

Veterinarians perceived similar high levels of benefits and moderate levels of risks of antimicrobials as farmers, although Swedish veterinarians perceived significantly more risks than veterinarians from the other countries. Veterinarians were very willing to reduce the antimicrobial usage at their clients' farms and believed that this would be highly feasible. Moreover, veterinarians appeared satisfied about the contact with their pig farming clients. This satisfaction was however lower in countries in which veterinarians reported a stronger pressure from farmers to prescribe antimicrobials (i.e., in Belgium, Germany and Switzerland).

We also investigated several policy measures that may be implemented to reduce antimicrobial usage in pig farming, among farmers and veterinarians. Overall, both groups showed higher acceptance of monitoring and collaboration with veterinarians than, for example, financial rewards or fines, in all countries.

After controlling for country and other demographic characteristics, results showed that farmers' intention to reduce their antimicrobial usage increased when they perceived more control and effectiveness of using less antimicrobials. Moreover, intention to reduce was higher among farmers who reported a higher antimicrobial usage than other farmers, probably because they acknowledged the need to reduce. Those who perceived more risks of antimicrobials, less need to apply antimicrobials in pig farming, who had a better contact with their vet and more experience with antimicrobial resistance were more willing to reduce their usage. Similarly, our results showed that veterinarians were more willing to reduce the antimicrobial usage at their clients' farms when they believed such a reduction was feasible and doable by their clients, when they perceived less need for antimicrobials in pig farming, had a good collaboration with their farmers and had followed more post-graduate courses. Interestingly, farmers' pressure to prescribe antimicrobials did not influence veterinarians' willingness to reduce antimicrobials usage.

Publications, posters and presentations

1. Articles

Postma, M.; Sjölund, M.; Collineau, L.; Loesken, S.; Stärk, KDC; Dewulf, J.: Assigning Defined Daily Doses Animal: a European multi-country experience. J Antimicrob Chemother. 2015 Jan; 70(1):294-302. doi: 10.1093/jac/dku347. Epub 2014 Sep 15.

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Visschers, V. H. M.; Backhans, A.; Collineau, L.; Loesken, S.; Nielsen, E. O.; Postma, M.; Belloc, C.; Dewulf, J.; Emanuelson, U.; grosse Beilage, E.; Siegrist, M.; Sjölund, M.; Stärk, K. D. C.: (in press). A comparison of pig farmers' and veterinarians' perceptions and intentions to reduce antimicrobial usage in six European countries.

2. Conference presentations and papers

Postma, M.; Sjölund, M.; Collineau, Loesken, S.; Okholm Nielsen, E.; Stärk, K.; Dewulf, J.: on behalf of the MINApig consortium, Assigning Defined Daily Doses Animal: a European multi-country experience, Safepork, Portland USA, September 2013

Postma, M.; grosse Beilage, E., Belloc, C.; Iten, D.; Okholm Nielsen, E.; Backhans, A.; Stärk, K.; Dewulf, J.: Potential alternatives to antimicrobials in pig production based on perceived effectiveness, feasibility and return on investment, Safepork, Portland USA, September 2013

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Postma, M.; Stärk, K.; Dewulf, J.: Results ranking alternatives for antimicrobials from 4th ESPHM, ESPHM, Edinburgh, May 2013

Postma, M.; Stärk, K.D.C.; Dewulf, J.K.: Potential alternatives to antimicrobials in pig production based on perceived effectiveness, feasibility and return on investment, OIE Global Conference on the Responsible and Prudent Use of Antimicrobial Agents for Animals, Paris, February 2013

Collineau, L.; Belloc, C.; Postma, M.; Dewulf, J.; Loesken, S.; grosse Beilage, E.; Backhans, A.; Sjölund, M.; Emanuelson, U.; Okholm Nielsen, E.; Seemer, H.; Visschers, V.; Stärk, K.: on the behalf of the MINAPIG Consortium. MINAPIG: a multi-country project to evaluate alternatives to antimicrobial usage in pig production. DACH Epidemiologietagung, Sept 3-5th 2014, Zurich.

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