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Herd-specific interventions to reduce antimicrobial usage in pig production without jeopardising technical and economic performance

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ABSTRACT

Pig farmers are strongly encouraged to reduce their antimicrobial usage in order to reduce the risk of antimicrobial resistance. Herd-level intervention is needed to achieve national and European reduction targets. Alternative, especially preventive measures, have to be implemented to reduce the need for antimicrobial treatments. However, little is known about the feasibility, effectiveness and return on investment of such measures. The objective of this study was to assess, across four countries, the technical and economic impact of herd-specific interventions aiming at reducing antimicrobial usage in pig production while implementing alternative measures.

An intervention study was conducted between February 2014 and August 2015 in 70 farrow-to-finish pig farms located in Belgium, France, Germany and Sweden. Herd-specific interventions were defined together with the farmer and the herd veterinarian. Farms were followed over one year and their antimicrobial usage and technical performance were compared with values from the year before intervention. Compliance with the intervention plan was also monitored. Changes in margin over feed cost and net farm profit were estimated in a subset of 33 Belgian and French farms with sufficient data, using deterministic and stochastic modeling.

Following interventions, a substantial reduction in antimicrobial use was achieved without negative impact the overall farm technical performance. A median reduction of 47.0% of antimicrobial usage was achieved across four countries when expressed in terms of treatment incidence from birth to slaughter, corresponding to a 30.5% median reduction of antimicrobial expenditures. Farm compliance with intervention plans was high (median: 93%; min-max: 20; 100) and farms with higher compliance tended to achieve bigger reduction ($\rho = -0.18$, $p = 0.162$). No association was found between achieved reduction and type or number of alternative measures implemented. Mortality in suckling piglets, weaners and fatteners, daily weight gain and feed conversion ratio did not significantly change over the course of the study, while the number of weaned piglets per sow per year slightly increased. The median change in net farm profit among Belgian and French farms was estimated to be €4.46 (Q25-Q75:-32.54; 80.50) and €1.23 (Q25-Q75:-32.55; 74.45) per sow per year using the detererministic and stochastic models, respectively. It was more influenced by a change in feed conversion ratio and daily weight gain than by a change in antimicrobial expenditures or intervention direct net cost. Therefore, costs of alternative measures should not be perceived as a barrier, but rather as an opportunity to optimise production practices for sustained productivity and improved animal health.

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1. Introduction

Because of the increasing concern about antimicrobial resistance, livestock farmers are strongly encouraged to reduce their antimicrobial usage (WHO, 2015). The prudent use of antimicrobials in veterinary medicine is a core pillar of the European Union (EU) action plan against the rising threat from antimicrobial resistance (European Commission, 2011). For example, following the discovery of the mcr-1 resistance gene in China in 2015 (Liu et al., 2016), EU member states were asked to reduce their use of colistin in animals down to a level of 5 mg per population correction unit within 3–4 years; this represents a 65% reduction across all EU countries when compared with the level used in 2016 (European Medicines Agency, 2016). Colistin is one of the most commonly used antimicrobials to prevent gastro-intestinal disorders in piglets after weaning, and therefore contributes to a large part of antimicrobial usage in pig production (Sjölund et al., 2016).

In order to successfully reduce antimicrobial usage at national and European levels, on-farm action is needed. The implementation of alternative, mostly preventive, measures has been proposed as a way to further reduce the need for antimicrobials on farms (European Commission, 2011). However, little is known about the feasibility, effectiveness and return on investment of these alternatives. Reducing antimicrobial usage might be perceived as being risky by stakeholders in the field; this is because it does not only imply direct costs (e.g. to implement a new vaccination), but might also come with indirect costs, e.g. increased mortality or reduced growth performances, as well as an increased risk of disease outbreaks. Pig farmers were shown to have high concerns about the financial situation at their farm (Visschers et al., 2015). Although other drivers (e.g. social drivers) do exist, economic drivers are known to strongly influence farmers' choices, including choices related to antimicrobial treatment practices (Coyne et al., 2014; Garforth, 2015). Risk avoidance and economic considerations were also mentioned as strongly influencing antimicrobial prescribing practices among veterinarians (Speksnijder et al., 2015).

An expert elicitation survey conducted among 111 European pig experts identified reinforced internal and external biosecurity as well as improved housing conditions (e.g. climate of the stable) as the most promising alternatives in terms of perceived effectiveness, feasibility and return on investment (Postma et al., 2015a). A recent intervention study conducted among 61 Belgian pig farms showed that a 52% reduction of antimicrobial usage from birth till slaughter, when expressed in terms of treatment incidence, could be achieved without impairing the herd production performances (Postma et al., 2016a); the average enterprise profit was estimated to increase by 42.99 € (CI 95% −79.13; 151.43) per sow per year following the implementation of the interventions (Rojo-Gimeno et al., 2016). The results from Rojo-Gimeno et al. (2016) showed high variability, and it is unknown whether these results can be generalized to other contexts, e.g. other countries or other types of alternatives. Besides, these studies (Postma et al., 2016a; Rojo-Gimeno et al., 2016) did not address the association between the achieved antimicrobial usage reduction and compliance with the intervention plan, type of measures or direct intervention costs.

Therefore, the objective of this study was to assess, across four countries, the technical and economic impact of herd-specific interventions aiming at reducing antimicrobial usage in pig production while implementing alternative measures. More specifically, we aimed to explore the following questions: i) how much antimicrobial usage can be reduced at herd level, ii) with what impact on the farm technical performance and the net farm profit and iii) with what compliance with the predefined intervention plan.

2. Material and methods

An intervention study was conducted between February 2014 and August 2015 among 70 farrow-to-finish pig farms located in Belgium (n = 16), France (n = 20), Germany (n = 25) and Sweden (n = 9). Fig. 1 provides a summary of the study workflow and supports the description of the method

2.1. Recruitment of participating farms

Farms were primarily recruited among those that previously participated, between December 2012 and December 2013, in a cross-sectional study that aimed to document antimicrobial use and to explore risk factors for antimicrobial usage in pig production related with the farm management characteristics, biosecurity practices and health status, as well as the farmer's attitude and behavior towards antimicrobial usage (Postma et al., 2016b; Sjölund et al., 2016; Visschers et al., 2016a). The selection criteria for these farms were to have more than 70 present sows and more than 500 finishers produced annually. More details on herd selection are provided in Sjölund et al. (2016).

In Belgium, of the 47 herds that had participated in the cross-sectional study, 29 were asked about their interest in participation in the intervention study. Of these 29 herds, 16 agreed on participation. The 13 herds that were not willing to participate refused due to a combination of lack of time and/or concerns about possible consequences for the herds health status (n = 12), or had extended animal health problems on the farm at the start of the project (n = 1). The 18 herds that were not selected by the researchers had already very low antimicrobial usage (n = 3), smaller numbers of sows (n = 3), had a lack of time due to personal or business related problems (n = 3), stopped sow practice in the meantime (n = 1) and eight already made clear not to be interested in participating in a follow-up study during the cross-sectional study.

In France, the 30 farms (i.e. 50% of the farms enrolled in the cross-sectional study) with the highest antimicrobial use were selected as potential candidates for enrollment in the intervention study. Herd veterinarians were first contacted and asked about their interest in participating in the intervention study together with the pre-identified farmer. In case of acceptance, herd veterinarians contacted the farmer to ask if they were interested in participating. Five veterinarians (in charge of six herds) did not respond after several attempts to contact them and one veterinarian (in charge of three herds) refused to participate. One veterinarian felt it was not possible to cooperate with the identified farmer. Six farmers refused to participate because of lack of time, lack of interest or because of concerns about the potential consequences from such an intervention on the health status of their pigs. Therefore, 14 French farms previously involved in the cross-sectional study were enrolled in the intervention study. Six additional farms were recruited based on the herd veterinarian's and farmer's willingness to participate. These farms complied with the same selection criteria as those used in the cross-sectional study.

In Germany, farmers who participated in the cross-sectional study were invited, during the cross-sectional study visit, to take part to the intervention study; 19 farmers accepted. Six additional farmers were recruited by contacting a veterinarian practice that provided contacts from interested farmers. Therefore, 25 German herds were enrolled in the intervention study.

In Sweden, all farmers participating in the cross-sectional study were informed about the planned prospective study during the farm visit of the cross-sectional study to give them the opportunity to participate. Six herds enrolled in the cross-sectional study agreed to enroll in this study. An additional three herds fulfilling the inclusion criteria were enrolled. These three herds were recruited with the aid of herd veterinarians from the Farm & Animal Health