

Responses to reviewers – PCI

AU: Dear recommender,

Thank you for handling this reviewing. Please find hereunder and in the new manuscript the responses to the reviewers and the corrections performed (uploaded on Zenodo on Friday, July 14th - <https://zenodo.org/record/8087233>).

Sincerely,

Pierre Levallois, Mily Leblanc-Maridor, Annalisa Scollo, Paolo Ferrari, Catherine Belloc and Christine Fourichon

PS: The line numbers differ between the first and second versions of the manuscript. All the line numbers refer to the second version of the manuscript (including the ones in the reviewers' comments or questions).

Reviewed by anonymous reviewer, 23 Jun 2023 12:10

- **This is a very interesting paper about the fitness of animal health plans considering the farmers' and farm veterinarians' perception of disease awareness and disease prevention needs. Under a farm-centric approach, the authors used a mixture of methods matching the farmers' and vet's opinions with the follow-up results. The aim of this work is relevant, and it is suitable for scientific publication.**

AU: Thank you for your review and your positive comments and questions

General comments:

- **I would like to see some characterization of the pig farm population. Are the pig farms independent? Are they organized in an industrial system? Cooperative? Percentage of organic and conventional farms in the sample? Information like this is relevant here. It is relevant regarding the representativity of your sample.**

AU: Indeed, additional information is relevant here. We wanted a diversity of farms, based on their health statuses and management practices. Therefore, we didn't want to recruit a cohort statistically representative of French farms. Additional information was provided lines 143-147:

“Two farms were organic and 18 were conventional. Seven farms out the 18 conventional farms had other specifications: i) four farms were Label Rouge (République Française, 2017), ii) two

farms were antibiotic-free from birth and iii) one farm was antibiotic free from 42 days of age. The 20 farms were related to 10 different cooperatives”.

In our study, farmers were the owners of their farms and none was in an industrial system. In France, most of farms are related to a cooperative.

We wrote another sentence in the first discussion paragraph, to mention the diversity of recruited farms. Line 565:

“Farms were recruited according to their diversity of health statuses and management practices.”

- **I would suggest formulating or replacing (when possible) the term "room for improvement" in the manuscript. It is a well-understood concept, no doubt, but there are some passages where the word/meaning could be upgraded or described more precisely with your arguments from your findings and corresponding interpretation. The argumentation might be improved.**

AU: Considering a comment of the second reviewer, we changed the definitions of room for improvement for technical performances and antimicrobial use. See hereunder the comment and the response to the second reviewer:

Comment of reviewer 2: “In relation to the definition of "room to improve" as each farm is unique it would be, in my opinion, more useful to compare each farm with before and after the intervention (as it was done for the clinical parameters) for the technical performances and antimicrobial usage. / Line 263: “Technical performances: when indicators were lower (ADG, PWSY) or higher (FCR, mortality) than reference values. / Antimicrobial use: when farm DDDvet were higher than first quartiles of the data distribution for a physiological stage”

Response to the comment of reviewer 2: “We considered that some indicators could have “null” values, such as clinical indicators or antimicrobial use (0 cough/2mns/100 animals or 0 mg/day/kg/1000 animals). We thus defined “room for improvement”, to avoid to conclude that there was no improvement when the initial situation was already excellent.

In the revised version, we changed the definition of improvement for technical performances. We considered in the first version of the manuscript that there was no room for improvement when technical performances were high. We agree that for technical performances (ADG, FCR), we can assume that there is always room for improvement (see further, lines 263-267). To assess improvement in technical performances we did not use a cut-off value for the initial performance. Our conclusions on improvement of technical performances were unchanged, in farms concerned by

disorder specific plans (Two farms where technical performance indicators changed only had non-disorder specific plans. To assess the effectiveness of these plans, technical performance indicators were not used).

In the revised version, we changed the definition of room for improvement for antimicrobial use. We considered that a room for improvement exists for antimicrobial use if $DDD_{vet} > 0$ mg/day/kg/1000 animals. One result changed after modifying this definition from “no room for improvement” to “deterioration” (F10b, Table 6). All the required modifications were performed in Table 2 and lines 263-267.”

Moreover, we rephrased some sentences considering your comment:

- Lines 311-315: “Indicators could be not assessed in two situations. Firstly, an indicator could be unavailable in a farm: no monitoring of technical performances, no records on antimicrobial use and no animals in a given physiological stage at the time of the visit. Secondly, there could be no room for improvement according to the baseline value of the initial visit (as defined in Table 2).”
- Lines 467-469: “The cumulated percentage of faeces scores 2 and 3 at visit 1 was 0% in three farms: there was no room for improvement in these farms (but the health plan formulated by the veterinarians targeted a digestive disorder)”
- Lines 502-503: “there was no room for improvement at visit 1 in three farms according to the baseline value of clinical indicators”
- Line 519: “(i) clinical indicator informed that there was no room for improvement at visit 1”
- Lines 655-657: “Thirdly, there was no clinical signs at the first visit. Therefore, we concluded that there was no room for improvement, even though veterinarians had previously observed the health disorder.”

Specific comments:

- **Line 54. The citation of the previous ‘major concern for citizens’ appears a little bit ‘rough’. At least, please consider adding any paper related to one health approach, consumers, zoonosis and risk perception.**

AU: References were added lines 54-56. The paper of Lun et al. (2007) refers to a review about the zoonosis risk related to *Streptococcus suis*. The paper of Clark et al. (2019) refers to an original research where the attitudes of consumers towards production diseases in intensive production systems of five European countries were described.

Lines 53-56: “Infectious diseases are very frequent in pig farms and their prevention and cure contribute to animal welfare (Fraser et al., 1997; OIE, 2021) and public health (Lun et al., 2007). Moreover, reducing the risk of infectious diseases is a concern for European consumers (Clark et al., 2019).”

- **Line 455. Space after dot.**

AU: Done.

- **Lines 457-459. Are all they cost-benefit decisions? Have you got this information? Open questions?**

AU: We did not ask if farmers took their decisions based on cost-benefits but the question was open. Farmers did not mention cost-benefits.

- **Line 274: do you think that "improved or deteriorated" regarding antimicrobial use is clear for the reader?**

AU: We rephrased as follows:

“Antimicrobial use: improved or deteriorated if the DDDvet decreased or increased by 10% between the two monitored periods.”

- **A concept point, if you are measuring effectiveness, you might consider in the future to talk about the effectiveness of the use of antimicrobials. So, it is not only about reducing the use; it is also about the reduction of the infection-related complications. Could you also state how this parameter could be affected by making efforts on improve prevention?**

AU: Indeed, the effectiveness of the use of antimicrobials could be assessed in further studies. We can suppose that the use of antimicrobials could be more effective when prevention is improved: bacterial load in the environment can be lower by improving hygiene; a lower frequency of treatments can reduce the probability of antimicrobial resistance. Indicators could be included in the assessment of tailor-made health plan when necessary (*e.g.* bacterial load, recovery rate after treatment). A perspective was proposed in discussion, lines 728-730:

“Indicator to assess the effectiveness of the use of antimicrobials could be considered, such as bacterial load or recovery rate after treatment”

- **Just a question, how the tailor-made health plan could work with early interventions (focusing on piglets)?**

AU: We are not sure that we understand your question. If you mean a health plan focused on early life (piglets), we can assume that an health plan can work similarly. We suppose that veterinarians would prioritize the main improvement needed for piglets, according to the health context.

If you mean early interventions after early detection of a disease, we suppose that tailor-made health plans could include some recommendations on monitoring piglets' health.

- **Lines 511-517. Could you reformulate this passage? It will improve the clarity, I think.**

AU: Done:

“Method D - Antimicrobial use method: one TMHP_{disorder} was effective, one had an intermediate effectiveness and four were ineffective. Effectiveness could not be assessed for eight TMHP_{disorder} for different reasons: there was no room for improvement in one farm; antimicrobial use could not be provided by veterinarians in four farms; no antimicrobials were given in three farms before the intervention, despite of the presence of an health disorder”

Reviewed by Carla Gomes, 24 May 2023 12:56

- **The manuscript reads very well and describes the complexity of trying to develop a method to evaluate effectiveness of herd health plans. An important issue that should be studied further.**

See all my annotated comments in the pdf document.

AU: Thank you for your positive review. Editing was directly done in the manuscript.

Main points:

- **Confusion between compliance and effectiveness. Compliance was only observed for the non-disorder specific plans, while an attempt of effectiveness was done for the disorder specific plans.**

AU: We wanted to assess the effectiveness in both type of plans. In our context, we did not have other indicators than compliance to assess the effectiveness of non-disorder specific plans. There was no major outbreak during the study period. In our sample, we did not record any

introduction of a new pathogen resulting in a new disease, whatever the compliance. There were new reproductive disorders on one farm (suspicion of leptospirosis, diagnostic not confirmed). However, the recommended preventive measures would have no effect of *Leptospira* transmission. This is why we could only use compliance to assess the effectiveness of non-disorder specific plans.

- **The implementation of recommendations by farmers is influenced by several factors, including factors related to the farmer and its farm but also factors related to how the message is communicated (and these are related to the veterinarian). It is not clear to me if vets were trained in how to effectively develop and communicate herd specific plans and what effect vets had on the compliance with the recommendations. (additional questions lines 139 and 679)**
- **Additional question in the manuscript line 139:** “have the vets received any training in how to formulate SMART recommendations and how to communicate them? Most of the times these (well formulated and communicated recommendations) are the parts that differentiate between good or bad compliance.”

AU: We fully agree that good communication is important to enhance compliance. The study design planned to perform a systematic biosecurity audit but not to additionally train vets on how to effectively develop and communicate herd specific plans. Vets developed and communicated herd specific plans as they use to do in their working routine. Vets were used to formulate biosecurity recommendations, since there was a focus on training farmers and auditing biosecurity in France at the time of the study due to potential risk of the African swine fever.

- **Additional question in the manuscript line 679:** “if the recommendations were formulated by the vets, would they be more prone to consider them a success? As far as I could understand you did not evaluate how adequate each recommendation was for each specific farm. My point is that compliance is influenced by all factors that you have mentioned before (time, money, willingness, etc.) but also the perception of the adequacy and feasibility of the tailored made plan. My experience with tailored made plans done by vets is that not always they are SMART.”

AU: We cannot objectively answer if vets would be more prone to consider a health plan based on their recommendations a success. Veterinarians were informed that their opinion about the health evolution would be compared to indicators. Veterinarians could perceive that their opinion could be challenged by indicator values. We thus suppose that they were more prone to be objective when formulating their opinions. Veterinarians did not always conclude to effective plans. 5/14 health plans targeting a health disorder were considered ineffective by veterinarians. Two veterinarians concluded differently on the effectiveness of different plans.

- **In relation to the definition of "room to improve" as each farm is unique it would be, in my opinion, more useful to compare each farm with before and after the intervention (as it was done for the clinical parameters) for the technical performances and antimicrobial usage. / Line 271: "Technical performances: when indicators were lower (ADG, PWSY) or higher (FCR, mortality) than reference values. / Antimicrobial use: when farm DDDvet were higher than first quartiles of the data distribution for a physiological stage"**
- **Additional question in the manuscript line 263: "why to use reference values or quartiles instead of comparing the values before with after intervention only? i.e. considering that all farms had "room to improve"**

AU: We considered that some indicators could have "null" values, such as clinical indicators or antimicrobial use (0 cough/2mns/100 animals or 0 mg/day/kg/1000 animals). We thus defined "room for improvement", to avoid to conclude that there was no improvement when the initial situation was already excellent.

In the revised version, we changed the definition of improvement for technical performances. We considered in the first version of the manuscript that there was no room for improvement when technical performances were high. We agree that for technical performances, we can assume that there are always room for improvement (ADG, FCR) (see further, lines 263-267). To assess improvement in technical performances we did not use a cut-off value for the initial performance. Our conclusions in improvement of technical performances were unchanged, in farms concerned by disorder specific plans (Two farms where technical performance indicators changed only had non-disorder specific plans. To assess the effectiveness of these plans, technical performance indicators were not used).

In the revised version, we changed the definition of room for improvement for antimicrobial use. We consider that a room for improvement exists for antimicrobial use if DDDvet > 0 mg/day/kg/1000 animals. One result changed after modifying this definition from no "room for improvement" to "deterioration" (F10b, Table 6). All the required modifications were performed in text (see hereunder).

- Table 2 (definitions of room for improvement)
- Table 6, plan for F10b
- Lines 263-267: "Technical performances: indicators could always be improved whatever the initial situation. | Antimicrobial use: when farm DDDvet > 0 mg/day/kg/1000 animals."
- Lines 483-487: "Antimicrobial use targeting a health disorder of interest decreased in one farm, neither decreased nor increased in one farm and increased in four farms according to DDDvet. Evolutions of DDDvet would have been relevant in four other farms but could not be assessed since they were not provided by veterinarians."
- Lines 511-517: "Method D - Antimicrobial use method: one TMHP_{disorder} was effective, one had an intermediate effectiveness and five were ineffective. Effectiveness could not be assessed for eight TMHP_{disorder} for different reasons:

antimicrobial use could not be provided by veterinarians in four farms; no antimicrobials were given in three farms before the intervention, despite of the presence of an health disorder”

- Lines 518-521: “Method E – All-indicator method (clinical observations, technical performances and antimicrobial use): five TMHP_{disorder} were ineffective. Effectiveness could not be assessed for nine TMHP_{disorder} since at least one indicator of the methods B, C and D was not assessed (for the reasons given above).”
- Lines 535-536: “The least used method were the all-indicator (E), technical performance (C) and antimicrobial use (D) methods (4, 6 and 7 times out of 14, respectively).”
- Lines 543-544: “The lowest proportions of scores 2 were obtained for the all-indicator (E), the technical performance (C) and antimicrobial use (D) methods (0/4, 1/6, and 1/7, respectively).”
- Lines 554-557: “Technical performance (C) and antimicrobial use (D) methods were the two methods whose results were least consistent with those of the veterinarians’ opinion (A) (2 times out of 6, 4 times out of 7, respectively). When discrepant, scores obtained with veterinarians’ opinions (A) were higher.”

- **Additional question in the manuscript line 93:** “Studied ?”

AU: We changed “stated” to “proposed”. Effectiveness of health plans has been studied. There was no precise definition of effectiveness. Methods to assess the effectiveness of herd health plans have been reviewed in dairy cows by Tremetsberger and Winckler (2015). It’s more a review of what can be done to assess the effectiveness of health plan than a reference method.

- **Additional question in the manuscript line 249:** what is the difference between 0% (sum of scores 2 and 3) and absence of scores 2 and 3?

AU: There’s no difference. The paragraph has been modified considering a previous comment of the second reviewer:

Comment of the second reviewer: “most of this is in table 1 so reduce this text.” -> The only remaining sentence is now line 249: “An absence of faeces scores 2 and 3 was observed in all farms where no digestive disorder was reported (cumulated percentage of 0%)”

- **Additional question in the manuscript line 351:** was there any situation where an outbreak of another disease happened while monitoring the farm? i.e. after visit 1

AU: There was one situation. We were informed by the veterinarian of farm F6 of an outbreak of abortions in gestating units around the time of visit 3 (suspicion of leptospirosis, diagnosis not confirmed). We considered that recommended preventive measures were not related to the prevention of this outbreak (to buy boots and overall for the hygiene lock, to clean loading area

after each departure to slaughterhouse, to connect nursery and fattening unit by a washable surface with walls, to clean specific fattening pens with lime). The initial health disorder targeted by the health plan on farm F6 was diarrhoea in suckling piglets. Faeces scores improved whereas antimicrobial use deteriorated between visits 1 and 3.

- **Additional question in the manuscript line 383:** what do you mean by inspection? visual inspection? any other analysis?

AU: Visual inspection. Precision line 383.

- **Additional question in the manuscript line 388:** what does this mean? integrators? co-ops?

AU: The sentence line 388 has been deleted and a further description of recruited farms has been provided to answer to a general comment of the second reviewer, lines 143-147:

“Two farms were organic and 18 were conventional. Seven farms out the 18 conventional farms had other specifications: i) four farms were Label Rouge (République Française, 2017), ii) two farms were antibiotic-free from birth and iii) one farm was antibiotic free from 42-day-old. The 20 farms were part of 10 different cooperatives”.

- **Additional question in the manuscript line 469:** a bit odd, was it because the particular digestive disorder had not effect in faeces?

AU: We agree that it is a bit odd. Digestive disorders were expected to have an effect on faeces score (ileitis in finishing pigs on farms F4 and F11, diarrhoea in suckling piglets on farm F8). When scoring faeces, no clinical sign of diarrhoea was observed at the time of visit 1. As developed in the discussion, expression of clinical signs varies over the time. We could have observed animals before or after diarrhoea expressions (lines 655-657).

Also, the sentence line 469 has been modified to answer to a comment of the second reviewer: “The cumulated percentage of faeces scores 2 and 3 at visit 1 was 0% in three farms: there was no room for improvement in these farms (despite the health plan formulated by the veterinarians targeted a digestive disorder).”

- **Additional question in the manuscript line 496:** I believe this one is F9. But what about farm F14? what was the clinical indicator for this farm?

AU: It is F9 indeed. No clinical indicator initially selected was relevant to show an improvement in the targeted health disorder in F14 (tail biting). However, the only one recommendation on

farm F14 was not implemented -> the health plan of F14 was considered “ineffective” since no recommendation was implemented.