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Representations of antibiotics and biosecurity by pig farmers

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The Use of Antibiotics in Veterinary Medicine: Representations of Antibiotics and Biosecurity by Pig Farmers

L'utilisation des antibiotiques en médecine vétérinaire : représentations des antibiotiques et de la biosécurité par les éleveurs de porcs

Abstract

The heavy reliance on antibiotics in livestock farming has contributed to the development of antimicrobial resistance. To tackle this phenomenon, it is important to know the determinants of their use. Thus, this study investigated the way in which French pig farmers perceive antibiotics and biosecurity depending on their farm's department and ALEA (Animal Level of Exposure to Antimicrobials). A qualitative study was carried out on 87 livestock farms of a French agricultural cooperative specialising in pig production. The results show a social representation of antibiotics organized around the notion of demedication (i.e. the elimination or reduction of reliance on antibiotics). Concerning biosecurity, "large consumers" of antibiotics associate it with the idea of constraints, regulatory standards and temporal distances separating them from this practice.

Résumé

La forte dépendance aux antibiotiques dans l'élevage a contribué au développement de l'antibiorésistance. Pour lutter contre ce phénomène, il est important de connaître les déterminants de l'utilisation des antibiotiques. Ainsi, cette étude a porté sur la perception des antibiotiques et de la biosécurité par les éleveurs de porcs français en fonction du département et de l'ALEA (*Animal Level of Exposure to Antimicrobials*) de leur exploitation. Une étude qualitative a été réalisée dans 87 élevages d'une coopérative agricole française spécialisée dans la production porcine. Les résultats montrent une représentation sociale des antibiotiques organisée autour de la notion de démédication (c'est-à-dire la suppression ou la réduction de la dépendance aux antibiotiques). Concernant la biosécurité, les « grands consommateurs » d'antibiotiques l'associent à l'idée de contraintes, de normes réglementaires et de distances temporelles les séparant de cette pratique.

1. Introduction

1.1. The use of antibiotics in livestock farming: context and issues

According to the WHO (World Health Organisation), more than half of the antibiotics produced in the world are intended for animals and a large number of these medicines are used in industrial livestock farming. In fact, the rearing conditions characteristic of these facilities (a large number of animals in close proximity) lead to a high consumption of antibiotics and, at the same time, increase the risk of bacterial resistance (Rushton et al., 2014; Schwarz et al., 2001). Moreover, multi-resistant bacteria originating from farming can be transmitted to humans as the same classes of antibiotics are used in human and veterinary medicine (Bonnet, 2014). The challenge is thus to preserve the effectiveness of antibiotics through a One Health approach (Parodi, 2018). With this objective, the WHO and other international institutions are encouraging countries to implement strategies aimed at reducing the use of antibiotics in veterinary medicine.

In France, in line with these recommendations, the National Agency of Veterinary Medicines (Anses-ANMV) carries out an annual survey of sales of veterinary medicines containing antibiotics. The data collected are used to measure the level of exposure of animals to antibiotics (ALEA: Animal Level of Exposure to Antimicrobials). In November 2011, Ecoantibio (the national plan to reduce the risks of antimicrobial resistance in veterinary medicine) predicted a drop of 25% in this exposure over 5 years from 2012 to 2016. The Anses report of 2018 shows that the overall objective of the Ecoantibio plan was reached with a fall in the ALEA of 36.6% (41.5 % for pigs). Nevertheless, pig farms remain one of the sectors most exposed to antibiotics with an average ALEA of 0.623 (Anses, 2018). The objective of the new 2017-2021 Ecoantibio plan is to improve on these results by developing, for example, communication campaigns about antimicrobial resistance and training in biosecurity.

In addition, an Ifop study (2017) revealed that 49% of French people have little or no knowledge of the term “antimicrobial resistance” while 71% of them think that the public authorities do not communicate enough about this phenomenon. The report also indicated that although the French

people are only partially familiar with antimicrobial resistance and its causes, their opinions on this topic are becoming fixed. For example, 76% are in favour of eating meat from animals reared without antibiotics. The expectations of consumers are thus carrying more and more weight and are encouraging farmers to change their practices, especially those enabling them to reduce their reliance on antibiotics. As a result, a large body of research in animal epidemiology is trying to identify the technical, health and structural factors influencing the use of antibiotics (van der Fels-Klerx et al., 2011; Chauvin et al., 2012). Among them, biosecurity figures as one of the most promising strategies in terms of reducing this use (Laanen et al., 2013; Postma et al., 2016). Biosecurity includes actions such as cleaning/disinfecting farm buildings and changing clothing. These types of measures are now the subject of many training courses, particularly in the poultry and pig sectors.

However, in order to communicate effectively about the risks linked to antimicrobial resistance and provide training in biosecurity suitable for farmers, it is essential to understand the different perceptions those involved have of antibiotics and the actions required to reduce their use. Their opinions, attitudes and beliefs are all factors that should be taken into account in order to support farmers appropriately in these changes in practices.

1.2. The contribution of social representations to explaining and preventing the use of antibiotics

The concept of social representation was introduced by Serge Moscovici in 1961 in his book entitled *Psychoanalysis*, *its image and its public.* In this work, Moscovici defined representations as “forms of naive knowledge meant to organise behaviours and guide communications”. These representations are composed of opinions, attitudes, beliefs and information related to an object or a situation (Lo Monaco, Delouvée & Rateau, 2016; Rateau, Moliner, Guimelli, & Abric, 2011). The content of a representation as well as its organisation are determined by the individual and the social and ideological environment to which he/she belongs and are modulated by the nature and intensity of the links the individual has with this social system. Thus, a social

84 representation enables individuals in the same group to understand, explain, and take a stand
85 regarding a phenomenon in agreement with the values and ideas of the group in question. The
86 representations have at least four functions in the social environment of a person: a
87 communication function; an identity function in the determination, construction and conservation
88 of the group identity as well as in intergroup relationships and the maintenance of social distance
89 (Jodelet, 1989); a justification function in that they allow the positions taken and the attitudes
90 toward the object of the representation to be justified; and lastly, a behavioural guidance
91 function, they are “prescriptive of behaviours and practices. They define what is lawful, tolerable
92 or inacceptable in a given situation” (Abric, 1994, p. 17).
93 Today, there are several theoretical orientations in the way of understanding social
94 representations (Rateau et al., 2011). Among them is the sociodynamic approach of Doise
95 (1990), one of the principles of which is based on the anchoring process proposed by Moscovici
96 (e.g. Clémence, 2001 ; Doise et al., 1992 ; Palmonari & Emiliani, 2016). Doise considers that
97 "Social representations are principles that generate positions linked to specific insertions in a set
98 of social relationships and organize the symbolic processes involved in these relationships"
99 (Doise, 1990 ; p.125). This model suggests examining the organization of relations between the
100 social meta-system (i.e., the common positions taken about an object of representation), the
101 cognitive system that corresponds to individual differences, and the social relations in which the
102 positions are produced (Palomari & Emiliani, 2016).
103 This research therefore sought to study the anchoring points of farmers in relation to antibiotics
104 and biosecurity at these three levels. The first step was to analyse the farmers' common positions
105 on these issues. In a second step, the organizing principles of the individual or sub-group
106 positions were studied. Finally, these position papers were discussed in the light of the context
107 and issues currently surrounding the use of antibiotics in veterinary medicine.
108 Consequently, the main objective of this study was to highlight the social representations of
109 antibiotics and biosecurity by analysing the associations of a group of farmers. Several factors

were taken into account in this analysis: the geographical location of the farmers and their way of farming, namely their reliance on antibiotics.

2. Research Questions

Moliner (1993) and Bonetto & Lo Monaco (2018) consider that the epistemic and affiliation needs of individuals underlie the processes of construction of social representations. Given the context and the issues associated with the use of antibiotics in the livestock farming sectors (emergence of antimicrobial resistance, regulatory standards, expectations of consumers, societal pressure), we consider that antibiotics and biosecurity have all the necessary characteristics to be objects of social representation among pig farmers.

For these two objects, we hypothesised that their organization and their content would be determined by both the geographical location (French department) and the ALEA of the farms. The geographical hypothesis refers to the idea of the greater or lesser proximity of these farms to the historic home of the cooperative: the Côtes-d'Armor. It was expected that the socio-representational universes of the farms situated within this territory would converge as regards the values, standards and attitudes asserted by the cooperative. The hypothesis taking into account the ALEA of farms is based on the link between the social representations and the practices of individuals in relation to the object considered.

3. Method

3.1. Participants

This research compared the social representations of farmers who belong to the same agricultural cooperative: Cooperl Arc Atlantique. This group, founded in 1966, specialises in the production of pigs and the processing of pork. The cooperative currently has 2,700 farmers and produces 5,800,000 pigs each year. Although over the years the group has become an agro-industrial complex of international stature, Cooperl Arc Atlantique was created on the initiative

136 of a few farmers in the region of Lamballe (Côtes-d'Armor) seeking sustainability for the
137 agricultural activities within their region. By founding this cooperative, these farmers hoped to
138 improve their living conditions, put their production on a long-term footing, change the image of
139 the farming world and curb the exodus of young people from the region. Cooperl Arc Atlantique
140 was thus founded on regional values. Since then, in order to adapt to the changes taking place in
141 agriculture (globalisation, environmental impact of activities, emergence of antimicrobial
142 resistance), the cooperative has diversified its activities and extended its geographical location
143 over all of western France. Gradually, farms in other departments have joined Cooperl Arc
144 Atlantique. As a result, it is now a very mixed group of farms, in terms of livestock units, rearing
145 practices and cultural affiliations, which must tackle antimicrobial resistance. The pig farms in
146 our sample are representative of this diversity. They are situated in different French departments
147 (Côtes-d'Armor, Ille-et-Vilaine, Morbihan, Loire-Atlantique, Mayenne, Manche; see Figure 1)
148 and present variable ALEA. In views of these specific features, we believed that these farmers
149 could highlight differences in the perception of antibiotics and biosecurity.
150
151 [INSERT FIGURE 1]
152
153 We administered the questionnaire from February to July of 2018; the participants completed the
154 questionnaire in their own offices. Initially, we had at our disposal a sample composed of about a
155 hundred pig farmers. However, some farmers did not consent to participate in the study, and
156 others did not complete the questionnaire in full. Our sample consisted of 87 farmers from the
157 Cooperl Arc Atlantique group: 8 women and 79 men (M = 48.82; SD = 9.55, min = 27; max =
158 67). The "gender" variable was not taken into account in the analysis because we met very few
159 women. The women we met worked on farms based on a family model. Most of the time, they
160 indicated that they were primarily involved in maternity care. They were selected by the farm
161 veterinary surgeons depending on their ALEA and geographical location in order to provide a

representative sample of farms from Cooperl. A large number of them were situated in Brittany. The average ALEA of the sample was 0.51, i.e. lower than the average ALEA of the pig sector in France. The farms were divided into two classes: the first, called “low” ALEA, included farms with an ALEA lower than 0.50; the second, called “high” ALEA, included farms where the animals were exposed to an ALEA equal to or higher than 0.50. The ALEA cut-off of 0.50 was chosen according to the criteria usually followed by veterinary studies and reports of the National Agency for Food, Environmental and Occupational Health Safety (ANSES in French). This leads, in our study, to a slightly unbalanced sample (there were 55 farms with a “low” ALEA and 32 with a “high” ALEA) but this allows a comparison with other studies in the field (a high ALEA is then identical).

[INSERT TABLE 1]

4. Materials

4.1. Procedure

After giving their consent to participate in the study, the farmers completed two free association tasks (Lo Monaco, Piermattéo, Rateau, & Tavani, 2017; Moliner & Lo Monaco, 2017): they had to produce the 4 words or expressions that came to mind when they thought of the stimulus “antibiotic” and then again for the stimulus “biosecurity”. Thus, we were able to understand how the farmers constructed meanings about these two objects, as well as their discourse associated with their use of antibiotics (real, future or envisaged) and the actions that they carried out in terms of biosecurity. The data collected were then lemmatised. Lemmatisation refers to the lexical analysis of a corpus comprised of words of the same family but taking different forms (noun, plural, infinitive verb, etc.); for example, the words “disinfectant” and “to disinfect” found in our corpus were transformed into “disinfection”.

5. Results

5.1. Inductor relations

The reason we chose to ask farmers about "antibiotics" and "biosecurity" was, as mentioned in the introduction, because we assumed that the two terms related to different realities and perceptions, (Abric, 2001; Flament & Rouquette, 2003) although they should both be linked in the fight against antibiotic resistance. In order to identify the relations of proximities and distances maintained by our two objects of representations questioned on the basis of the examination of the associative answers relative to each of them, we have calculated a corpus similarity index called Ellegård's index (Ellegård, 1959). This index consists of dividing the number of themes common to two corpuses (“antibiotics” and “biosecurity”; numerator) by the square root of the total number of themes evoked for the first corpus (“antibiotics”) multiplied by the total number of themes evoked for the second corpus (“biosecurity”).

In line with the literature (e.g., Brunel et al., 2017; Di Giacomo, 1980, 1986; Doise et al., 1992; Moliner & Lo Monaco, 2017; Robieux, Zenasni, Flahault, & Tavani, 2018), we thus calculated a similarity index between our two corpuses. The Ellegård index revealed that farmers share only 25% of common themes between the two corpuses. In other words, they share a very weakly similar vocabulary in their social representations of antibiotics and biosecurity. Farmers with a high ALEA shared a greater similarity with farmers with a low ALEA regarding the term "antibiotic" only (r^n=.53). This result was also found with biosecurity (r^n=.51). As the common vocabulary seems higher, we will now see, in detail, the organization of the two objects of social representations.

5.2. Results for “antibiotics”

The corpus was composed of productions from 87 participants. These were categorised by the authors, independently, and using classical rules of content analysis (di Giacomo, 1980; Lambert, Graham, & Fincham, 2009; Rosenberg & Jones, 1972). In total, for all the participants, 337 verbal associations were collected as some subjects did not provide the 4 words expected. Once

the corpus had been cleaned, 113 different semantic units were obtained (See Appendix 1 for the frequencies of the different categories).

In the same way as the work that is part of the socio-dynamic approach, all the associations were submitted to a Correspondence Factor Analysis (CORR. F. A., Benzécri, 1976; Deschamps, 2003; Doise, Clémence & Lorenzi-Cioldi, 1992). This factorial analysis highlights the differences in terms of frequencies of behaviours relative to the independent variables. It gives access to a summary of the data by revealing a particular structure. It also enables identification of the most significant factorial axes. The axes are composed of the different modalities of the independent variables. Lastly, it emphasises the correspondences between the modalities of the independent variables and the behaviours associated by the participants.

This analysis was performed on associations whose frequency was greater than 5 (N = 18, 76.93% of the corpus without unique terms) and using the departments and the ALEA as independent variables. The two first factors represented 60.33% of total inertia (i.e. Factor 1 = 32.41%; Factor 2 = 27.92%). Only the modalities of variables and the types of responses contributing to the construction of factors were retained. We retained the modalities or the types whose contribution per factor was higher than the average contribution (Deschamps, 2003). Thus, the modalities of variables that contributed to the construction of Factor 1 were the departments of Côtes-d'Armor (D22), Loire-Atlantique (D44), Manche (D50) and Morbihan (D56): CPF (D22) = .13 + CPF (D44) = .37 + CPF (D50) = .14 + CPF (D56) = .28. The total contribution to the definition of Factor 1 was .92 (i.e. 92%). Factor 2 was also constructed on the basis of different departments: CPF (D44) = .41 + CPF (D50) = .25 + CPF (D56) = .20, i.e. a contribution of 86% to the formation of Factor 2. Figure 2 illustrates this organisation.

[INSERT FIGURE 2]

Figure 2 shows that the geographical location of the farm (i.e. the department) determines the socio-representational field of antibiotics for the farmers. The Côtes-d'Armor centralises the socio-representational content of farmers for the object antibiotics with evocations such as *animal* and *medicine* in a very descriptive register. The graphical representation of the results of the CORR. F. A. shows that the departments of Loire-Atlantique, Manche and Morbihan are opposed on the two axes. The farmers of Morbihan share a socio-representational universe related to *antimicrobial resistance*, animal *well-being* and the label *pwa* (pork without antibiotics). In contrast, the departments of Loire-Atlantique and Manche give rise to evocations related to *animals*, the *cost* of antibiotics and *alternative solutions* enabling their use to be reduced. The results also show that the productions of participants, in contrast to what was expected, are not significantly associated with the consumption of antibiotics of farmers.

5.3. Results for "biosecurity"

The corpus was composed of the same participants as for the first phase of the study of productions from 87 participants. In total, for all the participants, 333 verbal associations were collected. Once the corpus had been cleaned, 111 different semantic units were obtained (See Appendix 2 for the frequencies of the different categories according to the variables taken into account).

All the associations were submitted to a Correspondence Factor Analysis (CORR. F. A., Benzécri, 1976; Deschamps, 2003). This analysis was performed on associations whose frequency was greater than 5 (N = 22, 76.93% of the corpus without hapax), and using the departments and the ALEA as independent variables. The two first factors represented 57.36% of total inertia (i.e. Factor 1 = 33.17%; Factor 2 = 24.19%). Only the modalities of variables and the types of responses contributing to the construction of factors were retained. We retained the modalities or the types whose contribution per factor was higher than the average contribution (Deschamps, 2003). Thus, the modalities of variables that contributed to the construction of

Factor 1 were the departments of Manche (D50) and Morbihan (D56) as well as the ALEA: CPF (D50) = .31 + CPF (D56) = .24 + CPF (low ALEA) = .10* + CPF (high ALEA) = .16. The total contribution to the definition of Factor 1 was .81 (i.e. 81%). Factor 2 was constructed only from the variable "department": CPF (D22) = .14 + CPF (D35) = .44, i.e. a contribution of 58% to the formation of Factor 2. Figure 3 illustrates this organisation.

[INSERT FIGURE 3]

The departments of farms determine the productions of participants and the socio-representational field of biosecurity. For example, the department of Ille-et-Vilaine features evocations such as *disinfection* and *footbath,* whereas the farmers of Côtes-d'Armor (historical site of the creation of the cooperative) use ideas more associated with the *health* aspects of their farm, *well-being* at work and *consumers*. The ALEA of the farm also characterises the productions of farmers. Those who use large quantities of antibiotics mention words such as the *constraints*, *vigilance*, *performance* or *standards* surrounding this farming practice.

6. Discussion and conclusion

Our objective was to compare the discourse of farmers depending on their use of antibiotics (low ALEA vs. high ALEA) and the geographical location of their farm. Thus, we were firstly interested in the potential relationships between practices and social representations (Abric, 1994; Jodelet, 1989; Moscovici, 1961). In fact, we investigated this link between the different farming practices related to the use of antibiotics and the social representations associated with them. Our results show that the ALEA of farms is not a determining factor in the representations of farmers regarding this object. Indeed, regardless of the level of consumption of antibiotics, the farmers refer to ideas opposing their use (e.g. *alternative solutions*, *antimicrobial resistance*, *pwa*). In other words, the large consumers of antibiotics do not seem to have particular

291 cognitions within their socio-representational field that would subsequently lead to greater use.
292 On the contrary, the vast majority of farmers participating in this study produced discourse that
293 demonstrates an awareness of the need to change certain farming practices (e.g. stopping the
294 preventive use of antibiotics). Arguments of different types (economic, health, quality of life at
295 work) appeared in the evocations of farmers. This diversity seems to be the sign of a successful
296 socio-representational structure for this object. In fact, for several years, these farmers have been
297 the target of awareness campaigns to convince them of the benefits of demedication. They have
298 been informed of the risks linked to the "irrational" use of antibiotics, made aware of the
299 economic and social issues inherent in demedication, told about alternative solutions and
300 behaviours to implement in order to reduce this use, etc. The farmers are therefore in constant
301 contact with many arguments inviting them to change some of their behaviours. Nevertheless,
302 although these strategies have led to concrete action in terms of livestock management for some
303 farmers, for others the shift from attitudes to behaviours has been less obvious. This is supported
304 by the social representations of farmers regarding biosecurity. In our study, the ALEA of farms
305 characterises the perception of biosecurity by farmers. When the ALEA is high, these farmers
306 prioritise ideas against implementing biosecurity and their representations are characterised by
307 constraints. They mention the regulatory standards and the attention required for this practice.
308 They perceive, at the same time, a pressure exerted by some institutions (European Union,
309 consumers, associations), and the ever more demanding expectations concerning how they
310 should organise their activity. An evaluative dimension runs through their socio-representational
311 field in that biosecurity figures in their perceptions as a set of procedures that complicates the
312 exercise of their activity, generating both financial and attentional costs. During discussions at
313 the end of the questionnaire, the farmers mentioned this practice as "*extra work*" going against
314 one of their main objectives: "*their well-being*". In fact, these representations may act as
315 obstacles to implementing biosecurity measures on their farm. The temporal dimension, which
316 also plays an important role in their discourse, gives weight to this hypothesis. Biosecurity is

317 seen by these farmers as a future practice whose content remains vague at present as do the
318 benefits (technical, economic, health) it is supposed to bring. Actually, for them, biosecurity is a
319 farming issue for future generations. The farmers with a low ALEA are ideologically opposed to
320 this type of representation. They produced more descriptive and functional evocations, using
321 elements directly from their behaviour in terms of biosecurity. For example, they mentioned
322 words such as "*disinfection*", "*clothing*", "*footbath*", etc. For these farmers, biosecurity consists
323 of concrete measures, applicable as of now and generating appreciable effects in different areas
324 of farming. Firstly, concerning health, these farmers perceive a gain in control over the
325 occurrence of some events (e.g. bacterial proliferation, presence of a virus). Secondly, the feeling
326 of working in a "hygienic" work environment increases their quality of life at work. In contrast
327 to the large consumers of antibiotics, biosecurity for these farmers is currently a meaningful and
328 beneficial practice. Their representational universe is thus focused on the reasons for observing
329 the rules of biosecurity in farming.
330 Another objective of our research was to explore the potential link between the department of the
331 farm and the representations of antibiotics. Certain results confirm our hypothesis that the
332 perception of antibiotics by the farmer is partly determined by his/her regional roots. The
333 territorial network of Cooperl Arc Atlantique extends over several departments and some are far
334 from the historical home of the cooperative responsible for its history, values, farming standards,
335 etc. In fact, we thought that some territories could give rise to variability in the perception of
336 certain important social objects in farming. The farm's department seems to be a more important
337 factor than its ALEA in predicting farmers' representations of antibiotics. Thus, and regardless of
338 the consumption of antibiotics, the farmers situated in the Côtes-d'Armor produce similar
339 discourse regarding antibiotics. They preferentially mention ideas related to the therapeutic
340 dimension of antibiotics in veterinary medicine. Their representations may be described as
341 "classic" in the sense that their associations are limited to the basic functions of antibiotics. They
342 perceive them as a farming tool among others. The other departments differ in their discourse by

343 stating the consequences of antibiotic use (e.g. "*antimicrobial resistance*", "*cost*") and solutions
344 to remedy it. Thus, two types of territory can be contrasted for this object of representation: the
345 Côtes-d'Armor farms that mention global and non-contextualised ideas vs. the farms situated, for
346 example, in the Morbihan that produce discourse taking account of health (i.e. antimicrobial
347 resistance) and economic (e.g. pwa label) issues linked to antibiotic consumption in the livestock
348 farming sectors. The representations for the other departments recall the need to reduce this use
349 and show a certain adherence to the demedication policy of the cooperative. These results seem
350 paradoxical with regard to the relatively late integration of these farms into the cooperative. Our
351 initial hypothesis therefore ran counter to this by thinking that the farmers located in the historic
352 home of the cooperative would act as messengers advocating demedication. Although these
353 farmers are not particularly averse to demedication, it is rather the departments like Morbihan
354 (department in our sample characterised by a low ALEA) that develop a "positive" and
355 supportive discourse on this topic. A historical explanation can be provided here. During its
356 lifetime, the cooperative has faced many challenges, particularly related to the impact of its
357 activity on the environment. The group's original farms (i.e. in Côtes-d'Armor) have therefore
358 become accustomed during their professional experience to changing some of their practices in
359 order to adapt to new contextual data. A phenomenon of habituation could have appeared for
360 these farmers concerning the dynamic aspect of modern agricultural activities. The "more
361 recent" farms of the cooperative have proportionally had to cope less with types of upheaval
362 such as the emergence of antimicrobial resistance. Thus, the seriousness and the exceptional
363 character of this phenomenon are undoubtedly more striking for these pig farms. This variability
364 in the perception of the phenomenon could encourage them to become more actively involved in
365 the field of ideologies.
366 This study thus reveals several elements. First, the discourse concerning antibiotics does not
367 seem to determine the reliance on their use on farms. Overall, the farmers are all aware of the
368 need to reduce the consumption of antibiotics in livestock farming. The campaigns of persuasion

(carried out at national and organisational levels) have thus had real effects on farmers' cognitions. However, these effects are limited in terms of behaviour on many farms. This finding is supported by the representations of farmers regarding biosecurity. Biosecurity requires the implementation of very concrete behaviours in order to lower the consumption of antibiotics. We note that for this object, the ALEA characterises the discourse of farmers. For the large consumers of antibiotics, the representations are abstract and extremely evaluative. Although an ideological opposition to this practice is emerging for these farmers, they are unable to connect this attitude to direct experiences linked to biosecurity measures. These results encourage us to think that supporting farmers in the process of demedication should not only consist of persuasive communication. We believe that measures including communications based on these representations and preceded by the implementation of concrete measures related to demedication (e.g. commitment to carry out some biosecurity procedures on farms) would reduce the consumption of antibiotics within the cooperative more effectively. Thus, this persuasive communication would bridge the gap between the representations of farmers – already in favour of demedication – and the actions needed to achieve it.

Finally, these results have implications for prevention. Several studies show that farmers or slaughterhouse staff are occupationally exposed to resistant bacteria such as resistant Staphylococcus aureus methicillinus aureus (MRSA) (Parisi et al., 2019; Van Gompel et al., 2019). Resistant bacteria pose a risk if transmitted to these workers. Indeed, they can cause illnesses that are difficult to cure if effective antibiotic treatment is not available (Khachatourians, 1998; Michael et al., 2014). Biosecurity, on the other hand, makes it possible to limit the dissemination and transmission of these pathogens (Moss et al., 2012; Bragg et al., 2014). In view of the representations collected during this study, it would be appropriate, in a One Health approach, to raise awareness and train farmers in biosecurity.

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484 *Appendix 1 – Farmers' evocations of the word "antibiotic" as a function of variables.*

Evocations	*Frequency*	*High ALEA*	*Low ALEA*	*Total*
Antibiotic resistance	28	10	18	56
Disease	22	8	14	44
Cost	19	6	13	38
Security	14	4	10	28
Not automatic	13	3	10	26
Care	12	4	8	24
Image	12	4	8	24
Treatment	11	4	7	22
Healing	10	5	5	20
Comfort	9	3	6	18
Wellness	8	2	6	16
Medication	6	1	5	12
Human Health	6	2	4	12
Required	5	3	2	10
PSA (Pork Without Antibiotic)	5	2	3	10
Animal	5	2	3	10
Alternative solution	5	3	2	10
Deadline	5	1	4	10

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487 *Appendix 2 – Farmers' evocations of the word "biosecurity" as a function of variables.*

Evocations	*Freq.*	*Côte-d'Armor*	*Ille-et-Vilaine*	*Loire-Atlantique*	*Manche*	*Mayenne*	*Morbihan*	*High ALEA*	*Low ALEA*	*Total*
Hygiene	21	11	8	0	0	0	2	3	18	42
One-way flow	15	10	3	0	0	1	1	6	9	30
Sanitary	14	9	3	1	0	0	1	4	10	28
Rigour	13	8	2	0	0	0	3	6	7	26
Constraint	12	5	2	0	1	1	3	6	6	24
Disinfection	12	4	5	0	1	1	1	3	9	24
Security	11	8	1	0	0	0	2	4	7	22
Clothing	8	4	3	0	1	0	0	2	6	16
Vaccine	8	4	3	0	0	0	1	4	4	16
Prevention	8	5	1	0	0	0	2	4	4	16
Washing	8	3	2	0	1	1	1	4	4	16
Wellness	8	6	0	1	0	0	0	3	4	14
Comfort	7	3	0	0	0	1	1	0	5	10
Consumer	5	3	0	0	0	1	1	3	2	10
Essential	5	3	1	0	0	0	1	2	3	10
Work	5	3	2	0	0	0	0	1	4	10
Pediluve	5	2	3	0	1	0	0	3	3	12
Demedication	5	0	1	0	1	0	3	1	4	10
Future	5	3	0	0	0	0	2	3	2	10
Norm	5	1	2	0	1	0	1	4	1	10
Performance	4	1	0	0	1	0	2	3	1	8
Progress	4	3	0	0	0	0	1	2	2	8
Vigilance	4	2	0	0	1	0	1	3	1	8
Economy	4	2	1	0	0	0	1	2	2	8
Animal	4	3	1	0	0	0	0	3	1	8

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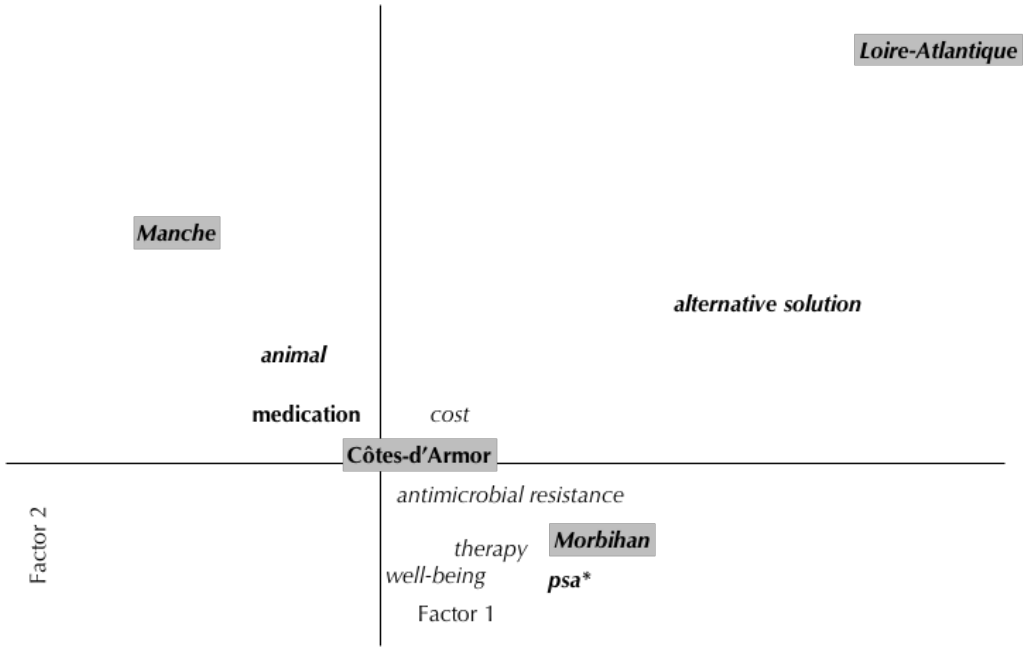
Figure 1. Location of the pig farms in our sample

Figure 2. Graphical representation of the results obtained by means of the CORR. F. A. concerning Factors 1 and 2.



Note: Grayed blocks refer to the experimental conditions. "**Experimental conditions**" contribute to the formation of Factor 1; "*Experimental conditions*" refer to the experimental conditions which contribute to the formation of Factor 2; "***Experimental condition***" refer to the experimental conditions which contribute to the formation of both Factors 1 and 2. "**Observations**" refer to the observations which contribute to the formation of Factor 1; "*Observations*" refer to the observations which contribute to the formation of Factor 2; "***Observations***" refer to the observations which contribute to the formation of both Factors 1 and 2.

* « psa » refers to a label Cooperl. This label concerns pigs without antibiotics.

Figure 3. Graphical representation of the results obtained by means of the CORR. F. A. concerning Factors 1 and 2.

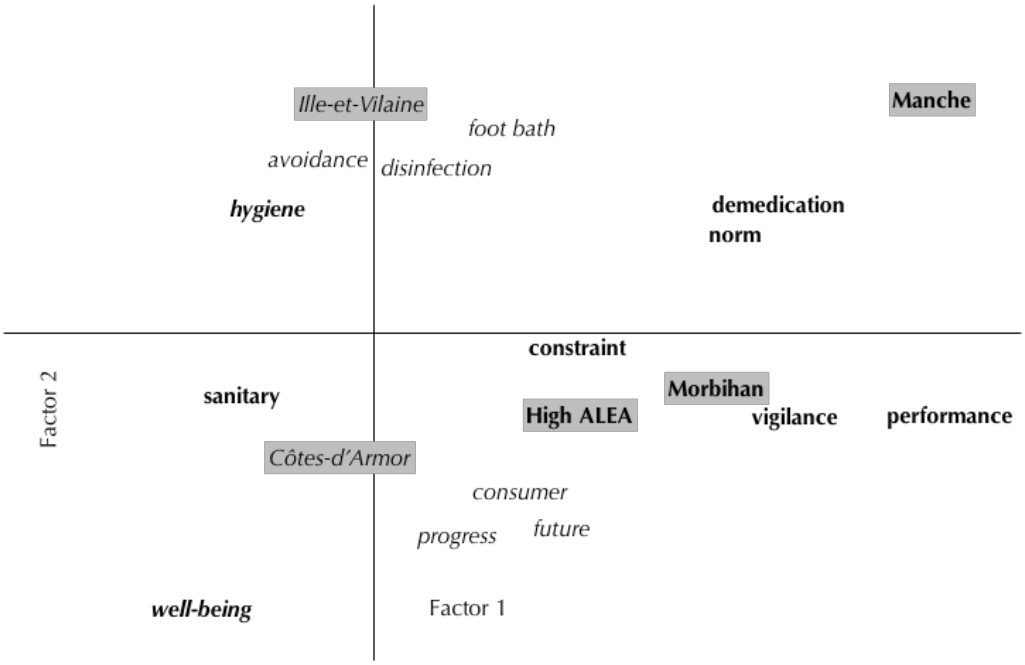


Table 1. Distribution of farmers based on the department and the ALEA class

	Number of farmers	*« Low » ALEA*	*« High » ALEA*	**Average ALEA**
Côtes-d'Armor	*45*	*29*	*16*	**0.58 (0.38)**
Ille-et-Vilaine	*20*	*13*	*7*	**0.42 (0.39)**
Morbihan	*15*	*9*	*6*	**0.34 (0.35)**
Loire-Atlantique	*1*	*1*	*0*	**0.15 (*)**
Manche	*3*	*2*	*1*	**0.37 (0.28)**
Mayenne	*3*	*1*	*2*	**1.01 (0.89)**