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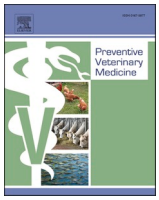

Improving the communication between farmers and veterinarians to enhance the acceptability of bovine tuberculosis eradication programmes

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ABSTRACT

France and Spain have been fighting against bovine tuberculosis (bTB) for years, even though new outbreaks continue to appear on both sides of the border, generating misconceptions about the disease and social distrust in the eradication programme and competent authorities. The perceived disease risk and the commitment of all interested parties are key factors for the successful implementation of control programmes, as they might influence the acceptability of recommended measures. Effective communication can contribute to increasing knowledge, trust and stakeholders' engagement, thus ensuring the acceptability of the eradication programme. This study was conducted in Catalonia (Spain) and Pyrenees-Atlantiques (France) in the frame of the INNOTUB project (https://innotub.eu/) to characterise the communication on bTB in the trans-Pyrenees region and provide recommendations to improve it. The communication on bTB was characterised by analysing 153 (Spain) and 66 (France) online freely available texts, published between 2018 and 2020, through Content Analysis and Critical Metaphor Analysis. Moreover, six farmers and four veterinarians were in-depth interviewed in each area to gather information about the communication on bTB. Interviews were made in original languages and analysed using a qualitative thematic approach. A pilot participatory intervention inspired by the Systematic Tool for Behavioural Assumption Validation and Exploration (STAVE) method was used to develop a list of proposals to improve communication and to promote the creation of territorial networks/committees on bTB prevention and control. It included three focus groups with farmers and veterinarians, a meeting with representatives of the regional veterinary services, and a final deliberative workshop. Results highlight the existence of a controversial debate on bTB and a heterogeneous understanding between stakeholders. Institutional and scientific communication mainly focus on bTB detection and control while other aspects are left in the background. On the contrary, farmers extend their communication to a greater variety of topics. The metaphorical framing strongly differed among actors, while veterinary services and researchers "fight" against bTB and "progress" toward the eradication, farmers place themselves in a framework of "sacrifice" and, particularly in Spain, they play a passive role. The proposals developed by the participants to improve the current communication on bTB included: (i) create participatory meeting spaces to share opinions and information; (ii) improve data accessibility (on epidemiological situations); (iii) develop clearer and written protocols and informative visual material; (iv) redesign the training courses (v) increase the stakeholders' participation in the design of protocols.

1. Introduction

The application of control programmes and preventive measures requires changes in people's behaviour and habits, and the maintenance of such changes over time (Moda, 2006; Pfeiffer, 2006; Ellis-Iversen et al., 2010; Hidano et al., 2018). Behaviour changes are difficult to

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induce and maintain, even in situations where recommendations, measures, or guidelines are evidence-based, practical, and affordable (Moda, 2006; Pfeiffer, 2006; Ellis-Iversen et al., 2010). The willingness to adopt changes is influenced, among other factors, by prior knowledge and the perception of the disease risk (Calba et al., 2016; Ritter et al., 2017; Hidano et al., 2018). Moreover, trust in competent authorities and institutions in charge of managing the risk, and confidence between stakeholders are other important factors that affect attitudes related to the implementation of preventive and control measures (Enticott et al., 2014). Therefore, stakeholders' engagement and commitment are key factors for the successful implementation of preventive and control strategies (Moda, 2006; Pfeiffer, 2006). Guaranteeing commitment requires providing support and advice and acknowledging aspects that can critically affect it, such as social networks, sources of advice, the relationship between farmers and advisors and the trust between them.

Bovine tuberculosis (bTB) constitutes a major concern both to human and veterinary public health sectors, due to the zoonotic aspects of this disease and the important economic and sociological problems that it implies. France and Spain have been fighting against bTB for years, although new outbreaks continue to appear on farms on both sides of the border. France is officially free of bTB since 2001, however, in the south-western areas the bTB incidences are increasing, putting in jeopardy the free status of the country (Crozet et al., 2019). In Spain, the eradication of the disease has not been achieved yet; the herd prevalence is very heterogeneous at the regional level, being below 1% in the northern regions and above 5% in the south-western regions (Anonymous, 2022). In both countries, the statutory national control plan for bTB in cattle includes continued *ante-mortem* surveillance on farms (i.e., regular testing of all animals older than 6 weeks within a herd and testing of cattle prior movements), and passive surveillance at the slaughterhouses (i.e., systematic examination of slaughtered cattle and reporting of suspected lesions) (Boschiroli and Bénet, 2014; Canini and Durand, 2020; Anonymous, 2022). The Single Intradermal Tuberculin Test (SITT) is the official test used for bTB detection, although the Comparative Intradermal Tuberculin Test (CITT) and the interferon-gamma assay (IFN-γ) may be also authorized. The frequency of the regular screening of cattle herds can differ within the country depending on the prevalence of the area. Cattle that test positive are slaughtered under official control and subjected to *post-mortem* examination at the slaughterhouses. Positivity is confirmed through culture of the mycobacteria. Once bTB is confirmed, the scheme implemented to control the outbreak can be either the test-and-slaughter strategy with the compulsory culling of tested positive cattle and the establishment of movement restrictions until recovering bTB-free status after three negative test rounds, or the whole herd depopulation with subsequent cleaning and disinfection of the farm and restocking after testing (Boschiroli and Bénet, 2014; Canini and Durand, 2020; Anonymous, 2022). The routine screening of cattle herds can be performed by private veterinarians accredited and authorized by the competent authority in the territorial area; however, the official veterinary services at the regional and county level are responsible for the correct execution of the programme in the field. In particular, the official veterinarians perform the audits on the field-testing practices of the private veterinarians, re-test cattle with doubtful results, and are in charge of investigating and managing bTB breakdowns (i.e., they conduct the outbreak investigation, and supervise the slaughter of positive animals and the cleaning and disinfections of establishments and utensils). The prolonged failure of control programmes has led to a serious social distrust in the usefulness of the official health programmes and scepticism in the possibility of eradicating bTB (Moda, 2006; Pfeiffer, 2006). Farmers and (private) veterinarian mainly attribute such failure to a lack of reliability of diagnostic tests, and a lack of control over the wild reservoirs (and itself) which are considered responsible for the maintenance of the disease in the territory (Ciaravino et al., 2017; Crozet et al., 2019; Ciaravino et al., 2020). This perceived lack of personal control on bTB was linked in literature to low engagement of farmers (and veterinarians) and a reduction of their level of trust in risk managers (i.e., governments, health authorities, official veterinary services), adding to the management of bTB a strong socio-political dimension (Enticott et al., 2014; Hamilton et al., 2019; Ciaravino et al., 2017). In this context, the communication between stakeholders is of utmost importance as it may affect how the disease is perceived, thus the acceptability and effectiveness of the bTB eradication programme.

Language is not neutral, and different ways of framing risks in communication may lead to different perceptions (Freudenstein et al., 2020). Appropriate communication helps to ensure that all stakeholders are informed of the nature and level of risk (i.e., improve understanding), and what behaviours are desirable to minimize it (EFSA European Food Safety Authority et al., 2021), supporting informed decision making and behavioural changes. Moreover, it can contribute to increasing trust in authorities and the degree of confidence among stakeholders (Keenan et al., 2020). Understanding how farmers and veterinarians conceptualize and frame bTB (i.e., how the risk is understood) is crucial to achieving effective communication and increasing the probability of success in eradicating the disease (Pfeiffer, 2006; Ellis-Iversen et al., 2010; Ritter et al., 2017). Therefore, the objective of this study was to characterise the communication on bTB between people involved in the implementation of the eradication programme and to develop recommendations to improve the communication strategies in place.

2. Materials and methods

The research was carried out in Catalonia (Spain) and Pyrénées-Atlantiques (France) as part of the INNOTUB project (https://innotub.eu/) aimed at improving control and surveillance of tuberculosis in livestock and wildlife in the trans-Pyrenees region.

2.1. Study design

Analysis of communication materials collected from different sources and in-depth interviews with farmers and private veterinarians were employed to characterise the communication about bTB (i.e., process, discourses, and outcomes), and to identify the sociological factors that might affect it. In particular, the analysis of the communication materials was applied to disclose the main topics and actors in the public debate on bTB (i.e., messages communicated by the different) and to explore how the disease is framed by the different stakeholders (i.e., the rhetorical strategies used and narratives that have been generated about bTB in order to explain and give meaning to the different events). The obtained results were then corroborated (and complemented) with the information gathered by in-depth interviewing farmers and veterinarians (i.e., opinions and perception about the current communication on bTB, relationships between stakeholders, and most commonly used communication channels). Results from both analyses (i.e., analysis of communication materials and in-depth interviews) allowed to better characterise how the bTB risk is perceived and understood, differences between stakeholders' views, and gaps/weaknesses and strengths of the current communication on bTB, providing prior information on the context to be changed which was used as a baseline for the pilot intervention to improve the effectiveness of future communication campaigns.

The development of recommendations to improve the communication between stakeholders was accomplished through a pilot participatory intervention involving farmers, private veterinarians, and official veterinary services. The pilot participatory process highlighted agreements, disagreements, and the reciprocal conceptualizations between farmers and veterinarians and allowed to develop, among all participants, proposals to improve the communication taking into account issues and communication failures identified through the context's characterization phase (i.e., analysis of communication materials and in-depth interviews).

In qualitative research methodologies eliciting participant experiences and opinions through individual or group interviews is a key means. Interviewing people involves engaging verbally with research participants in order to gain access to their particular perspective. In this context, the researcher's role, personal characteristics, and perspectives in relation to the study population and the research topic (i.e., positionality, identity, and power) may have a great influence on the data collection and the interpretation of the results (Wilson et al., 2022). Accounting for such aspects, researchers with a different background (i.e., veterinarians, epidemiologists, sociologists and experts in communication and cultural studies) were involved in planning and conducting the research and the results/data obtained from the different methods (i.e., communication analysis and qualitative interviews) were integrated in the final interpretation of findings.

2.2. Analysis of communication materials

The sampling frame was digital texts (i.e., press releases, and other communication materials) available online in Spanish, STUDY-LANGUAGE, or French. The keywords used for the online search were "Bovine tuberculosis". The criteria applied for the screening and selection of the sample (set of full texts to be analysed) were: i) the geographical area of reference: national level, and Catalonia or Pyrénées-Atlantiques (other regions were excluded); ii) the year of publication: only texts published between 2018 and 2020 were included; iii) the diversity of sources: institutional, scientific, and sector-specific sources (i.e., webpages of public institutions, research institutes, associations and unions, and newspapers and magazines from the fields of agriculture and animal health); iv) the level of diffusion of the source which was established according to read/consulted rankings (i.e., number of views) and top positions in the main search engines (e.g., Google, Bing, Yahoo) located using the keyword 'bovine tuberculosis'. In the case of sector-specific sources, it was agreed to include in the sample only the top-ten sources with the highest diffusion. The number of publications to select from each source was established under the criteria of "repetition": new publications (i.e., digital texts) were included until reaching the saturation point (i.e., the text's contents were similar to or the same than those already collected). The selected sample was analysed both quantitively and qualitatively. Content Analysis (CA) was applied to identify the main themes covered (i.e., communication's contents), the actors involved in the debate on bTB and the role they play (communication processes), considering this method a systematic procedure for assessing the content of documented information (Wimmer and Dominick, 2014). Public discourses on bTB and the language used were investigated by using the Critical Metaphor Analysis (CMA) proposed by Charteris-Black (2004, 2011), which focuses on metaphors as cultural and linguistic tools for conceptualising the disease. A metaphor was identified when there was a break in the semantic coherence that altered the normal reading of a passage (Charteris-Black, 2011). The identified metaphorical expressions were classified according to the source domain they contain (i.e., the conceptual or semantic area from which the metaphorical expressions are drawn), and the target domain to which they refer (i.e., the domain that is understood through their use).

2.3. In-depth interviews

In-depth interviews were carried out in the two study areas between May and September 2021 to gather information about how the communication on bTB is perceived, and the most trusted sources of information (i.e., processes and outcomes). In each area, six farmers and four private veterinarians were interviewed. A non-probabilistic convenience sampling strategy was used to ensure a balance between the homogeneity (requiring smaller size) and the heterogeneity (requiring larger size) of the targeted population, making sure to avoid failures in capturing insights, experiences, and opinions and, therefore, achieve the theoretical saturation of data (Palinkas et al., 2015). Furthermore, the sampling was intentional and by quotas (i.e., type and number of farmers and veterinarians was set a priori), fulfilling the characteristics that were requested according to the research project aims and assumptions on prior hypothesis made by the researchers. Only beef cattle farmers were enrolled on the study since this production system is the most common (in the studied areas), and the most affected by bTB outbreaks (Allepuz et al., 2011; Boschiroli and Bénet, 2014; Palisson et al., 2016; Ciaravino et al., 2017). Once it was decided that only beef farmers would be interviewed, other inclusion criteria considered for the sample's composition of farmers were: i) men and women, ii) farmers who experienced a bTB breakdown and farmers who not, iii) located in different counties of the study area (and, therefore, having different referents from the official veterinary services). For the sample of veterinarians, the main criteria were that they were private veterinarians (including men and women) accredited for performing the routine herds testing and working in different counties of the study area.

Participants were interviewed individually in their native language by researchers from the field of social science hired (and trained) for this purpose. The interviewers did not previously know the interviewees. The interviews were conducted face-to-face and lasted between 40 and 90 min each. An important criterion was to make the interview as easy as possible for the participant, therefore interviews were conducted in the place that each interviewee proposed, which was generally on the farm or in their house, although in some cases it was chosen a bar or restaurant in the area. Before starting the interview, the participants were informed about the contents and purpose of the study, thus they were required to sign a written consent form.

The interviews were driven by a semi-structured thematic guide which consisted of questions regarding participants' characteristics and background, knowledge and previous experience about bTB, learning and problem-solving processes, sources of information (formal and informal), perceptions about the current communication on bTB and suggestions to improve it (Table 1). Each interview began with questions to build rapport (i.e., icebreaker questions) and obtain information about the participant's background: age, working routine, previous experience with bTB, and social networks (i.e., Background and social relationships in Table 1). Thereafter, the flow of conversation was guided by the respondent's answers; the question order was allowed to vary, and different lines of enquiry were also pursued to cover all topics of interest. The interviews were audio-recorded, upon participants' consent, and transcribed verbatim. The transcripts were examined under a qualitative analysis through an iterative comparative method, following a thematic codification (Flick, 2009) based on a grounded theory orientation (Strauss, 1987). According to this analytical procedure, the fragments of the interviews corresponding to each theme or theoretical category (i.e., the major themes that they structured the interview script) were identified and selected, and interpreted comparatively through all the interviews, in a joint reading that allowed to extract main characteristics, possible divergences, nuances and contradictions potentially expressed by the different interviewed. The results of these interpretations, in a process of constant comparison, have served to contrast the working hypotheses, as well as to develop new hypotheses throughout the research process. Ethical approval for the study was obtained from the Research Ethics Committee of the Autonomous University of Barcelona.

2.4. Participatory intervention

The pilot participatory intervention was conducted in Catalonia. Its purpose was to generate, among all participants (i.e., farmers, private veterinarians, and official veterinarian services), recommendations to improve the communication on bTB and to reassure and enhance the dialogue between the stakeholders. An approach inspired by the STAVE (Systematic Tool for Behavioural Assumption Validation and Exploration) method (Espluga et al., 2016) was applied to guide the study

Table 1
The semi-structured thematic guide used to interview farmers and private veterinarians in Spain and France. The topic of interest and related questions 'examples are given in the table.

Major themes	Application / Meaning	Interview question (example)
Background and social relationships	Characterisation of the respondent's profile: - Years of professional experience and working routine. - Working routine and social network. - Interactions and contacts with other people in the working and leisure spheres (i.e., veterinarians, farmers and/or other actors).	• How many years have you been working in the sector? • Do you participate/are you part of organisations, trade unions, professional associations etc. etc.? What is your role? What is the frequency of meetings/contacts? • (*farmers only*): Do you practice mountain pastures? Are you part / Do you work with a cooperative? How many veterinarians usually visit your farm? why? (i.e., different profiles and circumstances). • (*veterinarians only*): How many farms do you usually visit in a day? In what circumstances (i.e., emergencies or regular visits)? How much time do you usually spend with the farmer? • How would you describe your relationship with other farmers/ veterinarians? (i.e., professional sphere)
Knowledge on bTB	Characterisation of previous experience with bovine tuberculosis (bTB): - Events that occur during detection and confirmation of bTB in a farm. - Concrete examples of what respondents have experienced directly or indirectly. - Communication during bTB outbreaks or suspicions - The information offered and how it is perceived. - How veterinarians handle their role in the programme and how they are supported. - Communication with farmers during outbreaks (notification, telephone, visit, etc.).	• Have you ever experienced any bTB outbreak? • Do you know what happens when a positive or suspected bTB case is detected in a farm? (If yes) How is the notification process handled? Who is in charge to notify a bTB case (and to whom)? How is the case notified to the farmers? What is the protocol to follow after a bTB case is detected and after the case confirmation? • (*farmers only)* What happens during the bTB screening test (i.e., execution and interpretation of results)? Have you received any communication on bTB? About which aspects? From whom? have you tried to contact anyone? Who? Why? Was it easy/possible? • (*veterinarians only)* have you personally detected the bTB case? (If yes) Have you received (from the official veterinary services) all the information you needed to manage the outbreak and the communication with the farmer? Did you have to inform the farmer? How have you done it? What did you say?
Learning and problem-solving processes	Characterisation of knowledge on bTB: - How knowledge on bTB is generated and shared considering formal and informal communication channels. - Person(s) of contact or reference in case of doubts about the disease and its control. - What information is received and from whom (considering formal and informal).	• How have you acquired knowledge about bTB? • Do you usually talk about bTB? With whom (i.e., other farmers, veterinarians? anyone else - other actors?) In what circumstances? • How do you usually solve doubts about bTB and its control? Have you shared them / talked about them with anyone? with whom?
Sources of information	Characterisation of the sources of information and the construction of the "narratives" on bTB: - Formal and informal sources and channels of communication: explore the information received from colleagues, by WhatsApp, by having heard it in the bar, by reading it on the internet, on Facebook, etc., as well as the information received by letter, e-mail, magazines, or official publications, etc., - Content of the received information (formal/informal).	• From which source is the information on bTB usually received? • What do you think about the available information about the disease (i.e., how to prevent it and/or eliminate it)? Which information do you receive? from which sources? What channels? • (*In the last 2–3 years*): - Have you received any communication/information on bTB? How? from whom? On what aspects/topics? (Passive reception) - Have you actively searched for information on the disease? What information? Where? Was it easy to find? (Active reception) - Have you given and/or received any talks on TB? On which topics? What target audience? Who organised the event? (Active and passive sharing) • In addition to formal communication, what other channels of communication do you know? Who participates? • Which channels and/or sources of information do you trust the most?
Perceptions of bTB communication	Characterisation of the current communication on bTB: - Formal and informal communication between farmers, private veterinarians, and official veterinary services (considering all possible directions). - Weakness/Strengths of the communication strategy on bTB and suggestions to improve it. - Perceptions and opinions on the role and activities of associations and trade unions in the sector.	• How do you value the communication with the official veterinary services regarding bTB? Why? • What are the most commonly covered topics or the most frequently communicated? Are these of your interest? • What are the weak and strong aspects of the current communication on bTB? Who communicates best/worst and why? • What would you like to change about it? How would you like it to be? What topics should be communicated? How (what channels)? Who should be in charge of it (from which sources)?

The topics of interest were not covered in any order during the interview. In the table, bTB: bovine tuberculosis.

design. The pilot intervention included sequential meetings with the farmers and private veterinarians, consultations with the official veterinary service veterinarians, and a final workshop. Participants were recruited through a purposive sampling strategy to seek a diversity of viewpoints within each group and provide the most comprehensive understanding of the factors at play. Farmers and private veterinarians who had already taken part in the in-depth interviews were also invited to participate. The focus groups were audio-recorded, with the permission of participants, and detailed notes on the discussions were taken by the researchers.

The first round of focus group sessions was conducted with farmers and private veterinarians separately (up to eight people per group) during November 2021. Selected results from the individual in-depth interviews were presented visually on slides as literal interview extracts and used for opening the discussion. Thereafter, the card clusters technique was used to gather proposals and ensure the contribution of each participant. Participants were invited to think individually and write on sticky notes their proposals/ideas to improve the relations between actors and communications on bTB ('silent generation of ideas'). Written ideas were shared, categorised by similar themes, and

discussed within each group. Preliminary findings from the groups were presented and discussed with the regional veterinarian service in a meeting on February 14, 2022. The received feedback was delivered to all the participants involved in the previous phases during a second focus group session through a collective presentation joined by farmers and private veterinarians together (i.e., a deliberative focus group) which was held on March 11, 2022. During the session, participants were able to consider both the results produced during the first meeting (i.e., ideas and suggestions) and the feedback received from the official veterinary services. The validity, relevance and suitability of the identified proposals were discussed within the group. Then, participants were allowed to adjust and refine their findings (i.e., previously developed proposals), accordingly. Finally, a deliberative workshop (i.e., a dialogue meeting) with representatives of farmers, private veterinarians, and regional veterinary services was organised on April 22, 2022, to find a consensus on the developed proposals. The workshop involved the key persons identified (up to five people per category) during the previous activities.

3. Results

The results obtained from the three approaches (i.e., analysis of communication materials, individual in-depth interviews, and pilot participatory intervention) are described separately below.

3.1. Analysis of communication materials

A sample of 153 Spanish and 66 French digital texts (i.e., corpus) were analysed to investigate topics, metaphors, and actors of the communication on bTB. The type of sources and the number of texts extracted from each source (i.e., units of analysis) are presented in Table 2.

In the Spanish sample (N = 153), 46% of the units were targeted at veterinarians and 36% at farmers. The remaining units were addressed to the scientific community (5% of the units) (i.e., researchers/experts) or to a more general public (13%), such as all the stakeholders involved in the control of the disease or the society/citizens. Differently, in the French sample (N = 66), the general public was the primary target audience (52% of units), while farmers and veterinarians were targeted by 24% of the units each. However, the thematic structure of the analysed units was similar in both countries. The main themes covered were related to bTB detection and control and the role of wild and domestic reservoirs other than cattle, which together represented 82% and 71% of the Spanish and French samples, respectively (Table 3). Whereas topics related to training and communication/outreach or the proposals to change the bTB eradication programme were little covered in both samples. The major difference between the two samples was observed on themes related to the risks of bTB and the benefits of being disease free, which appears in 13.6% and 1.3% of the French and Spanish texts, respectively (Table 3).

The relationship between themes and targeted audience observed in Spain and France is shown in Figs. 1 and 2, respectively. It is worth mentioning that topics related to training and communication/outreach do not appear in the Spanish communication to farmers; and that social and economic aspects were topics of concern in the communication to farmers and veterinarians, but not to other audiences (Fig. 1). On the other hand, in the French sample, the proposals to change the bTB eradication programme had certain relevance in the communication to the farmers, while social and economic aspects were not addressed independently of the targeted audience (Fig. 2).

Overall, there were 349 and 246 metaphorical expressions detected in the Spanish and French samples, respectively. The most frequently used metaphorical lines or frames referred to: "war" (n = 282; 47%), "religion" (n = 33; 6%), "container" (n = 101; 17%) and "motion" (n = 76; 13%), which together represented 83% of the used metaphorical expressions. The metaphorical expressions identified in the institutional communication of the Spanish and French samples were 18 and 38, respectively. The metaphors detected through the scientific communication were 44 and 125 in the Spanish and French samples, respectively. In both countries, institutional and scientific communication made use of metaphors mainly to refer to the disease (i.e., target domain). The source domain of "war" (i.e., military metaphors) was the metaphorical expression most frequently used (e.g., "*Necesidad de luchar en diferentes frentes contra la enfermedad*" [the need to fight against the disease on different fronts]; "*lutte contre cette infection [.] des outils pour la combattre*" [fight against this infection [.] tools to fight it]). It is worth noting that, in the Spanish sample, 23% of metaphorical expression identified in the scientific communication focuses on the role of science and researchers, making use of the frame of "motion", indicating their movement forward and advances in science (e.g., "*Los investigadores hemos dado un paso más*" [Researchers have gone one step further]) to refer to this target domain. The communication among farmers (i.e., sector-specific communication targeting farmers) was more diverse than the institutional and scientific communication both in Spain and France. Its variety was reflected by the wide range of target and source domains that were presented in their communication. In addition to the disease, farmers communicated about themselves and their herds, wild reservoirs, but also about protocols, laws, and regulations, science, and about their relations with the official veterinary services. Out of 233 and 77 metaphorical expressions detected, 85% and 77% of metaphors referred to five target domains in the Spanish and French samples, respectively. Besides the metaphor of "war", the domains of "motion" and "container" are largely used in both samples. As a peculiarity, the communication between Spanish farmers differed in that it included the usage of religious metaphors to refer to the farmer/livestock sector (i.e., target

Table 2
The selected sample of digital text by source and geographical area.

Sources	Type	Coverage Level	Spanish Units (N = 153)	French units (N = 66)
Institutional	Webpages of the ministry and departments of agriculture; other material produced by the official veterinary services	National / Regional	5	23
Scientific	The material produced by research institutes	National / Regional	9	14
Sector-specific: Veterinary and animal health	Online journals and magazines. Webpage and other material produced by unions or associations	National	64	11
Sector-specific: Agriculture and farming	Online journals and magazines. Webpage and other material produced by unions or associations	National / Regional	75	18

Table 3
Themes covered by the selected sample of French and Spanish texts.

Main covered themes	Spain (N = 153)	France (N = 66)
Social and economic aspects	4.6%	0.0%
bTB detection and control	57.5%	45.5%
Training and communication/outreach	3.9%	9.1%
Proposals to change the bTB eradication programme	7.8%	6.0%
Wildlife and domestic reservoirs other than cattle	24.9%	25.8%
bTB risks and benefits of being bTB-free	1.3%	13.6%

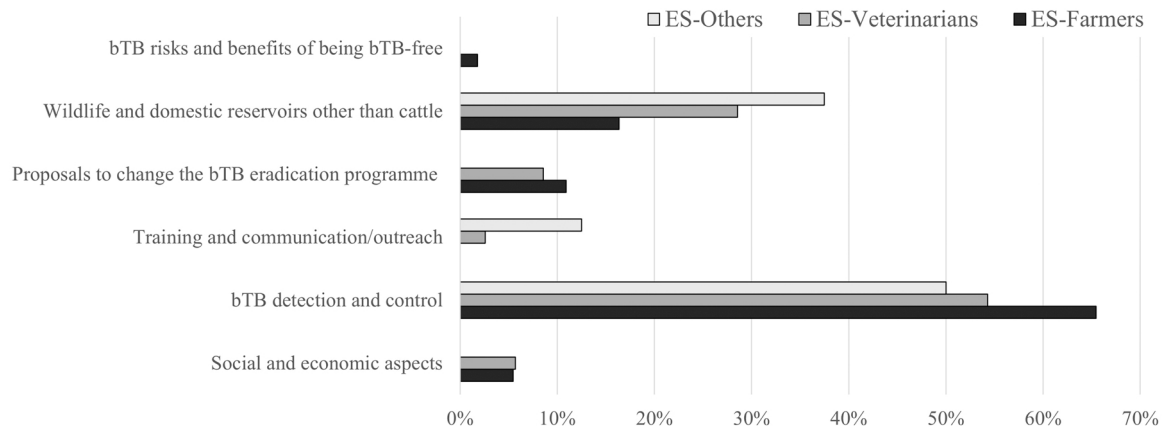

Fig. 1. Relationship between themes and targeted audience in the Spanish sample. The figure shows the proportion of texts analysed in the Spanish sample by topic and target audience. Black bars refer to farmers, dark grey bars to veterinarians, and light grey bars to other audiences which include the scientific community and the general public.

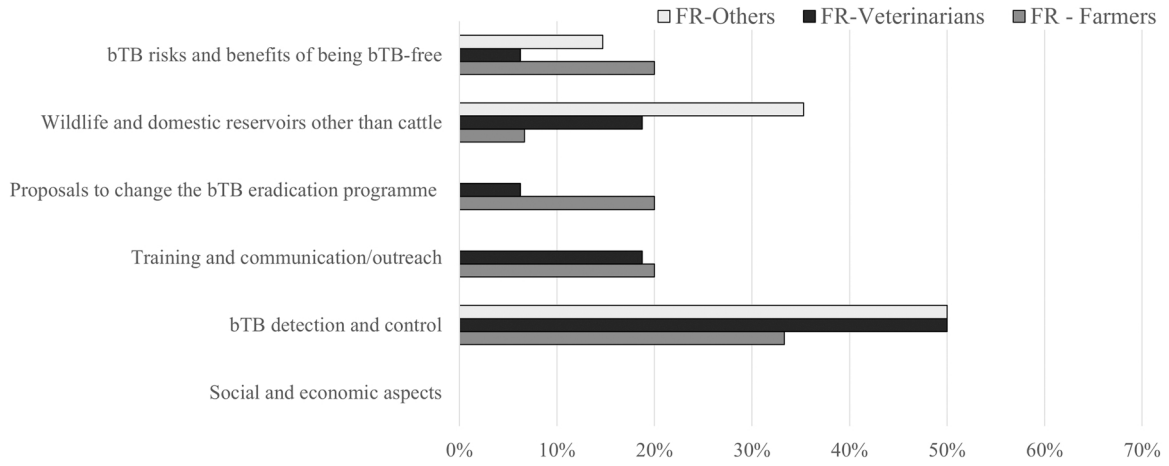

Fig. 2. Relationship between themes and targeted audience in the French sample. The figure shows the proportion of texts analysed in the French sample by topic and target audience. Farmers, veterinarians, and other audiences, which include the scientific community and the general public, are indicated with the black, the dark grey and the light grey bars, respectively.

domains "farmers and herds") (e.g., "*Consecuencias sangrantes para el sector*" [Bloody consequences for the sector]; "*No al castigo al ganadero por unos protocolos injustos*" [No to the punishment of the farmer due to unfair protocols]). Whereas the specificity of the French communication was the use of military metaphors to refer to the relationship between farmers and the official veterinary services. Differences in the communication of veterinarians were observed. In the Spanish sample (92 metaphorical expressions), the conceptual structure was close to that of farmers in terms of the diversity of target domains and source domains. In the French sample (30 metaphorical expressions) the conceptual structure followed that observed in the institutional and scientific communication, with 80% of metaphorical expressions referring to the disease (i.e., target domain "bovine tuberculosis").

3.2. In-depth interviews

The profile and composition of people interviewed in each area are shown in Table 4.

The qualitative thematic analysis focuses on two major areas: the social relationships between actors (i.e., farmer-to-farmer, farmer-to-private veterinarians, farmer-to-official veterinarians, private-to-official veterinarians) and the communication/outreach processes (i.e., sources of information, formal and informal communication, and training). Some extracts of the interviews ("E_i") are presented in their original language, and accompanied by English translations, in the tables from five to ten.

3.2.1. Social relationships between actors

Farmer-to-private veterinarian. In both countries, the interviewed farmers reported that relationships with their private veterinarians are generally good. Private veterinarians are the first person of contact in case of doubts (about bTB or anything else) or when there are problems

Table 4
Descriptive summary of the sample composition for the in-depth interviews.

	Pyrénées-Atlantiques (FR)	Catalonia (ES)
Farmers (N = 6)	83% Men	Sex ratio 1:1
	50% aged < 45 years	67% aged < 45 years
	33% experienced bTB cases	50% experienced bTB cases
	50% raised more species	17% raised more species
	Farms' Size:	Farms' Size:
	• < 50 heads: 2 farms	• < 50 heads: 1 farm
	• 50–100 heads: 3 farms	• 50–100 heads: 3 farms
	• > 200 heads: 1 farm	• > 200 heads: 2 farms
Veterinarians (N = 4)	75% Women	Sex ratio 1:1
	75% aged between 35 and 40 years	75% aged < 35 years
	50% had experience with bTB cases	50% had experience with bTB cases

Table 5
Social relationships between actors: extracts from the interviews with farmers.

Extract Code	Sentences in Original language	English Translation
Farmer-to-private veterinarian		
E1	"El veterinari que fa la clínica hi tenim molta confiança. […] És una persona a qui tenim cert respecte, i llavors li comentes coses." (F3-ES).	We have a lot of confidence in the clinician (vet). […] we have a certain respect for our veterinarian and then we comment on things.
E2	"On a une bonne relation avec les vétérinaires. Dès que j'ai des soucis, je pense qu'un coup de fil pour ça, on est bien conseillé ." (F1-FR).	We have a good relationship with veterinarians. As soon as I have some problem, I think to call them, we are well advised
E3	"El veterinari privat al final ha de fer el que li marquen. també li fan auditories a ell, si ho fa bé o malament. [.], també tens pressió allí . [.] Jo no en veig cap d'aliat aquí . Al final aliat és el que li passa i plorar-nos entre nosaltres i no hi ha més." (F3-ES).	The private veterinarian has to do what they (OVS) tell him to do.they (OVS) also audit him, whether he does it right or wrong. [.], you also have some pressure there [.] I don't see any allies here. Finally, your allies are those facing the same problem as you and cry together and that is it.
E4	"C'est vrai que voilà, autant avant on avait de très bonnes relations avec les vétérinaires et maintenant on voit que c'est tendu. [.] Autant avant il y a dix ans, avant que la tuberculose arrive l'ambient c'est bon avec les vétérinaires. Maintenant, on voit que y a quelque chose." (F3-FR).	Before we had very good relations with the veterinarians and now, we see that it is tense. [.] Ten years ago, before tuberculosis arrived, the "atmosphere" with the veterinarians was good. Now…there is something.
E5	Il gagnent plus d'argent. Ça c'est inévitable. [.] Il y a le travail, bien sûr, mais après il y a la prophylaxie. Avec la prophylaxie ils ont un fixe." (F4-FR).	They make more money. That's inevitable. [.] There is work, of course, but then there is prophylaxis. With prophylaxis, they have a fixed income.
Farmer-to-official veterinarian		
E6	"Si, Si. Poc flexibles i poc dialogants. I fora de la realitat també . Perquè per nosaltres ens suposa un sacrifici que et dona la sensació que ells no veuen, saps. [.] en general venen a fiscalitzar, més que a fer suggeriments de millora". (F4-ES).	They (OVS) are neither flexible nor open to dialogue. Moreover, they are out of touch with reality. Because it (bTB) implies a sacrifice for us that it seems they are not able to see [.] In general, they come to inspect/audit, rather than to make suggestions for improvement.
E7	"Ça fait des années qu'on leur dit qu'autre fois ils le gérer comme ça la maladie, aussi le positives, mais ils sont t ê tus, ils veulent rien savoir." (F3-FR).	For years we have been telling them that before the disease was managed differently, also the positive ones, but they are stubborn, they don't want to know anything.
E8	"Sí . En funció de la persona que trobes allà davant. Això és bastant important. (.) Però jo si que penso que comença a haver-hi una mica més de sensibilitat per part de l'administració.". (F3-ES).	It depends on the person. That's quite important. […] I do think that the OVS start having a little more empathy (It seems that there is a little more sensitivity)
Farmer-to-farmer		
E9	"Ens mirem d'ajudar (entre pagesos). A més aquí tenim l'Associació Agroalimentària que vulguis que no si mai necessites ajuda o el que siguis ho pots demanar. (F2-ES)."	We try to help each other (with other farmers, not specifically cattle breeders). In addition, here there is the Agri-Food Association, if you need any help or whatever, you can ask them
E10	"C'est l'amitié entre les éleveurs. […] C'est généralement correct. Si nous avons besoin d'un coup de main, nous appelons surtout avec des animaux, avec des vaches comme ça à vêler." (F4-FR).	There is the friendship between farmers. […] It's generally going well. If we need some help, we call each other, especially with animals or when cows are about to calve
E11	"La tuberculosi bovina no és un tema. ¿De parlar-ho nosaltres? No." (F4-ES).	Bovine tuberculosis is not an issue. Should we talk about it? No.
E12	"Oui, oui, ça allait. Oui, ça allait un peu encore. Mais, mais. Au début, dans le village, les deux premiers qui passe eu? Parlant de moi, parlant de l'autre… et quand on entend ça, c'est le r é sume. C'est très dur le monde agricole, c'est très dur, c'est très dur". (F2-FR).	Yes, yes, we had a good relationship [between farmers]. But then (after the first bTB cases occurred), in the village, people started talking about me, about the other. and when you hear that, that sums it all up. It's very hard in the farming world, it's very hard, it's very hard.
E13	"Il n'y a pas une coopérative qui travaillent la vente ensemble.[…]. Ici on est trop jaloux entre nous. Il n'y a pas la volonté de coopérer. Il y a beaucoup qu'on essai de faire ça. Mais c'est très lourd". (F5-FR).	No cooperative works on selling together. We are too jealous of each other here. There is no willingness to cooperate. There are many things we try to do. But it is very heavy.
E14	"No. Aquí el sector ramader cadascú batalla sol. Això és així i ja està." (F2-ES).	No. Here, within the cattle sector, each one battles alone. Indeed, and that is it.
E15	"Non, c'est très individualiste, très, très individualiste. […] Chacun travaille de son côté et on est de moins en moins nombreux" (F6-FR).	No, it's very individualistic, very, very individualistic. Everyone works on their own and we are less and less.

In the table, bTB: bovine tuberculosis; OVS: Official Veterinary Service; F: Farmer; V: private veterinarian; ES: Catalonia, Spain; FR: Pyrénées-Atlantiques, France

in the farm. They are perceived by farmers as easily accessible, trusted, and respected (Table 5, E1-E2). However, a certain distrust arose when dealing with a bTB-related issue/outbreak, since it is felt that different interests are represented by the two parties (Table 5, E3-E4). Some of the interviewed French farmers also perceived that bTB screening is a business activity for private veterinarians, which could be damaging for farmers (Table 5, E5).

Farmer-to-official veterinarian. Farmers' relationships with the official veterinary services are more complex and ambiguous, especially in areas where bTB outbreaks have occurred. In general, official veterinarians are perceived by farmers as distant, not open to dialogue, and mainly committed to monitoring or auditing than providing support. This was observed in both the French and the Spanish samples (Table 5, E6-E7). However, it is worth pointing out that, according to the Spanish farmers, relationships with official veterinarians can vary depending on the people involved (i.e., some individuals are more empathetic than others) (Table 5, E8).

Farmer-to-farmer. Similar findings arose from the interviews conducted in France and Spain. Farmers from the same territory maintain mutual relationships (Table 5, E9-E10). However, the characteristics and type of relationships may vary depending on the context. On the one hand, they maintain relationships of friendship and talk about routine/daily working activities (i.e., farming management); on the other, they perceive the other farmers as competitors (i.e., marketing of their products) and their relationships became more complicated when dealing with bTB because of the social stigma it generates (Table 5, E11-E13). Ultimately, some farmers expressed their feeling of working/living in an individualistic environment and with little support from their community (i.e., other cattle farmers) (Table 5, E14-E15).

Private veterinarians-to-farmers. In both countries, the private veterinarians perceived their relationships with farmers as generally good, although they acknowledged it may vary on individuals or farms, (Table 6, E1-E2). Nevertheless, they pointed out that such a good relationship may easily change when some bTB problem occurs. In Spain, the interviewed veterinarians referred to experiencing "bad moments" when communicating about suspected or confirmed bTB cases since farmers tend to "get angry" with them (Table 6, E3). In France, veterinarians reported that tense situations were caused by the execution of the bTB herds screening since farmers perceive it as aggression that undermines the mutual trust among parties (Table 6, E4). The interviewed veterinarians also highlighted that private veterinarians provide both technical assistance and psychological support to farmers, although they are not usually skilled in how to deliver "bad news", manage tense situations, or provide appropriate (psychological) support. Nevertheless, they assumed that delivering bad news to farmers is inevitable at times and is part of their job and they would like to receive more training

Table 6
Social relationships between actors: extracts from the interviews with the private veterinarians.

Extract Code	Sentences in Original language	English Translation
Private veterinarians-to-farmers		
E1	"Existeix el respecte al veterinari, jo crec. [.] Això depèn de cada granja. Però s í que crec que hi ha respecte pels veterinaris". (V3-ES)	There is respect for the private veterinarian, I think. [.] it depends on the farm. But I do think there is respect for the veterinarian.
E2	"Et il y a un rapport qui se fait professionnel avec les éleveurs, qui dépasse à mon avis l'origine de chacun. [.] En général, il y a une proximité avec les éleveurs et les relations sont bonnes". (V2-FR)	There is a professional relationship with farmers that, in my opinion, goes beyond the origin of each one. [.] In general, there are close and good relations.
E3	"És que no me'n recordo. Sí , el vaig trobar jo. Les vaig trobar positives. I crec que jo vaig anar a la comparada, o alguna cosa així . Vaig anar a fer la comparada, em sembla. I clar, vas amb la inspectora. i va sortir positiu i aquell home tenia poquíssimes vaques, menys de 10. I es va haver de matar tot. I l'home se'ns va enfadar. Però és que es va enfadar amb mi!". (V3-ES)	I don't remember it well, but yes, I found reactors and I came back to do the comparative skin test, or something, like that. And of course, I had to go with the officer veterinarian. the animals resulted to be bTB positive. The farmer had very few cows, less than 10 and he had to slaughter them all. The farmer got angry … But he was angry with me!.
E4	"Nous, on a plusieurs éleveurs qui ont dû mettre des animaux en prophylaxie et ça a fini de rompre tout lien envers nous. Et oui. Ben oui, oui, ça, déclenché des hostilités […] La prophylaxie est perçue comme une aggression. Vraiment. Et donc, on a des rapports qui se sont beaucoup tendus". (V4-FR)	We have several farmers who had to do the prophylaxis and ended up breaking all ties with us… Well, yes, that triggered hostilities. […] Farmers perceive the bTB prophylaxis as an attack. Really. And so, our relationships have become very tense.
E5	"Il n'y a pas de soutien psychologique pour les éleveurs. Nous sommes le soutien psychologique. C'est nous, c'est nous, les psychologues des éleveurs. Non, il n'y a rien. [.] On arrive à les accompagner, mais c'est assez difficile et même psychologiquement. Psychologiquement, c'est très compliqué , très compliqué . […] Ça fait partie globalement du travail, que ce soit pour de la tuberculose ou pour d'autres problèmes. À un moment, il faut savoir faire ça aussi. On n'est pas formés pour, mais il faut que savoir […] Même peut être un excellent vétérinaire si on ne sait pas accompagner les gens, ça se passe mal et à l'inverse, on peut être un vétérinaire très moyen si on s'est accompagner correctement les éleveurs. Ça se passe très bien". (V1-FR)	There is no psychological support for farmers. We are their psychological support. That is new … the psychologists of farmers. […] We manage to accompany them (farmers with bTB cases), even psychologically, but it was quite difficult. Psychologically, it is very complicated, very complicated. […] It's part of the job overall, whether it's for tuberculosis or other problems. At some point, you have to know how to do that too. We are not trained for it, but we have to know how to do it […] you can be an excellent veterinarian but if you do not know how to accompany people, things go wrong and conversely, you can be average but if you properly accompany the farmers, it is going to be fine.
E6	"un mal tràngol. ja L'assumeixo com a part de la feina". (V2-ES)	I had a very hard time. but I already assume it is part of the job
E7	"Hi ha molt pique, molt. I es va intentar fer l'associació de ramaders, que semblava que per primer cop a la història s'agrupava en una entitat tots tres sectors, oví - cabrum, boví i equí . Continua existint, però l'activitat és nul·la. Costa molt". (V4-ES)	There is a lot of resentment, a lot. There has been an attempt to form a farmers' association, and it seemed that for the first time in history all three sectors, sheep-goat, cattle and equine, were grouped in one organisation. It still exists, but the activity is null. It's very hard.
E8	"On a l'impression des fois que ce genre d'opération devrait presque être fait par des vétérinaires qui ne sont pas les vétérinaires qui accompagnent les éleveurs. Parce qu'on a forcément affectées avec les éleveurs, a aussi une relation de clientèle avec ces éleveurs à un moment où nos clients ne peut pas non plus être trop méchants avec eux". (V1-FR)	We sometimes have the feeling that the bTB screening should be done by veterinarians who are not working on farms. Because we are necessarily influenced, and we also have a customer relationship with them, we cannot be too mean to them either.
Private-to-official veterinarians		
E9	"És a dir, no hi ha empatia per part del Departament cap als veterinaris de camp. Zero. O menys. Sota zero. […] Si. I falla molt, molt i molt la relació entre Departament i veterinaris de camp, que és de poca confiança. Es pensen que tot ho fem per putejar, per fer-ho malament. no confien que vulguem fer les coses bé . No et diuen mai: ostres això ho feu molt bé . No és que vull que m'ho vinguin a dir, però la sensació sempre és que t'estan vigilant a veure on la cagues". (V3-ES)	There is no empathy from the Department (OVS) towards the private/field veterinarians. Zero. Or less. Below zero […] Yes. The relationship between the Department and private veterinarians fails very, very often; there is very little trust. They think we do everything to screw them, to do it badly… They don't trust that we want to do things well. They never say: dang, you are doing that well. It is not that I want them to come and tell me, but you always get the feeling that they are monitoring to see where you fuck up…
E10	"Il y a très peu d'écoute, c'est à dire que si on les appelle pour se plaindre, ils sont forcés de nous écouter. Mais par contre, je n'ai pas l'impression, qu'on consulte pour savoir comment ça se passe, est ce qu'on pourrait changer des choses? On nous dit ce qu'il faut faire et on le fait. Voilà. […] La D-FR pour nous, est comme les éleveurs pour nous, a une notion de contrôle qui est très importante pour nous c'est une autorité de tutelle. Il y a une notion de contrôle et c'est vrai qu'on va y plus facilement s'adresser aux GDS, qui va être plus dans l'accompagnement que dans le contrôle et avec qui on va pouvoir parler plus ouvertement de certaines pratiques, de certaines choses dans les pratiques de tuberculination". (V1-FR)	There is very little listening, that is to say, if we call them to complain, they are forced to listen to us. But on the other hand, I don't have the impression that we consult to find out how things are going, could we change things? We are told what to do and we do it. So… […] The D-FR for us is the same as we are for the farmers. They have a notion of control which is very important for us, it is a supervisory authority. […] There is a feeling of control and it's indeed easier to approach the GDS, who will be more in support than in control and with whom we will be able to talk more openly about certain practices, of certain things in the practices of prophylaxis
E11	"jo com a veterinari. jo em sento jutjat, com que l'Administració no confia amb nosaltres. […] El Departament no ens cita mai per explicar-nos segons què . només ens cita per amenaçar-nos, per donar-nos lliçons, per dir-nos que si no s é què ens inhabilitaran". (V4-ES)	Me, as a veterinarian, I feel judged, itś as if the Administration doesnt trust us. [.] The Department never sets an appointment with us to explain something. only to threaten us, to teach us a lesson, to tell us that if this or that, they will disqualify us
E12	"Ils travaillent très distants. Oui, ça complètement. Bon, après, ils essayent de se rendre compte qu'ils sont venus quand même sur le terrain. Ils sont venus nous accompagner, voir. Je ne sais pas si c'était pour nous contrôler ou si c'était pour eux se rendre compte".(V4-FR)	They work very remotely. Yes, that is completely. Well, afterwards, they try to realise/understand what happen in the field. They came to accompany us, to see. but I don't know if it was to control us or to see
E13	"També posen faltes, si dius que eres a una hora i é s una altra. Si hi ha hagut algun canvi ho has de dir. Tu has d'enviar la planificació de cada setmana dient on seràs a cada hora. Jo què s é el dilluns a les 9 h si a aquella granja. Un dels veterinaris amb qui vaig a vegades t é una falta per això. Perquè a última hora no ho van poder fer per no s é què i. Hi ha aquesta mania persecutòria al Departament, de que fem les coses per putejar-los. I li van fotre una falta perquè no havia avisat. Però és que va ser un canvi.". (V3-ES)	They also give warnings, if you say a certain time but it's another. If there has been any change you must say so. You have to send the schedule for each week saying where you will be at each hour. What do I know on Monday at 9 am if at that one farm. One of the vets I visit sometimes got a warning for that. Because, at the last minute, they couldn't do it for I don't know what reason and. There is this persecutory obsession in the Department, that we do things to fuck them. And they gave him a foul because he hadn't been notified. But it was just a last-minute change.
E14	"De la part de la D-FR il y a pas de d'adaptation, y'a pas d'option, il n'y a pas d'avancée, c'est le GDS plutôt. […] Je pense que quand même, ils ne sont pas totalement déconnectés de la r é alité et des problèmes que ça pose, mais que de toute façon, personne n'a de solutions de proposition pour les r é soudre ou pour que ça se passe mieux. C'est surtout ça. On a pas, on n'a pas d'autres, on a pas d'autres options non plus n'ont pas mieux à nous proposer". (V4-FR)	On the part of the D-FR, there is no adaptation, there are no options, and there is no progress, it is rather the GDS. […] I still think that they are not totally disconnected from reality and from the problems that this poses, but that in any case, no one has any proposed solutions to solve them or to make things go better. That's mostly it. We don't have, we don't have others, we don't have other options either, they don't have anything better to offer us

In the table, bTB: bovine tuberculosis; OVS: Official Veterinary Service; F: Farmer; V: private veterinarian; ES: Catalonia, Spain; FR: Pyrénées-Atlantiques, France

on such aspects (Table 6, E5-E6). The interviewed veterinarians also pointed out a certain lack of cohesion among farmers which makes their work even more challenging (Table 6, E7). Moreover, according to those interviewed in France, due to the client/commercial relationship between farmers and private veterinarians, the bTB herds screening should be performed by veterinarians other than those working on the farm (Table 6, E8).

Private-to-official veterinarian. Relationships between private veterinarians and official veterinary services are described as formal and one-way. The interviewed veterinarians from both countries perceived the official veterinary services as a control body (i.e., supervisory role) which is distant from the field reality, has no empathy, and mainly focused on control rather than supporting private veterinarians (Table 6, E9-E10). Moreover, the interviewed veterinarians had the perception of being blamed and judged by the official veterinary service, which tends to put into question their work creating an atmosphere of distrust (Table 6, E11-E12). In particular, the Spanish veterinarians pointed out that the field audits of testing performance conducted by OVs make them feel uncomfortable, because some unforeseen change (beyond their control) may arise (Table 6, E13). According to French veterinarians, the official veterinary service works well and efficiently in technical terms but does not always address their field's practical needs to offer appropriate solutions (Table 6, E14).

3.2.2. Training and communication/outreach process

3.2.2.1. Sources of information in Catalonia (Spain). In Spain, both farmers and veterinarians reported that they often search for information on bTB online. The institutional channels (i.e., the web pages of the regional Department of agriculture) were the most mentioned sources of information by the interviewed farmers. Besides, they reported acquiring information on bTB also through sector-specific newspapers and magazines (e.g., Agrodigital, Agroinformación, etc.), from local farmers 'associations, by participating in workshops, and seminars (Table 7, E1-E3). According to the Spanish veterinarians, the institutional channels (including the Official College of Veterinarians) are their main sources of information about the regulatory changes concerning bTB (Table 7, E4). In more general aspects, common sources of information are training courses and seminars (Table 7, E5). The university was also mentioned by veterinarians as a trusted source of reliable information in case of specific doubts (Table 7, E6). Additionally, both farmers and veterinarians referred to receive information from informal channels, among which social networks had a relevant role (i.e., WhatsApp groups) although such channels are used mainly for communicating about social-related topics, or management and production issues (Table 7, E7-E9).

3.2.2.2. Sources of information in Pyrénées-Atlantiques (France). The farmers interviewed in France indicated both the health defence groups and their own (private) veterinarian as their main sources of information on bTB (Table 7, E10). The Livestock health defence groups not only send information to farmers, but often they also organize training sessions with them. Unions were another reported source, although the issued information was sometimes perceived as rather 'exaggerated' (Table 7, E11). The French Agency for Food, Environmental and Occupational Health & Safety (ANSES) and the Chamber of Agriculture were also mentioned as a source of information on bTB. According to the private veterinarians interviewed in France, the information on bTB is mostly provided by the official veterinary services and obtained mainly through official reports and meeting with them. Professional associations, such as the Livestock health defence groups or the "Groupement technique vétérinaire (GTV)" were also reported as important sources (i.e., meetings and webpages) (Table 7E12-E13), while more informal channels were not mentioned.

3.2.2.3. Formal/Official communication on bTB in Catalonia 1 (Spain). According to both the farmers and veterinarians interviewed in Spain, the official communication about bTB (i.e., routine control activities, and management of positive or suspected cases) is not always fluid, well-structured, and accurate. The interviewed veterinarians reported that sometimes they receive the same information several times (e.g., from different sources or channels simultaneously), while at other times they perceive to receive it by chance (Table 8, E1). The Spanish farmers pointed out the lack of a well-defined information circuit in case of a bTB positive/suspected case and a clear protocol on what to do after receiving its notification (Table 8, E2-E3). They also claimed that the delivered information is not exhaustive or clear enough and that the available information on bTB is limited and not easily accessible (Table 8, E4).

3.2.2.4. Formal/Official communication on bTB in Pyrénées-Atlantiques (France). The farmers interviewed in France reported that the communication on bTB is mainly related to the national control plan activities (i.e., frequency of herds screening) and that they receive additional information only when bTB cases occur in nearby territories (Table 8, E5-E6). The received information is well-valued, although it is suspected to be incomplete and with many uncertainties (Table 8, E7). Moreover, the current way of notifying confirmed bTB cases was considered inappropriate (Table 8, E8), since it contributes to the social stigma against farmers who have suffered a bTB outbreak. According to the interviewed veterinarians, in case of suspected or confirmed bTB cases on the farm, the official protocol and the communication flow are clear and well-established (Table 8, E9). However, it was also reported that there is little information on bTB which is useful to talk with the farmers (i.e., general contexts, risks and consequences, and sources of infections) (Table 8, E10-E11). Furthermore, according to both farmers and private veterinarians, the official veterinary service is not the most appropriate actor to communicate on bTB to farmers, which would rather prefer to receive these notifications from their private veterinarians (Table 8, E12-E13).

3.2.2.5. Perceptions of the received training. In both countries, the interviewees reported having attended some courses or workshops on bTB. Courses were generally perceived as relevant and useful by the farmers, but workload and time constraints were often mentioned as the main barriers to participation (Table 9, E1-E3). The provided information was highly valued and considered the best information available (given the great scientific uncertainty about the disease). However, it was considered incomplete, and farmers often feel under-informed (Table 9, E4-E5). In particular, the interviewed farmers complained about the lack of information about the disease prevalence in wildlife (i.e., species sampled, number of samples, detected prevalence), the bTB cases detected at slaughterhouses (i.e., suspicions and confirmed cases), and the proportion of confirmed cases among the reactor animals detected on-farm. Moreover, the interviewed farmers perceived that the official veterinarians (and, sometimes, also the private ones) are not very explicit or clear when talking about bTB and do not share all the information with them (Table 9, E6-E7). The feeling that official veterinarians are hiding (from farmers) crucial information on the disease makes farmers suspicious and distrustful.

All the interviewed veterinarians attended some mandatory courses on bTB, and their perceptions of the training contents were similar in both countries. They acknowledged that such mandatory training is useful (especially for veterinarians with little experience in the field), however, its contents are perceived as too theoretical and remote from the actual reality in the field (Table 9, E8-E10). In their opinion, the training focuses mostly on the technical aspects (e.g., the pathogenesis of lesions, testing and interpretation of results), but not enough on the holistic context related to the disease (i.e., the socio-economic impacts, bTB consequences for farmers, causes of the outbreaks, bTB in wildlife,

Table 7
Sources of information: extracts from the interviews with farmers and private veterinarians

Extract Code	Sentences in Original language	English Translation
Sources of information in Catalonia (Spain).		
E1	"Tot a través de l'Oficina Comarcal del D-ES i una mica d'anar per casa." (F1-ES).	All through the D-ES Regional Office and a bit of going around the house.
E2	"Si. I després també per curiositat també mires a aquests diaris digitals que hi ha. Agrodigital, Agroinformación. bueno noticies que surten que tu vas llegint i vas buscant més informació. Veus algun article que hi publiquen." (F3-ES).	Yes. And then also out of curiosity you also look at these digital newspapers that are there. Agrodigital, Agroinformación. well news that comes out that you are reading and looking for more information. You see an article published there.
E3	"A veure, a l'Associació ens pengen sempre les jornades PATT i. Jo n'he fet diversos de cursos al Ruralcat. Bé , ara no tinc gaire temps. Ja m'agradaria fer-ne més." (F2-ES)	Let's see, at the Association we always have the PATT days and. I've taken several courses at Ruralcat. Well, I don't have much time now. I would like to do more.
E4	"Si hi ha canvis, els veterinaris de l'oficina del D-ES ens ho comuniquen [.] També el Col·legi. El Col·legi de Veterinaris de *Catalonia -Province* cada dia pel matí als col·legiats ens envia un llistat de notícies importants relacionades amb la veterinària. I a vegades hi pot haver sortit alguna cosa de tuberculosi bovina." (V1-ES)	If there are changes, the veterinarians at the D-ES office inform us [.] Also the College. The Veterinary College of *Catalonia -Province* sends members a list of important news related to veterinary medicine every morning. And sometimes something from bovine tuberculosis may have come out.
E5	"I de xerrades. es va muntar la PATT aquella quan va haver-hi el brot. Van muntar diverses jornades de contacte entre fauna salvatge i domèstica". (V2-ES)	And of talks. the PATT was set up when there was the outbreak. They set up several days of contact between wild and domestic fauna.
E6	"Jo si vols que et sigui sincera, jo quan tinc dubtes de tuberculosi bovina o quan he volgut muntar una xerrada sobre tuberculosi, ho vam fer a través de la universitat [.] És amb qui més confio de preguntar-los-hi. I també hi puc parlar sincerament". (V3-ES)	If you want me to be honest with you, when I have doubts about bovine tuberculosis or when I wanted to set up a talk about tuberculosis, we did it through the university [.] He is the one I trust the most to ask them about. And I can honestly talk about it too
E7	"Tenim el grup de WhatsApp que som 200 i pico. (.) I mira, ens serveix per: tinc un mamó per vendre, tal dia. Ho com que és molt social, fins i tot 'tu que s'ha mort tal persona'. Cobreix molts vertents això." (F3-ES).	We have a WhatsApp group, we are 200 and counting. (.) And look, it's useful for us: I have a calve to sell, one day. And people respect that. I think it is very social, even 'you who has died such and such a person'. It covers a lot of ground.
E8	"El de l'Associació Agroalimentària. I després anem creant grups alternatius de. anem a comprar planter. amb els mateixos o amb grups alternatius". (F2-ES)	The one from the Agri-Food Association. And then we're creating alternative groups of. we're going to buy seedlings. with the same or with alternative groups.
E9	"Si. A amb cada associació d'aquestes tenim un grup de WhatsApp. En el meu cas és contacte de feina i l'informal. A part hi ha el grup de WhatsApp de Ramaders. Hi ha un grup de sanejament a l'Associació de Ramaders". (V2-ES)	Yes. With each of these associations, we have a WhatsApp group. In my case, it is work and informal contact. Apart from that there is the Farmers WhatsApp group. There is a sanitation group in the Farmers Association.
Sources of information in Pyrénées-Atlantiques (France).		
E10	"Oui, oui, on reçoive très souvent communications au tour la tuberculose par le GDS. Souvent, c'est le groupement sanitaire qui gère les maladies et au niveau départemental et ceux qui nous envoient des informations. Mais bon, après, c'est toujours la même chose quoi. Par mail, souvent par courrier. Un bulletin annuel que par rapport à toutes les maladies et donc qui font le point sur la maladie, le nombre de cas… et voilà". (F3-FR)	Yes, yes, we very often receive communications about tuberculosis through the GDS. Often, it is the health group that manages the diseases at the departmental level and those who send us information. But hey, afterwards, it's always the same thing. By e-mail, often by post. An annual bulletin in which all the diseases are reported, their possible sources, the number of cases. and that's it.
E11	"C'est la Fédération départementale des syndicats d'exploitants agricoles […] Les informations malgré qu'elles soient exagérées, peut être un peut les syndicats agricoles qui remontent les informations à la base. Des fois, il pousse un peu le bouchon un peu loin. Mais bon, l'information elle est bonne". (F4-FR)	It is the Departmental Federation of Farmers' Unions [.] The information, despite being exaggerated, comes from a bit of the agricultural unions that trace the information to the base. Sometimes he pushes things a bit too far. But hey, the information is good
E12	"Information sur la tuberculose arrive de la GDS et le D-FR. Oui, bien sûr. Les deux organismes". (V4-FR)	Information on tuberculosis comes from the GDS and the D-FR. Yes, of course. The two organisms.
E13	"Tout c'est fiable, je trouve. J'ai confiance avec la D-FR, j'ai confiance avec le GTV. C'est juste que ça manque parfois de clarté . Mais la confiance je l'ai". (V3-FR)	Everything is reliable, I think. I trust the D-FR, I trust the GTV. It's just that sometimes it lacks clarity. But I have confidence.

In the table, bTB: bovine tuberculosis; OVS: Official Veterinary Service; F: Farmer; V: private veterinarian; ES: Catalonia, Spain; FR: Pyrénées-Atlantiques, France; D-ES: Regional veterinary service in Catalonia; D-FR: Regional veterinary service in Pyrénées-Atlantiques; GTV: Groupement Technique Vétérinaire; GDS: Groupements de Défense Sanitaire.

information on other territories) and it does not provide skills on how to communicate with farmers (e.g., how to inform on bTB cases or explain what will happen as a consequence of bTB detection). Moreover, according to the interviewees, the training is usually delivered through a top-bottom approach, which rarely considers their knowledge and experience from the field, while it should be more interactive, grounded on real cases, and create space for sharing opinions (Table 9, E11-E12). As specificity, the veterinarians interviewed in France referred that since the (private) veterinarians themselves have many doubts about bTB (i.e., sources and dynamic of infections), they could have transmitted this feeling of scepticism to the farmers (Table 9, E13), while some of the Spanish veterinarians perceived the mandatory nature of this training as a "punishment" and a sign of distrust from the official veterinary service (Table 9, E14).

3.2.2.6. Informal communication on bTB among farmers. In both countries, bTB -related issues are not addressed much in the informal communication among farmers. According to the interviewed farmers, a higher priority is usually given to other concerns, such as management or production issues, and bTB is a topic of discussion mainly when cases are detected (or suspected) in the nearby territory (Table 10, E1-E3). The Spanish farmers referred that sometimes they talk on bTB through informal WhatsApp groups, during private meetings (i.e., barbecues), or in public community spaces or events (i.e., local livestock markets, or bars) (Table 10, E4). The French farmers reported talking about bTB with their veterinarians or with laypeople from the same areas (i.e., neighbours, friends, or relatives), but not necessarily with other farmers, and the target of conversations is usually the routinary herds screening (Table 10, E5).

3.2.2.7. The Informal communication on bTB among private veterinarians. According to the veterinarians interviewed in Spain, private veterinarians share and receive information on bTB mainly through informal channels (i.e., phone calls, WhatsApp groups or other social networks). In their opinion, informal communication is very important since it provides them with an overview of what is happening in the field at any given moment. They also recognised a certain lack of internal organization and communication between them (Table 10, E6). This was attributed, on the one hand, to the sensitive nature of the topic (i.e., bTB and infectious diseases in general) and, on the other, to commercial competition between them which hinders their mutual support (Table 10, E7-E8). The private veterinarians interviewed in France reported that they do not share much information or experiences on bTB (Table 10, E9). It usually occurs among veterinarians who experienced

Table 8
Formal/Official communication on bTB: extracts from the interviews with farmers and private veterinarians.

Extract Code	Sentences in Original language	English Translation
Formal communication in Catalonia (Spain).		
E1	"Però, nosaltres, al final, la branca més propera del Departament seria el comarcal. Et truca el Cap d'Oficina i et diu 'escolta que aquest any.'. O, a vegades som nosaltres, que rebem informació d'altres llocs. La informació a vegades arriba més per casualitat que per vies pròpiament formals, eh. [.] Per exemple, 'ara han dit que ho han de fer al coll'. Això igual t'arriba de no s é on. Llavors ho preguntes al D-ES per veure si és així o no. No hi ha un canal d'informació clar." (V1-ES)	But, for us, in the end, the closest branch of the Department would be the county branch. The Head of Office calls you and says 'listen, so this year.'. Or, sometimes we receive information from other places. Information sometimes arrives more by chance than through properly formal channels […] For example, 'now they have said that they have to do it in the neck'. This still comes to you from I don't know where. Then you ask the D-ES to see if that is the case or not. There is no clear information channel.
E2	"No. No! Que un correu ni res. Comunicacions personals amb el veterinari de l'oficina.[] No ho s é . És que arriba un punt, que no ho s é . Un protocol escrit de com va tot no l'hem vist mai. […] La comunicació hauria de ser més àgil. Entre nosaltres i l'administració. O que fos més clara la informació. O que els protocols fossin més. no s é ." (F1-ES)	No. No! That is an email or nothing. Personal communications with the veterinary officer in the county […] I don't know. There comes a point that I don't know. We have never seen a written protocol of how everything goes. […] Communication should be more agile. Between us and the administration. Or that the information was clearer. Or that the protocols were more. I don't know.
E3	"Fèiem reunions amb el Departament. El que vam fer és posar en dubte tot el sistema que tenien. Posar en dubte tot aquest procediment, protocol, perquè no trobàvem que fos eficaç ." (F3-ES)	We held meetings with the Department. What we did is question the whole system they had. Questioning this whole procedure and protocol, because we didn't think it was effective.
E4	"No. Fins i tot des de l'Oficina Comarcal tardaven dies a saber aquests resultats. I ara mateix se n'està fent, de proves d'aquestes a la fauna, encara. I van sortint animals positius. I mo n'enterem per què aquest m'ha dit, aquest ha fet, aquest no s é què . No hi ha res. Jo crec que no hi ha cap lloc oficial o cap web de la Generalitat on anar a mirar i et diguin" (F1-ES)	Yes, samples continue to be taken. But no one has ever told us anything about whether or not positive boars have come out. And we find out why this one told me, this one did, this one I don't know what. There is nothing. I believe that there is no official place or website where you can go to look (at the data).
Formal communication in Pyrénées-Atlantiques (France)		
E5	"Cet autour de la prophylaxie qui nous en parlent le plus. Le souci, c'est que le souci par rapport à la tuberculose, vraiment la tuberculose. Comme on n'est pas vraiment concerné , on se sent un peu loin malgré qu'on soit pris, on n'en parle pas trop. […] La communication a été faite dès qu'il y a eu des cas qui ont été pas trop trop loin de chez nous.[…] Les informations au tour de la tuberculose sont claires. Oui, ils sont clairs parce que ceux qui nous ont annoncé , c'est clair, était en marqués sur papier.". (F4-FR)	It is around prophylaxis that we are most informed. The concern is the concern about bTB, really the bTB. As we are not really concerned, we feel a little far away, we do not talk about it too much. […] Communication was made as soon as there were cases that were not too far from our home. […] The information around bTB is clear. Yes, they are clear because those who announced it to us, it was clear, they were marked on the paper.
E6	"à part le GDS, les vétérinaires qui nous donne des informations? L'administration? … Non. Appart quand tu est touchée, ça il te donnent des informations. Sinon" (V3-FR)	Apart from the GDS, which of the vets is giving us information? The administration?. No. Apart from when you are affected, then they give you information. If not. I don't know if there is better information out there.
E7	"Oui, l'information est claire. Par contre, ceux qui nous donnent les informations n'ont pas encore la vérité sur la tuberculose et donc ils ne peuvent pas donner quelque chose qu'ils n'ont pas. Donc, ils donnent des pistes pour s'en protéger." (F2-FR)	Yes, the information is clear. On the other hand, those who give us the information do not yet have the truth about tuberculosis and, therefore, they cannot give us something they do not have.
E8	"Voilà, donc, on était vu comme des gens sales. On avait la tuberculose. Ils pourraient le dire autrement. Et voilà, donc il y a ça, c'est pas bien, je trouve […]. Quand il m'a appelé pour me dire que le voisin avait la tuberculose… bon tanpis, on va faire attention. Parce que tout le monde l'avait, parce que tout le monde savez à quoi […] Et le plus inquiet? L'agriculteur qui a été le plus inquiet et le plus "olalà", il n'a pas eu de vaches chez lui ".(F2-FR)	So, we were seen as dirty people. We had tuberculosis. They could say it differently. And there it is, so there's this, it's not good, I think. When he called me to tell me that the neighbour had tuberculosis… well, we'll be careful. Because everyone had it, and because everyone knows what […] And the most worried? The farmer is the most worried and the most "olalà", he didn't have any cows at home.
E9	"La communication vétérinaire sanitaire qui est assez bonne et une simplification qui se fait au fur et à mesure. Au début, c'était encore un petit peu brouillon. Ça commence à être beaucoup plus clair, même pour ceux, parce que nous on est déjà confronté , c'est un peu plus facile pour nous que d'autres vétérinaires dans les zones savent pas toujours très bien quoi faire. Aujourd'hui, on a à disposition un document pour les mesures qui est assez clair, avec des indications directement sur le document, ce qui facilite l'interprétation des r é sultats en direct, avec en plus une présentation pour lui expliquer. C'est assez clair, ça, ça y est. Au début, j'étais un peu déficient. ".(V1-FR)	Veterinary health communication which is quite good and simplification which is done step by step. At first, it was still a little messy. It's starting to be a lot clearer, even for those, because we've already faced it, it's a little easier for us than for other vets in the areas, they don't always know very well what to do. Today, we have available a document for the measures which is quite clear, with indications directly on the document, which facilitates the interpretation of the results live, with in addition a presentation to explain it. It's pretty clear, that's it. At first, I was a little deficient.
E10	"Des information, des informations factuelles sur l'organisation de la champagne, sur le positif, mais pas d'information scientifique sur les voies de contamination. Est ce que dans quelle direction chercher? Est ce qu'il y a des recherches qui sont faites sur justement la contamination par la faune sauvage et éventuellement sur la lutte qu'on pourrait mettre en place? ".(V1-FR)	Information…there is concrete information on how to organise the bTB screening campaign, on the positives, but no scientific information on the routes of contamination/transmission. Which direction to look in? Is there research being done on contamination by wildlife and, in case, on the measures to fight against it?
E11	"L'information, oui. L'information en question, oui. Mais après qu'est ce qu'on peut vraiment faire? C'est pas ça, c'est pas l'accès à l'information, c'est l'accès au mode d'action tout court. Qu'est ce qui se passe?". (V4-FR)	Information, yes. The information in question, yes. But then what can we really do? It's not that, it's not access to information, it's just access to the mode of action. What is it that is happening?
E12	"Eux, ils sont tellement habitués à parler de tuberculose qu'ils se rendent compte que c'est comme un docteur qui annonce un cancer. Il en annonce tous les jours. Il te le dit comme ça et quand tu es concerné , tu ne le prends pas… C'est pareil, je compare à ça". (F2-FR)	They are so used to talking about tuberculosis that they realize it's like a doctor announcing cancer. He announces it every day. He tells you like that and when you're concerned, you don't take it… It's the same, I compare it to that.
E13	"Avec les vétérinaires du GDS, oui [je fais confiance], avec les vétérinaires administratifs, non. Et là, il y a énormément d'efforts à faire par rapport à la tuberculose. Mais c'est toujours pareil, on dit, etc". (F6-FR)	With the GDS vets, yes (I trust them), with the OVS, no. And there, there are enormous efforts to be made about bTB. But it's always the same, we say, etc.

In the table, bTB: bovine tuberculosis; OVS: Official Veterinary Service; F: Farmer; V: private veterinarian; ES: Catalonia, Spain; FR: Pyrénées-Atlantiques, France; D-ES: Regional veterinary service in Catalonia; D-FR: Regional veterinary service in Pyrénées-Atlantiques; GTV: Groupement Technique Vétérinaire; GDS: Groupements de Défense Sanitaire.

Table 9
Perceptions of the training about bTB: extracts from the interviews with farmers and private veterinarians.

Extract Code	Sentences in Original language	English Translation
Perception of training among farmers		
E1	"N'he fet alguna, s í (Jornada PATT sobre TbB). Però ara fa temps que no, eh. Amb temes de la fauna salvatge, de si era o no portadora" (F6-ES)	I have done some, yes (PATT Conference on bTB). But it's been a while now, eh? About the themes of wild fauna, whether or not it was a carrier
E2	"Il y a eu des formations faites par les vetos, des sessions d'une journée entière. Il y a deux ans, il y a des ans, quand on a commencé à voir des cas de tuberculose un peu partout au niveau du GDS,du groupement départemental sanitaire. Ils ont commencé à demander aux vétérinaires de chaque secteur de faire des formations, des informations, des sessions d'un jour. Aussi, que nous explique la tuberculose, comment ça marche, comment on peut l'attraper ". (F4-FR)	There was training done by the vets, full-day sessions. Two years ago, years ago, when we started to see cases of tuberculosis almost everywhere at the level of the GDS, the departmental health group. They started asking veterinarians in each sector to do training, information, and one-day sessions. Also, what does tuberculosis tell us, how it works and how you can catch it?
E3	"Segurament ha estat més per desídia que per cap altra cosa. Per tenir molta feina i." (F5-ES)	It was probably more out of laziness than anything else. Because of the high workload and …
E4	" Après on a eu une formation obligatoire, quand on a la tuberculose, par le GDS, c'est le groupe de defense sanitaire, et cette formation est bien. Elle est bien parce qu'on est entre éleveurs et vétérinaires du GDS qui sont sympa, qui sont quand même. Il n'y a pas de tabou, tout le monde dit, on a parlé , on a… et ça c'est bien, je trouve ça c'était très bien. Elle était bien cet formation". (F2-FR)	Afterwards, we had compulsory training, when you have tuberculosis, by the GDS, the health defence group, and this training is good. It is good because we are between breeders and veterinarians of the GDS who are nice, whatever. There's no taboo, everyone said, we talked, we… and that's good, I think that was very good. It was a good training
E5	"je ne sais pas si elle existe le meilleur information. Moi, la meilleure. Après il faut continuer les tests. Bon, très bien les améliorer parce que je pense que il y en a des bons et des moins bones. Mais après la r é el information, buff… c'est compliqué à dire". (F3-FR)	I don't know if there is better information out there. For me, the best. Then you have to continue the tests. Well, it's very good to improve them because I think there are good ones and others that are not so good. But then the real information, buff. it's hard to say
E6	"A tots dos [privat i oficial]. El que passa és que els hi fas preguntes a tots dos i són molt ambigus responent, perquè segurament no estan d'acord amb moltes coses, saps? [.] El de l'Oficina Comarcal poca cosa dirà, perquè ell sempre. naden i guarden la roba, no? I l'altre amb aquest percal tampoc parlarà molt, saps?". (F5-ES)	"To both [private and official]. The thing is, you ask them both questions and they're very ambiguous in their answers because they probably don't agree on a lot of things, you know? [.] The one from the County Office will say little because he always. they swim and keep their clothes, don't they? And the other one with this perch won't talk much either, you know?"
E7	"Après ils ne nous disent pas tout. On le sait par les éleveurs, ce n'est pas par le vétérinaire. Ils nous disent les cas qui a eu et voilà. Ils ne te le disent pas, quoi. Parce qu'après, il y a plusieurs formes de maladies. Il y a plusieurs, je ne sais pas comme ils appellent ça, plusieurs… formes.". (F3-FR).	"Afterwards they don't tell us everything. We know this from the breeders, not from the veterinarian. They tell us the cases that had and that's it. They don't tell you, what. Because afterwards, there are several forms of the disease. There are several, I don't know what they call it, several…forms…".
Perception of training among veterinarians		
E8	"Nous devons faire la formation pour remplir notre mandat de santé , notre qualification de vétérinaire pour faire de la prophylaxie, etc. une de ces formations porte sur la tuberculine, ce qui est intéressant et permet de modifier un peu ce discurs" (V1-FR)	We have to do the training to fulfil our health mandate, our qualification as a veterinarian to do prophylaxis, etc. one of these courses is on the tuberculin skin test, which is interesting and allows you to modify this discourse a little
E9	"Era molta teoria sobre la tuberculosi bovina i jo ja feia anys que anava a ajudar al sanejament, i anava al curs pensant, amb ganes de saber, que m'explicarien com reaccionar davant d'un positiu, quines són les passes a seguir després d'un positiu. I el curs era tot teoria sobre tuberculosi i una mica de pràctica de com rasurar, mesurar i punxar, com interpretar el resultat, o sigui què és un positiu i què és un negatiu, però només això. I ja està. No ens van donar res d'informació de com actuar davant d'un positiu, de com donar la notícia, de quan tens un positiu quines conseqüències t é sobre el pagès, quines pel ramat. Res de tot això que era el que més m'interessava" (V1-ES)	There was a lot of theory about bTB, and I have been doing the skin test for years, and I went to the course with the expectation (and wanting to know) they would have explained how to react when detecting a reactor animal, what are the next steps to follow. And the course was all theory about bTB and a bit of practice on how to shave, measure and prick, how to interpret the result, e.g., what is positive and what is negative, but that's all. And that's it. They didn't give us any information on how to act in the face of a positive, how to report it to farmers, what consequences a bTB case has on the farmer, and what consequences for the herd. None of this, which was what I was most interested in
E10	"Tous les vétos devaient passer (la formation obligatoire) et qui était n é cessaires. […] Alors bon, y'a pas de problème, on y va, on regarde, mais ça on l'avait déjà eu à l'école vu, clairement, il y avait des jeunes vétos qui peut être n'avaient pas le fait, ce qui c'était bien, mais il y aussi pleines de véto qu'ils l'avait déjà fait, pas mal. Je ne sais pas si c'était hyper utile. […]C'était un peu. Je trouvais le discours un peu directif. Il n'y avait pas trop de débats, alors personne ne disait rien. Moi, je trouve que ça aurait pu être mieux utilisés. […] La partie technique, peut-être. Mais pour le reste, il p è che sûrement. La partie épidémiologie, la partie communication, le. Que se passe-t-il quand j'ai un cas ? Qu'adviendra-t-il des agriculteurs?" (V3-FR)	All vets had to pass (mandatory training) and that was necessary. […] So well, there's no problem, we go, we look, but that we had already seen at school, there were young vets who perhaps did not have the did, which was good, but there's also plenty of vetoes as they've already done, not bad. I don't know if that was super helpful. […] It was a little. I found the speech a little directive. There wasn't too much debate, so nobody said anything. I think it could have been put to better use. […] The technical part, perhaps. But for the rest, it surely fails. The epidemiology, the communication. What happens when I have a case? What will happen to the farmers?
E11	"Sí . Es va fer una xerrada. allò també va ser interessant., que després de 10 anys del sector ramader i els veterinaris de camp dient que la fauna salvatge tenía tuberculosi i ells de dir que no (l'Administració), allí per primera vegada ho vaig sentir a dir a algú del Departament." (V4-ES)	Yes. They (OVS) gave us a talk. that was also interesting. that after 10 years of the livestock sector and field vets saying that wildlife had bTB and them saying that no (the Administration), for the first time I heard someone from the Department say it
E12	"Si. Com una formació més real. Que no sigui les coses s'han de fer així i ja està. Que sigui més aterrat al món real dels ramaders. […] És com que hi ha dos móns. El que es creu el Departament, el què es vol creure; i el que es fa." (V3-ES)	Yes. Like a "more real" training. Otherwise, things have to be done this way and that's it. Be more grounded in the real world of farmers. [.] It's like there are two worlds. What the Department believes, what they want to believe; and what is actual done. (in the Department).
E13	"Il y a beaucoup de choses qu'on ne maîtrise pas dans la tuberculose et qui font que la communication avec les éleveurs de la part des vétérinaires a été déficiente aussi. C'est à dire que les vétos, on est complètement coupables aussi du fait que les éleveurs disent que c'est un test de merde parce que les vetos, ils n'avaient pas envie de le faire ou qu'ils faisaient la queue en disant que de toute façon, c'était un test de merde." (V1-FR)	There are many things that we do not control in bTB and that means that communication from veterinarians to farmers has also been deficient. That is to say that the vets, we are also completely guilty of the fact that farmers say that it is a shitty test because the vets did not want to do it or that they were queuing in saying anyway it was a shitty test
E14	"A nivell de formació, ens venen i ens diuen 'si no feu més de x% de proves al coll, sou susceptibles de ser sancionats o inhabilitats'. Llavors et fiquen allí la llista, 'aquest període hem inhabilitat a tants veterinaris'. Pues, mira" (V4-ES)	At the training level, they come to us and tell us 'If you don't do more than x% of tests on the neck, you are liable to be sanctioned or disqualified'. Then they put you on the list: 'this period we disqualified so many vets'. Well, look…

In the table, bTB: bovine tuberculosis; OVS: Official Veterinary Service; F: Farmer; V: private veterinarian; ES: Catalonia, Spain; FR: Catalonia, France; D-ES: Regional veterinary service in Catalonia; D-FR: Regional veterinary service in Catalonia; GTV: Groupement Technique Vétérinaire; GDS: Groupements de Défense Sanitaire.

some bTB outbreak and in informal contexts (e.g., after a training event) or among those of the same health defence group (i.e., GTV) (Table 10, E10). They also recognised that there are some discrepancies in the information provided by the different veterinarians to the farmers, which should be avoided (Table 10, E11).

3.3. Participatory pilot intervention

The main proposals/ideas to improve the communications on bTB, which were developed by farmers and veterinarians (separately) during the first round of focus groups, are summarised in Figs. 3 and 4, respectively.

Both farmers and private veterinarians expressed the need of sharing information on the epidemiological situation in the region and asked for more regular feedback on the number and location of bTB outbreaks and updates on positive wildlife reservoirs. They also would like to have more voice (i.e., greater participation) in the design of protocols and the decision-making processes. Especially farmers claimed protocols that can be adapted to specific cases, without generating comparative grievances ("protocolised flexibility") and the production of concise (and written) documents which clarify rules and explain step by step the protocol to follow in case of doubt or bTB-positive cases (Fig. 3). Moreover, they suggested giving more value to their work through pedagogical actions among the general population to raise awareness about the rural sector's contribution to society. Finally, they proposed to establish a 'Crisis Committee' to support decisions on specific cases or bTB outbreaks (Fig. 3).

On the other hand, private veterinarians don't feel that their work is valued and relied by the official veterinary services, and they would like to receive constructive advice and not be just supervised or criticized (Fig. 4). The veterinarians also highlighted the need of creating participatory spaces to communicate doubts or make joint reflections and share reliable information between farmers and veterinarians (e.g., thematic conferences) (Fig. 4).

The generated proposals were presented to the regional veterinary officers (i.e., official veterinary services) and the feedback received from the official veterinary services was discussed jointly by farmers and veterinarians (i.e., second round focus group) to find a consensus and agree on their validity. After discussion, the following list of proposals was agreed upon between farmers and private veterinarians:

- Meeting spaces: Creating communicative and participatory spaces to share opinions, and reliable and understandable information. Facilitate meetings in the territory to make joint reflections (e.g., thematic conferences).
- Acknowledgement: Give more value to the work done by both veterinarians and farmers and implement pedagogical actions toward the general population to raise awareness about the rural world and its contributions to society.
- Clearer protocols: Have clear rules and protocols that can be adapted to specific cases, without generating comparative grievances ("protocolled flexibility").
- Listening mechanisms: Carry out audits of private veterinarians not only to inspect their work but also to accompany and support them / their working activities. Give farmers and private veterinarians more voice (greater participation) in designing protocols. Establish a 'Crisis Committee' to support decisions on specific cases (bTB outbreaks) → representatives of farmers, veterinarians, and OVS.

The above-described list of proposals was presented collectively and discussed among farmers, private veterinarians, and representatives of the official veterinary service in the final workshop. During this last meeting, all participants expressed to be aware of the need of improving the communication processes. At the end of the workshop, participants agreed to implement the following actions:

- Organise meetings which could also be used for discussing doubts and simplifying procedures, or for the detection of administrative dysfunctions (i.e., working groups).
- Improve the accessibility of the information already available in the territory: simpler and more transparent mechanisms than those currently in place (e.g., updating websites or sharing databases).
- Produce visual material (infographics, short videos, fact sheets, etc.) with contextual information about the disease (impact, risks, procedures, etc.).
- Redesign the training courses to make them less unidirectional (for example, give space for sharing experiences and knowledge from the field), and to widen the range of topics besides the more technical already included (e.g., content related to social, economic, pedagogical, and administrative aspects).

Farmers and private veterinarians also recognised that to realise their proposals they should first strengthen their organization and engagement and generate an internal debate to identify the priority issues to be solved together with the official veterinary services. It was acknowledged that private veterinarians linked to livestock health defence groups should play a major role in such an organizational process.

4. Discussion

In the trans-Pyrenees region, the bTB eradication programmes are carried out in a social context marked by a certain distrust between the various actors, which makes it difficult to reach a common understanding of the disease and reduce the acceptability of the bTB eradication programmes in place. The study followed a comprehensive approach which integrated different (mainly qualitative) social research methods to gain insight into the communication (i.e., contents and processes) existing among people involved in the bTB eradication programme and to understand the sociological factors which might influence their communication. This approach allowed us to address, from an evidence-based perspective, the concerns and viewpoints of people involved in the implementation of the bTB eradication programme. Furthermore, it investigated possible solutions to the identified barriers and developed recommendations to promote (and improve) communication on bovine tuberculosis between stakeholders.

Results from this study pointed out that the sociocultural and political-institutional dimensions of the bTB risks prevail over the economic and health dimensions and highlighted the importance of improving the level of information and trust between actors (i.e., farmers, private veterinarians, and official veterinary services). There is a heterogeneous understanding of bTB between people involved in the eradication programme which is reflected in the different language used by the farmers, private veterinarians, and official veterinary services (i.e., metaphorical strategies and topics communicated). The analysis revealed the divergence between farmers and public bodies and scientists: the institutional and scientific communication focused almost exclusively on the detection and control of the disease, while other social and economic aspects were left in the background. On the contrary, farmers extend their communication to a greater variety of themes and in their communication referred to a large variety of target domains, indicating their concern for different aspects related to bTB and not only for the disease itself. Moreover, the framing of bTB strongly differs among actors, highlighting the existence of a controversial debate about bTB in which each party defends different positions: the official veterinary services and researchers "fight" against bTB and "progress" towards its eradication, farmers place themselves in a framework of sacrifice and, particularly in Spain, they play a passive role (Capdevila et al., 2022). The literature agrees that the management of bTB in a territory (i.e., surveillance, prevention, and control) is a controversial, conflictive, and complex issue (Grant, 2009; Cassidy, 2012; Enticott et al., 2014; Maye et al., 2014; Naylor et al., 2014; Robinson, 2017; Allen

Table 10
Informal communication on bTB: extracts from the interviews with farmers and private veterinarians.

Extract Code	Sentences in Original language	English Translation
Informal communication on bTB among farmers		
E1	(por diferentes grupos de whatsapp) "han circulat els últims anys alguna informació, més enllà d'informar que un company ho ha tingut" (F6-ES)	Some information (on bTB) has circulated in recent years, beyond reporting that a colleague has had it
E2	"On en parle avec les vetos, on en parle entre nous aussi, mais très peu. Parce que bon, comme je vous dis, on se sent pas concernés. On parle d'autres maladies. Il y a d'autres problèmes sur l'éthique, sur les vaches, sur des avortements. […] Quand on est en transhumance on fait attention à tout et à tout le monde parce que la maladie n'est pas socialiste, comme on dit, c'est à dire on ne partage pas la maladie. On va partager les bons moments, les mauvais, mais la maladie se la garde eux même." (F4-ES)	We talk about bTB with the vets, and we talk about it among ourselves too, but very little. Because well, as I tell you, we don't feel concerned. We are talking about other illnesses. There are other issues regarding ethics, cows, or abortions. […] When we are in transhumance, we pay attention to everything and everyone because the disease is not socialist, as they say, it is to be said that we do not share the disease. We will share the good times, and the bad, but the disease takes care of itself.
E3	"Oui, on été un peu renseigné parce que comme il n'y a dans le coin, pas très, très loin. […] Oui, mais après, on en revient toujours dans le problème. C'est que quand on est pas concerné , trop on le lit, on est pas… Et quand tu est là." (F2-FR)	Yes, we were a little informed because as there is in the area, not very, very far. […] Yes, but afterwards, we always come back to the problem. It's that when you're not concerned, you read it too much, you're not. And when you're there.
E4	"No ho s é . La nostra actitud en front això ara és de moment no ha arribat, quan arribi ja ens n'ocuparem. Mira, l'altre dia vam fer una barbacoa amb noies ramaderes. gent que es dedica al món dels boscos. tot això. No se'n va parlar. No és una preocupació ara. (F2-ES)	I do not know. Our attitude towards this right now is that it has not arrived yet, when it arrives, we will deal with it. Look, the other day we had a barbecue with farmers. people who work in the world of forests. all that. It was not discussed. bTB is not a concern now.
E5	"Oui, avec les voisins de la ville. Et avec les vétérinaires. Quand vient le temps de la prophylaxie, on se demande si ça se passe bien ou pas. Suivons un peu les événements" (F5-FR)	Yes, with the people from the town. And with the vets. When the time for prophylaxis comes, you wonder if it's going well or not. We follow the events a little.
Informal communication on bTB among veterinarians		
E6	"Tenim un grup de WhatsApp, però bueno. Vam decidir a l'última reunió, de fa un any o més, que faríem una reunió per zones de Catalonia amb veterinaris per explicar bé què és ADSG als veterinaris, i que els veterinaris ho expliquessin als seus ramaders. Per intentar fer una xarxa real per a què funcionés una mica millor". (V3-ES)	We have a WhatsApp group, but hey. We decided in the last meeting, a year ago or more, that we would hold a meeting in the area between veterinarians in Catalonia to explain well what ADSG is, so that the veterinarians would have explained it to their farmers. To try making a real network, work a little better
E7	"Hi ha algun grup de WhatsApp de veterinaris, que comenteu la jugada? No no. Som poc organitzats a vegades. (.) També a vegades prefereixes comentar-ho així o per telèfon i no deixar res per escrit perquè de vegades no da lugar". (V2-ES)	Is there a WhatsApp group of vets, who comment on it? no no, We are not very organized sometimes. (.) Also sometimes you prefer to comment on it like now (face-to-face) or on the phone, and do not leave anything written because sometimes it doesn't work…
E8	"i amb veterinaris privats, jo el que veig és molt més individualisme que en qualsevol altra espècie. [.] Per competència laboral totalment. " (V4-ES)	and with private vets (of cattle), what I see is much more individualism than in any other species. [.] For labour competition entirely
E9	"On a pas ce regard là. Il y a une confidentialité totale. Il y a vraiment une opacité , même autour de l'identité des élevages qui sont atteints pour les protéger, évidentment. " (V4-FR)	We don't have that look. There is total confidentiality. There is an opacity, even around the identity of the farms that are affected to protect them, obviously
E10	"On se rencontre quand on a des r é unions, notamment chez GTV, par la formation. nous avons aussi un groupement d'achat. Nous sommes donc un groupe de sept, sept ou huit cliniques " (V1-FR)	Ens trobem quan tenim reunions, en particular al GTV, mitjançant la formació per actuar tots junts de manera coordinada. Després tenim un grup de compres. Per tant, som un grup de set, set o vuit clíniques
E11	"Je pense qu'il y'a une vraie travail d'harmonisation du discours, etc. entre vétérinaires, qui a faire dans un premier temps avant de communiquer. Avant de communiquer avec les éleveurs, il faut que les vétérinaires trouve que le discours est légitime, que la personne qui porte le discours est légitime et que toutes sont d'accord avec ce discours là". (V1-FR)	I think that there is a real work of harmonization of the discourses, etc. between veterinarians, what has to do first before communicating. Before communicating with the farmers, the veterinarians have to find/feel/understand that the discourse is legitimate, that the person carrying the discourse is legitimate and that everyone agrees with that discourse

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et al., 2018; O'Hagan et al., 2016; Hamilton et al., 2019; Robinson, 2019; Ciaravino et al., 2020; Keenan et al., 2020; Clarke et al., 2022) with a dominant sociopolitical component. This is due on a wide range of factors linked, on the one hand, to the characteristic of the disease and its control (i.e., wildlife, testing, chronic progress) (Enticott et al., 2014; Naylor et al., 2014; Allen et al., 2018; Crimes and Enticott, 2019) and, on the other hand, to broader psycho-sociological factors, such as scepticism and the perception of lack of self-control (Hamilton et al., 2019), the lack of trust in government and public bodies (Enticott, 2008; Enticott et al., 2014; Ciaravino et al., 2017) and the lack of perceived benefit of being bTB free (Ciaravino et al., 2017).

Especially in conflictual contexts, understanding how people communicate on a topic is key. Discursive strategies and statements used in public debates can influence opinions and societal interest, perceptions, and actions. Moreover, the language is the means by which people create frames, i.e., the mental structures that reflect views and understanding of the world (i.e., how the reality is perceived, described, and evaluated) (Entman, 1993). The ideas underlying a frame are reflected in specific linguistic choices, being metaphor a relevant one (Gamson and Modigliani, 1989). The use of metaphors allows people to communicate a complex, new, or conflictive issue (in this case bTB) using realities that are closer to them or that are of common knowledge (Bougher, 2012). Metaphors express and reinforce different ways of conceptualising and experiencing certain matters (Charteris-Black, 2004; Charteris-Black, 2011). Therefore, the identification and interpretation of metaphors used when communicating about bTB enables one to delve into the different views that the different stakeholders may have about the disease. In Spain and France, the communication on bTB mainly focus on detection and control of the disease in cattle, being the greatest concern for all stakeholders related to testing, and the role of wildlife. Results also confirm that farmers experience (and perceive) bTB in a particularly complex manner and there are several aspects of their concerns. Gaps between scientific communication and circulating knowledge on bTB have already been reported (Robinson, 2019). Moreover, previous studies pointed out that wildlife and its management, testing quality and its impact on the bTB scheme, and scepticism around eradication, among others, were important aspects of concern, influencing farmers (and veterinarians) attitudes and hampering motivation and engagement (Enticott, 2008; Warren et al., 2013; Maye et al., 2014; Ciaravino et al., 2017; O'Hagan et al., 2016; Hamilton et al., 2019; Ciaravino et al., 2020; Clarke et al., 2022). Therefore, it is envisage to broaden the themes covered by the institutional/scientific communication, since bTB has multiple dimensions that need to be addressed; in particular, addressing issues that directly affect and/or concern farmers

Fig. 3. Proposals to improve the communication on bTB developed by farmers during the first round of focus groups.Representation of the sticky notes with the proposals and recommendations generated by the farmers during the first group session (i.e., focus group).

Fig. 4. Proposals to improve the communication on bTB developed by private veterinarians during the first round of focus groups. Representation of the sticky notes with the proposals and recommendations generated by the veterinarians during the first group session (i.e., focus group).

(and private veterinarians), such as bTB risks and benefits, bTB consequences for farmers, or topics related to economic and social aspects would be beneficial and could contribute to their motivation and interest toward bTB.

The observed differences in the metaphors used to communicate on bTB reveal divergent and sometimes even incompatible narratives by the different stakeholders. Military metaphors have been commonly used to refer to infectious diseases, being one of the standard metaphor systems for animal and human diseases (Blankshain et al., 2023; Nerlich, 2004; Ribeiro et al., 2018; Wallis and Nerlich, 2005; Wicke and Bolognesi, 2020). The use of the war rhetoric by policymakers and health authorities has been previously described and linked with political and scientific uncertainty about pathogens' transmission and effective preventive measures (Ribeiro et al., 2018; Wicke and Bolognesi, 2020), mobilization of resources and public support or to justify the implementation of severe control measure (i.e., movement restrictions, culling, slaughtering, burying) (Nerlich, 2004). In both countries, the war rhetoric was mainly used by the official veterinary services and when referring to the surveillance and control of the disease (e.g., "*Necesidad de luchar en diferentes frentes contra la enfermedad*" [the need to fight against the disease on different fronts], "*Un plan de lutte national*" [a national plan to fight against]): bTB is explicitly placed in the role of enemy and the farmers are implicitly placed in the role of a fighter. As in a war, the official veterinary services decide the rules and use the "tools" provided by the scientist, but farmers (and to some extent private veterinarians) are just soldiers that have to fight against the disease. In Spain, the "war" frame does not take farmers into account; they do not appear in the developed narrative and, only in a few cases, do experts or authorities mention that farmers should be considered allies. In this context, farmers perceive that they (the soldiers) are the only ones who are suffering the consequence of this war (i.e., slaughtering cattle) and they live the eradication programme as a kind of punishment that have to suffer because of their condition of being a farmer. In the French context, it seems that farmers play a more active role, and they perceive

themselves to be part of the "fight" against bovine tuberculosis. However, the frequent use of the "war" frame as a conceptual metaphor to refer to the official veterinary services, suggests the existence of tense relations between the two parties. Although the war rhetoric can be useful to justify the slaughter policy, it may lead to negative consequences (Nerlich, 2004) or have minimal effects on individual attitudes toward health policies (Blankshain et al., 2023). In a "war", there are only "winners" and "losers" (i.e., being bTB-free is construed as winning, while the occurrence of cases corresponds to losing the war/fight) and the Spanish farmers tend to perceive themselves as "losers", which might contribute to demotivation and concerns about loss of control. Therefore, a common understanding of bTB is needed as well as the search for common and broader metaphorical frameworks. In agreement with Keenan et al. (2020), we highlight the importance of sharing similar frames on the disease, since using the same metaphors means assuming a similar view on the issue.

It would also be important to empower farmers to turn them into active subjects of the measures, as also observed by Little (2019), when comparing the bTB management strategies implemented in Michigan and the UK. However, the combination of companionship and mutual distrust observed among farmers (i.e., farmer-to-farmer relationships) might represent a barrier to this process and their active participation in both disease control and prevention. Moreover, farmers (and to a lesser extent veterinarians) obtain information and establish communication networks also through informal channels which seem to play an important role in making farmers feel as a part of a larger community, reducing the feeling of loneliness in their work sphere. Thus, such channels should be considered to share knowledge and information with farmers and strengthen farmers' empowerment and cooperation.

Participants' viewpoints on the communication on bTB and on the social relations between farmers and veterinarians that emerged from both the Spanish and French in-depth interviews were similar. Farmers trust their private veterinarians, and, in a way, private veterinarians perceive themselves as closer to the farmers than to the official veterinary services. In agreement with other studies (Boireau et al., 2017), private veterinarians resulted to be one of the major sources of information for farmers, and the most suitable actor to fill the communication gap between farmers and official veterinary services. Private veterinarians were aware to be key actors in the communication with farmers but also to play a passive role, indicating the (perceived) scientific uncertainty on the disease and time constraints as the main reasons for their weak communication. At the same time, they highlighted difficulties in their relationships with farmers when dealing with bTB-related issues, which was attributed, on the one hand, to the lack of training in communication skills, and, on the other hand, to the commercial nature of their relationship (i.e., farmers are their clients, and veterinarians worry of losing them), as already reported in the literature (Boireau et al., 2017; Ciaravino et al., 2017; Crozet et al., 2019). The available (official) information was considered not exhaustive, accessible, or clear enough, generating an atmosphere of permanent suspicion between official and private veterinarians and between veterinarians and farmers. In addition, farmers sometimes perceive discrepancies in the information received by the different veterinarians (i.e., regional veterinary services, local veterinary officers, and private veterinarians) and in the criteria applied to manage bTB outbreaks. This feeling reinforced the perceived uncertainty on the cause of bTB breakdowns and the efficacy of preventive and control measures.

Providing accurate information and effective communication material is crucial to avoid misunderstanding and confusion which, in turn, may lead to low commitment and negative attitudes (i.e., refusal) towards the prevention and control of infectious diseases (Alders and Bagnol, 2007; Boireau et al., 2017), in this case, bovine tuberculosis. However, it should be considered that perception of low self-efficacy (and powerlessness) or lack of trust in government and public bodies (i.e., sources of information) may hamper the willingness to be informed on a certain issue (Hamilton et al., 2019).

The participatory activities carried out with the farmers, private veterinarians, and official veterinary services raised some improvements that can be made in the communication about bTB. In the light of our results, ensuring (or improving) farmers and veterinarians' accessibility to data on bTB, sharing clearer and written protocols, and developing informative (visual) material should be priority (first) steps for improving the communication on bTB. Moreover, the way information is delivered and knowledge shared are also of paramount importance, as already highlighted in literature (Hamilton et al., 2019; Little, 2019). Our findings suggest that the creation of horizontal meeting space to share information, discuss doubts and simplify procedures (with no fears of possible consequences) would be beneficial for the knowledge-sharing process and it could contribute to improve relationships between farmers, private and official veterinarians. At the same time, training courses on bTB should be designed in favour of a more holistic and bottom-up approach, covering not only technical but also social, economic, administrative, and pedagogical (i.e., how to deliver bad news) aspects, and giving space for sharing experiences and knowledge from the field. Finally, the stakeholders' participation in the design of protocols on the prevention and control of bTB and risk management measures should be increased. Some of the developed proposals (i.e., the creation of participatory meeting spaces and a 'Crisis Committee' together with the official veterinary services) indicate there is a need to give more voice to farmers and private veterinarians and involve them at earlier stages of the decision-making process on the management of the disease (i.e., to make part of the solution). However, it also emerged that both farmers and private veterinarians should carry out an internal debate to prioritize obstacles that make their daily work difficult and identify needs and concerns. This should allow farmers and veterinarians to play a more active role in the dialogue with the official veterinary services. As it was said above, private veterinarians from the livestock health defence groups could be key players in this articulation, although it would be necessary to carry out preliminary informative and pedagogical work to make them feel more involved and be better prepared to participate in decision-making processes.

Some potential limitations of the study should also be considered. Analyses of the communication materials were based on a corpus of text that has been constructed based on precise methodological criteria, however, the corpus only included text available online. As a limitation, our findings may not reflect all the topics and figurative frames that exist on bTB. However, the existence of repeated contents within the sample indicated that the most important aspects/themes were captured and the results from in-depth interviews confirmed that the most relevant sources of information for farmers and private veterinarians were included in the sample. The sample size and the quota of farmers and veterinarians (six and four in each area, respectively) was established a priori. The selected number of participants relied on previous studies based on grounded theory and it was considered that interviewing 10 people from each study areas was sufficient to saturate the discursive space, especially considering that the interviewees would also participate in several iterative focus groups, so the quantity and quality of qualitative data would be important. The STAVE approach was used to enable the dialogue between regional veterinary services, farmers, and private veterinarians (i.e., people in charge of the implementation of animal health policies and people targeted by such policies). This method is successful in reducing the mismatch between what people say they do and what they actually do, facilitating the engagement process, and promoting the exchange of knowledge and views between different groups (Espluga et al., 2016). However, the dialogue between the different parties cannot always be achieved because people may refuse to participate or due to the existence of polarised opinions (i.e., controversial issues), as is the case of bovine tuberculosis (Hamilton et al., 2019; Ciaravino et al., 2020). In such circumstances, an additional step might be required to engage people, and the STAVE method might serve as the starting point for finding a common framework to restore the dialogue (Espluga et al., 2016). Furthermore, gathering several

people in the same place on the same date is usually expensive and complex, especially in the case of these professional profiles, who tend to be widely dispersed throughout the territory. Some of the researchers leading the study and participating to the field activities, mainly veterinarians and epidemiologists, are not totally unknown to the participants. This facilitated the access to the sample and made it easier for farmers and veterinarians to agree to participate in the deliberative workshop and iterative groups discussion. However, this familiarity could also lead to some bias, such as inhibition or prudence when explaining certain delicate or compromised topics. To minimize such potential bias, the in-depth interviews were carried out by sociologist (unrelated to the main researchers and unknown to participants) which were hired and trained for this purpose. Moreover, a researcher specialized in group dynamization techniques (unknown to participants) managed and moderated the iterative groups discussion and the deliberative workshops. Nevertheless, it is worth to mention that the research design based on the STAVE method seeks to strengthen the links between the participants so that they mutually construct their own discourses and collectively reflect on them, trying to minimize the presence of researchers in the final results. The pilot intervention was conducted in Catalonia (Spain) only, and the validity of the results for Pyrénées-Atlantiques (France) is therefore unclear. However, the similarity in the characteristic of the communication on bTB and the social relationships strongly suggest that some of the recommendations, such as to design of new content for the training course on bTB, produce visual informative material and improve the accessibility of the already available data, might be extrapolated and applied to the whole area under study (i.e., the trans-Pyrenees region). Additionally, an online discussion group was organised with some private French veterinarians (February 7, 2022) to share and get feedback on the results from the press analysis and the in-depth interviews conducted in France. They highlighted and agreed especially on the need of receiving regular (i.e., monthly) feedback on the situation in the region (i.e., number of outbreaks, number of positive badgers, their location, follow-up on the management of previous outbreaks, etc.) and on the need of including new content in the "Habilitation Sanitaire" training for veterinarians, such as a session on psychological support to farmers. They also commented that the psychological support could be done either by private veterinarians (as is usually the case) or it could also be offered by the official veterinary service. For the latter, it would be a very elegant way to show farmers that the official veterinary service acknowledges that the management of bTB can be extremely traumatizing.

In conclusion, this study shows the structure of social relations, power, understanding and viewpoints that exist between the different actors involved in the public debate on bTB (cattle farmers, private veterinarians, official veterinary services, etc.). Moreover, it suggests a series of proposals, developed through participatory activities with different stakeholders, that can be directly applied (by health authorities and risk managers) to improve communication on bTB and boost trust between farmers and (official) veterinarians. However, their effective implementation would require a more structured organization of both the farmers' sector and the private veterinarians' group, and a higher commitment to participate in decision-making processes (i.e., find a common framework to restore the dialogue between parties and engage people). Despite their consistency with the literature, it is possible that these results are context-dependent, because this structure of relationships will be different in different countries or even regions, in particular regarding farmers' expectations, or the territorial collective organization of farmers and veterinarians. Nevertheless, the results indicate that there are a series of factors or elements that should be considered to ensure an effective communication on bTB, and that will probably be relevant in most social and political contexts. In particular, a common understanding of the disease among all actors should be ensure. This can be achieved by broadening the discursive strategies used and the range of communicated topics, including those of more concern (and interest) among farmers and veterinarians. Besides, information on the disease should be clear, visual, and easily accessible to all stakeholders, and the role of all actors acknowledged. A high level of participation of farmers and (private and official) veterinarians should be ensured, especially at earlier stages of the decision-making process on the management of the disease since their involvement in the development of recommendations and proposals can contribute to promoting their commitment and empowerment.

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