



‘Implementation of bio...what?’ Farm workers’ subjectivities in Spanish dairy cattle farms through an ethnographic approach

Sebastian Moya ^{a,b}, Josep Espluga-Trenc ^{c,*}, Gareth Enticott ^d

^a Centre for Evidence-Based Veterinary Medicine (CEVM), School of Veterinary Medicine and Science, University of Nottingham, Loughborough, United Kingdom

^b Host-Pathogen Interactions (IHAP) - National Research Institute for Agriculture, Food and Environment (INRAE) - École Nationale Vétérinaire de Toulouse (ENVT), Toulouse, France

^c Institut de Govern i Polítiques Públiques / Departament de Sociologia, Universitat Autònoma de Barcelona, Bellaterra (Cerdanyola del Vallès) 08193, Spain

^d School of Geography and Planning, Cardiff University, Cardiff, Wales CF10 3WA, United Kingdom

ARTICLE INFO

Keywords:

Biosecurity
Dairy cattle farm
Ethnography
Farm workers

ABSTRACT

This study explores the implementation of biosecurity measures by farm workers through daily work routines on dairy cattle farms in Spain. The implementation of biosecurity measures on dairy cattle farms is mainly decided by farmers and veterinarians, but it is carried out by both farmers and farm workers. However, farm workers may be affected by socio-employment factors such as the precariousness of their work such that implementation of biosecurity measures may be context dependent and may differ from official recommendations. An ethnographic approach was used through observations and conversations on four farms in two regions of Spain, two in Galicia (north-west) and two in Catalonia (north-east) to explore these factors. The profiles of participants were farmer-family workers, internal worker-employees and external worker-employees. Results showed that there were social differences, particularly communicative and hierarchical differences, between workers and farmers that influenced the implementation of biosecurity measures. Workers implemented biosecurity practices incompletely, differently or incorrectly from their supervisors’ instructions. Workers also relied on what the authors called an anthropomorphic approach to implementing biosecurity measures, which deviated from farm guidelines. In order to improve the implementation of biosecurity measures on dairy cattle farms, it is necessary to consider workers as key stakeholders in biosecurity. Such consideration could also help to professionalise workers, reduce their turnover and increase their permanence on these farms.

1. Introduction

Biosecurity measures are practices designed to reduce the likelihood of the introduction, establishment, survival or spread of a pathogen inside or outside a farm (Huber et al., 2022). On dairy cattle farms, biosecurity measures may include controls on visitors, vehicles and animal purchases (source or destination testing) (Villaamil et al., 2020). However, the implementation of biosecurity measures is heterogeneous between farms (Aleri and Laurence, 2020; Sahlström et al., 2014) and context specific (Harun et al., 2022; Sayers et al., 2013; Brennan and Christley, 2012), revealing a lack of consistency between theoretical biosecurity recommendations and empirical biosecurity practices (Moore et al., 2008). The purpose of this paper is to explore factors that explain these variations using an ethnographic study of dairy cattle farms in Spain, focussing on work-related and employment practices.

In the European Union, both farmers and veterinarians are legally responsible for preventing outbreaks of infectious diseases on animal farms (European Commission, 2016). To this end, farmers and veterinarians may jointly decide to implement biosecurity measures, with farmers as farm owners often viewing biosecurity as positive for animal health and welfare (Richens et al., 2018; Sayers et al., 2013). But while farmers and veterinarians decide on biosecurity practices, farm workers are also involved in implementing them, following the farmers’ instructions (Moya et al., 2020a). In fact, the responsibility of farm workers becomes even more important when considering that they spend the most time on the farm and have the most contact with the animals (Berhanu et al., 2022). While workers are responsible for certain management and administrative tasks within the farm, these tasks are often broad and non-specific and may vary between farms. Farm workers may therefore perform a variety of roles and functions, such as

* Corresponding author.

E-mail addresses: sebastian.moyaduran@nottingham.ac.uk (S. Moya), josepluis.espluga@uab.cat (J. Espluga-Trenc), enticottg@cardiff.ac.uk (G. Enticott).

<https://doi.org/10.1016/j.prevetmed.2024.106407>

Received 12 March 2024; Received in revised form 25 November 2024; Accepted 6 December 2024

Available online 11 December 2024

0167-5877/© 2024 The Authors. Published by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

managers, supervisors (Merenda et al., 2023; Diniso and Jaja, 2021), general workers, temporary workers (Diniso and Jaja, 2021), caretakers and even veterinary care givers (Merenda et al., 2023). In addition, workers may interact with other stakeholders, such as farmers and veterinarians, to varying degrees and in different directions in the daily farm routine, depending on their roles, functions and tasks. Moreover, farm workers are frequently non-native. For instance, on dairy cattle farms in California (United States of America), between 33 % and 50 %—approximately 500,000 to 800,000 individuals—of all farm workers in the United States reside there (La Cooperativa Campesina de California, 2023; Merenda et al., 2023).

These social and employment factors may influence how biosecurity is implemented on farms. Previous research within animal disease (Enticott, 2012) and policy implementation (Lipsky, 1980) suggest that farm workers are likely to develop their own approaches and understandings of biosecurity – defined by Lipsky (1980) as ‘street-level’ practices and Lowe et al. (1997) as ‘field-level’ practices— that reflect how the reality of everyday work and need to ‘get the job done’, resulting in a differentiated approach to implementation. For farm workers, the development of these practices may be shaped by the precarious employment conditions they often face. This can result in workers being undertrained and overworked, prompting the adoption of coping strategies that may deviate from strictly following farmers’ instructions (Scott and Rye, 2021; Collins and Bayliss, 2020; Hoggart and Mendoza, 1999).

The consequences of farm workers’ own practices are that biosecurity measures may deviate from recommendations, potentially resulting in negative impacts not only on animal health but also on the farm, the livestock sector (Van Schaik et al., 1998), and public health (Youssef et al., 2021). In the context of biosecurity, however, few studies have investigated these effects amongst farm workers. Existing studies have mainly focused on farmers (Imada et al., 2023; Zhu et al., 2023; Moya et al., 2021, 2020a; Singh et al., 2020; Roche et al., 2019; Wolff et al., 2019; Enticott, 2008) and veterinarians (Moya et al., 2021, 2020a; Singh et al., 2020; Roche et al., 2019; Enticott, 2012). Other stakeholders such as paraveterinarians (Singh et al., 2020), transport drivers (Duarte et al., 2024), veterinary academics (Singh et al., 2020), other animal health professionals (Zhu et al., 2023) and government veterinarians (Moya et al., 2023; Enticott, 2014) have received little attention. In contrast, most studies of dairy cattle farm workers have focused on infectious disease risks associated with work practices rather than their social factors (Dobos and Balla, 2021; Elsohaby et al., 2020; Benschop et al., 2017; Torres-González et al., 2013).

Drawing on these perspectives, this paper focuses on the implementation of biosecurity measures by farm workers through daily work routines on dairy cattle farms in Spain. Currently, Spain has a legal framework that promotes the implementation of biosecurity measures in livestock farms (Ministerio de Agricultura, Pesca y Alimentación, 2023; Ministerio de la Presidencia, Relaciones con las Cortes y Memoria Democrática, 2022). However, there is still poor or inadequate implementation, resulting in the introduction, establishment, survival or spread of infectious diseases on dairy cattle farms (Dhaka et al., 2023; Harun et al., 2022). One of the possible reasons for this is that efforts have focused on farmers and veterinarians, but not on farm workers. Daily work routines for farm workers are structured daily sequences of tasks to ensure that animal production is maintained. An ethnographic approach was used to conduct this study to capture the complexities and nuances of farm workers’ daily practices and perspectives allowing analysis of what actors ‘do’ and not just what they ‘say they do’ (Hammersley and Atkinson, 2019). These data are intended to serve as a basis for identifying ways to improve biosecurity standards on livestock farms.

2. Materials and methods

We explored the daily work routines of farm workers on dairy cattle

farms to understand how they implement biosecurity measures. To do this, we draw on the paradigm of critical realism. Critical realism recognises that although there are realities independent of our observations (realist ontology), our understanding of them is socially constructed (constructivist epistemology) (Bhaskar, 2008; Archer, 1995). This paradigm allows us to understand that people’s subjectivities are crucial in interpreting and reconstructing our understanding of the world. In this sense, we rely on an ethnographic approach, which allows a researcher to closely observe the everyday lives of people involved in a particular context and to understand their perspectives (Hammersley and Atkinson, 2019; Wilson and Chaddha, 2009), addressing their social interactions and behaviours (Reeves et al., 2008). This study was based on the standards for reporting qualitative research (SRQR) (O’Brien et al., 2014).

2.1. Field setting

For the ethnographic fieldwork, farms were selected using convenience sampling, coordinated by AA, JC, FJD, and EY. The sampling took into account the different types of dairy cattle farms in Spain, mainly small and family-owned in Galicia (north-west) and owned by large production companies in Catalonia (north-east) ((Ministerio de Agricultura y Pesca, Alimentación y Medio Ambiente, 2016; Ministerio de Agricultura y Pesca, Alimentación y Medio Ambiente, 2018; De Llano, 1989). A total of four dairy cattle farms were selected, two in Galicia and two in Catalonia (Table 1). The researchers chose four farms to ensure diversity of data without compromising the manageability of the ethnographic approach (Hammersley and Atkinson, 2019; Fetterman, 2010). On these farms, farm workers worked full or half days, with breaks for breakfast, lunch and/or snacks. These workers also had access to changing and toilet facilities (exclusive or shared with farmers) with different layouts (with or without lockers, with or without showers) and formal (usually shared with farmers) or informal (usually improvised in another area of the farm) dining areas. Workers represented different profiles within the farms: farmer-family workers, internal worker-employees, and external worker-employees. Farmer-family workers were paid personnel who typically lived near or with the farmer; internal worker-employees generally resided on the farm, while external worker-employees did not. Additionally, external workers often held other jobs, meaning they were not exclusively farm labourers.

2.2. Fieldwork

The fieldwork was conducted between 13 February 2018 and 29 January 2019. The first author (SM, a veterinarian trained in qualitative methods, non-native to the country but Catalan-Galician-Spanish speaker) spent an average of two weeks on each of the dairy cattle farms, from 6 am to 9 pm, Monday to Friday, including some Saturdays and Sundays. This decision stemmed from the authors’ aim of exploring (as a first approximation) the social factors of farm workers’ biosecurity practices *in situ* in different contexts, coupled with the study’s own economic constraints. Indeed, while fieldwork in traditional ethnography tends to be long-term, it can be appropriate in short-term ethnography when specific and limited objectives are set (Hammersley and Atkinson, 2019; Agar, 1980), as was the case in this study. The following areas of the farms were considered for the fieldwork: pen area, calf area, quarantine and nursing area, milking parlours, feed, substrate and waste storage areas, machinery and equipment rooms, offices and warehouses, and arable land. These areas were selected to ensure adequate observation of key aspects of biosecurity, such as animal handling and other farm management. In addition, this selection included not only farm workers, but also farmers, veterinarians and other stakeholders, allowing the researcher to capture relevant practices associated with these activities. However, not all areas were present on all four farms.

During the fieldwork, SM’s role was mainly that of another farm

Table 1
Characteristics of dairy cattle farms in the study.

Dairy cattle farm	Start decade	Total number of animals	Number of animals in lactation	Number of animals in rearing	Own rearing (internal/external)	Farm size (in hectares)
Galicia-I	1950s	220*	100	85	internal	60
Galicia-II	1980s	490	290	200	internal and external	100
Catalonia-I	1960s	100*	45	25	internal	30
Catalonia-II	1930s	580*	205	200	internal	90

* includes males

worker, carrying out daily tasks such as milking cattle, feeding cattle and cleaning bedding, but also acting as a veterinarian, providing advice on animal health. These roles were discussed with the farmers prior to the fieldwork and communicated to the farm workers. Although the farm workers knew that these roles were for research purposes, they may have changed their behaviour due to observer effects, whereby individuals change their behaviour when they know they are being studied (Fetterman, 2010; Gobo, 2008). Minimising this effect is crucial in ethnography and can be achieved by integrating into the environment, participating in everyday activities and building trusting relationships (Fetterman, 2010), as was the case in this study. The first author was constantly in the company of farm workers, farmers and veterinarians visiting these farms to understand the routines in which farm workers were involved. SM and the participants had no relationship prior to the study. A pilot approach was carried out on the farm Catalonia-I. Following this pilot, no significant adjustments were required as the methodology proved to be appropriate for the objectives of the study.

2.3. Data collection

The methods used in the field were participant observation (Hammersley and Atkinson, 2019) and informal conversations (Swain and King, 2022). Data collection using these methods was carried out by taking field notes and recording voice notes. Field notes were taken during breaks and at the end of the working day, and voice notes were recorded *in situ*. On a daily basis, all notes were transcribed to focus and deepen the farm workers' biosecurity routines. All the data collected was compiled into a *corpus* for analysis in a single Word document, which was transcribed into Spanish by SM. After the data collection, the findings were discussed (either in person or over the phone) with farm workers and farmers. However, this was not feasible with the farm workers from the Catalonia-I and Catalonia-II farms, as they did not speak any of the languages known to the first author.

2.4. Data analysis

Data analysis was carried out using reflexive thematic analysis (Braun and Clarke, 2020, 2006), through a recursive and iterative process between data collection and analysis (Timmermans and Tavory, 2012). This analysis allows for a theoretically flexible exploration of qualitative data, emphasising the reflexivity and active role of the researcher in creating rich and interpretive patterns of shared meaning (Braun and Clarke, 2019, 2006). The data was classified and coded in two stages: deductively, from pre-established codes, and inductively, from codes derived from the data. Deductive coding was considered with reference to Bourdieu's (1977) theory of practice to explore the influence of social and cultural structures on the daily practices of farm workers, and Foucault's (1980) theory of power relations to understand the hierarchical dynamics between farm workers and farmers. The codes were then organised into two main sub-themes: implementation of biosecurity measures (descriptive observations), and subjectivities of implementation (explanatory conversations). From these sub-themes, three themes were finally developed: social differences (communicative and hierarchical differences) and anthropomorphic approach. This analysis was carried out by SM together with JE (sociologist) and GE

(geographer), both with experience in animal health research. Specifically, the deductive and inductive coding and the generation of sub-themes were carried out by SM, while the generation of themes was carried out by the three authors through discussions among themselves. The qualitative software ATLAS.ti was used for the analysis.

Within the themes, ethnographic vignettes based on observations and conversations were used to illustrate the findings in the results section. For the purposes of data collection and analysis, and to illustrate the findings, the vignettes were linked to farms labelled Galicia-I, Galicia-II, Catalonia-I and Catalonia-II. The vignettes were translated into English from the Spanish *corpus* by SM.

2.5. Statement on positionality and reflexivity

The position of the researcher can influence data collection and analysis (Pitard, 2017). All researchers in this study have knowledge and experience in conducting studies related to dairy cattle farms. The first author comes from the natural sciences (veterinarian), while the second and third authors come from the social sciences (sociologist and geographer, respectively). The first author speaks Catalan-Galician-Spanish and the second Catalan-Spanish, while the third author speaks neither of these languages. None of the authors knew the participants beforehand, although the first author developed a relationship with some of them during data collection. The first author supervised the collection and analysis of the data and the writing of the manuscript. SM was a pre-doctoral researcher at the time of data collection and analysis for this study, whose previous research also focused on biosecurity measures on dairy cattle farms from a sociological perspective. Although SM is a veterinarian, he has never practised in Spain, being originally from another country. The first author considered his positionality and reflexivity throughout the data collection and analysis process.

3. Results and discussion

All farms had both female and male animals, either male calves or young bulls, except Galicia-II which had only females. All farms had internal rearing, except Galicia-II which had both internal and external rearing. On all farms there were different profiles of farm workers: in total seven farmer-family workers, two internal worker-employees, and five external worker-employees. Farmer-family workers were present on all farms, although Galicia-II had more than the others. Internal and external workers came from a variety of backgrounds, including non-European countries and non-livestock sectors. Specifically, in the Catalonia-I and Catalonia-II farms, the internal and external worker-employees did not speak Catalan-Spanish; while the rest of the farm workers were native to the country, speaking Galician-Spanish in Galicia and Catalan-Spanish in Catalonia. These workers interacted with a variety of stakeholders, including veterinarians, transport drivers, sellers and maintenance staff. The characteristics of the farms in Galicia and Catalonia and of the workers who participated in this study are detailed in Tables 1 and 2.

Observations and conversations revealed that there were social differences, in particular communicative and hierarchical differences between farm workers and farmers. In some cases, these differences led workers to implement biosecurity measures that were incomplete or

Table 2
Characteristics of farm workers in the study.

Dairy cattle farm	Number of farmer-family workers (details)	Number of internal worker-employees (details)	Number of external worker-employees (details)
Galicia-I	1 (1 F, calf keeper)	0	3 (2B)
Galicia-II	4 (2 F, calf keeper and farm manager)	0	1 (1B)*
Catalonia-I	1 (1 F, farm manager)	0	1 (non-native to Spain)
Catalonia-II	1	2 (non-native to Spain)	0
Total	7	2	5

Internal workers lived on the farm and external workers lived off the farm. F: females, in this case, it refers to people who identify and are identified as women according to their biological sex (cisgender women); B: background other than livestock. *newly recruited

different from those instructed by their supervisors. In turn, tensions and conflicts between the two stakeholders led to mistakes in the implementation of biosecurity. These mistakes appeared to be either inadvertent (due to lack of feedback), or deliberate (due to bad feeling). The fieldwork also showed that workers' behaviour was driven by what the authors called an anthropomorphic approach (i.e. viewing animals as similar to humans). This approach also led workers to implement biosecurity measures that deviated from farm guidelines. Thus, three themes were developed: 1) communicative differences, 2) hierarchical differences (both grouped under social differences), and 3) anthropomorphic approach; these are detailed below:

3.1. Social differences

3.1.1. Communicative differences

The communicative differences between farm workers and farmers were attributed to differences in their mother tongues and the technical and non-technical language used in their communicative interactions. In the Catalonia-I and Catalonia-II farms, one worker (specifically the external worker-employee) and two of the workers (particularly the internal worker-employees), respectively, were non-native to the country and non-native speakers of the local languages. In both cases, the workers lacked a solid foundation in Catalan-Spanish, the native language of the farmers, which led to difficulties in fully understanding instructions and occasional misunderstandings. On the Catalonia-II farm, the aforementioned linguistic base was insufficient for a worker to fully comprehend the farmer's instructions regarding the guidance of the young bulls. The instructions were misinterpreted and partially carried out by the worker, resulting in a conflict between the two parties due to the bulls' contact with other animals.

"A truck had arrived at the farm to take young bulls to another farm. The farmer and two of the farm workers were directing the bulls towards the truck. However, the third worker did not understand the farmer's instructions - to use a wooden stick to block the bulls' path to a road leading to other pens. One of the bulls ran towards the road. As the farmer and the two workers chased the bull, two other bulls escaped from the truck in the same direction. The three bulls came into contact with other cattle. The farmer argued with the third worker" (Excerpt of the field notes of Catalonia-II)

Tensions due to native language differences seemed to increase during critical moments requiring immediate action, such as handling animals. However, these tensions seemed to decrease during routine tasks, such as cleaning pens. In Catalonia-II, the presence of a farmer-family worker may have helped to share the workload, potentially reducing stress and linguistic tensions compared to Catalonia-I (with a farmer-family worker in a specific role), where the farmer retained all his responsibilities.

Language differences between farm workers and farmers meant that workers implemented biosecurity measures without following farmers' instructions in detail. One reason for this implementation is that these differences made communication between the two stakeholders difficult (Viveros-Guzmán and Gertler, 2015). In fact, language differences in speaking and listening can also occur between other stakeholders, such as between different professionals working with animals and researchers in the field (Martinez et al., 2024; Gwaze et al., 2011). This issue becomes particularly important when it is shown to be cross-cutting and common to different animal production systems (Gwaze et al., 2011; Arcury et al., 2010). Moreover, these differences can pose a particular risk to the mental well-being of workers (Viveros-Guzmán and Gertler, 2015), who may even face discrimination for speaking their mother tongue at work (Farquhar et al., 2008). These differences therefore constitute a linguistic barrier that requires an effort on the part of the workers to learn Galician-Catalan-Spanish and on the part of the farmers to try to understand the workers better. However, to really tackle this barrier, structured language training programmes could be considered and a working culture that values multilingual communication could be promoted (Tietze et al., 2021; Hazel and Svennevig, 2018). To this end, the use of real-time translation technologies and bilingual manuals can be helpful (Abdullahi et al., 2020). In addition, the introduction of regular intercultural communication workshops could improve mutual understanding and reduce language barriers.

Four farm workers, specifically the external worker-employees on the Galicia-I and Galicia-II farms, had backgrounds other than livestock. The workers demonstrated a limited understanding of the technical aspects and language of dairy cattle farming. On the Galicia-I farm, the workers' lack of familiarity with the fundamental principles of calf bedding cleaning prevented them from effectively utilising their acquired knowledge. The workers approached this task in their own way, which differed from the fundamental principles and led to conflicts with the farmer.

"One of the explanations farmers gave to farm workers when they were hired was that each area of the farm had its own tools to prevent the spread of infectious diseases. However, to clean the calf bedding, the workers used the garden shovels and rakes from the pen area. 'Ideally we shouldn't do this, but it's not so bad if we only do it once in a while', justified one of the workers. The same worker who, when was asked about the basics of biosecurity, replied 'Implementation of bio...what?'. At this point the farmer argued with the worker, who abandoned his task" (Excerpt of the field notes of Galicia-I)

Tensions between technical and non-technical language appeared to persist across all situations. However, in Galicia-I, the presence of only one farmer-family worker (alongside three external worker-employees) may have contributed to a higher level of conflict. This contrasts with Galicia-II, where most of the workers were farmer-family members, who were familiar with the technical language.

The difference between the technical and non-technical language used by farm workers and farmers also led to a different implementation of biosecurity measures by workers compared to the instructions given by farmers. This difference can be explained by the fact that workers are often not trained by farmers in the tasks they need to perform on a daily basis, such as biosecurity practices. As a result, workers lack basic technical knowledge of the farms, a situation that extends to other areas such as pesticide use (Farquhar et al., 2008; Arcury et al., 2010). In this sense, workers acquire this technical knowledge only over time, where those with experience are considered valuable in contributing to farm productivity (Klocker et al., 2020). This difference can also occur between farmers and veterinarians, where the use of different nomenclature for signs and symptoms associated with lameness can lead to problems of mutual understanding and therefore difficulties in preventing lameness (Balzani and Hanlon, 2020). These findings highlight the critical need for targeted training programmes to address workers' knowledge gaps, similar to the case of veterinary and zootechnical

training (Vargas-Bello-Pérez and Hernández-Castellano, 2019). Training workers can help to make them an integral part of on-farm biosecurity discussions, which also has a direct impact on their safety and working environment (Farquhar et al., 2008) and fosters a sense of ownership and responsibility for animal health. Regular technical training and practical workshops can be held to ensure that workers are familiar with biosecurity measures and other farm practices. It is important to emphasise that while training is essential, it is unlikely to solve all the problems identified. The results presented point to a labour context in the dairy cattle sector characterised by poor employment conditions and high turnover of a low-skilled workforce. This situation makes it difficult for workers to access training, even when it is available. Improving the working context is essential to adequately meet official biosecurity recommendations. This working context is likely tied to a production model focused on high animal densities to maximise production and reduce costs.

In Galicia-I and Catalonia-I and II, the farmers were older than their farm workers, unlike in Galicia-II, where the farmer was younger. This generational difference may partly be related to the relative absence of communication tensions in the latter case, but this is something to be better explored in further studies. Additionally, communication in Galicia-II tended to be more cordial and fluid (both verbal and physical), which may have helped to mitigate conflicts, in contrast to the other farms.

Differences in communication may impact both animal health and the working conditions of farm workers and farmers. New farm workers may experience initial adjustment challenges, while long-standing workers may suffer from prolonged fatigue, contributing to a cycle of high turnover and low retention. Both farm workers and farmers may face issues of work overload due to the lack of a robust communication process, which makes it difficult to establish sustainable practices on the farm.

3.1.2. Hierarchical differences

The distinction between the status of farm workers and farmers was most apparent in their interactions with each other. In this context, farmers were observed to engage in verbal attacks on workers, who in turn demonstrated a tendency to either be submissive or to defend themselves. On the Catalonia-I farm, the farmer held the view that one of the workers, in particular the external worker-employee, was incompetent and failed to fulfil his daily duties adequately. This treatment was characterised by an argument between the two parties, during which the farmer shouted at the worker in a vehement manner without attempting to establish or mediate a dialogue beforehand. The farmer argued that the worker had failed to attempt to alter his erroneous practices. However, the farmer did not provide the worker with feedback to rectify these practices, such as the internal movements of the animals.

“The farm worker had to move male calves and young bulls in a block from one pen to another because new male calves had to be brought in. However, the worker moved all the animals together in one area, not as a block. The farmer got angry and treated the worker badly, insulting him in front of the customers (individuals who regularly purchased his dairy products). This practice was only explained to the worker once by the farmer in the context of proper animal management. However, the farmer never gave any feedback to the worker” (Excerpt of the field notes of Catalonia-I)

In the Galicia-I farm, one farm worker, specifically one of the external worker-employees, described the farmer as a person who only issued directives and exerted control over him, with a pervasive sense of intimidation. This treatment prompted the worker to deliberately perform his daily tasks, such as substrate storage, in an incorrect manner, with the intention of provoking the farmer. This conduct resulted in the worker being dismissed from the farm for being confrontational, according to the farmer, who did not acknowledge any inappropriate treatment toward the worker.

“The farm workers had been stacking and storing straw for animal bedding all day, following the farmer’s instructions. However, one of the workers confronted the farmer and said ‘All day long you’ve been waiting for us to make a mistake so you can throw it in our faces, and I can’t take it anymore’. The farmer simply replied that the workers had mixed clean straw with dirty straw (containing wildlife waste). The worker then admitted that he had deliberately mixed the straw because he was tired of being watched by the farmer for no apparent reason” (Excerpt of the field notes of Galicia-I)

Hierarchical differences tended to manifest themselves between farmers and their internal and external employees. On farms where family members worked without defined roles—who tended to be men, as in Galicia-II and Catalonia-II—the hierarchical relationship between them and farmers tended to be more horizontal, although the farmers provided guidance to each member. In Galicia-I and II and Catalonia-I, female farmer-family workers had specific roles such as calf keeper or farm manager. This horizontality promoted greater cooperation and facilitated the daily management of the farms and the resolution of conflicts. In Galicia-I and Catalonia-I, on the other hand, the hierarchy of farmers was more traditional.

Hierarchical differences between farm workers and farmers may contribute, at least in this study, to the incorrect implementation of biosecurity measures by workers. These differences may also exist between other stakeholders on other issues, such as between senior and junior veterinarians on antibiotic prescribing (Moya et al., 2024a; Tompson et al., 2021; Coyne et al., 2016). However, these hierarchical differences between workers and farmers can lead to moments of tension and conflict between them. In particular, in the farms included in this study, those with external worker-employees tended to experience more tensions and conflicts than those with farmer-family workers and internal worker-employees. As a result, workers may implement biosecurity measures incorrectly, either accidentally or deliberately. As Foucault (1980) articulates, power relations, such as hierarchical differences, are inherent in social interactions and shape behaviours and practices in subtle and overt ways. One way to address these differences and their tensions and conflicts is to establish open channels of communication between all stakeholders, in which farmers can take into account workers’ perspectives (Klocker et al., 2020). Implementing conflict resolution mechanisms and encouraging regular feedback sessions can also help reduce tension and conflict and improve the working environment. Furthermore, in addition to these hierarchical differences between workers and farmers, workers are often marginalised, possibly due to their ‘invisibility’ within the primary sector (Saldanha, 2022). In fact, this marginalisation can manifest in a lack of recognition for their work and absence of representation in key farm decisions, further entrenching their unseen role within the sector. This analysis highlights how power dynamics can perpetuate marginalisation and resistance, further complicating these relationships (Foucault, 1980). In this sense, studies are needed to further explore these dynamics between workers and farmers, which may also be related to the turnover of these workers.

3.2. Anthropomorphic approach

The farm workers employed an anthropomorphic approach in their daily work, as defined by the authors. This approach entailed the view that animals were analogous to humans with regard to physiological processes, which informed the development of daily practices. On the Galicia-I farm, the workers, particularly the external worker-employees, were provided with their own changing and toilet facilities. Nevertheless, during cleaning one of the pens, two of the workers urinated in the same facilities as the animals. The workers asserted that cows were animals with physiological processes analogous to those of humans. Indeed, the workers asserted that the animals required exposure to infectious diseases in order to enhance their immune systems, in a manner analogous to that experienced by humans.

“While the farm workers were cleaning one of the pens, two of them started urinating in it. One of them commented ‘Urine is urine’, while the other added ‘It’s also a way for the cows to boost their immune systems’. When workers were asked about management protocols, the first replied ‘The cows piss, shit and eat just like us, and they are here just like us, so there is no problem’” (Excerpt of the field notes of Galicia-I)

Conversely, this approach also facilitated the care of the animals. One farm worker, specifically one of the farmer-family workers on the Galicia-II farm, perceived the calves as children in need of special care. The worker was wholly invested in the recuperation of calves exhibiting gastrointestinal symptoms as a consequence of bovine viral diarrhoea (BVD). Despite the challenging nature of the task, the worker dedicated herself to meticulously cleaning and disinfecting the calf area.

“The farm was experiencing an outbreak of BVD affecting calves. The farm worker gave the calves a feed supplement three times a day to replenish their lost electrolytes. The worker also cleaned and changed the calves’ bedding twice a day. In addition, whenever a calf died, the worker rigorously disinfected the entire area with chemical disinfectants such as bleach. She justified this practice by saying ‘I’m like a mother who has to take care of her sick children, otherwise they’ll die’” (Excerpt of the field notes of Galicia-II)

The anthropomorphic approach was observed on farms in Galicia but not in Catalonia, possibly because the farm workers did not speak the same language as the researcher, making it difficult to understand their practices in depth. In Catalonia, the absence of this approach seemed to be reflected in the fact that the workers simply followed the farmers’ instructions, with minimal involvement in animal management. In contrast to what happened in Galicia-II with the association of calves as ‘sick children’, a lack of involvement could lead to farm workers failing to detect early signs or symptoms of disease. With regard to gender differences, in Galicia, the association of calves as ‘sick children’ was observed with a female farm worker who took on the role of calf keeper. This association may relate not only to her gender but also to her involvement as a family member more engaged in animal management. In contrast, on farms in Catalonia, such as Catalonia-II, where most workers were non-family men, this association did not appear, possibly reflecting the different roles and dynamic observed in each setting.

The anthropomorphic approach resulted in farm workers either completely ignoring the implementation of biosecurity measures or becoming deeply involved in them. This approach can be unfavourable to companion animals, as it alters their natural behaviour and affects their physiological health (Mota-Rojas et al., 2021). In wildlife conservation, this approach can have positive effects through an empathetic attitude towards that conservation (Yue et al., 2021), as well as counterproductive attitude (Root-Bernstein et al., 2013). The anthropomorphic approach is undoubtedly an inherently humane stance (Airenti, 2018), although it remains a subject of ongoing debate. Therefore, while this approach can have negative effects on the animals, as in the case of workers who completely ignore biosecurity measures, it can also have positive effects, as in the case of a worker who becomes deeply involved in biosecurity practices. Bourdieu’s (1977) theory of practice helps us to understand that these daily practices are not simply individual choices but are influenced by the cultural structures within which the farm workers operate. The workers’ anthropomorphic approach can thus be seen as a manifestation of the habitus shaped by their cultural environment, which guides their actions and interpretations in ways that both challenge and conform to established biosecurity norms. To address this, training on animal behaviour and welfare can help workers understand the importance of biosecurity measures beyond an anthropomorphic perspective. In addition, fostering a culture that balances empathy for animals with adherence to scientific biosecurity practices can improve overall compliance and animal health.

It is also important to note that although it was the farm workers who

showed this anthropomorphic approach, it was also observed that farmers in Catalonia-I and Galicia-II associated animals with their ‘children’, although their priorities were more oriented towards the business aspects of animal management.

In addition to the social (communicative and hierarchical) differences and the anthropomorphic approach, it is important to note that the farms did not provide any direct or indirect training to farm workers on biosecurity and other management procedures. The farmers indicated that the primary rationale for this was the high turnover of workers and the associated loss of resources (time and money) involved in providing such training.

The results of this study showed that the subjectivities of farm workers in relation to the implementation of biosecurity measures were influenced by social (communicative and hierarchical) differences and an anthropomorphic approach. Firstly, communicative differences were understood as social structures (i.e. a complex framework of dynamics between groups and individuals through social roles and norms) characterised by Catalan-Spanish (in Catalan farms) and technical language. In the Galician farms, the fact that the participants were native speakers meant that there was no evidence of issues related to Galician-Spanish. Secondly, hierarchical differences were understood as power relations (i.e. dynamics of control and influence—whether visible or invisible, formal or informal—within and between social entities, including groups and individuals) that may limit the correction of faulty practices or contribute to the performance of biosecurity tasks that were carried out incorrectly by workers. Finally, the anthropomorphic approach was understood as the representation of animals (i.e. the representation of animal species in contexts where they can take on human characteristics), where workers associated dairy cattle with physiological processes and special care as in humans. These social factors interact in a complex way and have a direct or indirect impact on the implementation of biosecurity measures by workers on dairy cattle farms in Spain.

4. Limitations

The researcher, who had a dual role as farm worker and veterinarian during the ethnography, sometimes had to actively intervene when critical biosecurity situations arose. Mediation between farm workers and farmers was essential to ensure that biosecurity measures were properly implemented and that risks to animal health were minimised. Although these interventions may have influenced the researcher’s role as an observer, they are inherent to the dynamics of ethnographic research. The interaction between actors in the field and the need to maintain biosecurity placed the researcher in a more active role than would have been ideal from a purely observational perspective, reflecting the complexities and practical compromises of this type of research.

This ethnographic approach analysed the perspectives of farm workers on biosecurity practices. While these perspectives can be seen as a partial and subjective version of reality (Moore, 2005) influenced by researchers (Gellner, 1959), in reflexive thematic analysis this is seen as an integral part of the process. This analysis incorporates reflexivity by acknowledging how the researcher’s position as a male, veterinarian and non-native to the country but Catalan-Galician-Spanish speaker might have influenced the data generated. The researcher’s perspective on the implementation of biosecurity measures provides a concrete but inherently subjective view that enriches such an analysis. To complement this ethnographic approach, a methodological triangulation of the data is recommended, accompanying this approach with interviews and focus groups that enrich the understanding of the phenomenon studied (Briggs, 2007; Agar and MacDonald, 1995). According to Nowell et al. (2017), combining methods in reflexive thematic analysis strengthens the credibility and validity of findings. In addition, it was not possible to provide exclusive study time for all workers, as external worker-employees also worked elsewhere. Another limitation was the language barrier between the first author and the workers on the

Catalonia-I and Catalonia-II farms, as SM did not speak their languages. Finally, it is important to highlight the lack of gender perspective, where there were only four women, two in the role of calf keeper (Galicia-I and Galicia-II) and two in the role of farm manager (Galicia-II and Catalonia-I). However, based on the findings in relation to female farm workers, it can be noted that this is consistent with [Enticott et al. \(2022\)](#) who found that female farm workers often internalise and express their gender identity through caring practices, as was the case with the calf keepers. Finally, it is important to note that this study is exploratory in nature (as a first approximation) of the social and employment factors influencing the implementation of biosecurity measures by farm workers, which could be used as a basis for future in-depth studies.

5. Conclusions

Farm workers on dairy cattle farms in Spain have their own subjectivities that can influence the implementation of biosecurity measures. These subjectivities are defined by social differences, especially communicative and hierarchical differences, and by the anthropomorphic approach of these workers. This influence becomes important because these workers are an important stakeholder since they spend the most time on the farm and have the most contact with the animals. Furthermore, while these farms are heterogeneous in terms of both their social structure (and power relations) and their social organisation (i.e. the interactions and relationships within these structures), it is possible that these subjectivities may be repeated on other farms. It is even possible that these subjectivities are linked to the traditions of these farms ([Moya et al., 2020b](#)). On the other hand, these social factors, combined with the poor working conditions of workers in the primary sector, such as temporary employment, as well as previous experiences on different farms, in different countries, or in other sectors, may be more unfavourable to biosecurity practices. Additionally, it is important to recognise that, alongside these factors, there are other elements that may also affect the implementation of these practices, which have not been considered in this study, and which may be configured differently depending on the context of each farm ([Moya et al., 2024b](#)). Therefore, farm workers should be involved alongside farmers and veterinarians in intervention programmes, whether broad or specific, such as those related to biosecurity. This would not only professionalise the role of these workers, but also make them visible as a key stakeholder contributing to improved biosecurity standards on these farms. Consequently, this consideration could also motivate these workers ([Kolstrup, 2012](#)), reducing farm worker turnover and increasing their permanence within the farms – a challenge recognised within modern agriculture around the world ([United States Department of Agriculture, 2024](#)). However, it is necessary to go beyond training and challenge the models of livestock systems so that they change their perspective and care for them and provide them with optimal working conditions.

Funding

This study was supported by the Comisión Nacional de Investigación Científica y Tecnológica (CONICYT) of Chile; the Universitat Autònoma de Barcelona (grant number B18P0040); the Ministerio de Ciencia e Innovación of Spain (grant numbers AGL2016-77269-C2-1-R, AGL2016-77269-C2-2-R); and the European Regional Development Fund (ERDF).

Ethical statement

This study was approved by the Ethics Committee of the Universitat Autònoma de Barcelona (CEEAH 4055). An informed consent form was used to explain the aims of the study and the conditions and guarantees of the participants. This document stated that the data would be treated confidentially and anonymously, that no financial compensation would be offered for participation, and that observations and conversations would be written down and audio recorded. Participation in the study

was completely voluntary and participants could withdraw at any time. Both the farmers, as representatives of their farms, and the first author signed this consent form, with a copy for each party. The farm workers were also informed of the aims and details of the study on the basis of this consent form and gave their verbal consent. In the case of farm workers who did not speak any of the first author's languages, a mobile phone application was used to assist with translation.

CRediT authorship contribution statement

Gareth Enticott: Supervision, Conceptualization, Writing - review & editing. **Sebastián Moya:** Writing - review & editing, Writing original draft, Visualization, Project administration, Investigation, Conceptualization, Formal analysis. **Josep Espluga-Trenc:** Supervision, Visualization, Writing - review & editing.

Declaration of Competing Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationship that could be construed as a potential conflict of interest.

Acknowledgments

The authors would like to thank all the participants in the ethnographic approach and Alberto Allepuz (AA), Jordi Casal (JC), Francisco Javier Diéguez (FJD) and Eduardo Yus (EY) for their help in recruiting them.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationship that could be construed as a potential conflict of interest.

References

- Abdullahi, M., Shehu, I., Sani, Y., 2020. A multilingual translation system for enhancing agricultural e-extension services delivery. *International Conference on Information and Communication Technology and Its Applications*. Federal University of Technology, Minna, Nigeria.
- Agar, M., 1980. *The professional stranger: An informal introduction to ethnography*. Academic Press, New York.
- Agar, M., MacDonald, J., 1995. Focus groups and ethnography. *Hum. Organ.* 54 (1), 78–86. (<http://www.jstor.org/stable/44126575>).
- Airenti, G., 2018. The development of anthropomorphism in interaction: Intersubjectivity, imagination, and theory of mind. *Front Psychol.* 9, 2136. <https://doi.org/10.3389/fpsyg.2018.02136>.
- Aleri, J., Laurence, M., 2020. A description of biosecurity practices among selected dairy farmers across Australia. *Anim. Prod. Sci.* 60, 1711–1720. <https://doi.org/10.1071/AN19340>.
- Archer, M., 1995. *Realist social theory: The morphogenetic approach*. Cambridge University Press, Cambridge.
- Arcury, T., Estrada, J., Quandt, S., 2010. Overcoming language and literacy barriers in safety and health training of agricultural workers. *J. Agromedicine* 15 (3), 236–248. <https://doi.org/10.1080/1059924X.2010.486958>.
- Balzani, A., Hanlon, A., 2020. Factors that influence farmers' views on farm animal welfare: A semi-systematic review and thematic analysis. *Animals* 10 (9), 1524. <https://doi.org/10.3390/ani10091524>.
- Benschop, J., Collins-Emerson, J., Maskill, A., O'Connor, P., Tunbridge, M., Yupiana, Y., Weston, J., 2017. Leptospirosis in three workers on a dairy farm with unvaccinated cattle. *N. Z. Med. J.* 130 (1462), 102–108.
- Berhanu, K., Ayana, D., Megersa, B., Ashenafi, H., Waktole, H., 2022. Cryptosporidium in human-animal-environment interphase at Adama and Asella areas of Oromia regional state, Ethiopia. *BMC Vet. Res.* 18, 402. <https://doi.org/10.1186/s12917-022-03497-w>.
- Bhaskar, R., 2008. *A realist theory of science*. Routledge, New York.
- Bourdieu, P., 1977. *Outline of a theory of practice*. Cambridge University Press, Cambridge.
- Braun, V., Clarke, V., 2006. Using thematic analysis in psychology. *Qual. Res. Psychol.* 3 (2), 77–101. <https://doi.org/10.1191/1478088706QP0630A>.
- Braun, V., Clarke, V., 2019. Reflecting on reflexive thematic analysis. *Qual. Res. Sport Exerc. Health* 11 (4), 589–597. <https://doi.org/10.1080/2159676X.2019.1628806>.

- Braun, V., Clarke, V., 2020. One size fits all? What counts as quality practice in (reflexive) thematic analysis? *Qual. Res. Psychol.* 18 (3), 328–352. <https://doi.org/10.1080/14780887.2020.1769238>.
- Brennan, M., Christley, R., 2012. Biosecurity on cattle farms: A study in north-west England. *PLoS One* 7 (1), e28139. <https://doi.org/10.1371/journal.pone.0028139>.
- Briggs, C., 2007. Anthropology, interviewing, and communicability in contemporary society. *Curr. Anthropol.* 48 (4), 551–580. <https://doi.org/10.1086/518300>.
- Collins, F., Bayliss, T., 2020. The good migrant: Everyday nationalism and temporary migration management on New Zealand dairy farms. *Polit. Geogr.* 80, 102193. <https://doi.org/10.1016/j.polgeo.2020.102193>.
- Coyne, L., Latham, S., Williams, N., Dawson, S., Donald, I., Pearson, R., Smith, R., Pinchbeck, G., 2016. Understanding the culture of antimicrobial prescribing in agriculture: A qualitative study of UK pig veterinary surgeons. *J. Antimicrob. Chemother.* 71(3), 3300–3312. <https://doi.org/10.1093/jac/dkw300>.
- De Llano, P., 1989. *Arquitectura popular en Galicia*. C.O.A.G. La Coruña, Spain.
- Dhaka, P., Chantziaras, I., Vijay, D., Singh, M., Bedi, J., Caekebeke, N., Dewulf, J., 2023. Situation analysis and recommendations for the biosecurity status of dairy farms in Punjab, India: A cross-sectional survey. *Animals* 13 (22), 3458. <https://doi.org/10.3390/ani13223458>.
- Diniso, Y., Jaja, I., 2021. Dairy farm-workers' knowledge of factors responsible for culling and mortality in the Eastern Cape Province, South Africa. *Trop. Anim. Health Prod.* 53 (3), 398. <https://doi.org/10.1007/s11250-021-02845-6>.
- Dobos, A., Balla, E., 2021. Industrial dairy cattle farms in Hungary source of *Coxiella burnetii* infection in humans. *Vector Borne Zoonotic Dis.* 21 (7), 498–501. <https://doi.org/10.1089/vbz.2020.2749>.
- Duarte, F., Allepuz, A., Casal, J., Armengol, R., Mateu, E., Castellà, J., Heras, J., Ciaravino, G., 2024. Characterization of biosecurity practices among cattle transport drivers in Spain. *Prev. Vet. Med.* 224, 106138. <https://doi.org/10.1016/j.prevetmed.2024.106138>.
- Elshohby, I., Ahmed, H., El-Diasty, M., Elgedawy, M., Mahrous, E., El Hofy, F., 2020. Serological and molecular evidence of *Mycobacterium bovis* in dairy cattle and dairy farm workers under the intensive dairy production system in Egypt. *J. Appl. Microbiol.* 129 (5), 1207–1219. <https://doi.org/10.1111/jam.14734>.
- Enticott, G., 2008. The ecological paradox: Social and natural consequences of the geographies of animal health promotion. *Trans. Inst. Br. Geogr.* 33 (4), 433–446. <https://doi.org/10.1111/j.1475-5661.2008.00321.x>.
- Enticott, G., 2012. The local universality of veterinary expertise and the geography of animal disease. *Trans. Inst. Br. Geogr.* 37, 75–88. (<http://www.jstor.org/stable/41427929>).
- Enticott, G., 2014. Relational distance, neoliberalism and the regulation of animal health. *Geoforum* 52, 42–50. <https://doi.org/10.1016/j.geoforum.2013.12.004>.
- Enticott, G., O'Mahony, K., Shortall, O., Sutherland, L., 2022. Natural born carers? Reconstituting gender identity in the labour of calf care. *J. Rural Stud.* 95, 362–372. <https://doi.org/10.1016/j.jrurstud.2022.09.034>.
- European Commission, 2016. Regulation (EU) 2016/429 of the European Parliament and of the Council of 9 March 2016 on transmissible animal diseases and amending and repealing certain acts in the area of animal health ('Animal Health Law').
- Farquhar, S., Shadbeh, N., Samples, J., Ventura, S., Goff, N., 2008. Occupational conditions and well-being of indigenous farmworkers. *Am. J. Public Health* 98 (11), 1956–1959. <https://doi.org/10.2105/AJPH.2007.124271>.
- Fetterman, D., 2010. *Ethnography. Step-by-step*. SAGE Publications, Los Angeles.
- Foucault, M., 1980. *Power/Knowledge: Selected interviews and other writings 1972–1977*. Pantheon Books, New York.
- Gellner, E., 1959. *Words and things*. Penguin, London.
- Gobo, G., 2008. *Doing ethnography*. SAGE Publications, London.
- Gwaze, F., Mwale, M., Chimonyo, M., 2011. Challenges encountered in conducting farmer-oriented livestock research among resource-limited farmers of Sub-Saharan Africa: A review. *Afr. J. Agric. Res.* 6 (21), 4840–4851.
- Hammersley, M., Atkinson, P., 2019. *Ethnography: Principles in practice*. Routledge, London.
- Harun, M., Shimelis, S., Andargie, B., Abdi, M., Bekere, H., 2022. Assessment of biosecurity status in dairy cow farms. *Bull. Natl. Res. Cent.* 46, 152. <https://doi.org/10.1186/s42269-022-00836-7>.
- Hazel, S., Svennevig, J., 2018. Multilingual workplaces – Interactional dynamics of the contemporary international workforce. *J. Pragmat.* 126, 1–9. <https://doi.org/10.1016/j.pragma.2017.11.005>.
- Hoggart, K., Mendoza, C., 1999. African immigrant workers in Spanish agriculture. *Sociol. Rural.* 39, 538–562. <https://doi.org/10.1111/1467-9523.00123>.
- Huber, N., Andraud, M., Sassu, E.L., Prigge, C., Zoche-Golob, V., Käsbohrer, A., D'Angelantonio, D., Viltrop, A., Żmudzki, J., Jones, H., Smith, R.P., Tobias, T., Burrow, E., 2022. What is a biosecurity measure? A definition proposal for animal production and linked processing operations. *One Health* 15, 100433. <https://doi.org/10.1016/j.onehlt.2022.100433>.
- Imada, J., Roche, S., Thaivalappil, A., Bauman, C., Kelton, D., 2023. Investigating Ontario dairy farmers motivations and barriers to the adoption of biosecurity and Johnes' control practices. *J. Dairy Sci.* 106 (4), 2449–2460. <https://doi.org/10.3168/jds.2022-22528>.
- Klocker, N., Dun, O., Head, L., Gopal, A., 2020. Exploring migrants' knowledge and skill in seasonal farm work: More than labouring bodies. *Agric. Hum. Values* 37, 463–478. <https://doi.org/10.1007/s10460-019-10001-y>.
- Kolstrup, C., 2012. What factors attract and motivate dairy farm employees in their daily work? *Work* 41 (1), 5311–5316. <https://doi.org/10.3233/WOR-2012-0049-5311>.
- La Cooperativa Campesina de California, 2023. 31 California farmworker facts you should know. (<https://lacooperativa.org/31-california-farmworker-facts-you-should-know/#:~:text=Between%201%2F3%20and%201,of%20California's%20farmworkers%20are%20undocumented>).
- Lipsky, M., 1980. *Street-level bureaucracy dilemmas of the individual in public services*. Russell Sage Foundation, New York.
- Lowe, P., Clark, J., Seymour, S., Ward, N., 1997. *Moralizing the environment countryside change, farming and pollution*. UCL Press, London.
- Martinez, A., Salazar, L., Pietrosemoli, S., Schmidt, M., Awosile, B., Garcia, A., 2024. Understanding communication barriers: Demographic variables and language needs in the interaction between English-speaking animal professionals and Spanish-speaking animal caretakers. *Animals* 14, 624. <https://doi.org/10.3390/ani14040624>.
- Merenda, V., De Oliveira, E., Lopez-Soriano, M., Arruda, A., Robbins, A., Pais-García, M., 2023. Dairy workers' attitudes toward dairy cattle euthanasia. *J. Dairy Sci.* 106 (10), 7076–7088. <https://doi.org/10.3168/jds.2023-23223>.
- Ministerio de Agricultura y Pesca, Alimentación y Medio Ambiente, (2016). Informe nacional de vacuno de leche.
- Ministerio de Agricultura, Pesca y Alimentación, 2023. Real Decreto 364/2023, de 16 de mayo, por el que se establecen las bases de desarrollo de la normativa de la Unión Europea de sanidad animal, en lo relativo a las obligaciones de vigilancia del titular de la explotación y al plan sanitario integral de las explotaciones ganaderas, y por el que se modifican varias normas de ordenación ganaderas.
- Ministerio de Agricultura, Pesca, Alimentación y Medio Ambiente, 2018. Panel situación sector lácteo España. <https://www.mapa.gob.es/es/ganaderia/temas/produccion-y-mercados-ganaderos/sectores-ganaderos/vacuno-lechero/informacion-del-sector/informes.aspx>.
- Ministerio de la Presidencia, Relaciones con las Cortes y Memoria Democrática, 2022. Real Decreto 1053/2022, de 27 de diciembre, por el que se establecen normas básicas de ordenación de las granjas bovinas.
- Moore, H., 2005. *The truths of anthropology*. *Camb. Anthropol.* 25, 52–58.
- Moore, D., Merryman, M., Hartman, M., Klingborg, D., 2008. Comparison of published recommendations regarding biosecurity practices for various production animal species and classes. *J. Am. Vet. Med. Assoc.* 233 (2), 249–256. <https://doi.org/10.2460/javma.233.2.249>.
- Mota-Rojas, D., Mariti, C., Zdeinert, A., Riggio, G., Mora-Medina, P., Del Mar Reyes, A., Gazzano, A., Domínguez-Oliva, A., Lezama-García, K., José-Pérez, N., Hernández-Ávalos, I., 2021. Anthropomorphism and its adverse effects on the distress and welfare of companion animals. *Animals* 11 (11), 3263. <https://doi.org/10.3390/ani11113263>.
- Moya, S., Chan, K., Hinchliffe, S., Buller, H., Espluga, J., Benavides, B., Diéguez, F.J., Yus, E., Ciaravino, G., Casal, J., Tirado, F., Allepuz, A., 2021. Influence on the implementation of biosecurity measures in dairy cattle farms: Communication between veterinarians and dairy farmers. *Prev. Vet. Med.* 190, 105329. <https://doi.org/10.1016/j.prevetmed.2021.105329>.
- Moya, S., Coviglio, A., Belloc, C., Comer, C., Eberhart, J., Fortané, N., Paul, M., 2024a. A qualitative analysis of the unwritten rules influencing antibiotic prescribing practices among French poultry veterinarians. *JAC Antimicrob. Resist.* 6 (2), d1ae044. <https://doi.org/10.1093/jacamr/d1ae044>.
- Moya, S., Hibbard, R., Asenjo, G., Skjølstrup, N., Chan, K., Eberhart, J., Fortané, N., Paul, M., 2024b. Capturing the complexity of veterinarians' antibiotic prescribing practices in the livestock sector: A meta-ethnography across contexts. *JAC Antimicrob. Resist.* 6 (6), d1ae177. <https://doi.org/10.1093/jacamr/d1ae177>.
- Moya, S., Navea, J., Casal, J., Ciaravino, G., Yus, E., Diéguez, F.J., Benavides, B., Tirado, F., Allepuz, A., 2023. Government veterinarians' perceptions of routine biosecurity focused on dairy cattle farms in north-western and north-eastern Spain. *Front. Vet. Sci.* 10, 1043966. <https://doi.org/10.3389/fvets.2023.1043966>.
- Moya, S., Tirado, F., Diéguez, F.J., Allepuz, A., 2020b. From biosecurity to securityecologies: An analysis between old dairy farming traditions and routines and veterinary recommendations in Spain. *Sociol. Rural.* 61, 372–397. <https://doi.org/10.1111/soru.12333>.
- Moya, S., Tirado, F., Espluga, J., Ciaravino, G., Armengol, R., Diéguez, F.J., Yus, E., Benavides, B., Casal, J., Allepuz, A., 2020a. Dairy farmers' decision making to implement biosecurity measures: A study of psychosocial factors. *Transbound. Emerg. Dis.* 67 (2), 698–710. <https://doi.org/10.1111/tbed.13387>.
- Nowell, L., Norris, J., White, D., Moules, N., 2017. Thematic analysis: Striving to meet the trustworthiness criteria. *Int. J. Qual. Methods* 16, 1–13. <https://doi.org/10.1177/1609406917733847>.
- O'Brien, B., Harris, I., Beckman, T., Reed, D., Cook, D., 2014. Standards for reporting qualitative research: A synthesis of recommendations. *Acad. Med.* 89 (9), 1245–1251. <https://doi.org/10.1097/ACM.0000000000000388>.
- Pitard, J., 2017. A journey to the centre of self: Positioning the researcher in autoethnography. *Forum Qual. Soc. Res.* 18 (3). <https://doi.org/10.17169/fqs-18.3.2764>.
- Reeves, S., Kuper, A., Hodges, B., 2008. Qualitative research methodologies: Ethnography. *BMJ* 337, a1020. <https://doi.org/10.1136/bmj.a1020>.
- Richens, I., Houdmont, J., Wapenaar, W., Shortall, O., Kaler, J., O'Connor, H., Brennan, M., 2018. Application of multiple behaviour change models to identify determinants of farmers' biosecurity attitudes and behaviours. *Prev. Vet. Med.* 155, 61–74. <https://doi.org/10.1016/j.prevetmed.2018.04.010>.
- Roche, S., Kelton, D., Meehan, M., Von Massow, M., Jones-Bitton, A., 2019. Exploring dairy producer and veterinarian perceptions of barriers and motivators to adopting on-farm management practices for Johnes' disease control in Ontario, Canada. *J. Dairy Sci.* 102 (5), 4476–4488. <https://doi.org/10.3168/jds.2018-15944>.
- Root-Bernstein, M., Douglas, L., Smith, A., Verissimo, D., 2013. Anthropomorphized species as tools for conservation: Utility beyond prosocial, intelligent and suffering species. *Biodivers. Conserv.* 22, 1577–1589. <https://doi.org/10.1007/s10531-013-0494-4>.

- Sahlström, L., Virtanen, T., Kyyrö, J., Lyytikäinen, T., 2014. Biosecurity on Finnish cattle, pig and sheep farms - Results from a questionnaire. *Prev. Vet. Med.* 117, 59–67. <https://doi.org/10.1016/j.prevetmed.2014.07.004>.
- Saldanha, K., 2022. The invisibility of farmworkers: Implications and remedies. *Lat. Stud.* 20 (1), 28–49. <https://doi.org/10.1057/s41276-021-00349-w>.
- Sayers, R., Sayers, G., Mee, J., Good, M., Bermingham, M., Grant, J., Dillon, P., 2013. Implementing biosecurity measures on dairy farms in Ireland. *Vet. J.* 197 (2), 259–267. <https://doi.org/10.1016/j.tvjl.2012.11.017>.
- Scott, S., Rye, J., 2021. Praised, prized, yet penalised: A critical examination of low-wage hiring queues in the global strawberry industry. *J. Rural Stud.* 88, 473–481. <https://doi.org/10.1016/j.jrurstud.2021.04.014>.
- Singh, J., Singh, B., Tiwari, H., Josan, H., Jaswal, N., Kaur, M., Kostoulas, P., Khatkar, M., Aulakh, R., Gill, J., Dhand, N., 2020. Using dairy value chains to identify production constraints and biosecurity risks. *Animals* 10 (12), 2332. <https://doi.org/10.3390/ani10122332>.
- Swain, J., King, B., 2022. Using informal conversations in qualitative research. *Int. J. Qual. Methods* 21, 16094069221085056. <https://doi.org/10.1177/16094069221085056>.
- Tietze, S., Back, H., Piekkari, R., 2021. Multilingual and intercultural communication. In: Cooren, In.F., Stücheli-Herlach, P. (Eds.), *Handbook of management communication*. De Gruyter Mouton, Berlin, pp. 373–388.
- Timmermans, S., Tavory, I., 2012. Theory construction in qualitative research: from grounded theory to abductive analysis. *Soc. Theory* 30 (3), 167–186. <https://doi.org/10.1177/0735275112457914>.
- Tompson, A., Mateus, A., Brodbelt, D., Chandler, C., 2021. Understanding antibiotic use in companion animals: A literature review identifying avenues for future efforts. *Front. Vet. Sci.* 8, 719547. <https://doi.org/10.3389/fvets.2021.719547>.
- Torres-González, P., Soberanis-Ramos, O., Martínez-Gamboa, A., Chavez-Mazari, B., Barrios-Herrera, M., Torres-Rojas, M., Cruz-Hervert, L., Garcia-Garcia, L., Singh, M., Gonzalez-Aguirre, A., Ponce De Leon-Garduño, A., Sifuentes-Osornio, J., Bobadilla-Del-Valle, M., 2013. Prevalence of latent and active tuberculosis among dairy farm workers exposed to cattle infected by *Mycobacterium bovis*. *PLoS Negl. Trop. Dis.* 7 (4), e2177. <https://doi.org/10.1371/journal.pntd.0002177>.
- United States Department of Agriculture, 2024. Economic Research Service. Farm Labor, <https://www.ers.usda.gov/topics/farm-economy/farm-labor/>.
- Van Schaik, G., Dijkhuizen, A., Benedictus, G., Barkema, H., Koole, J., 1998. Exploratory study on the economic value of a closed farming system on Dutch dairy farms. *Vet. Rec.* 142 (10), 240–242. <https://doi.org/10.1136/vr.142.10.240>.
- Vargas-Bello-Pérez, E., Hernández-Castellano, L., 2019. Practical and innovative solutions to overcome language barriers in veterinary and animal science education in the European Union. *J. Appl. Anim. Res.* 47, 429–432. <https://doi.org/10.1080/09712119.2019.1651728>.
- Villaamil, F., Arnaiz, I., Allepuz, A., Molins, M., Lazaro, M., Benavides, B., Moya, S., Casal, J., Yus, E., Diéguez, F.J., 2020. A survey of biosecurity measures and serological status for bovine viral diarrhoea virus and bovine herpesvirus 1 on dairy cattle farms in north-west and north-east Spain. *Vet. Rec. Open* 7 (1), e000399. <https://doi.org/10.1136/vetreco-2020-000399>.
- Viveros-Guzmán, A., Gertler, M., 2015. Latino farmworkers in Saskatchewan: Language barriers and health and safety. *J. Agromedicine* 20 (3), 341–348. <https://doi.org/10.1080/1059924X.2015.1048400>.
- Wilson, W., Chaddha, A., 2009. The role of theory in ethnographic research. *Ethnography* 10 (4), 549–564. <https://doi.org/10.1177/1466138109347009>.
- Wolff, C., Abigaba, S., Sternberg Lewerin, S., 2019. Ugandan cattle farmers' perceived needs of disease prevention and strategies to improve biosecurity. *BMC Vet. Res.* 15 (1), 208. <https://doi.org/10.1186/s12917-019-1961-2>.
- Youssef, D., Wieland, B., Knight, G., Lines, J., Naylor, N., 2021. The effectiveness of biosecurity interventions in reducing the transmission of bacteria from livestock to humans at the farm level: A systematic literature review. *Zoonoses Public Health* 68 (6), 549–562. <https://doi.org/10.1111/zph.12807>.
- Yue, D., Tong, Z., Tian, J., Li, Y., Zhang, L., Sun, Y., 2021. Anthropomorphic strategies promote wildlife conservation through empathy: The moderation role of the public epidemic situation. *Int. J. Environ. Res. Public Health* 18 (7), 3565. <https://doi.org/10.3390/ijerph18073565>.
- Zhu, X., Wang, J., Zhang, Z., Yan, L., Liu, H., Chen, Y., Robertson, I.D., Guo, A., Aleri, J., 2023. A participatory approach to understand the attitudes and perceptions towards priority endemic cattle diseases among dairy farmers and animal health experts in Henan province, China. *Prev. Vet. Med.* 218, 105994. <https://doi.org/10.1016/j.prevetmed.2023.105994>.