



Veterinary health management in Azorean bovine dairy farms

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Abstract

Aim of study: To describe veterinary services and farm management practices in cattle dairy farms in São Miguel Island in the Azores and to identify weak points for improvement.

Area of study: São Miguel Island, Azores (Portugal).

Material and methods: A questionnaire survey was sent to all veterinarians who work in São Miguel Island. It asked about veterinary activity and perceptions of veterinarians working on dairy farms. The van der Waerden test was used to compare the degree of implementation of measures in farms between cooperative veterinarians and private veterinarians.

Main results: The overall questionnaire response rate was 67% (20/30). The percentage of veterinarians dedicated to bovine medicine as the main service was 55.6%. Overall, between 40% and 60% of veterinarians implemented a variety of Veterinary Herd Health Medicine (VHHM) programs such as mastitis control, breeding assessment and postpartum management, and the average implementation score of these VHHM, on a 1 to 5 scale, was 2.8 (95% confidence interval: 2.0-3.5). However, other VHHM programs such as biosecurity or hygiene procedures were implemented at a lower rate, ranging between 20% and 30%, and this needs to be improved.

Research highlights: Veterinary practitioners in São Miguel Island, Azores still focus their activity more on individual bovine medicine than in VHHM programs; besides, there is room for improvement in the implementation of some of these programs, such as reproduction, hoof health, nutrition, hygiene and biosecurity. This may be a similar situation to that of other regions in the world with a similar production structure.

Additional key words: herd health; individual medicine; practitioner; veterinary profession; dairy cattle; herd assessment.

Abbreviations used: CI (confidence interval); CV (cooperative veterinarians); IS (implementation score); PV (private veterinarians); SEM (standard error of the mean); VHHM (veterinary herd health management);

Citation: Medeiros, I; Fernandez-Novoa, A; Simoes, J; Astiz, S (2022). Short communication: Veterinary health management in Azorean bovine dairy farms. Spanish Journal of Agricultural Research, Volume 20, Issue 3, e05SC02. <https://doi.org/10.5424/sjar/2022203-18976>

Supplementary material (Annex; Tables S1-S3) accompanies the paper on SJAR's website.

Received: 09 Nov 2021. **Accepted:** 29 Jun 2022.

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Funding agencies/institutions	Project / Grant
Portuguese Foundation for Science and Technology (FCT)	Project UIDB/CVT/00772/2020 (CECAV)
	LA/P/0059/2020 (AL4AnimalS)

Competing interests: The authors have declared that no competing interests exist.

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Introduction

Azores is an archipelago with 9 islands located in the Atlantic Ocean, with a dairy cattle sector employing 17.6% of the active population and producing 30% of the Portuguese milk supply. As in other European and worldwide countries (Barkema *et al.*, 2015), the dairy sector has changed greatly in recent decades, with a reduction in the number of farms, an increase in herd size and an intensification of management systems. Cattle veterinarian services in São Miguel Island in the Azores are traditionally provided by professionals working at producers' organizations with partial public support (cooperative veterinarians; CV) and those working in the private sector and linked to animal nutrition firms (private veterinarians; PV). Similar organizational veterinary structures are observed in other Azores islands, in the north of mainland Portugal and other regions worldwide. The role of veterinarians has also inevitably changed (Svensson *et al.*, 2018; Weyl-Feinstein *et al.*, 2021). In addition to clinical services, practitioners are expected to advise on herd nutrition, housing, animal welfare, farm management and disease prevention. Veterinary herd health management (VHHM) programs are aimed at preventing herd health problems and enhancing productivity and economic efficiency (Svensson *et al.*, 2018), and has been demanded by Azorean producers (Medeiros *et al.*, 2021). The focus on health and prevention of disease at the herd level has become a priority and has partially replaced individual cow-oriented medicine (Derks *et al.*, 2013). The dairy cattle veterinary professionals in Azores are adapting to covering both types of demanded services. The present study aimed at understanding the extent to which veterinarians have achieved this objective by analyzing their response to a questionnaire survey addressing implemented veterinary practices and commonly encountered farm management problems in São Miguel Island dairy farms.

Material and methods

Questionnaire and veterinarians

The survey, carried out between July 2019 to December 2020, targeted every veterinarian working on dairy farms on São Miguel Island, Azores, including 22 veterinarians registered with the National Professional Register System working in cooperatives (CV), 7 veterinarians employed by animal nutrition companies (PV) and one additional PV with his own practice. The questionnaire used was a modified version of the one employed in a previous study (O'Shaughnessy *et al.*, 2013). The structured questionnaire addressed six topics (Annex [suppl]): veterinary experience, dedication to ambulatory clinical work, implementation of herd health programs such as mastitis control, biosecurity and hygiene, disease prevention and further

recommendations. The questionnaires were anonymously processed and included 26 closed, binary questions with 5 associated tables to express the degree of implementation of specific practices employing an implementation score (IS) on a 1 to 5 scale (1: low intensity/frequency of implementation and 5: maximal implementation), and five open-ended questions with five associated tables to register the degree of implementation (IS: 1-5) of 95 measures. The response rate considered questionnaires with replies to at least half of the questions.

Statistical analysis

Frequencies and proportions were calculated for qualitative binary variables and mean \pm standard error of the mean (SEM) and 95% confidence interval (95% CI) for quantitative ones. The van der Waerden test was used to compare the frequency of the different responses obtained regarding the veterinary activities between CV vs. PV vets, using the central estimations of the responses. The JMP® 14 software for Windows (SAS Institute, Cary, NC, USA) was used.

Results and discussion

This study summarizes the opinion of dairy cattle veterinarians in São Miguel Island, Azores (Portugal), on implemented veterinary practices, herd health status and farm management practices in dairy farms in the island. The questionnaire response rate was 66.7% (20/30), similar to that previously reported in other surveys (Gerber *et al.*, 2020). The mean (95% CI) number of years of professional experience of the surveyed veterinarians was 6.9 (3.8–10.3) years.

The percentage of practitioners performing different kinds of veterinary services is reported in Table 1. Integral service covering bovine medicine, consultancy, herd reproduction and nutritional management advice on at least one farm, was provided by 3/20 veterinarians (15.0%), and all were PV. Instead, official zoosanitary procedures such as mandatory disease surveillance and vaccination and hygiene programs, were performed by 55.6% (10/18) of respondents, all being exclusively CV (Table 1). Official zoosanitary procedures are still one of the most frequent veterinary services more commonly required by farmers not enrolled in herd-level disease prevention programs. The proportion of veterinarians involved in herd reproduction management and milk quality programs were 28% and 17%, respectively (Table 1).

The percentage of veterinarians performing health surveillance was significantly higher among CV than PV (54.6% vs. 0%; $p=0.03$). On the other hand, the percentage of veterinarians providing nutritional advice to farmers, as a specific veterinary service, was marginally higher among PV (43%; 3/7) than CV (9%; 1/11; $p=0.09$; Table 1). This

Table 1. Advisory/assessment of health programs implemented on dairy farms and implementation score (IS) according to a 5-point frequency scale (mean \pm SEM) by practitioners (CV vs PV), and percentage of veterinarians working by subject (veterinarian activity).

Veterinary activities	Percentage (n/N)	Average ^[1] (95% CI)	CV (n/N)	PV (n/N)	p value
Health surveillance	33.3 (6/18)	-	54.6% (6/11)	0% (0/7)	0.03
≥ 1 type of health plan implemented	77.8 (14/18)	-	72.7% (8/11)	85.7% (6/7)	0.52
Individual cow-oriented medicine	55.6 (10/18) ^[2]				
- Lameness		2.8 (2.1-3.6)	2.3 \pm 0.4 (10/11)	3.7 \pm 0.6 (6/7)	0.04
- Calf management		3.7 (2.9-4.4)	3.4 \pm 0.5 (10/11)	4.0 \pm 0.4 (7/7)	0.38
- Heifer management		2.8 (2.0-3.6)	2.3 \pm 0.4 (9/11)	3.8 \pm 0.6 (4/7)	0.07
- Dry cow management		3.5 (2.9-4.2)	3.1 \pm 0.4 (10/11)	4.2 \pm 0.5 (6/7)	0.04
Zoosanitary procedures	33.3 (6/18)				
- Biosecurity		3.0 (2.3-3.7)	2.9 \pm 0.4 (9/11)	3.3 \pm 0.8 (4/7)	0.52
- Parasite control		3.8 (3.1-4.4)	3.7 \pm 0.4 (9/11)	4.0 \pm 0.5 (5/7)	0.67
- Vaccination		3.9 (3.4-4.5)	4.0 \pm 0.3 (9/11)	3.8 \pm 0.6 (5/7)	0.75
Herd-level reproduction	27.8 (5/18)				
- Breeding assessment (AI/Sires)		2.5 (1.2-3.5)	1.6 \pm 0.4 (9/11)	4.9 \pm 0.8 (5/7)	0.02
- Fertility		3.9 (3.2-4.6)	3.3 \pm 0.4 (8/11)	4.8 \pm 0.2 (6/7)	0.009
- Postpartum management		4.1 (3.5-4.6)	3.7 \pm 0.3 (10/11)	4.7 \pm 0.2 (6/7)	0.03
Herd-level nutrition	22.2 (4/18)				
- Nutrition		3.5 (2.8-4.1)	2.8 \pm 0.3 (9/11)	4.5 \pm 0.2 (6/7)	0.002
Herd-level milk quality assessment	16.7 (3/18)				
- Adequate milking practices		3.8 (2.9-4.7)	3.6 \pm 0.6 (10/11)	4.2 \pm 0.5 (6/7)	0.42
- Mastitis control (complete) ^[3]		3.7 (3.0-4.4)	3.6 \pm 0.4 (10/11)	4.0 \pm 0.7 (4/7)	0.47
Animal welfare farm certification	5.6 (1/18)				

^[1] Scale 1–5; 1: low intensity/frequency of implementation and 5: maximal implementation. ^[2] Two respondents did not differentiate among services. ^[3] Mastitis control programs were implemented by 61.1% (11/18) of the veterinarians. 95% CI: 95% confidence interval. n/N: number of veterinarians with positive response with respect to all respondent veterinarians. CV: cooperative veterinarians. PV: private veterinarians. AI: artificial insemination.

is probably because PV worked for nutritional companies and providing such advice was their duty.

Eighteen veterinarians answered the health plans block (11 CV and 7 PV; Table 1). At least one type of health plan was implemented by 77.8% (14/18) of the veterinarians (Table 1). The implementation score (IS) averaged 2.8 (95% CI: 2.0–3.5), and was 2.1 \pm 0.2 for CV and 3.7 \pm 0.6 for PV ($p=0.05$). Mastitis plans included etiological culture, antibiogram, milking and parlor evaluation, mastitis and dry cow therapy, vaccination and on-farm culture protocols. Eighteen veterinarians answered this questionnaire block (12 CV; 6 PV), with 11/18 (61.1%) implementing mastitis control programs. The level of implementation by farmers of such programs was moderate (IS=3.2 \pm 0.2; $n=15$), according to 83.3% (15/18) of the veterinarians addressing this issue. Specifically, dry cow therapy was reported by 77.8% of the veterinarians responding (14/18), with an IS of 2.7 \pm 0.3 ($n=14$).

The nutritional programs were more likely implemented in dairy farms by PV (IS=2.8 \pm 0.3; $n=7$) than by CV

(IS=4.5 \pm 0.2; $n=11$; $p<0.01$). Moreover, PV implemented more frequently breeding assessment programs, including artificial insemination and/or bull sire selection, than CV did (IS=1.6 \pm 0.4 vs. 4.9 \pm 0.8, respectively; $p<0.05$). A similar situation was found for the implementation of fertility health programs, including for example, routine postpartum exams (IS=3.3 \pm 0.4 for PV vs. 4.8 \pm 0.2 for CV; $p<0.001$; Table 1). These results reflect that these issues are more important for nutritional consultants (in fact, private veterinarians), trying to maximize the frequency of new lactations and to optimize yields through an adequate reproductive efficiency.

The survey corroborated differences in the veterinary service provided by PV and CV in São Miguel Island, Azores, and this occurs also in other countries (Derks *et al.*, 2013). Despite similar ambulatory clinical services provided by both CV and PV, private veterinarians on São Miguel Island are significantly more focused on herd health, highlighting a trend of change in this region, as formerly described. Drivers for this can vary (PV more focused on integral service

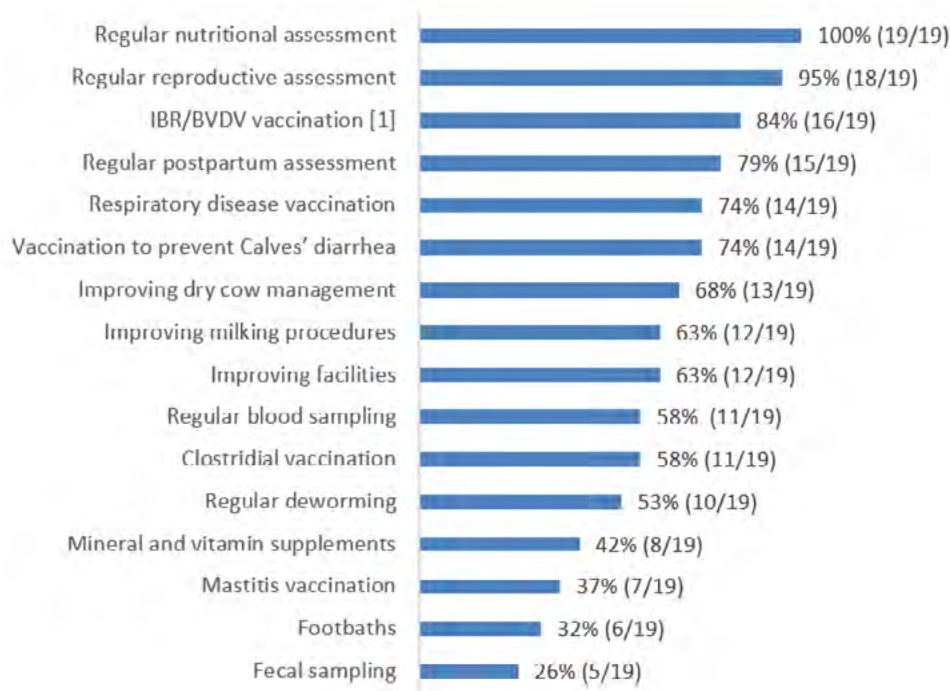


Figure 1. Percentage of practitioners considering the need for different preventive measures on dairy farms in the Azores. In parenthesis, n/N: number of veterinarians with a positive response among all responding veterinarians. [1] IBR, infectious bovine rhinotracheitis; BVDV, bovine viral diarrhea virus.

vs. CV on official zoosanitary procedures and bovine medicine) but moving beyond the traditional role of veterinarians is a fact all over the world (van der Leek, 2015). In Sweden, the lack of understanding of the benefits of such programs, organization and program adherence, coupled with a high turnover of veterinarians were the main reasons for farmers not to engage in VHHM programs (Svensson *et al.*, 2018). These are important issues that need to be considered to facilitate the implementation of VHHM in São Miguel Island and elsewhere. Veterinary herd health management contributes to a rapid increase in productivity, health, and economic efficiency in farms (Gertzell *et al.*, 2021). Moreover, the implementation of such services meets societal concerns about sustainable livestock production, animal welfare, disease prevention and biosecurity (Cannas da Silva *et al.*, 2006; Carmo *et al.*, 2018). Our study points out areas for improvement in Azores cattle veterinary practice particularly breeding assessment, disease prevention and control and biosecurity programs (Table S1 [suppl]) with an interesting perception of the prevalent problems perceived by the veterinarians. This divergence may reflect diversity of farmers and farm types, requiring different services based on the problems they experience (Fruscalso *et al.*, 2020; Weyl-Feinstein *et al.*, 2021).

Table S2 [suppl] shows that about half of the veterinarians (55.6%; 10/18) agreed that farmers implement preventive measures to avoid problems reported in Table S2, although their implementation was moderately frequent (IS=3.0±0.3; n=10).

Table S3 [suppl] shows that seasonal transhumance was practised in farms from 88.9% (16/17) of the veterinarians (IS=3.3; 95% CI: 2.8-3.8). Veterinarians with farms using antimicrobials adequately according to all rules of good practices accounted for 16.7% (3/18). Seventeen veterinarians answered the biosecurity and hygiene block (11 CV; 6 PV), with only 35% (6/17) reporting that farmers implemented appropriately biosecurity and hygiene programs (all CV; IS=2.1±0.3; n=6; Table S3). Low adherence to this kind of measure has been reported as a problem worldwide (Moya *et al.*, 2020), and it is an obvious challenge for farms in the Azores. Most farmers do not provide veterinarians disposable clothing for entering in their farms and biosecurity measures described were: (1) footbath/wheels entering disinfection, (2) professionals' cloths and material disinfection among farms, (3) limited cattle transhumance (seasonal cattle movement between pastures using public roads, to stay in pastures 1-3 weeks depending on the type of forages, until parcels are grazed), (4) land parceling, (5) limiting purchase of animals and testing and isolation/quarantine of incoming animals, (6) banned burial of animals on the land, (7) public health education, and (8) hygiene and milking routine improvement.

Veterinarians answering the questionnaire prevention block numbered 19 (13 CV; 6 PV) and 73.7% (14/19) stated that farms applied preventive measures with moderate frequency (IS=2.6±0.3; n=14; Table S3), and all of them considered that the degree of implementation was insufficient. Figure 1 presents the percentage of veterinarians that

consider specific practices important for successful dairy cattle production.

Farmers with complete vaccination programs are more likely to reduce disease dissemination and incidence, achieving higher milk yields and fertility. Likewise, nutrition programs are key issues in the herd health and efficiency of dairy farms (Cardoso *et al.*, 2020). Moving beyond traditional veterinary services towards VHHM programs requires a shift in mindset by both, the veterinarian and the client, which is sometimes forced by only one member of this equation: the veterinarian or the farmer (van der Leek, 2015). Shifting veterinary services from focusing on individual cow to herd-level medicine is often a matter of decades.

Nineteen veterinarians answered the further recommendations block (12 CV; 7 PV). The following recommendations were suggested: increasing yield efficiency; continuing education of farmers and consultants; digitalization of farm data (morbidity, cost analyses), evolution of the traditional mentality; and creation of a certified agrarian school.

This survey highlights that individual cow-oriented medicine, carried out by cooperative veterinarians, remains a large proportion of the veterinary service provided in dairy farms in São Miguel Island in the Azores. The implementation of veterinary herd health management programs, presently performed mostly by private veterinarians working for nutritional companies, needs enhancement, as a deep interrelationship between both veterinary services is likely to ensure ideal health and welfare in dairy farms. A higher investment in biosecurity, disease prevention and education of farmers in this region is needed. The results of our study should be pertinent to other regions of Portugal with similar farming and veterinary structures.

Authors' contributions

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Visualization: I. Medeiros, A. Fernandez-Novo, S. Astiz, J. Simões.

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Writing – review & editing: I. Medeiros, A. Fernandez-Novo, S. Astiz, J. Simões.

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Writing – original draft: L.B. Ferracioli, L.C. Carvalho, F.E.L. Budiño.

Writing – review & editing: F.E.L. Budiño.

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Table S1. Veterinarian's perception of health problems prevalence in dairy farms and prevalence score (PS), according to a 5-points scale^[1] (mean and 95% confidence interval) by the practitioners.

Health problem	PS Average	95% CI
Rearing problems		
Pneumonia (calves)	4.2	3.8-4.6
Diarrhea (calves)	4.0	3.4-4.6
Calves/heifers poor management	3.7	3.3-4.1
Umbilical alterations and infections	2.1	1.6-2.5
Meningitis	1.9	1.6-2.3
Congenital defects	1.4	1.1-1.8
Udder problems		
Mastitis (lactation)	4.1	3.7-4.6
Mastitis (dry cows)	2.6	2.1-2.9
Adult cows and heifers' problems		
<u>Metabolic problems</u>		
Diarrhea (adult cows)	3.7	3.1-4.3
Ketosis	3.6	3.0-4.2
Acidosis	3.4	2.9-4.0
Displacement abomasum	3.3	2.7-3.9
<u>Reproductive problems</u>		
Poor fertility (overall)	4.0	3.6-4.4
Abortion	3.4	2.8-3.9
Retained placenta	3.4	2.7-4.0
Repeat breeder's	3.1	2.5-3.7
<u>Infectious problems</u>		
IBR/BVDV ^[2]	3.7	3.1-4.3
Paratuberculosis	3.5	3.0-4.1
Clostridial diseases	2.2	1.7-2.7
<u>Others</u>		
Pneumonia (heifers and cows)	4.0	3.6-4.4
Lameness	3.9	3.2-4.5
Poor dry cow management	3.3	2.9-3.7
Toxins (fungal/vegetal)	3.0	2.5-3.5
Photosensitization	2.8	2.1-3.5
Parasitism	2.5	1.9-3.1
Sudden death	1.7	1.4-2.1
Nutritional problems		
Poor nutrition (low BCS) ^[3]	3.0	2.4-3.6
Mineral/vitamins deficiency	2.7	2.1-3.3
Hypomagnesemia	1.5	1.1-1.9

^[1] Scale 1 to 5: 1, scarcely prevalent (in<10% farms); 2, sometimes occurring (10–40% farms); 3, moderately prevalent (40-60% farms); 4, highly prevalent (>60% farms); 5, completely ubiquitous (100% farms).

^[2] IBR, infectious bovine rhinotracheitis; BVDV, bovine viral diarrhea virus.

^[3] BCS, body condition score.

Table S2. Specific veterinary procedures and degree of implementation score (IS), according to a 5-point scale^[1] (mean and 95% confidence interval) by the practitioners.

Procedure ^[2]	IS Average	95% CI
Hoof health procedures		
Digit amputation	1.0	1.0-1.0
Trimming	1.1	0.9-1.3
Disease control and surveillance		
Abortion pathogens diagnosis (laboratory)	2.0	1.4-2.6
Fecal samples for parasitology analyses	1.3	0.9-1.7
Serological study (specific pathogens)	2.3	1.8-2.9
Brucellosis surveillance	2.3	1.3-3.3
Tuberculosis surveillance	2.2	1.2-3.1
Monitoring BVDV ^[2]	2.0	1.2-2.8
Monitoring IBR ^[2]	2.0	1.4-2.7
Monitoring paratuberculosis	2.1	1.5-2.6
Monitoring leptospirosis	1.7	1.1-2.3
BRD (laboratory diagnosis) ^[2]	1.9	1.4-2.3
Postpartum (puerperal) disease management	3.1	2.4-3.9
Surgical procedures		
Castration (males)	1.1	0.9-1.3
Cesarian	1.5	1.1-2.0
Dehorning	1.3	0.9-1.7
RDA surgery ^[2]	1.7	1.3-2.2
LDA surgery ^[2]	2.6	2.1-3.2
Eye enucleation	1.1	0.9-1.2
Excision of eyelid tumors	2.2	1.6-2.8
Reproduction		
Routine ultrasound scanner reproductive examination	2.3	1.5-3.1
Pregnancy diagnosis	2.3	1.5-3.1
Dystocia/calving assistance	2.7	2.0-3.4
Ambulatory clinic		
Photosensitization	1.9	1.3-2.5
Necropsies	1.5	1.2-1.8
Intestinal torsion	1.3	1.1-1.6
Uterine torsion	2.5	1.8-3.1
Abomasal ulceration	1.6	1.1-2.1
Nutrition		
Body condition scoring	1.9	1.2-2.6
Blood monitoring for minerals	1.0	1.0-1.0
Udder health		
Mastitis control	2.8	2.1-3.4
Milk quality control	2.2	1.3-3.1
Preventive measures adopted by farmers ^[3]	3.0	2.5-3.5

^[1] Scale 1 to 5: 1, <10 procedures performed during the last 18 months; 2, 10–30 procedures; 3, 31–50 procedures; 4, >50 procedures (*e.g.*, diagnosis, treatments, prevention, control).

^[2] BVDV, bovine viral diarrhea virus; IBR, infectious bovine rhinotracheitis; BRD, bovine respiratory disease; RDA, right displacement abomasum; LDA, left displacement abomasum.

^[3] According to 55.6% (10/18) of the veterinarians.

Table S3. Degree of seasonal transhumance and implementation score (IS) preventive measures by farmers regarding the veterinarian's perception and according to a 5-point scale^[1].

Procedure	Percentage (n/N)	IS mean±SEM
Seasonal transhumance	88.9 (16/17)	3.3±0.2
Appropriate biosecurity and hygiene programs	35 (6/17)	2.1±0.3
Implementation of preventive measures	73.7 (14/19)	2.6±0.3

^[1] Scale 1-5: 1, low intensity/frequency of implementation and 5, maximal implementation.
SEM: standard error of the mean.

Annex. Survey on veterinary advise and health management to estimate differences depending on veterinary professional structure in bovine dairy farms from S. Miguel Island (Azores).

**Questionnaire
2020/2021**

Date: ___/___/_____

The following questionnaire is part of a survey, within the scope of my Master's Dissertation in Veterinary Medicine, which aims to understand the health management and know the principals' problems affecting São Miguel's dairy farms.

In the following questions, please sign the answers with a cross (X). In case of affirmative answers, follows a scale of 1 to 5. One (1) when applicable to a few farms, and five (5) when applicable to all farms. Please follow this scale as well on tables 1 and 3.

Thank you for your collaboration.

Personal Information (optional):

- Name: _____
- E-mail: _____
- Phone Number: _____
- Company: _____

Veterinary Experience:

- How many years have you been working in dairy farms of São Miguel Island? _____
- Is there any farm whose clinical work was your practice solely responsible?
 - Yes___ No___
 - If yes, how many? _____
- Services provided:
 - Individual Medicine: Yes___ No___
 - Zoosanitary procedures: Yes___ No___
 - Herd reproduction: Yes___ No___
 - Herd nutrition: Yes___ No___
 - Herd milk quality: Yes___ No___
 - Another: Yes___ No___
 - If yes, which? _____

Health Plans and Ambulatory Clinics:

- Do you normally apply health plans on the dairy farms you usually work on?

1	2	3	4	5

 - Yes___ No___

- If yes, what aspects do these plans cover?

- Approached aspects in health plans:

Questionnaire 1: Of the following topics, which do you usually advise your clients, in order to control the existing problems?

Plans	1	2	3	4	5
Adequate milking practices					
Mastitis control (complete)					
Breeding assessment (AI/Sires)					
Fertility					
Postpartum management					
Lameness					
Calf management					
Heifer management					
Dry cow management					
Nutrition					
Biosecurity					
Parasite control					
Vaccination					
Another					

Abbreviation: AI- Artificial insemination

- Veterinarian procedures performed by practitioners:

Questionnaire 2: In the past 12 to 18 months, did you perform any of the following procedures in dairy farms? If yes, please indicate on average, the number of interventions.

Procedures	N° of interventions			
	<10	10-30	30-50	>50
Digit amputation				
Trimming				
Abortion pathogens diagnosis (laboratory)				
Fecal samples for parasitology analyses				
Serological study (specific pathogens)				
Brucellosis surveillance				
Tuberculosis surveillance				
Monitoring BVDV				
Monitoring IBR				
Monitoring paratuberculosis				
Monitoring leptospirosis				
BRD (laboratory diagnosis)				
Postpartum (puerperal) disease management				
Castration (males)				
Cesarian				
Dehorning				
RDA surgery				
LDA surgery				
Eye enucleation				
Excision of eyelid tumors				
Routine ultrasound scanner reproductive examination				
Pregnancy diagnosis				
Dystocia/calving assistance				
Photosensitization				
Necropsies				
Intestinal torsion				
Uterine torsion				
Abomasal ulceration				
Body condition scoring				
Blood monitoring for minerals				
Mastitis control				
Milk quality control				

Abbreviations: BVDV, bovine viral diarrhoea virus; IBR, infectious bovine rhinotracheitis; BRD, bovine respiratory disease; RDA, right displacement abomasum; LDA, left displacement abomasum.

- List of main problems or diseases:

Questionnaire 3: From your point of view, what are the main problems that have affected or are still affecting dairy farms of São Miguel Island.

Problems	1	2	3	4	5
Pneumonia (calves)					
Diarrhea (calves)					
Calves/heifers poor management					
Umbilical alterations and infections					
Meningitis					
Congenital defects					
Mastitis (lactation)					
Mastitis (dry cows)					
Diarrhea (adult cows)					
Ketosis					
Acidosis					
Displacement abomasum					
Poor fertility (overall)					
Abortion					
Retained placenta					
Repeat breeder's					
IBR/BVDV					
Paratuberculosis					
Clostridial diseases					
Pneumonia (heifers and cows)					
Lameness					
Poor dry cow management					
Toxins (fungal/vegetal)					
Photosensitization					
Parasitism					
Sudden death					
Poor nutrition (low BCS)					
Mineral/vitamins deficiency					
Hypomagnesemia					

Abbreviations: IBR, infectious bovine rhinotracheitis; BVDV, bovine viral diarrhea virus; BCS, body condition score.

- Do you consider that farms take the necessary measures to avoid or reduce those problems?

Yes___ No___

1	2	3	4	5

- Do you consider that farmers make an appropriate and thoughtful use of antimicrobials?

Yes___ No___

1	2	3	4	5

- The farms to which you provide services, practice transhumance (seasonal movement of animal) using public roads?

Yes___ No___

1	2	3	4	5

Mastitis Control

- Do you usually implement mastitis control programs in dairy farms?

Yes___ No___

1	2	3	4	5

- If yes, what it consists of?

- Do you consider that farmers adopt good milking practices?

Yes___ No___

1	2	3	4	5

- And correct hygiene practices?

Yes___ No___

1	2	3	4	5

- Do you consider that farmers correctly apply drying protocols to the cows?

Yes___ No___

1	2	3	4	5

Biosecurity and hygiene in farms

- Do you consider that farms adopt appropriate biosecurity and hygiene measures?

○ Yes___ No___

1	2	3	4	5

- Individual clothing is provided by farms, when visiting them?

○ Yes___ No___

1	2	3	4	5

- In your opinion, what farmers should do, to improve biosecurity in their farms?

Prevention

- Do you consider that farms take the necessary preventive measures to decrease or avoid the appearance of diseases?

○ Yes___ No___

1	2	3	4	5

- In general, do you consider that the adopted measures are adequate?

○ Yes___ No___

1	2	3	4	5

- Considers that farms should invest more in preventive medicine?

○ Yes___ No___

- List of preventive measures:

Questionnaire 4: Considering the principal diseases that are affecting São Miguel Island dairy farms, from the following preventive measures; which one/s do you consider essential, to decrease and control those diseases?

Regular nutritional assessment	
Regular reproductive assessment	
IBR / BVD vaccination	
Regular postpartum assessment	
Respiratory diseases vaccination	
Vaccination to prevent calves' diarrhea	
Improving dry cow management	
Improving milking procedures	
Improving facilities	
Regular blood sampling	
Clostridial vaccination	
Regular deworming	
Mineral and vitamin supplements	
Mastitis vaccination	
Footbaths	
Fecal sampling	

Abbreviations: IBR- Infectious bovine rhinotracheitis; BVD- Bovine viral diarrhea virus

Further recommendations

- At the present, do you consider that the work performed by veterinarians adequate to the needs of the farmers?
 - o Yes___ No___
- Future guidelines for farmers and for Azorean livestock sector:

Questionnaire 5: In what should dairy farms focus and invest, in order to reduce their problems, improving productivity and yield?

Collaboration with veterinarians and related specialized technicians	
Continuous education and activity of existing workers	
Health management improvement	
Improvement of facilities	
Biosecurity improvement of dairy farms	
Other	

Comments/Recommendations:

Thank you for your collaboration!