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The use of animal-based measures at slaughter for assessing the welfare of calves on farm: EFSA's AHAW Network exercise

European Food Safety Authority

Abstract

The AHAW Network includes nationally appointed EU Member State organisations representatives with expertise in the fields of animal health and animal welfare. At the annual AHAW Network meeting held in June 2021, an exercise was held to collect information from Network members on the use of animal-based measures (ABMs) at slaughter to assess the welfare of calves on farm. A questionnaire was sent prior to the meeting to collect basic information on the use of such ABMs in the various European countries. Among the information, the ease of use, and the relationship of the ABMs with one or more welfare consequences were collected. During the meeting, the exercise continued with discussion and further elaboration of the information submitted. Meeting participants were asked to express their opinion by voting on the method of scoring the ABMs, their ease of use, and which ABMs to prioritize. The exercise was held for the assessment of ABMs during *ante-mortem* and *post-mortem* inspections and, as a result of this exercise, informative lists of the promising ABMs to be used at slaughterhouses to monitor the welfare of calves in the farm were produced.

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Key words: calves, animal-based measures, slaughter, welfare assessment, on-farm welfare, *ante-mortem* and *post-mortem* inspections.

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1. Introduction

The new Farm to Fork (F2F) strategy was published on 20 May 2020 (https://ec.europa.eu/food/sites/food/files/safety/docs/f2f_action-plan_2020_strategy-info_en.pdf) and includes a new comprehensive approach to increase European food sustainability.

In the framework of its F2F strategy, the EC has started a comprehensive evaluation of the animal welfare legislation and requested EFSA to provide a comprehensive and updated assessment of the scientific knowledge on welfare aspects of i) pigs, ii) calves, iii) laying hens, iv) broilers and v) animal transportation.

Against this background, the EC requested EFSA to review the available scientific publications and possibly other sources to provide a sound scientific basis for future legislative proposals.

EFSA is requested to: i) describe, based on existing literature and reports, the current husbandry systems and practices of keeping the animals ii) describe the relevant welfare consequences iii) define qualitative or quantitative measures to assess the welfare consequences (animal-based measures) iv) identify the hazards leading to these welfare consequences v) provide recommendations to prevent, mitigate or correct the welfare consequences (resource and management-based measures).

In addition, the EC has identified practical difficulties or insufficient information in ensuring the welfare of the animals in certain specific scenarios. For these specific scenarios, EFSA should propose detailed qualitative (yes/no question) or quantitative (minimum/maximum) animal-based measures (ABMs) and preventive and corrective measures.

In the F2F mandates, a specific scenario relates to defining ABMs collected and assessed in slaughterhouses to monitor the level of animal welfare on farms.

With specific reference to the protection of calves, EFSA is requested to collect evidence on the use of ABMs collected on slaughterhouses to monitor the level of welfare on calf farms¹, with specific reference to male dairy calves raised for the production of "white" veal meat.

EFSA is therefore developing the relevant sections of the scientific opinions on the welfare of calves, including a list of *ante-mortem* and *post-mortem* ABMs that could be used at slaughter to assess the welfare of calves on farm.

The AHAW Network includes nationally appointed EU Member State (including EFTA Countries) organisations representatives with expertise in the field of animal health and animal welfare. At the annual AHAW Network meeting held in June 2021, an exercise was carried out to collect information from Network members on the use of ABMs at slaughter to assess welfare of calves on farm.

2. Methodology

2.1. Questionnaires on the use of ABMs at slaughter to assess welfare on calf farms

Two questionnaires were sent to the Network representatives prior to the meeting to collect information from their countries.

The questionnaires were the following:

- questionnaire for *ante-mortem* inspection of calves
- questionnaire for *post-mortem* inspection of calves

The questionnaires reported an initial list of potentially relevant ABMs, together with their descriptions, produced by the EFSA working group (WG) experts modified after Boyle and Mee (2021). The list of ABMs and their descriptions is reported in the Annexes A and B of this report. These ABMs are also reported in Table 1 divided by *ante-mortem* and *post-mortem* use. A list of welfare consequences, and their descriptions, was also produced by EFSA's experts to be used to analyse the association between

¹ <https://open.efsa.europa.eu/questions/EFSA-Q-2020-00480>

ABMs at slaughter and welfare consequences on farm. The list of welfare consequences is reported in Annex C.

According to Council Directive 91/629/EEC a calf is defined as a bovine animal up to six months old². Both questionnaires aimed at collecting data on veal calves and not on beef calves.

Table 1: List of ABMs produced by the EFSA's WG experts, modified after Boyle and Mee (2021). Descriptions of ABMs are reported in the Annexes.

Calves	
<i>Ante-mortem (see Annex A)</i>	<i>Post-mortem (see Annex B)</i>
1. Body condition	1. Lung lesions -pneumonia
2. Lameness	2. Lung lesions - pleurites
3. Skin lesions- wounds/injuries	3. Pericarditis
4. Skin lesions - abscesses	4. Skin lesions – bruises
5. Manure on the body	5. Abscesses
6. Coughing/sneezing	6. Bursitis (swelling)
7. Nasal/ocular discharge	7. Abomasal lesions
8. Pumping/ Laboured breathing	8. Rumen lesions
9. Rectal prolapse	9. Rumen disorders
10. Hernia	10. Intestinal disorders
11. Diarrhoea	11. Carcass colour
	12. Carcass condemnations
	13. Carcass aspect

In each questionnaire, Network members were requested to:

- A. Indicate which of the listed ABMs are currently used in the slaughterhouses in the country as indicators of on-farm animal welfare;
- B. Indicate which scoring systems are in place to assess these ABMs;
- C. Provide an estimation of the ease of use of these ABMs (easy-medium-difficult);
- D. Identify the association between the ABMs and welfare consequences on farm.

2.2. Exercise during the meeting

2.2.1. Open discussion

² Council Directive 91/629/EEC of 19 November 1991 laying down minimum standards for the protection of calves OJ L 340, 11.12.1991, p. 28–32

The outcomes of these questionnaires were discussed during the AHAW Network meeting, held on 28-29 June 2021, where the exercise was extended to discuss the data submitted by Network members through the questionnaire. The main objectives were, for each ABM:

- to gather information on whether Network members have any database (electronic recording) of the ABM;
- to discuss the aim of monitoring the ABM at the slaughterhouse (i.e. if the ABM was already recorded with the specific purpose of assessing animal welfare, and/or for other purposes);
- to know Network members' opinion on future development, i.e. if in their country the monitoring system is likely to be implemented in future
- to discuss possible scoring systems
- to define the ease of use of the ABM in a monitoring process implemented at the slaughterhouse.
- to collect information on the association between the ABM and the calf welfare consequences on farm.

2.2.2. Poll

In the context of a possible set up of a European standardised monitoring system in the future, participants were invited to score three specific questions. Microsoft Forms (Microsoft ©) was the tool used to issue real-time polls and collect the answers. Each participant could submit the poll only once, and the submission was anonymous.

The questions of the poll were:

1. For each ABM: would it be sufficient to score yes/no, does it need a more detailed scoring, or is it impossible to assess this ABM?
2. Do you think the ease of use of this ABM is easy, medium, or difficult?
3. If only a limited number of ABMs is possible to score in practice, which are the most important ABMs to prioritize? Do you think this ABM is essential, desirable, not important?

Polling results were visualised, further analysed and commented in the plenary discussion. After the poll, the results were shown to the participants and a discussion was carried out to comment or explain the results.

3. Results of the assessment

Nine questionnaires were submitted, and the data were discussed at the meeting to get a common understanding on the information provided. This gave the opportunity to four additional Network members to add information on the use of ABMs in their countries.

From the questionnaire and the AHAW Network meeting it emerged that veal calf production is not uniform across the European countries: the main producers are Belgium, Italy, France, the Netherlands and Germany, a few countries are small producers (e.g. Austria) and others do not raise and slaughter bovines younger than six months (e.g. Sweden). In addition, some other countries (e.g. Ireland) slaughter calves but not for the production of 'white' veal meat (beef calves).

All the ABMs which were pre-listed in the questionnaires were reported as used at slaughter by one or more countries (Figures 1 and 6). A few additional ABMs related to the health status of the animals were suggested. These additional ABMs were reviewed in plenary discussion and it was agreed that they were already covered by carcass aspects and condemnations.

During the meeting discussion it was clarified that most of the ABMs are used for meat inspection for food safety and food quality purposes (with database), and only in few cases for assessing calf welfare on farms.

Moreover, the outcomes of this assessment are not routinely communicated to the farmers unless in the cases of severe situations. Communication to the farm can be initiated by the veterinary inspector at the slaughterhouse or the Food Business Operator (see sections 3.1.2 and 3.2.2 for more details).

The main outcomes of the entire exercise are reported in the following sections.

3.1. ABMs assessed in *ante-mortem* slaughter

The number of countries assessing each of the ABMs is in Figure 1.

As shown in Figure 1, most of the countries assessed in *ante-mortem* inspection of calves: skin lesions (all), lameness, manure on the body, hernia, rectal prolapse, body condition.

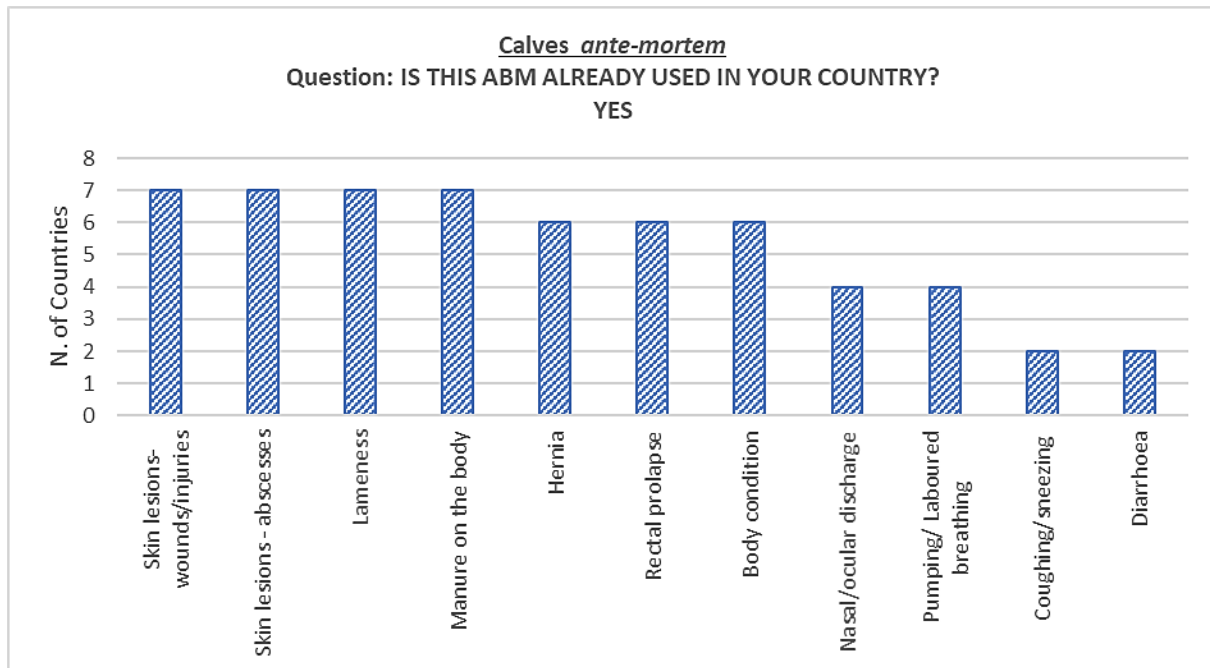


Figure 1: ABMs assessed in *ante-mortem* inspection in calves in the different countries. The y-axis indicates the number of countries (on a total of 9 responding countries) reporting the use of each ABM. The ABMs proposed by the EFSA working group are visualized in the x-axis.

3.1.1. Assessment of ABMs at slaughter in *ante-mortem* inspection by Competent Authorities (CAs) or Food Business Operators (FBOs)

Network members were requested to indicate whether the assessment of the ABMs *ante-mortem* was performed in the context of controls organised by Food Business Operators (FBOs), or in the context of official controls performed by Competent Authorities (CAs). The results showed that ABMs were only carried out by CAs (Figure 2).

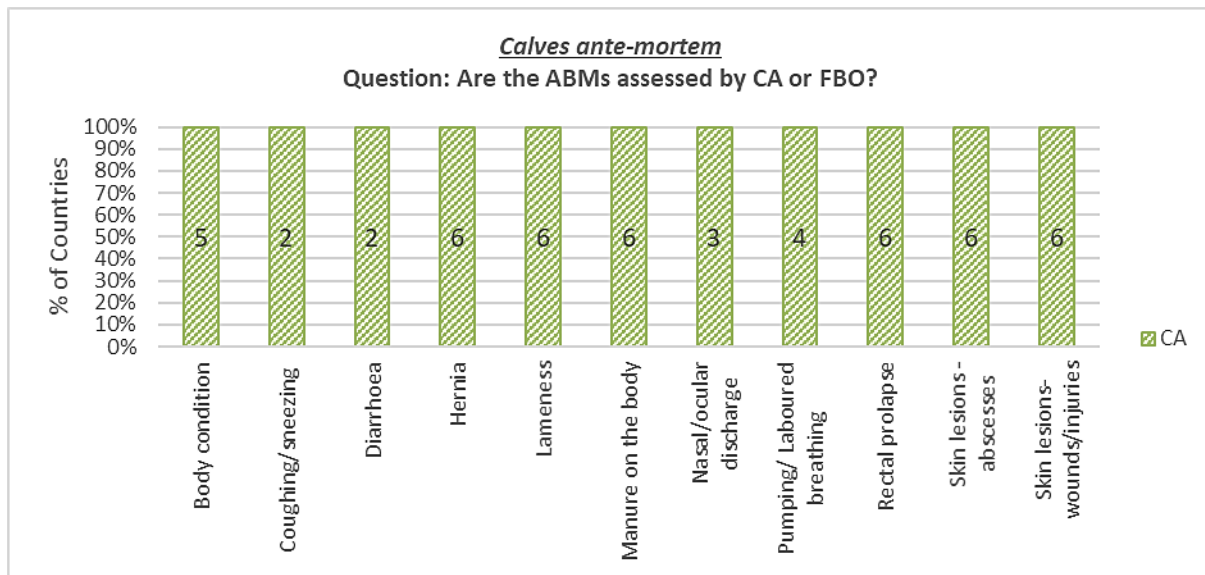


Figure 2: Proportion of countries where ABMs are used in *ante-mortem* inspection of calves by Competent Authorities (CAs) or Food Business Operators (FBOs). The histograms report the number of respondents.

3.1.2. Identification of on-farm welfare consequence associated to ABMs assessed *ante-mortem*

The results showed that the respondents associated each ABM monitored at slaughter with at least one on-farm welfare consequence (Table 2). Moreover, they considered many ABMs to be related to more than one welfare consequence. In particular, the assessment of skin lesion- wounds/injuries at slaughter was associated to 7 welfare consequences, and similarly lameness (5 welfare consequences) and body conditions (4). Coughing/sneezing, hernia, rectal prolapse, skin lesions-abscess were related to a single welfare consequence.

The results showed that for 15 out of the 33 on-farm welfare consequences proposed in the questionnaire there was at least one ABM associated.

Table 2: ABMs and relates welfare consequences in calves assessed *ante-mortem*, as suggested by respondents.

ABM observed at slaughter	On-farm related welfare consequences
Skin lesions-wounds/injuries	Bone lesions (incl. fractures and dislocations) Group stress Handling stress Locomotory disorders (including lameness) Resting problems Restriction of movement Soft tissue lesions and integument damage
Lameness	Bone lesions (incl. fractures and dislocations) Group stress Locomotory disorders (including lameness) Restriction of movement Soft tissue lesions and integument damage
Body condition	Gastro-enteric disorders Metabolic disorders Prolonged hunger

	Umbilical disorders and hernias
Manure on the body	Gastro-enteric disorders Resting problems Restriction of movement
Nasal/ocular discharge	Cold stress Heat stress Respiratory disorders
Diarrhoea	Gastro-enteric disorders Metabolic disorders
Pumping/Laboured breathing	Heat stress Respiratory disorders
Coughing/sneezing	Respiratory disorders
Hernia	Umbilical disorders and hernias
Rectal prolapse	Gastro-enteric disorders
Skin lesions- abscesses	Soft tissue lesions and integument damage

3.1.3. Scoring methods in *ante-mortem* assessment

In the questionnaire, details on the scoring method used to assess the ABMs used in *ante-mortem* inspection were requested.

Results showed that most of the respondents (64.0%) did not answer the question, because several countries do not slaughter calves for the production of 'white' veal meat. The 16.0% of the respondents used a simple assessment method based on presence/absence of the ABM (from here onward referred as 'yes/no scoring'), to quantify the prevalence in a batch. Only 1.3% selected 'other scoring system', precisely Italy indicated that the ABM 'manure on the body' is evaluated using a more detailed scoring system, according to different levels of manure on the body.

During the discussion at the meeting, some members highlighted the possibility of future development of these scoring methods, and it was agreed to further assess this item.

Therefore, at the meeting, participants were also asked to express their opinion on the need to use a simple or a more sophisticated scoring method, as a future development. This question was posted in the poll. Results showed that for most Network members and for most ABMs a simple Y/N score would be sufficient (see Figure 3). Only for the assessment of body condition, the development of a more detailed scoring system was suggested from most of the participants.

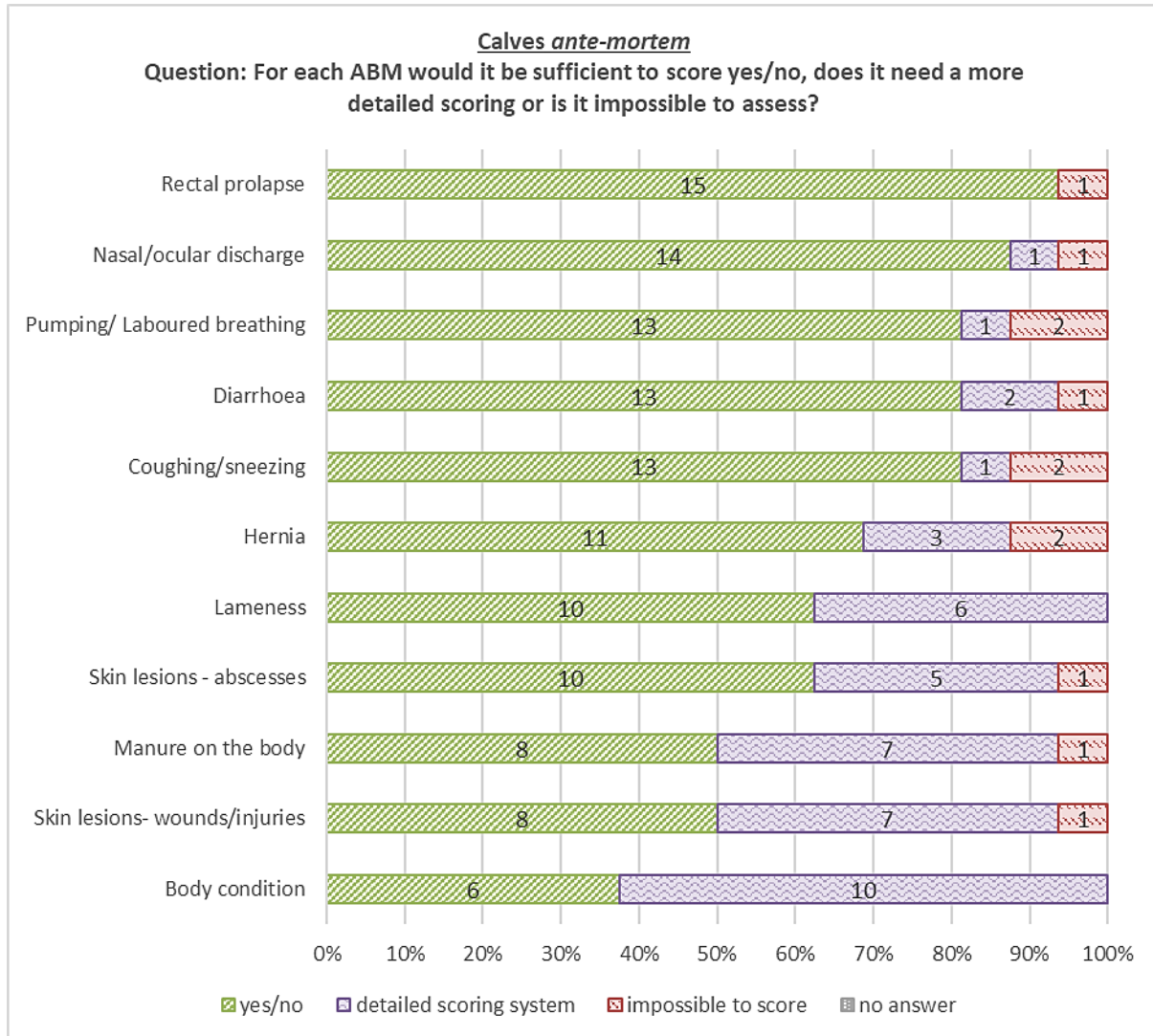


Figure 3: ABMs and scoring methods: results from the poll on the need of a simple or a more sophisticated method, as a future development. The histograms report the number of respondents.

3.1.4. Ease of use of ABMs assessed *ante-mortem*

Meeting participants were also asked to express their opinion on the ease of use of each ABM by classifying them in three categories: easy, medium or difficult. From the poll more than 50% of the respondents rated that ABMs easy to be used in *ante-mortem* assessment were: rectal prolapse, manure on the body, diarrhoea, hernia and nasal/ocular discharge (Figure 4).

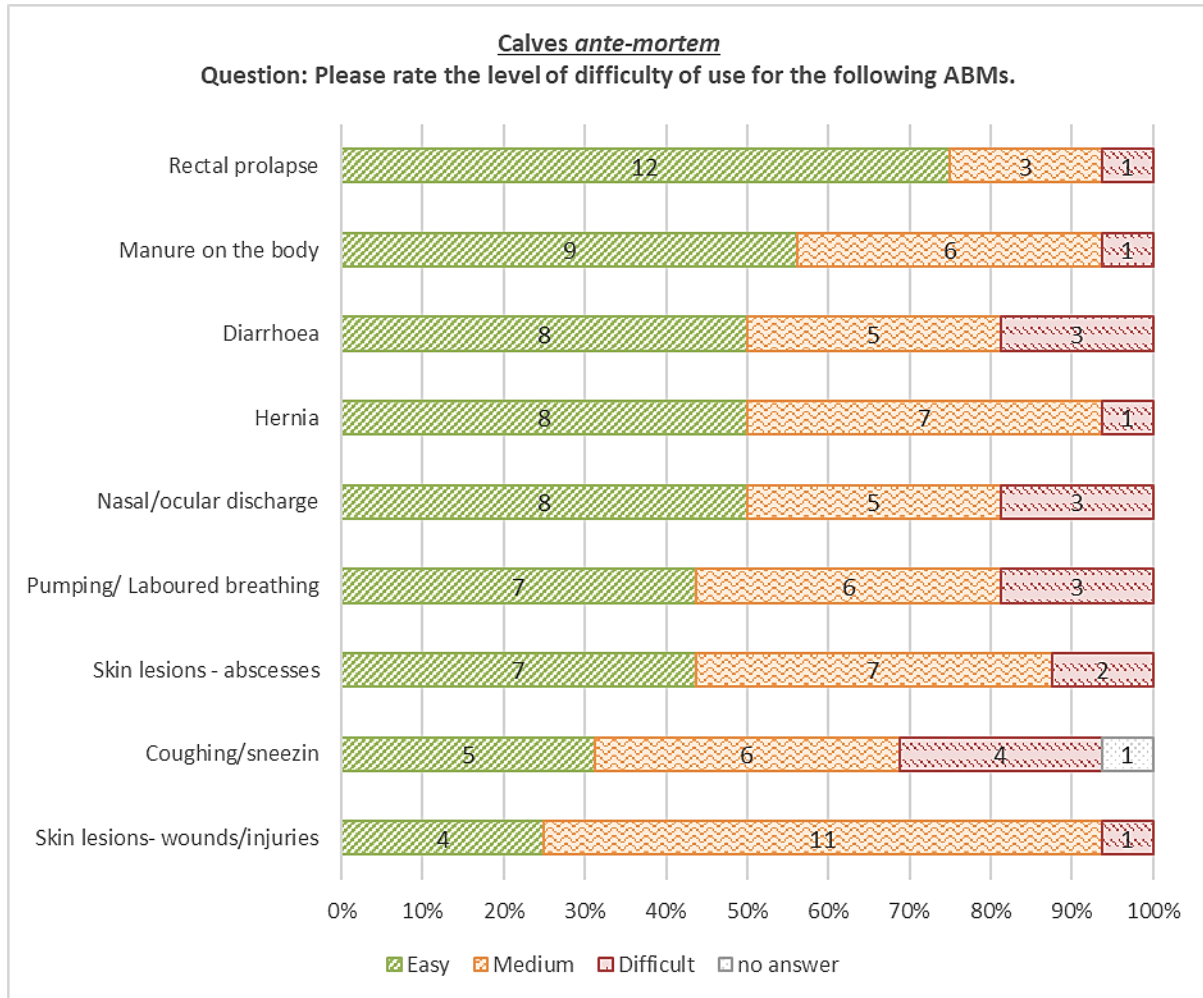


Figure 4: Results of the poll on the ease of use of ABMs. The histograms report the number of respondents.

3.1.5. Prioritization of ABMs *ante-mortem*

Network members were asked to prioritize the ABMs, i.e. to classify them as essential, desirable, or not important. The response from the poll was that the majority of the respondents polled that ABMs body condition, lameness and skin lesions- wounds/injuries should be prioritized when assessing the on-farm calves welfare using the ABMs at slaughter (Figure 5).

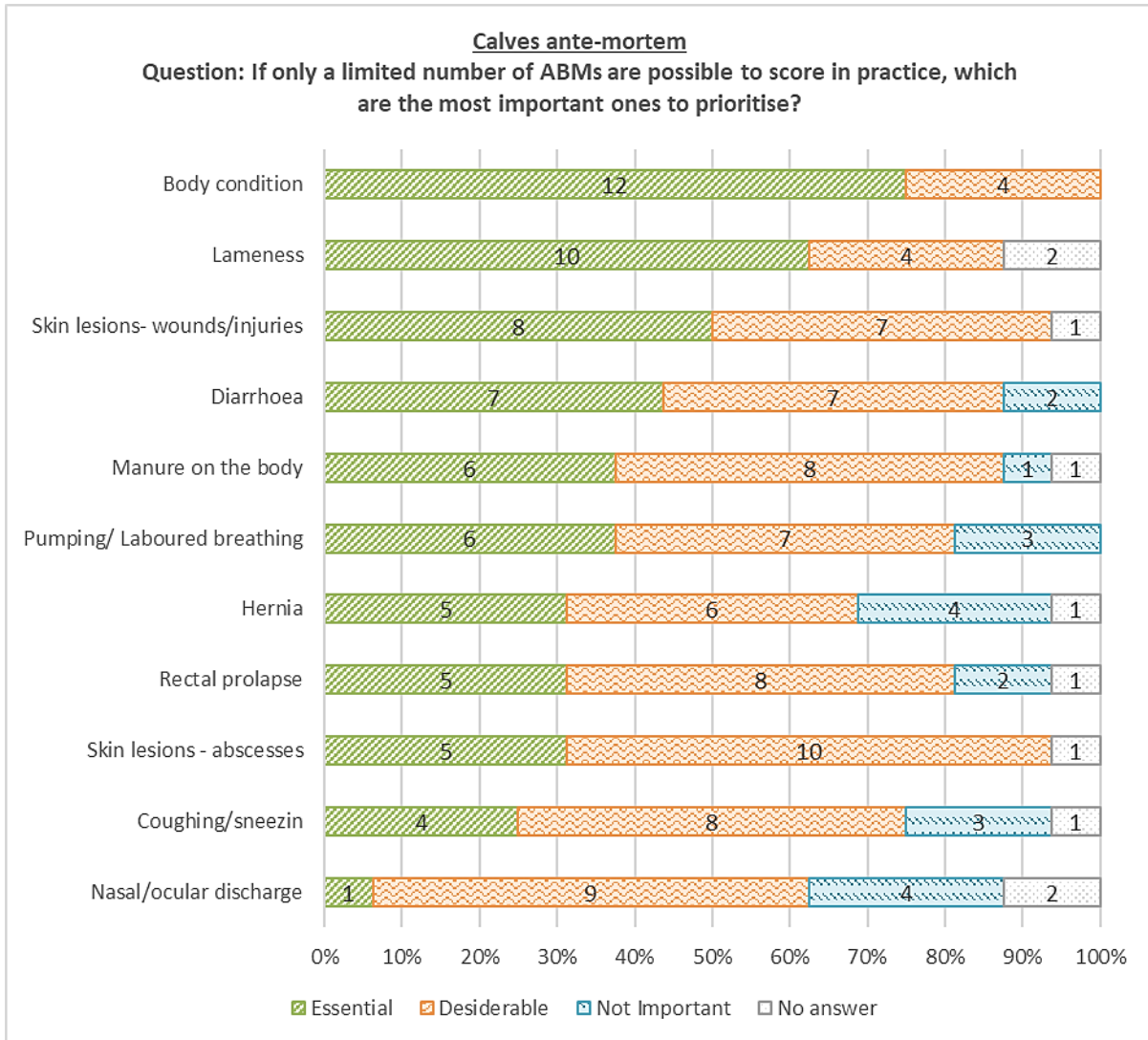


Figure 5: Results of exercise on prioritization of the ABMs. The histograms report the number of respondents.

3.2. ABM assessed *post-mortem* at slaughter

The number of countries assessing the proposed ABMs is in Figure 6.

As shown in Figure 6, during the *post-mortem* assessment in calves, ABMs that were used by more than 50% of the Network members who responded at the questionnaire were: lung lesions (all), pericarditis, abscesses, carcass condemnations, carcass aspects, bursitis (swelling) (Figure 6).

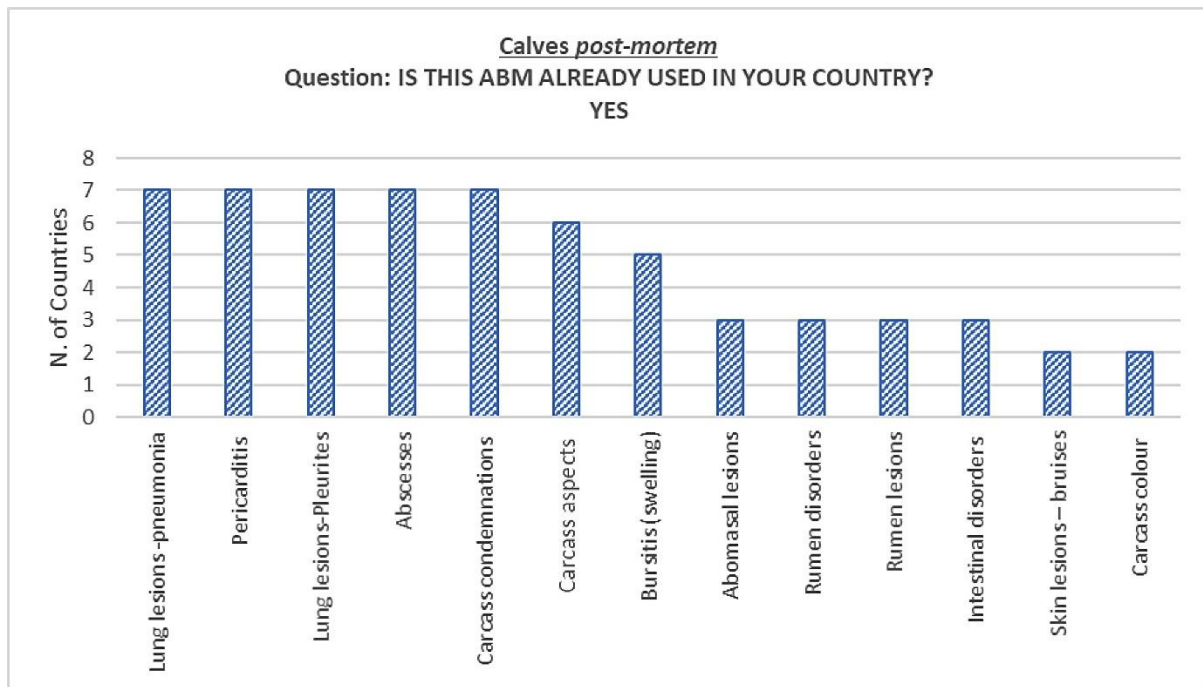


Figure 6: ABMs assessed in *post-mortem* inspection in calves in the different countries. The y-axis indicates the number of countries (on a total of 9 responding countries) reporting the use of each ABM. The ABMs proposed by the EFSA working group are visualized in the x-axis.

3.2.1. Assessment of ABMs at slaughter in *post-mortem* inspection by Competent Authorities or Food Business Operators

The results of this question showed that almost all ABMs (with the exception of carcass aspect) were assessed by the Competent Authorities (CAs) (Figure 7). From the open discussion it emerged also that many ABMs were recorded mainly for meat safety purposes, rather than animal welfare assessment. However, Network members recognized the opportunity to use the same ABMs in the welfare assessment protocols, to monitor on-farm calf conditions.

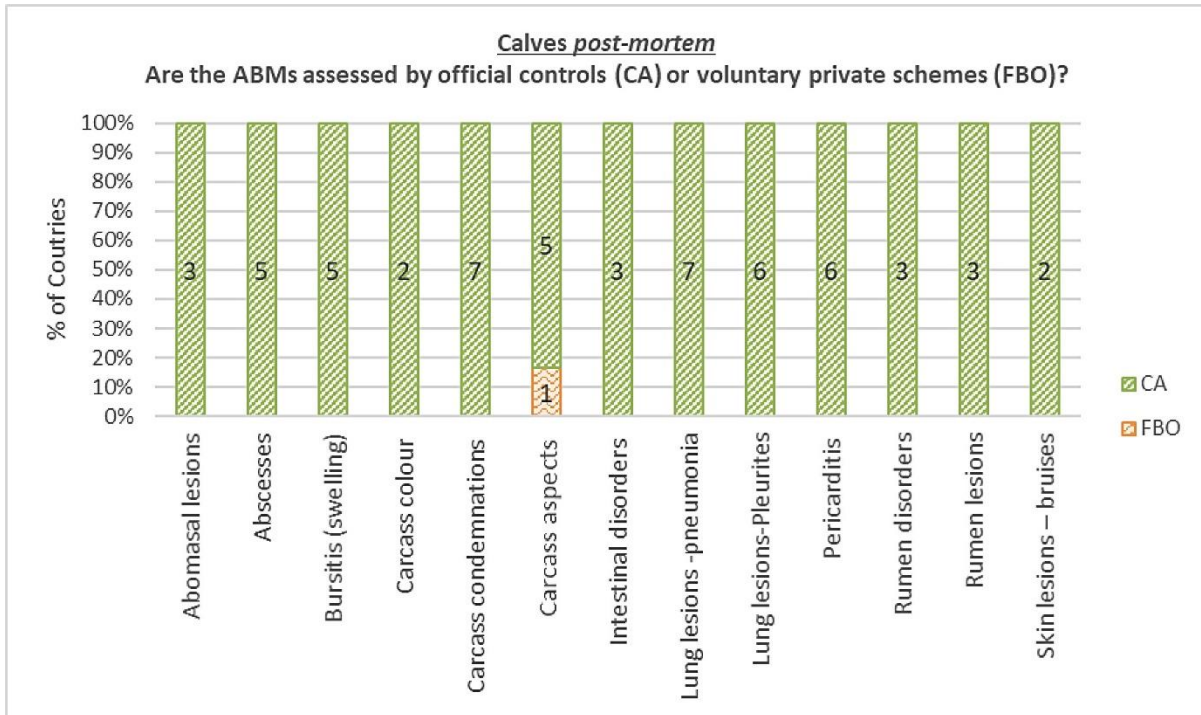


Figure 7: Proportion of Countries where ABMs are used in *post-mortem* inspection of calves by competent authorities (CA) or food business operators (FBO). The histograms report the number of respondents.

3.2.2. Identification of welfare consequence associated with ABMs assessed *post-mortem*

The results showed that each ABM was identified by the respondents as associated to at least one on-farm welfare consequence, except for pericarditis, that was not related to any welfare consequences (Table 3).

Some ABMs indeed were related to more than one welfare consequence: carcass condemnation (6 welfare consequences), carcass colour (4), skin lesions -bruises (4), rumen lesions (3), rumen disorders (3), intestinal disorders (3), carcass aspect (3). Lung lesions (pneumonia and pleurites) were related to 1 welfare consequence.

The results showed that 14 out of the 33 on-farm welfare consequences proposed in the questionnaire were associated with at least one ABM at slaughter.

Table 3: ABMs and associated welfare consequences in calves in *post-mortem* assessment.

ABM observed at slaughter	On-farm related welfare consequences
Carcass condemnation	Bone lesions (incl. fractures and dislocations) Locomotory disorders (including lameness) Metabolic disorders Reproductive disorders Respiratory disorders Umbilical disorders and hernias
Carcass colour	Gastro-enteric disorders Inability to chew and/or ruminate Muscle disorders Prolonged hunger
Skin lesions – bruises	Gastro-enteric disorders

ABM observed at slaughter	On-farm related welfare consequences
	Metabolic disorders Restriction of movement Skin disorders (others than soft tissue lesions and integument damage)
Rumen disorders	Gastro-enteric disorders Inability to chew and/or ruminate Metabolic disorders
Rumen lesions	Gastro-enteric disorders Inability to chew and/or ruminate Metabolic disorders
Carcass aspects	Gastro-enteric disorders Metabolic disorders Prolonged hunger
Intestinal disorders	Gastro-enteric disorders Prolonged hunger
Abomasal lesions	Gastro-enteric disorders
Abscesses	Soft tissue lesions and integument disease
Bursitis (swelling)	Resting problems
Lung lesions – pneumonia	Respiratory disorders
Lung lesions – pleuritis	Respiratory disorders
Pericarditis	-

3.2.3. Scoring methods in *post-mortem* assessment

Details on the scoring method used to assess the ABMs used in *post-mortem* inspection were requested in the questionnaire. Results showed that, most of the respondents (53.0%) provided no answer to this question, because several countries do not slaughter veal calves.

During the open discussion at the meeting, some members highlighted the possibility of future development of these scoring methods, and it was agreed to further assess this item.

Therefore, at the meeting, participants were requested to express their opinion on the need to use a simple or a more sophisticated scoring method, as a future development. This question was posted in the poll. Results from the poll showed that for most of the ABMs a Y/N method would be preferred. However, rumen disorders, intestinal disorders, and carcass aspect, were considered impossible to be scored from most of the respondents (Figure 8).

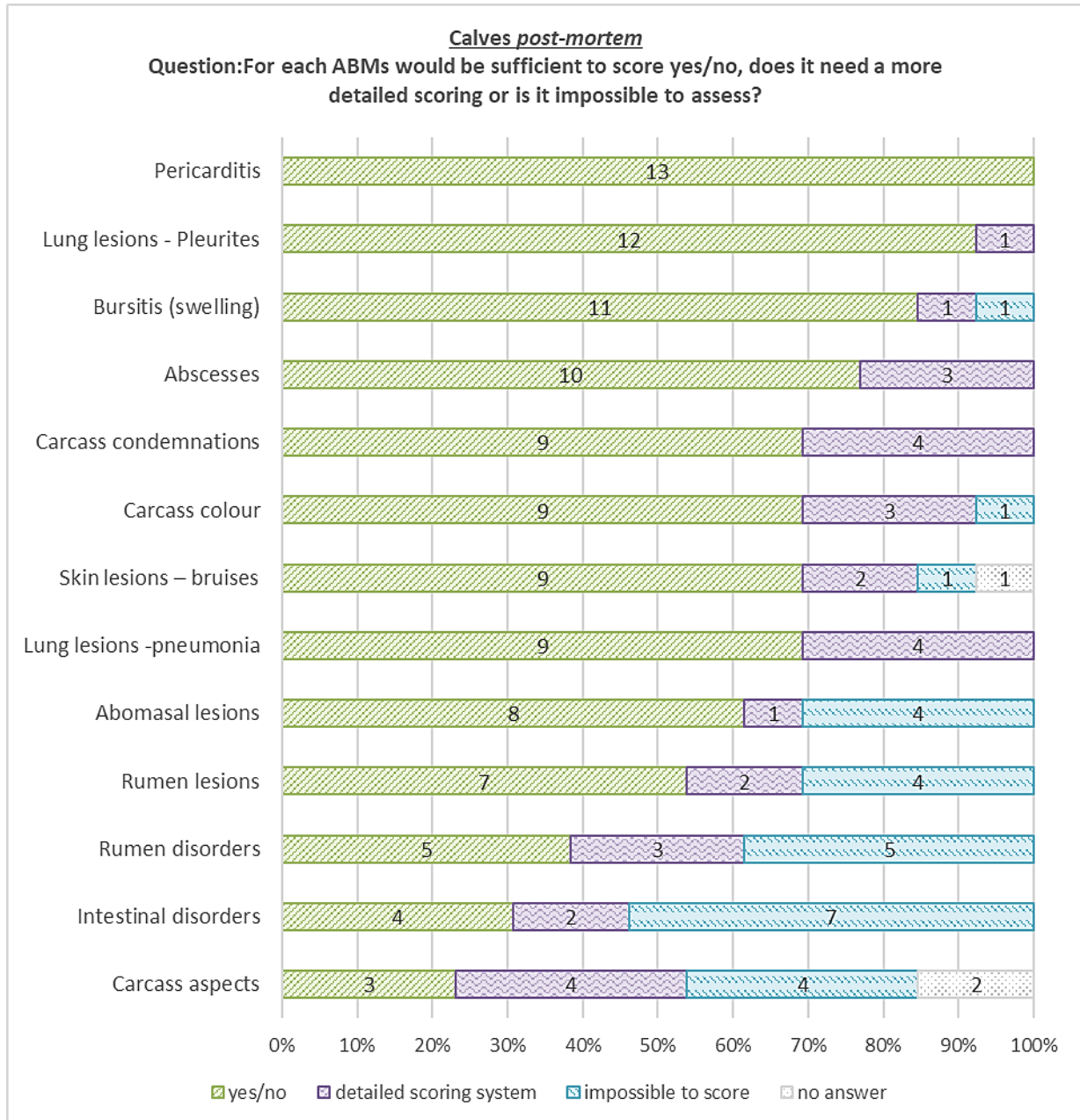


Figure 8: ABMs and scoring methods: results from the poll on the need of a simple or a more sophisticated method, as a future development. The histograms report the number of respondents.

3.2.4. Ease of use of ABMs assessed *post-mortem*

Meeting participants were also asked to express their opinion on the ease of use of each ABM by classifying them in three categories: easy, medium or difficult. From the poll, more than 50% of the respondents indicated that the ABMs rated as easy to use in *post-mortem* assessment were: carcass condemnations, abscess, lung lesions- pleuritis, carcass colour and pericarditis. Carcass aspect was considered of medium assessment difficulty (Figure 9). All the ABMs regarding the gastrointestinal package (i.e. abomasal lesions, intestinal disorders, rumen lesions and rumen disorders) were considered difficult to be assessed at the slaughterhouse.

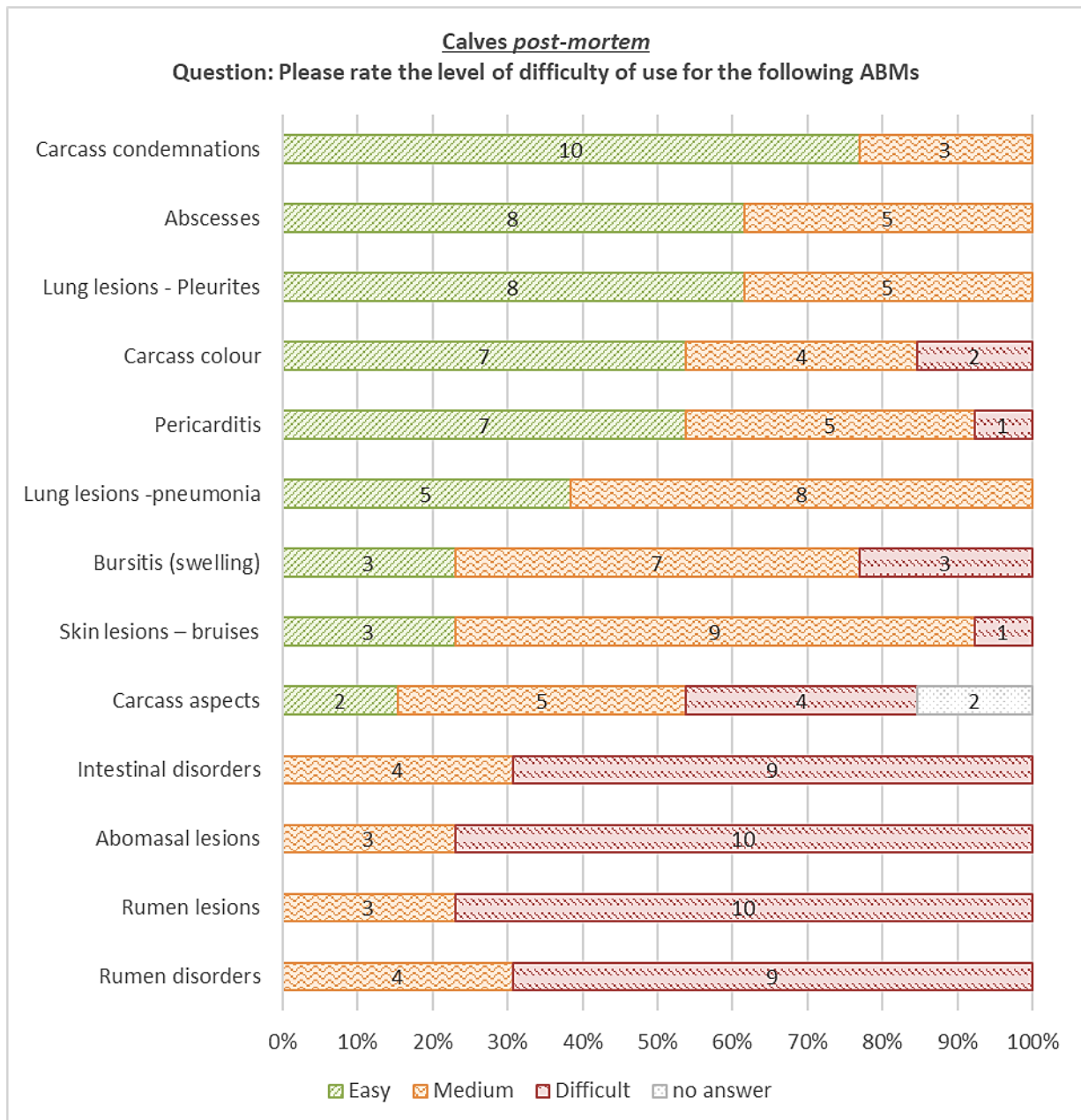


Figure 9: Results of the poll on the ease of use of ABMs. The histograms report the number of respondents.

3.2.5. Prioritization of ABMs *post-mortem*

Network members were asked to prioritize the ABMs, i.e. to classify them as essential, only desirable or not important for any future welfare monitoring scheme. In response to the poll, most of the respondents considered that carcass condemnations and lung lesions (pleuritis and pneumonia) as essential for assessing animal welfare on-farm (Figure 10). In particular, carcass condemnation was rated as the most important ABM to be prioritised.

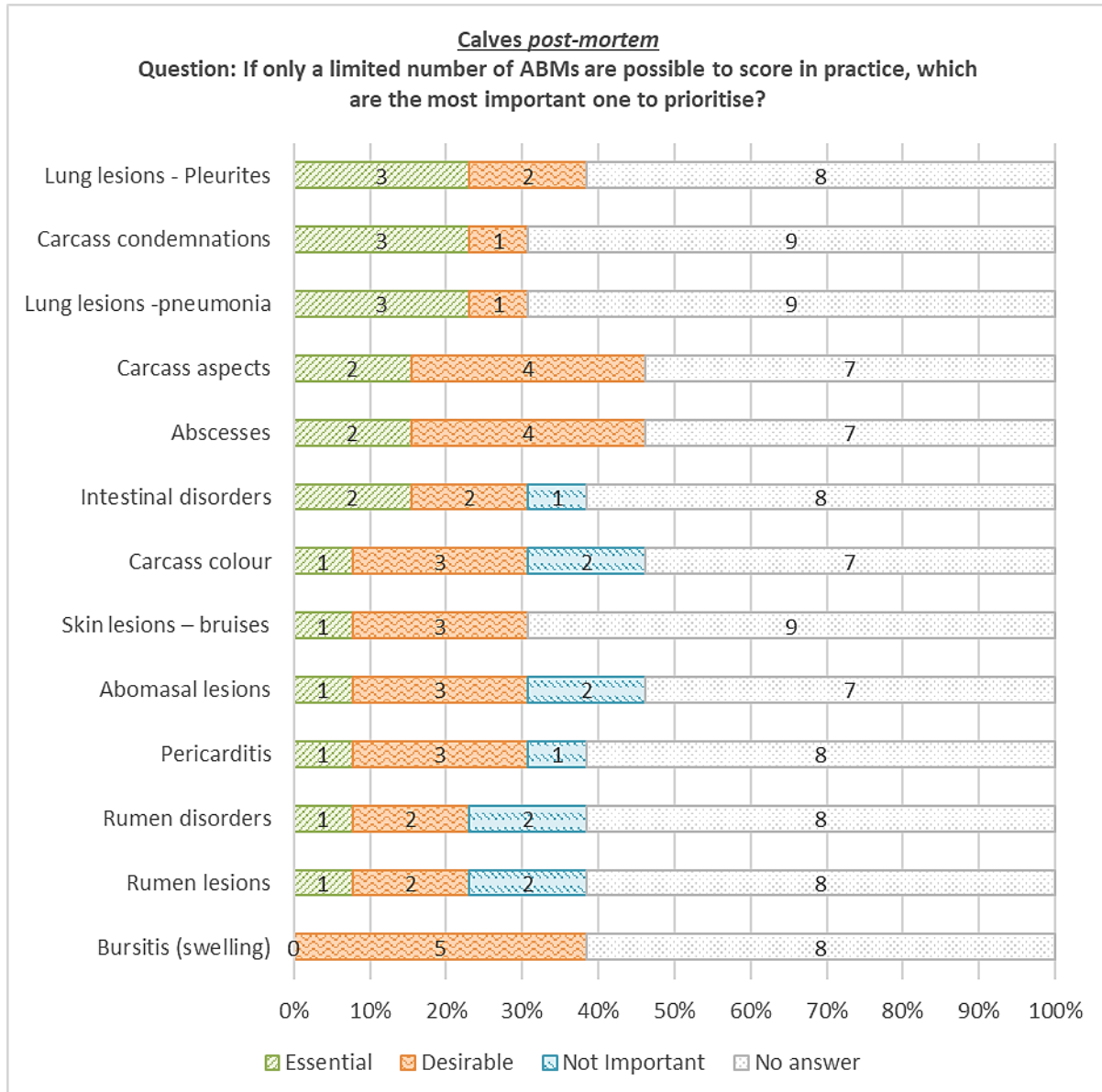


Figure 10: Results of exercise on prioritization of the ABMs. The histograms report the number respondents.

4. Conclusions

To address the F2F mandates, EFSA is assessing a list of ante-mortem and post-mortem ABMs for use at slaughter to monitor animal welfare on farm. The EFSA AHAW Network members shared their practical knowledge on the use of these ABMs in an exercise performed during the Network meeting held in June 2021.

Network members consider that the ABMs proposed by EFSA’s working group are (almost without exception) strongly related to welfare consequences on farm. This supports their inclusion in the EFSA scientific opinion on the “Protection of calves” that will be delivered in 2023. Among the list proposed by EFSA, the Network members selected the ABMs that are considered essential for a welfare assessment at slaughter (see Figure 5 for *ante-mortem* and Figure 10 for *post-mortem*). The information obtained in this report will be considered in the scientific opinion.

5. References

Boyle LA, and Mee JF, 2021. Factors Affecting the Welfare of Unweaned Dairy Calves Destined for Early Slaughter and Abattoir Animal-Based Indicators Reflecting Their Welfare On-Farm. *Frontiers in Veterinary Science*, 2021 (8). doi: 10.3389/fvets.2021.645537

Annex A – Questionnaire *ante-mortem* inspection of veal calves

ANTE-MORTEM INSPECTION OF VEAL CALVES							
ABM	DESCRIPTION	IS THIS ABM ALREADY USED IN YOUR COUNTRY?	IF SO, WHICH SCORING SYSTEM DO YOU USE? Please specify which scoring system is in place in your country and how is it scored; specify if this scoring is used under official or voluntary controls			EASE OF USE	CORRESPONDING WELFARE CONSEQUENCE ON FARM
		Please answer (Yes/No) and specify if it relates to official controls (CA) or private voluntary schemes (FBO)	Scoring method 1 - Total count of the affected animals (yes/no score)	Scoring method 2 - More sophisticated way for scoring the ABMs, e.g. scored according to: - type (e.g. swelling for lameness) - location (leg or hoof/claw for lameness) severity (lameness score for lameness)	Scoring method 3 - other scoring method (please detail it)	Please estimate if the use of this ABM is: easy-medium-difficult	In your view, what welfare problem on farm does this ABM indicate? e.g. restriction of movements, resting problems.
Body condition	The body condition reflects body reserves or fat accumulation of an animal. Body condition scoring is used to critically examine						

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	the nutritional status of a calf.						
Lameness	Inability to use one or more limbs in a normal manner						
Skin lesions-wounds/injuries	<p>Fresh or healed injuries on the skin of the body (excluding the tail), which can be scratches, scabs (surface penetration of the epidermis) or wounds (penetration of the muscle tissue).</p> <p>(depending on whether injuries are fresh or healed they can be dated to understand whether they were caused during transport or on the farm)</p>						
Skin lesions - abscesses	Foci of infection with collection of pus that are visible externally to the skin						
Manure on the body	Presence of manure/faeces on the body						
Coughing/sneezing	The calf expels air from the lungs with a sudden sharp sound						
Nasal/ocular discharge	Defined as clearly visible flow/discharge from the nostrils or from the eyes; it can be transparent to yellow/green and often is of thick consistency						

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Pumping/ Laboured breathing	Heavy and laboured calf breathing						
Rectal prolapse	Internal tissue extrudes from the rectum						
Hernia	Protrusion of a bodily structure or organ through the wall that normally contains it, resulting in a lump under the skin						
Diarrhoea	Loose watery manure below the tail head on both sides of the tail, with the area affected at least the size of a hand						
OTHER ABMS							

Annex B – Questionnaire *post-mortem* inspection of veal calves

POST-MORTEM INSPECTION OF VEAL CALVES								
ABM	DESCRIPTION	IS THIS ABM ALREADY USED IN YOUR COUNTRY?	IF SO, WHICH SCORING SYSTEM DO YOU USE?			EASE OF USE	CORRESPONDING WELFARE CONSEQUENCE ON FARM	
		Please answer (Yes/No) and specify if it relates to official controls (CA) or private voluntary schemes (FBO)	Please specify which of the two below scoring system is in place in your country and how is it scored; specify if this scoring is used under official or voluntary controls	Scoring system 1 - Categorical (Presence/Absence in the observed individual animal)	Scoring method 2 - More sophisticated way for scoring the ABMs - e.g. scoring scales based on the severity? (please detail it)	Scoring method 3 - other scoring method (please detail it)	Please estimate if the use of this ABM is: easy- medium- difficult	In your view, what welfare problem on farm does this ABM indicate? e.g. gastrointestinal disorders (due to group stress, poor diet, diet composition and features)
Lung lesions - pneumonia	Inflammation of the lung tissue with or without an overlying pleurisy.							
Lung lesions - Pleurites	Inflammation of the pleurae with fibrinous pleural adhesions							
Pericarditis	Fibrosis of pericardial sac, with or without the presence of fluid							

Animal-based measures at slaughter for calves

Skin lesions – bruises	An injury (contusion) involving rupture of small blood vessels and discoloration without a break in the overlying skin						
Abscesses	Foci of infection with collection of pus that may occur internally or externally.						
Bursitis (swelling)	A bursa is a fluid filled sac that develops as a result of a pressure injury on the weight-bearing points of the legs. Bursae are most prevalent in the front of the carpal joints and the hock region of the hind limbs, although they can occur in other locations						
Abomasal lesions	Abomasal erosions, ulcers and scars.						
Rumen lesions	Lesions to the rumen mucosa: a hyperkeratosis, plaques and plaques with trapped hair						
Rumen disorders	The presence of milk in the rumen is cause for concern. Milk in the rumen of calves reflects failure of the oesophageal groove to close properly and to						

Animal-based measures at slaughter for calves

	deliver milk directly into the abomasum.						
Intestinal disorders	Enteritis is the most common lesion found in the calf's intestines though congenital defects (e.g., intestinal or anal atresia or stenosis) are found occasionally.						
Carcass colour	Very pale carcass colour associated with low haemoglobin concentration and anaemia						
Carcass condemnations	Carcass and parts that are unfit for use as food, described as: <ul style="list-style-type: none"> - n. of calves - weight of the carcass waste per group 						
Carcass aspects	Aspect of carcass composition (shape) and fat level						
OTHER ABMS							

Annex C – Overall list of welfare consequences

Welfare consequence	Description
Restriction of movement	The animal experiences stress and/or negative affective states such as pain, fear, discomfort and/or frustration due to the fact that it is unable to move freely, or is unable to walk comfortably (e.g. due to overcrowding, unsuitable floors, gates, barriers).
Resting problems	The animal experiences stress and/or negative affective states such as discomfort, and/or frustration due to the inability to lie/rest comfortably or sleep. (e.g. due to hard flooring, inability to perch or vibration during transport). This may eventually lead to fatigue.
Group stress	The animal experiences stress and/or negative affective states such as pain, fear and/or frustration resulting from a high incidence of aggressive and other types of negative social interactions, often due to hierarchy formation and competition for resources or mates.
Sensorial under and/or overstimulation	The animal experiences stress and/or negative affective states such as fear, discomfort due to visual, auditory or olfactory under/overstimulation by the physical environment.
Handling stress	The animal experiences stress and/or negative affective states such as pain and/or fear resulting from human or mechanical handling (e.g. sorting and vaccination of newly hatched chicks, loading/unloading, catching and crating of animals to be transported, inversion).
Isolation stress	The animal experiences stress and/or negative affective states such as frustration and/or fear resulting from the absence of or from limited social contact with conspecifics.
Separation stress	The animal experiences stress and/or negative affective states such as fear and/or frustration resulting from separation from conspecifics.
Inability to perform comfort behaviour	The animal experiences stress and/or negative affective states such as discomfort and/or frustration resulting from the thwarting of the motivation to maintain the function and integrity of the integument (e.g. cannot keep clean, scratch, dust bathe).
Inability to perform sexual behaviour	The animal experiences stress and/or negative affective states such as frustration resulting from the thwarting of the motivation to engage in sexual activities.
Inability to avoid unwanted sexual behaviour	The animal experiences stress and/or negative affective states such as pain and/or fear resulting from inability to avoid forced mating.
Inability to perform exploratory or foraging behaviour	The animal experiences stress and/or negative affective states such as frustration and/or boredom resulting from the thwarting of the motivation to investigate the environment or to seek for food (i.e. extrinsically and intrinsically motivated exploration).
Inability to express maternal behaviour	The animal experiences stress and/or negative affective states such as frustration resulting from the thwarting of the motivation to care for offspring, including during the pre-partum/pre-laying phase.
Inability to perform sucking behaviour	The animal experiences stress and/or negative affective states such as frustration resulting from the thwarting of the motivation to suck from an udder.

Inability to chew and/or ruminate	The animal experiences stress and/or negative affective states such as frustration resulting from the thwarting of the motivation to ingest sufficient amounts of fibrous feed or the inhibition of rumination.
Inability to perform play behaviour	The animal experiences stress and/or negative affective states such as frustration resulting from the thwarting of the motivation to engage in social/locomotory or object play.
Predation stress	The animal experiences stress and/or negative affective states such as fear and/or pain resulting from being attacked or perceiving a high predation risk
Prolonged hunger	The animal experiences craving or urgent need for food or a specific nutrient, accompanied by a negative affective state, and eventually leading to a weakened condition as metabolic requirements are not met
Prolonged thirst	The animal experiences craving or urgent need for water, accompanied by an uneasy sensation (a negative affective state), and eventually leading to dehydration as metabolic requirements are not met.
Heat stress	The animal experiences stress and/or negative affective states such as discomfort and/or distress due to the difficulty to maintain body temperature in the thermoneutral zone when exposed to high effective temperature.
Cold stress	The animal experiences stress and/or negative affective states such as discomfort and/or distress due to the difficulty to maintain body temperature in the thermoneutral zone when exposed to low effective temperature.
Locomotory disorders (including lameness)	The animal experiences negative affective states such as pain, discomfort and/or due to impaired locomotion induced by e.g. bone, joint, skin or muscle damage.
Soft tissue lesions and integument damage	The animal experiences negative affective states such as pain, discomfort and/or distress due to physical damage to the integument or underlying tissues, e.g. multiple scratches, open or scabbed wounds, bruises, ulcers, abscesses and feather or hair loss. This welfare consequence may result from negative social interactions such as aggression, tail-biting or feather pecking, from handling or from damaging environmental features, or from mutilation practices (e.g. beak trimming, de-toeing, de-horning, tail docking).
Bone lesions (incl. fractures and dislocations)	The animal experiences negative affective states such as pain, discomfort and/or distress due to fractures or dislocations of the bones (excluding those fractures leading to locomotory disorders).
Skin disorders (other than soft tissue lesions and integument damage)	The animal experiences negative affective states such as pain, discomfort and/or distress due to e.g. infections (e.g. dermatophytosis/ringworm, pseudomonosis, staphylococcosis, viral diseases), ectoparasites (e.g. mange or red mites), inflammation of the skin or sunburn.
Respiratory disorders	The animal experiences negative affective states such as discomfort, pain, air hunger and/or distress due to impaired function or lesion of the lungs or airways.
Eye disorders	The animal experiences negative affective states such as discomfort, pain and/or distress due irritation or lesion or lack of function of at least one eye.
Gastro-enteric disorders	The animal experiences negative affective states such as inappetence, discomfort, pain and/or distress due to impaired function or lesion of the gastro-intestinal tract resulting from for example nutritional deficiency, infectious, parasitic, or toxic agents.
Reproductive disorders	The animal experiences negative affective states such as pain and/or discomfort due to a disorder of the reproductive system resulting from physical injury or infection (including dystocia and metritis).

Mastitis	The animal experiences negative affective states such as pain and/or discomfort due to the inflammation of at least one of the mammary glands.
Metabolic disorders	The animal experiences negative affective states such as inappetence, weakness, fatigue, discomfort, pain and/or distress due to disturbed metabolism (e.g. acidosis and ketosis), deficiencies in several nutrients (e.g. anaemia) or induced by ectoparasites affecting metabolism (anaemia due to red mites) or poisoning
Muscle disorders	The animal experiences negative affective states such as discomfort and/or pain due to a disorder or lack of function of the muscles (e.g. myopathy in broilers).
Umbilical disorders and hernias	The animal experiences negative affective states such as discomfort and/or pain due to inflammation of the navel or any type of hernias