



Welfare assessment during electrical stunning in rabbits

—

November 12th, 2024



Designated by
the EU Commission



Agenda

10:00: General presentation of the EURCAW-Poultry-SFA - V. Michel

10:15: Introduction to electrical stunning in rabbits and indicators - A. Velarde

10:20: Refinement of indicators and efficiency of stunning – A. Contreras-Jodar

10:30: Methods and recommendations – A. Contreras-Jodar and V. Michel

10:45: Discussion

General presentation of the EURCAW-Poultry-SFA

Virginie Michel (Coordinator, ANSES)



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REGULATION (EU) 2017/625 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 15 March 2017

Art. 95 of 'The Official Controls Regulation':

"The Commission shall, by means of implementing acts, designate European Union reference centres for animal welfare that shall **support the activities of the Commission and of the Member States**"



Since October 2018



Since February 2020



Since June 2021





Designation mid-January 2024

Main Target groups and objective

- **Target groups:** European Commission, Competent Authorities, National Reference Centres and ‘Supporting Bodies’ from MSs: science, training, communication
- **Objectives:** to support implementation of welfare legislation in a harmonized way through MSs
 - on farms, transportation and killing
 - poultry & other small farmed animals

What the Centre is and is not...

 The Centre is	 The Centre is not
To assist Commission and MSs	To be solicited by other institutions
Able to deliver scientific and technical advice	To do risk assessment
To help implementation of legislation	To interpret legislation

EURCAW-Poultry-SFA team

Virginie MICHEL



Maryse GUINEBRETIERE



Louise KREMER



Antonio VELARDE



Aranzazu VARVARÓ



Aida XERCAVINS



Frédérique MOCZ



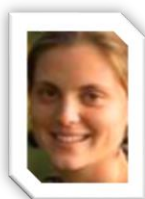
Emilie NEHLIG



Alexandra
CONTRERAS-JODAR



Xènia
MOLES



Leonardo J. VINCO Antonio LAVAZZA



Anja B. RIBER Steen H. MØLLER Emily LEISHMAN



Francesca FUSI



Clara TOLINI



Salvatore PODDA



Priority areas

1. Broiler chickens on farm
2. Laying hens housed in alternative housing systems
3. State of consciousness after stunning
4. Rabbits on farm, with a focus on alternative housing systems
5. Turkeys on farm and during transport



Activities:

1. Coordinated assistance
2. Animal welfare indicators
3. Scientific and technical studies
4. Training courses
5. Disseminating research and innovations



Activity 2. Animal welfare indicators

1. Compile a list of legal requirements to check during official controls
2. Identify relevant welfare indicators to verify compliance with the legal requirements identified
3. Propose validated indicators and methods for assessment

Activity 3. Scientific and technical studies

- To provide scientific and technical expertise on the official controls and the implementation of the legislation related to poultry.
- To identify the gaps of knowledge and the bottlenecks regarding legislation and formulate different topics for scientific and technical studies.
- To develop in the framework of the Centre, some scientific studies designed to answer questions raised in activity 2.
- Identify good practices

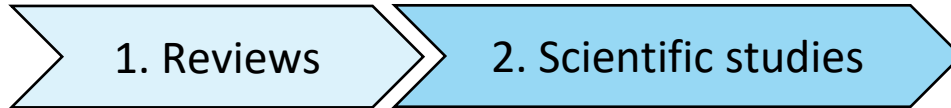


1. Waterbath stunning - broiler chickens and turkeys

1. Reviews

- List of the **relevant indicators** for the assessment of consciousness of broilers and turkeys after waterbath stunning.
- Description of the considered **validated indicators and associated methodology**
- **Identification of gap of knowledge** regarding indicators.

1. Waterbath stunning - broiler chickens and turkeys



- Repeatability and feasibility of indicators of consciousness in **broiler chicken** after waterbath stunning and the impact of electrical key parameters on stunning efficiency.
- Repeatability and feasibility of indicators of consciousness in **turkeys** after waterbath stunning and the impact of electrical key parameters on stunning efficiency.


1. Waterbath stunning - broiler chickens and turkeys



European Union Reference Centre for Animal Welfare Poultry SFA

Indicator Factsheet

How to assess the state of consciousness in broilers (waterbath stunning)



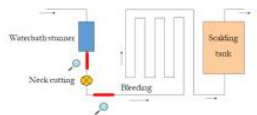
Introduction

- Waterbath stunning (WBS) is intended to induce unconsciousness until death that occurs due to bleeding.
- As WBS is not always effective, it is required to monitor that birds are unconscious at the exit of the WBS and do not regain consciousness before death.
- This factsheet explains the method to check the state of consciousness of birds with the most feasible, repeatable and valid animal-based indicators (ABIs) regardless of line speed and the method for sample size calculation.

Method for the assessment

Place for the assessment: At two different stages.

- Stage 1:** From the exit of the WBS and before bleeding to assess the effective stunning of the birds.
- Stage 2:** During bleeding, to assess that unconscious birds do not recover consciousness before death.



Position: if possible, check the birds in ventral position.

ABIs: use all those listed in Table 1 simultaneously on each bird according to the stage of observation. Commercial videos linked to QR codes.


Any bird showing at least one outcome of consciousness should be considered as conscious or recovering consciousness.

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Indicator Factsheet

How to assess the state of consciousness in turkeys (waterbath stunning)



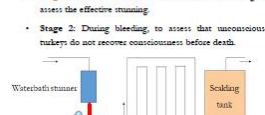
Introduction

- Waterbath stunning (WBS) is intended to induce unconsciousness until death that occurs due to bleeding.
- It is required to monitor that turkeys are unconscious at the exit of the WBS and do not regain consciousness before death. Hence, turkeys that show indicators of consciousness should be re-stunned using back-up methods to avoid them unnecessary pain, distress and suffering.
- This factsheet contains:
 - The method for the assessment of the state of consciousness after WBS.
 - The most relevant Animal-Based Indicators (ABIs).
 - The method for sample size calculation.

Method for the assessment

Place for the assessment: At two different stages (Figure 1)

- Stage 1:** From the exit of the WBS and before bleeding to assess the effective stunning.
- Stage 2:** During bleeding to assess that unconscious turkeys do not recover consciousness before death.



Position: if possible, check the birds in ventral position.

Figure 1: Places for the assessment. The red segments are the observation area.

Figure 2: Relevant ABIs of consciousness. Red arrows indicate where to put the attention on the turkey's body. Videos linked to QR codes.


Although less precise and less repeatable between observers, presence of consciousness in stage 1 and presence of head shaking in stage 2 should not be regarded as ABIs of consciousness (see Table 1). Any bird showing at least one outcome of consciousness should be considered as conscious or recovering consciousness.

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Best practice Factsheet

Captive bolt as a back-up stunning method during slaughter of turkeys




Introduction

- Stunning methods are not always effective since failure at inducing unconsciousness and recovery of consciousness of turkeys before death might happen.
- Legislative requirements on the protection of animals at the time of killing include assessing the state of consciousness of the animals regularly and ensuring that appropriate back-up equipment is immediately available on the spot to be used in the case of failure of the stunning equipment initially used.
- However, re-stunning turkeys that show outcomes of consciousness after the stunning procedure is a process that remains pending for most of poultry slaughterhouses. In most of the cases, turkey are manually re-stunned out after bleeding when stunning or bleeding is not efficient.


Back-up stunning method

This factsheet shows a good practice related to a back-up stunning method for turkeys.


1. Penetrate captive bolt stunner adapted for turkeys are hung with an extension cord from the ceiling and placed at the business operator's shoulder height.



2. When a turkey is showing at least one sign of consciousness, the business operator in charge takes with one hand a V-shaped, 1-meter-long fork and seizes the bird's head while moving on the shoulder line.



3. With the other hand, the captive bolt is taken and placed perpendicular to the bird's head and is fired through the skull into the brain causing instant death to the bird.



4. Several captive bolts are placed along the slaughter line allowing for re-stunning of animals at any place from stunning to the scalding tank.

Advantage for welfare: it allows re-stunning on the line of heavy birds difficult to unhook and spares avoidable pain, distress and suffering to ineffectively stunned turkeys. Flaws: in most of slaughterhouse design does not allow to re-stun turkeys between the exit of the waterbath and bleeding because of lack of space and time before neck cutting.

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1. Waterbath stunning - broiler chickens and turkeys



Webinars:

- Repeatability and feasibility of indicators of consciousness in **broiler chicken** after waterbath stunning and the impact of electrical key parameters on stunning efficiency.
- Repeatability and feasibility of indicators of consciousness in **turkeys** after waterbath stunning and the impact of electrical key parameters on stunning efficiency.

Motion video:

- Method and relevant indicators of the state of consciousness in broiler chickens



2. Controlled atmosphere stunning (CAS)

1. Review

- Main welfare aspects of stunning broilers by exposure to controlled atmosphere:
 - List of CAS methods and legal requirements
 - For each CAS methods:
 - 📄 Description and available equipment
 - 😊 Positive welfare aspects
 - 😞 Negative welfare aspects



2. Controlled atmosphere stunning (CAS)

1. Review

2. Factsheet



Main welfare aspects of stunning broilers by exposure to controlled atmosphere



Introduction

- There are two main types of stunning systems commercially used in poultry, electrical waterbath stunning (WBS) and controlled atmosphere stunning (CAS).
- CAS consists in exposing the chickens to modified gas environments or by reducing the atmospheric pressure, which induce a gradual loss of consciousness.
- WBS is used in both small-scale and large-scale abattoirs, while CAS is nearly always used in large-scale abattoirs, likely because CAS systems involve large investments but also increase the slaughter capacity.

Available equipment

Currently, CO₂ in two phases is by far the most common CAS method in use in the European Union.

- Tunnel
- Closed cabiner
- Pit



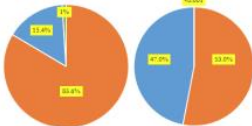
Percentage of the different CO₂ stunning equipment that are currently in use in European Union. Data extracted from 20 out of 27 European Member States that replied a EURCAW-Poultry-SFA survey in 2021.

Advantages of CAS

- No uncrating and shackling conscious birds.
- Stunning can be either reversible or irreversible.
- When irreversible, it prevent from recovery before death occurs.

CAS welfare concerns

- Induction of unconsciousness is not instantaneous and involves a transitional period during which negative welfare outcomes may occur.
- CAS systems may incorporate windows or cameras for monitoring the behaviour of the animals. However, it does not allow a clear view of all animals.



Proportion of slaughterhouses (left) and slaughtered chickens (right) according to the different stunning methods used in the European Union in 2021. Data extracted from 20 out of 27 European Member States that replied a EURCAW-Poultry-SFA survey.

CAS methods

- Stunning with carbon dioxide (CO₂) in two phases
- Stunning with inert gases
- Stunning with carbon dioxide associated with inert gases
- Low atmospheric pressure stunning (LAPS)

Main welfare aspects of stunning broilers by exposure to controlled atmosphere

1. Stunning with CO₂ in two phases

Broilers are first exposed to low concentration of CO₂ (up to 40%) until unconsciousness occurs. Thereafter, the CO₂ concentration is increased in the second phase inducing a deeper state of unconsciousness and then death.

It renders the bird unconscious when using a low level of CO₂ (< 40%) followed by a second phase where broilers are killed painlessly with exposure to a high CO₂ concentrations.

If birds are conscious, concentrations of CO₂ at above 40% cause unpleasant sensation, pain and respiratory distress when inhaled. This could occur when the exposure time in the first phase is too short leading to animals arriving conscious in the second phase in which CO₂ is above 40%.

3. Stunning with CO₂ associated with inert gases

Broilers are induced to unconsciousness by direct or progressive exposure to a gas mixture containing CO₂ up to 40% associated and inert gases.

- Broilers tolerate the inhalation of concentrations below 40% CO₂, inert gases are imperceptible to birds and the reduction of available oxygen is not perceived either.
- The duration of induction to unconsciousness is shorter than with inert gases.
- The occurrence of vigorous convulsions expressed as wing flapping in unconscious birds are less pronounced than the other CAS methods and thus, the likelihood of unconscious animal while convulsing to harm neighbouring birds that are still conscious is lowered.

2. Stunning with inert gases

Broilers are exposed to inert gas mixtures with a maximum of 2% residual oxygen, leading to loss of consciousness. Inert gases displace oxygen from the atmospheric air and this ensures that the birds are stunned by anoxia (i.e., lack of oxygen) and death if the duration of the process is prolonged enough.

Inhalation of inert gases does not cause aversive reactions after initial exposure, as they are imperceptible to birds.

After loss of consciousness, birds can perform severe convulsion which may produce wing fractures as well as injuries and distress to other birds that have not yet lost consciousness.

The duration of induction to unconsciousness is longer than with CO₂ in two phases. If birds are not exposed enough time, they can recover consciousness rapidly if breathing atmospheric air at the exit of the stunning system.

4. LAPS

Broilers are induced to a non-recovery state of unconsciousness through progressive hypobaric anoxia (i.e., lack of oxygen due to lowered atmospheric pressure).

It produces a non-recovery state of birds and thus, it does not compromise the welfare of the bird during the following slaughtering procedures.

Pain may happen since defecation and prolapses of cloaca were observed during LAPS suggesting expansion of gas trapped in gut and probably also in other body cavities.

Only approved for the stunning of broilers of less than 4 kg of body weight according to a prescribed pressure curve carefully described in the implementing regulation.

Related to controlled atmosphere stunning methods

Carbon dioxide in two phases, inert gases or in carbon dioxide in association with inert gases:	COUNCIL REGULATION (EC) No 1099/2009 [Annex I, Chapter II]
Specific requirements	<p>"8. Under no circumstances shall gases enter into the chamber or the location where animals are to be stunned and killed in a way that it could create burns or excitement by freezing or lack of humidity."</p>
Carbon dioxide in two phases, inert gases or in carbon dioxide in association with inert gases:	<p>COUNCIL REGULATION (EC) No 1099/2009 [Annex II]</p> <p>"6.1. Gas stunners, including conveyor belts, shall be designed and built to:</p> <ol style="list-style-type: none"> optimise the application of stunning by gas; prevent injury or contusions to the animals; minimise struggle and vocalisation when animals are restrained."
Gas stunning equipment	<p>"6.2. Gas stunners shall be equipped to measure continuously, display and record the gas concentration and the time of exposure, and to give a clearly visible and audible warning if the concentration of gas falls below the required level. The device shall be placed so as to be clearly visible to the personnel. These records shall be kept for at least one year. Gas stunners shall be designed in a manner that, even at the maximum permitted throughput, the animals are able to lie down without being stacked on each other."</p>
Carbon dioxide in two phases, inert gases or in carbon dioxide in association with inert gases:	<p>COMMISSION IMPLEMENTING REGULATION (EU) 2018/723 of 16 May 2018 amending Annexes I and II to Council Regulation (EC) No 1099/2009 [Annex I, Chapter 2, point 10]</p> <p>"10.1. During the first phase, the decompression rate shall not be greater than equivalent to a reduction in pressure from standard sea level atmospheric pressure 760 to 250 Torr for a period of not less than 50 seconds."</p> <p>"10.2. During a second phase, a minimum standard sea level atmospheric pressure of 160 Torr shall be reached within the following 210 seconds."</p> <p>"10.3. The pressure time curve shall be adjusted to ensure that all birds are irreversibly stunned within the cycle time."</p> <p>"10.4. The chamber shall be leak tested and pressure gauges calibrated before each operational session and not less than daily."</p> <p>"10.5. Records of absolute vacuum pressure, time of exposure, temperature and humidity shall be kept for at least one year."</p>
LAPS:	<p>COMMISSION IMPLEMENTING REGULATION (EU) 2018/723 of 16 May 2018 amending Annexes I and II to Council Regulation (EC) No 1099/2009 [Annex II, point 7]</p> <p>"7.1. Low atmospheric pressure stunning equipment shall be designed and built to ensure a vacuum of the chamber enabling slow gradual decompression with reduction in available oxygen and holding at minimal pressure."</p> <p>"7.2. The system shall be equipped to measure continuously, display and record the absolute vacuum pressure, the time of exposure, the temperature, the humidity and to give a clearly visible and audible warning if the pressure deviates from the required levels. The device shall be clearly visible to the personnel."</p>
LAPS:	<p>LAYOUT, construction and equipment of slaughterhouses</p>



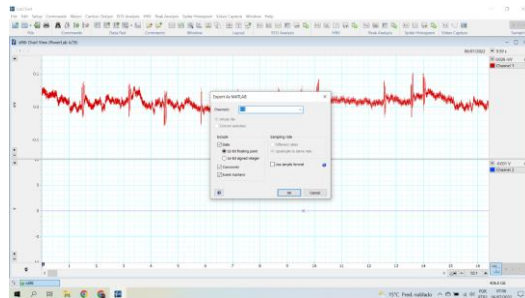
2. Controlled atmosphere stunning (CAS)



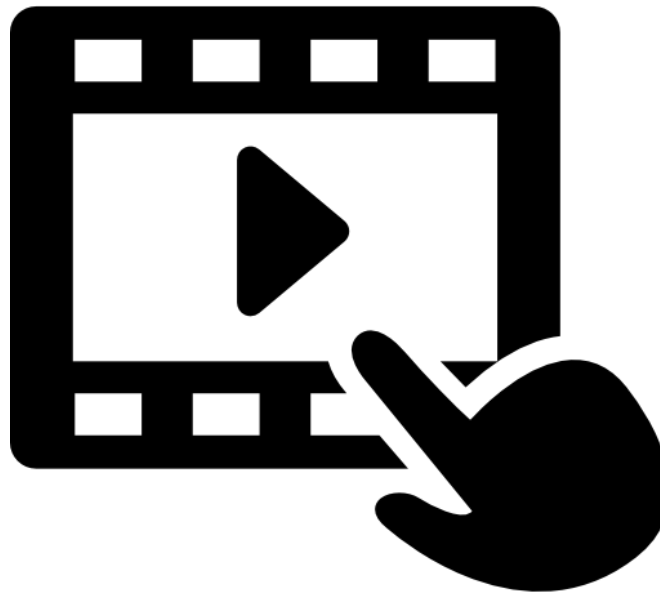
- Assessment of welfare during exposure to alternative gas mixtures to carbon dioxide in two phases in broiler chickens

Gas mixtures tested:

1. CO₂ in two phases (1st: 40% CO₂ (2 min); 2nd: 90% CO₂ (2 min))
2. 40% CO₂ + 60% N₂ (<2% O₂); 4 min
3. 20% CO₂ + 80% N₂ (<2% O₂); 4 min



Activity 5. Dissemination of research findings and innovations



VIDEO

Indicators of consciousness

Antonio Velarde (Deputy, IRTA)



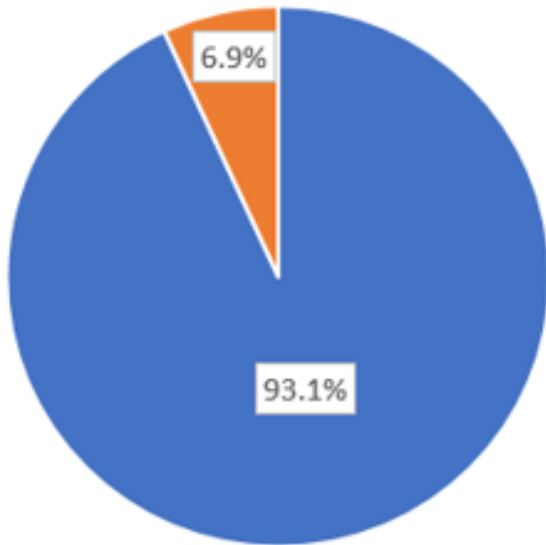
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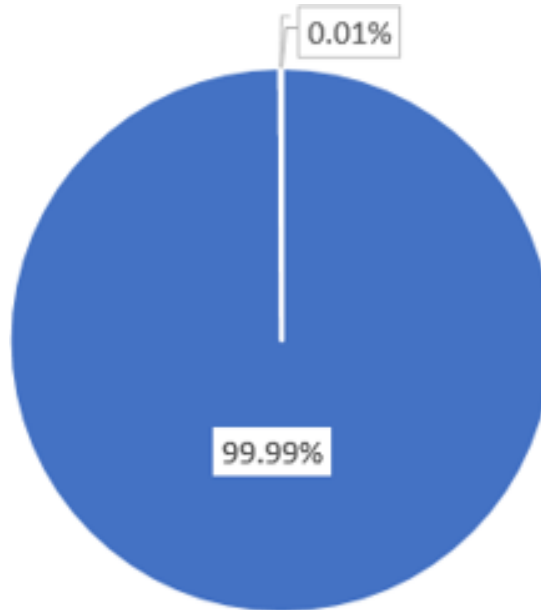
1. Among the authorised stunning methods for rabbits, **only head-only electrical** stunning and **captive bolt** are currently **in use** in EU.

- 233 declared list of rabbit SHs

Slaughterhouses



Rabbits



■ Head-only electrical stunning ■ Captive bolt

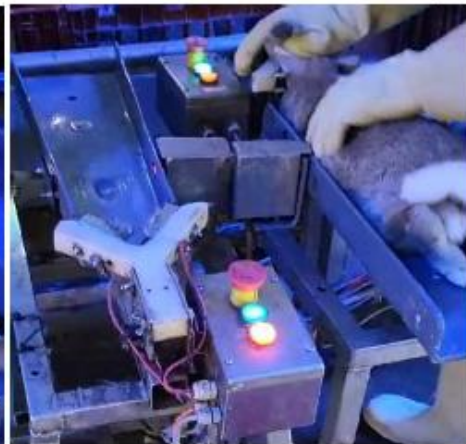
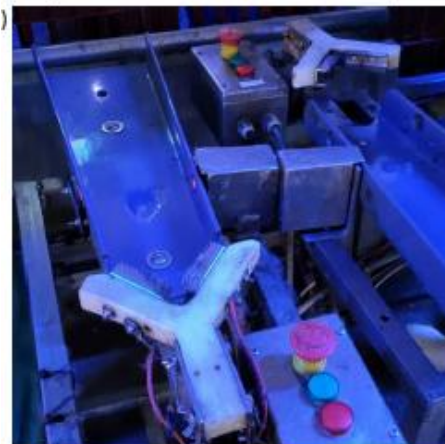
EURCAW-Poultry-SFA. (2023)



1. **62 million** were slaughtered in the EU in 2022 of which **Spain, France and Italy** accounted for **88% of the total**
2. **Legislation** did not lay down **minimum key parameters** for rabbits (current, frequency, voltage, exposure time, stun-to-stick interval)
3. **Variability on the recommended key parameters** found in national guidelines:

- **Current:** >140 or > 400 mA
- **Frequency:** 50 Hz
- **Voltage:** 100-117 V
- **Minimum time of exposure:** 0.5 – 3 s
- **Maximum stun-to-stick Interval:** 5 – 20 s

5. Variability on the head-only stunning devices used



EURCAW-Poultry-SFA. (2023)

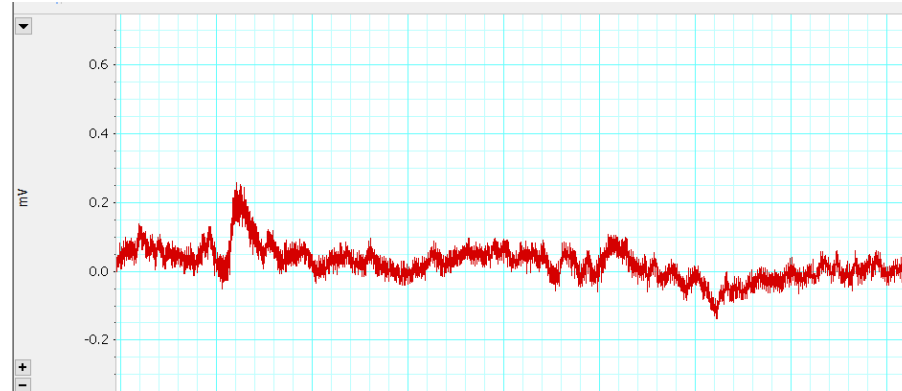
Regulation 1099/2009

Article 5: requires operators to carry out regular checks to ensure that animals do not present any signs of consciousness or sensibility

Article 16: requires slaughterhouse operators to put in place and implement monitoring procedures.



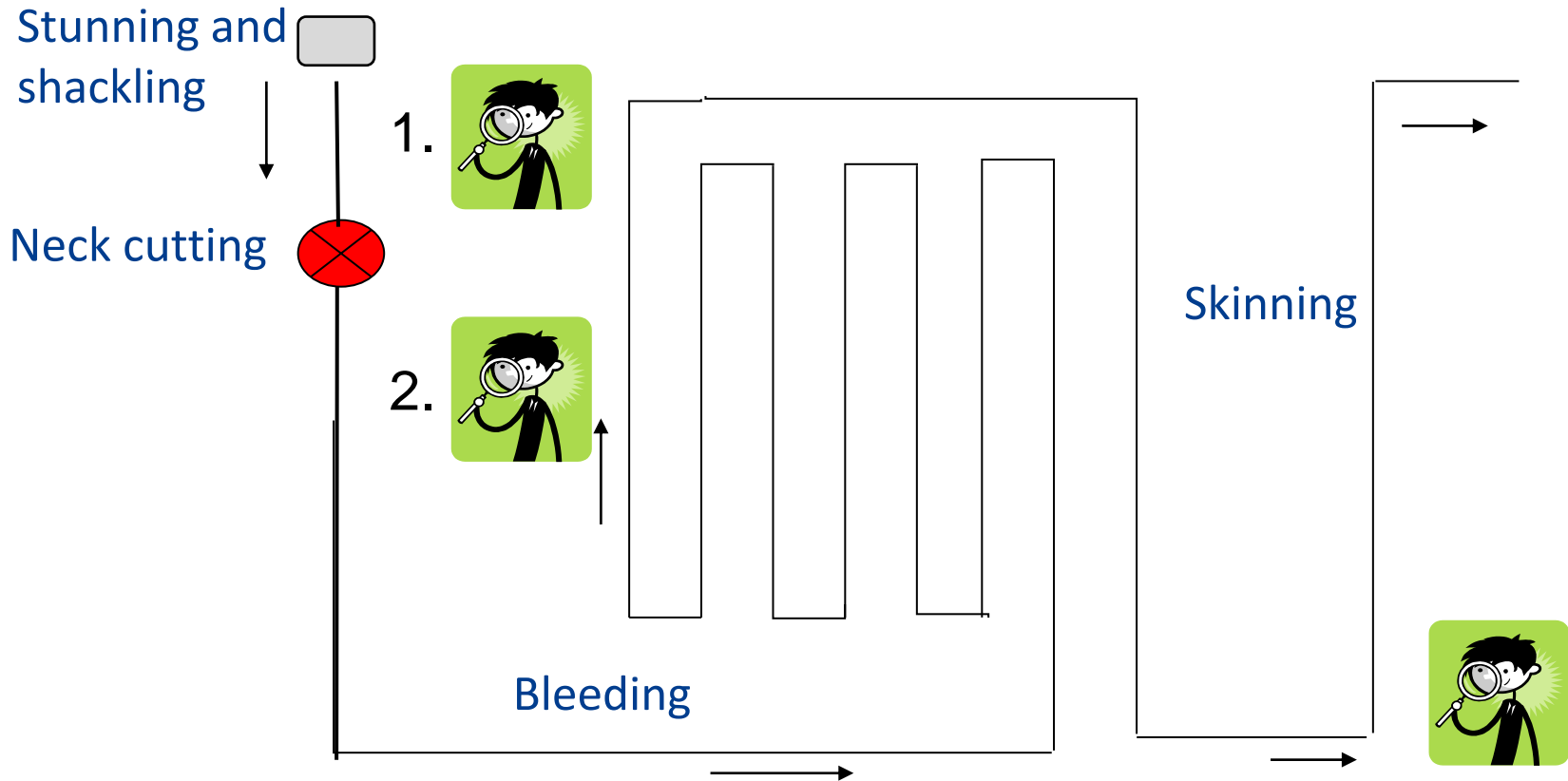
✓ Electroencephalography (EEG)



✓ Animal-based indicators (ABIs):


1. **Behaviour** (e.g. escape attempts)
2. **Physical signs** (e.g. onset of seizures, cessation of breathing, fixed eye)
3. **Presence or absence of response to external stimulus** (e.g. corneal reflex and response to pain stimulus)


Evaluation of the state of consciousness



Sensitivity and specificity

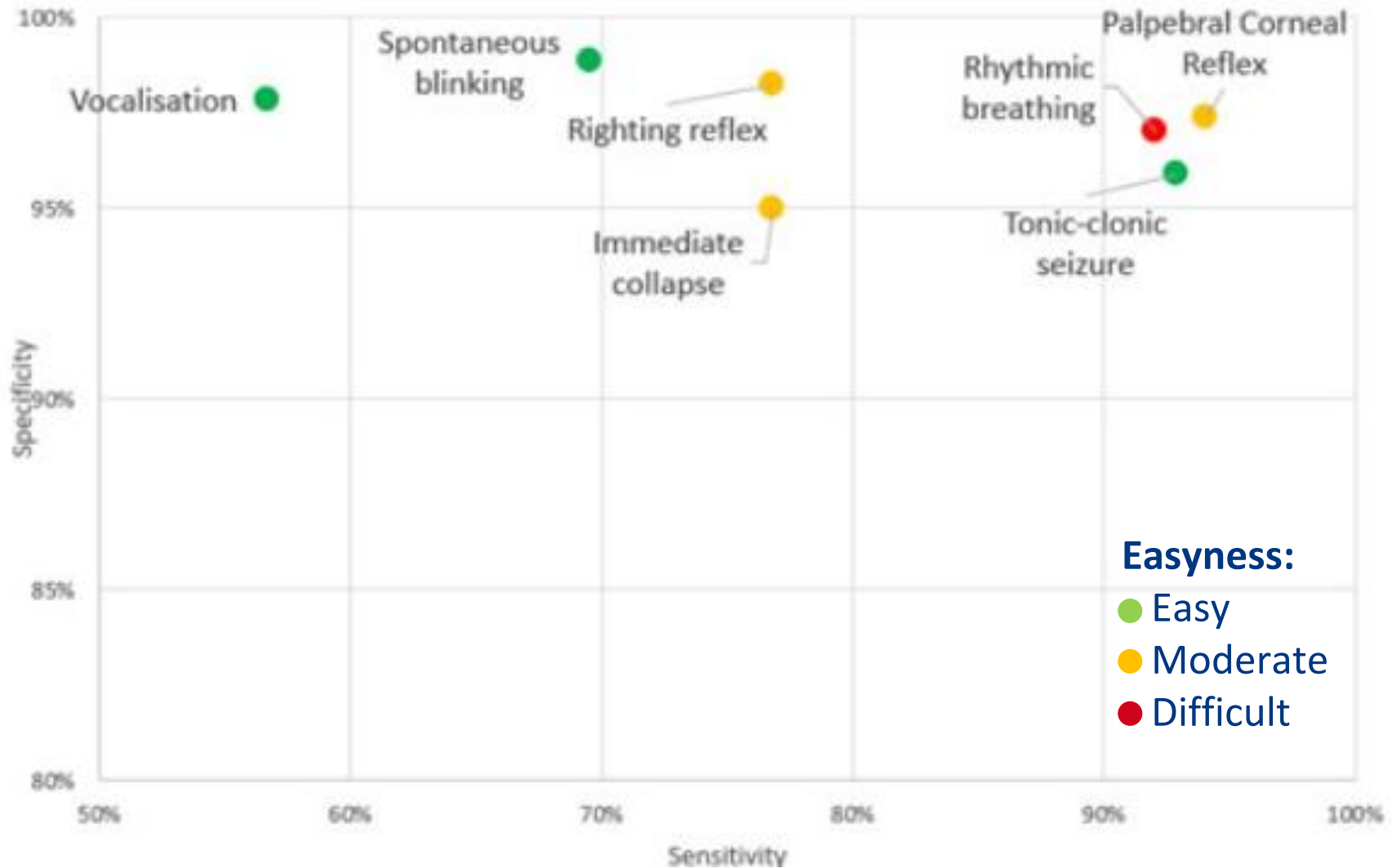
Sensitivity: is the percentage of (truly) conscious animals that are tested as conscious

	Reality		
Indicator	Conscious	Unconscious	
Conscious Corneal Reflex +	✓	Animal is unconscious, but diagnosed as conscious	 Logistic problem
Unconscious Corneal Reflex -	Animal is conscious, but diagnosed as unconscious	✓	


Welfare problem

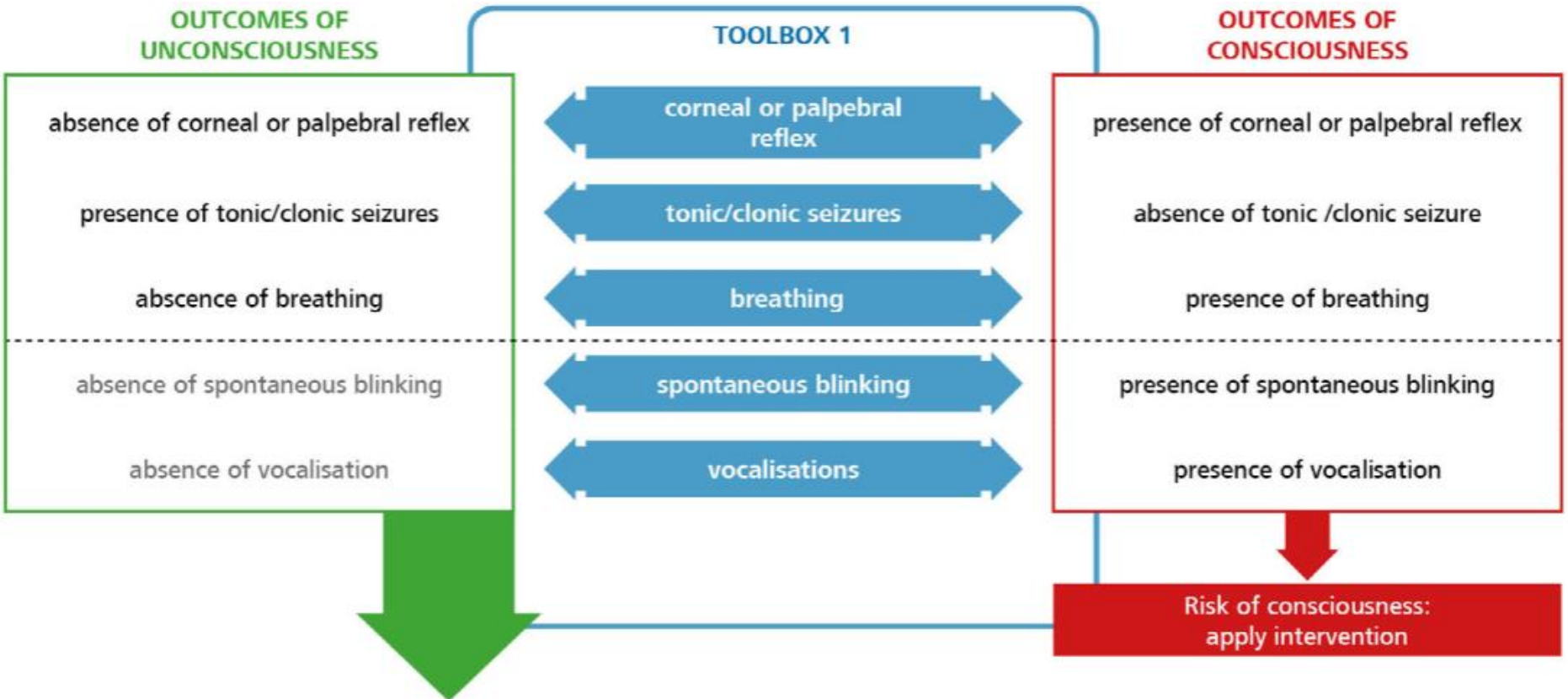
EFSA (2013)

Sensitivity, specificity and easyness



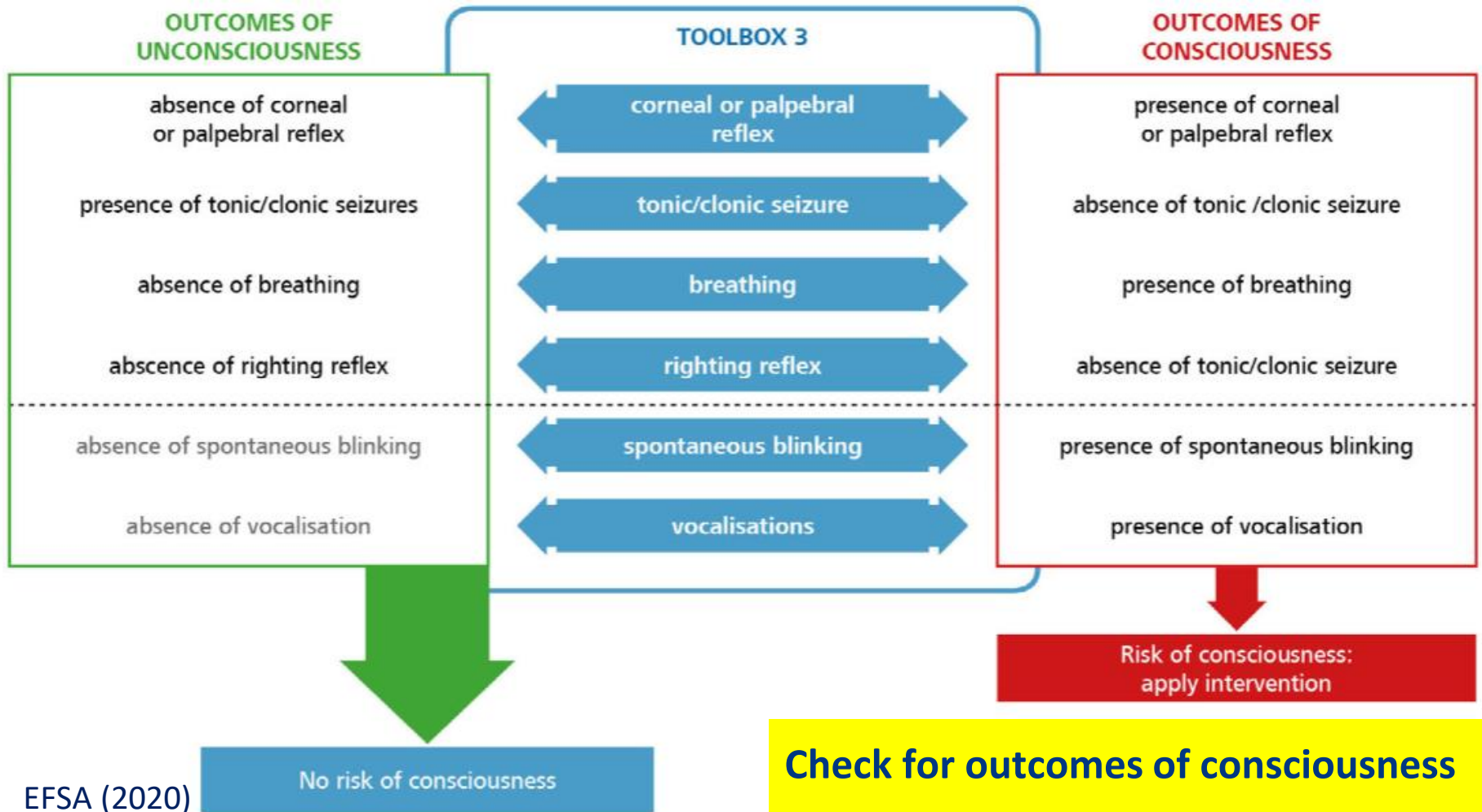
EFSA (2020)

STAGE: IMMEDIATELY AFTER STUNNING



Check for outcomes of consciousness

STAGE: DURING BLEEDING



Refinement of indicators and efficiency of stunning

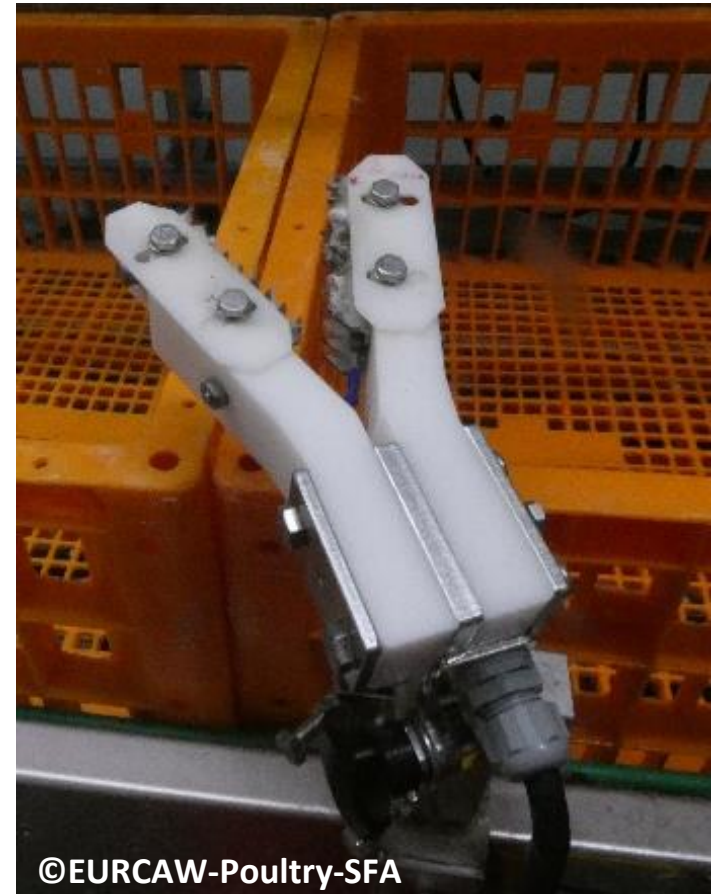
Alexandra Contreras-Jodar
(Researcher, IRTA)



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1. **Wide variability on the recommended key parameters** found in national guidelines
2. **Heterogeneity in the indicators chosen** by OV's to assess the state of consciousness in rabbits



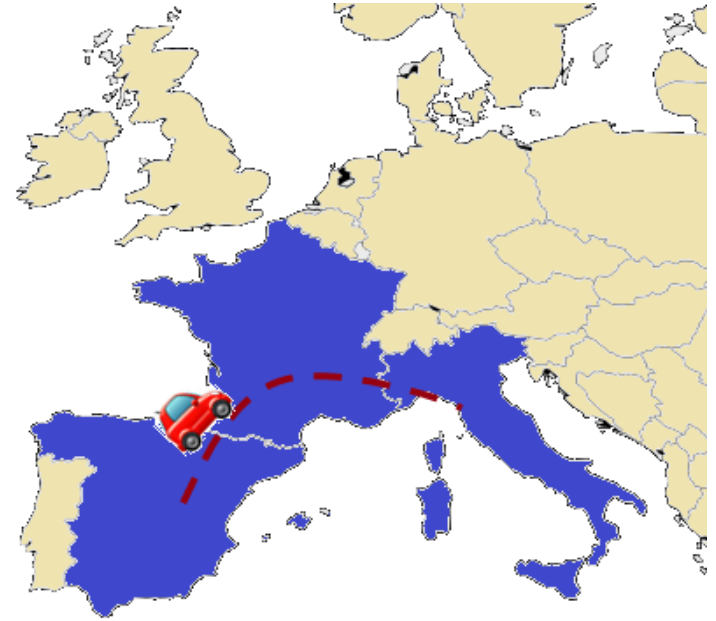
EURCAW-Poultry-SFA. (2023)



The Team:



Rabbit slaughterhouses (SHs):



16 different SHs from the 3 main rabbit producer countries in the EU



General:

Identify a refined list of indicators that can be used to assess the state of consciousness of head-only electrical stunned rabbits in commercial slaughterhouses to ensure consistency of controls and to evaluate the efficiency of induction of unconsciousness.

Specific:

1. Assess the **inter-observer repeatability** of the most valid and feasible indicators of consciousness according to the EFSA (2020)
2. Elucidate the **association** among the indicators
3. Assess **efficiency of stunning**
4. Find **key factors** that contribute to effective stunning





SH	Speed, rabbits/h	Wetting heads	Stunners, n	Stun-to-stick interval(s), s	Bleeding method	Bleeding cut	Operators bleeding, n
1	800	No	2	10 and NA	M	Lateral	1
2	1500	NA	2	11 and NA	M	NA	2
3	1600	No	1	22	M	Lateral	1
4	2600	No	3	15, 10 and 8	M	Lateral	1
5	2100	No	4	36, 30, 24 and 19	M	Ventral	2
6	700	No	1	15	M	Ventral	1
7	700	Yes	1	2	M	Lateral	1
8	600	No	1	3	M	Lateral	1
9	1850	Yes	3	18, 12 and 7	M	Ventral	1
10	1400	Yes	3	<1	A	Ventral	1
11	700	NA	1	3	M	Ventral	1
12	800	Yes	1	16	M	Lateral	1
13	1700	No	3	25, 19 and 6	M	Ventral	1
14	1920	Yes	3	33, 24 and 17	M	NA	1
15	3200	Yes	4	22, 20, 18 and 13	M	Lateral	2
16	3600	No	3	20, 13 and 5	M	Ventral	2

*Bleeding method: M (manually); A (automatically); SH: slaughterhouse; NA: data not available

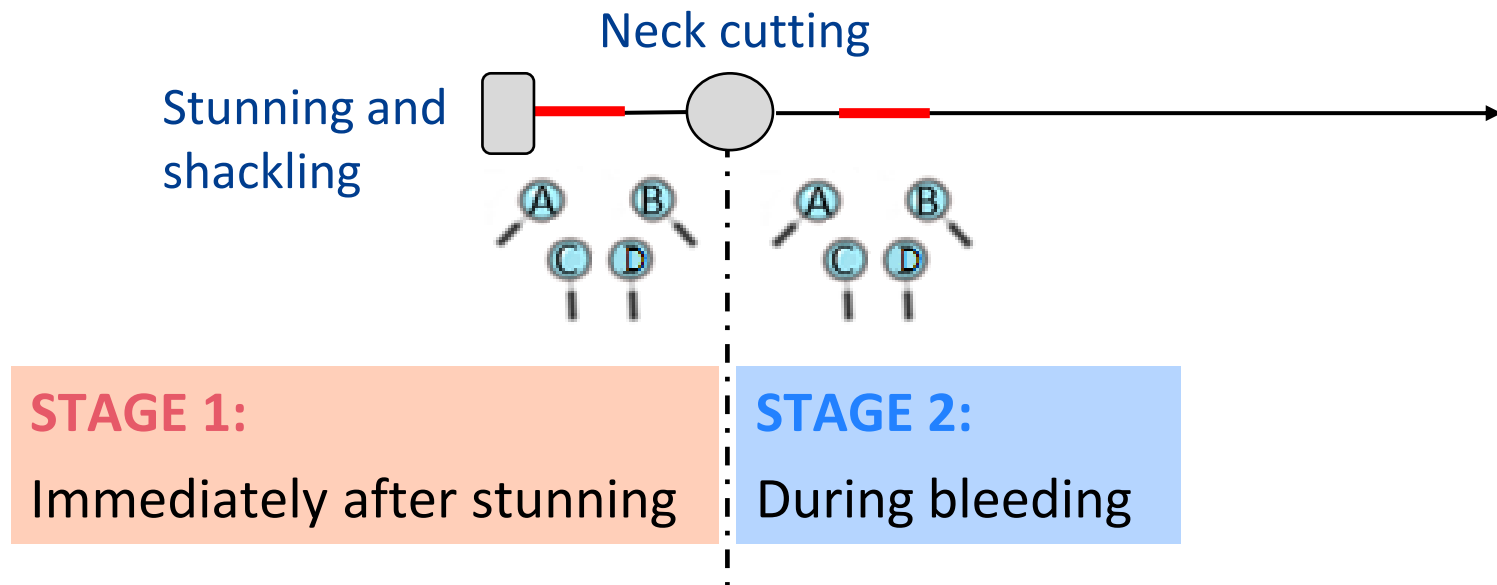


❑ Observers:

16 slaughterhouses, 38 batches, 11,540 rabbits

4 observers 

❑ Sample assessment: Position and stages during the assessment of indicators





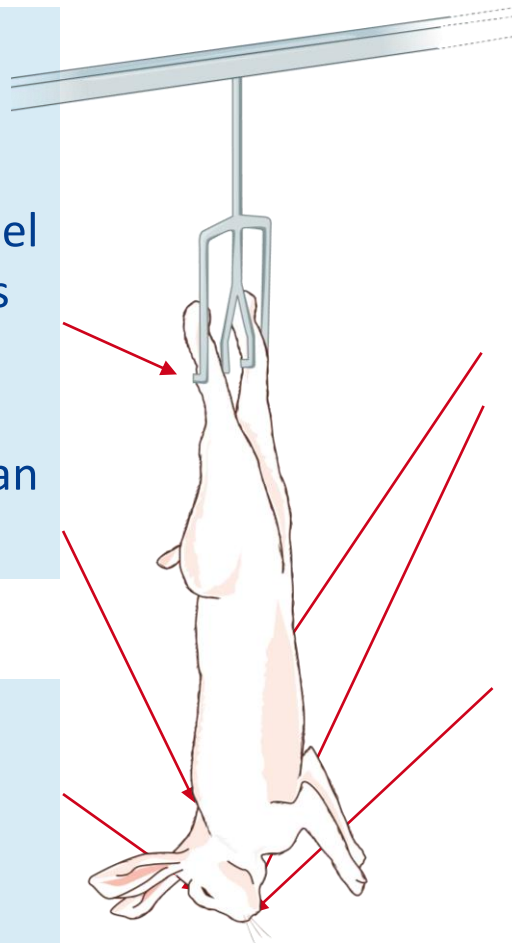
STAGE 1: IMMEDIATELY AFTER STUNNING

Absence of TONIC-CLONIC SEIZURE

Rabbit do not show arched and stiff neck (*i.e.* necks appear parallel to the ground) and paws and ears held tightly close to the body. Then followed (or not) by kicking action and/or leg paddling that can be either rhythmic or erratic

Presence of SPONTANEOUS BLINKING

Rabbit opens/closes eyelid on its own (fast or slow) without stimulation.



Presence of BREATHING

Presence of rhythmic breathing considered as a minimum of two openings of the mouth and thoracic or abdominal muscles associated to inhalation and expiration with similar cadence.

Presence of VOCALISATIONS

Single or repeated shrieking (screaming).



STAGE 2: DURING BLEEDING

Absence of TONIC-CLONIC SEIZURE

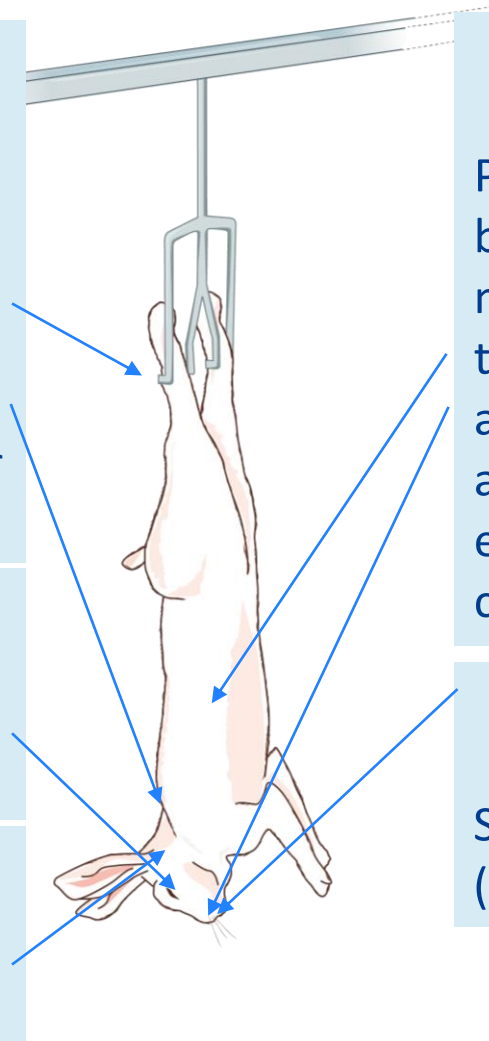
Rabbit do not show arched and stiff neck (*i.e.* necks appear parallel to the ground) and paws and ears held tightly close to the body. Then followed (or not) by kicking action and/or leg paddling that can be either rhythmic or erratic

Presence of SPONTANEOUS BLINKING

Rabbit opens/closes eyelid on its own (fast or slow) without stimulation.

Presence of RIGHTING REFLEX

Attempt to regain posture and/or raise the head.



Presence of BREATHING

Presence of rhythmic breathing considered as a minimum of two openings of the mouth and thoracic or abdominal muscles associated to inhalation and expiration with similar cadence.

Presence of VOCALISATIONS

Single or repeated shrieking (screaming).

a) Inter-observer repeatability of ABIs



1. Crude proportion of agreement (PoA): % of agreement

Can be misleading as it does not take into account the scores that the observers assign due to chance

2. Fleiss' kappa (κ): degree to which the observed proportion of agreement among observers exceeds what would be expected if all observers made their ratings completely randomly. Ranges from -1 to 1.

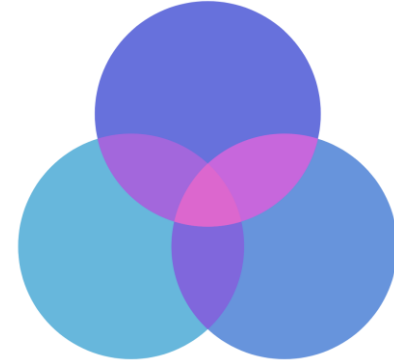
According to Fleiss *et al.* (2003):

- $\kappa > 0.75$: **Excellent** agreement beyond chance
- $0.40 < \kappa < 0.75$: **Fair to good** agreement beyond chance
- $\kappa < 0.40$: **Poor** agreement beyond chance

$\kappa \approx 0$ when there is an insufficient scoring variation (i.e., low prevalence of outcomes of consciousness) despite high agreement between observers

b) Association between the observed ABIs

- **Proportions among combinations of ABIs:** displayed as Venn diagram



c) Relationship between electrical parameters and stunning efficiency

Compare the effectiveness of stunning among the different combination of electrical key parameters through:

- **Prevalence:** % of rabbits showing at least one outcome of consciousness

d) Key factors that contribute to effective stunning

- **Logistic regression**

Results: Inter-observer repeatability

Stage 1: Immediately after stunning Stage 2: During bleeding

Item	All	
Tonic-clonic seizure		
Agreement, %	98.5	✓
κ interpretation	Fair to good	✓
Breathing		
Agreement, %	99.2	✓
κ interpretation	Fair to good	✓
Spontaneous blinking		
PoA, %	99.5	✓
κ interpretation	Fair to good	✓
Vocalisation		
Agreement, %	100	✗
κ interpretation	*	✗

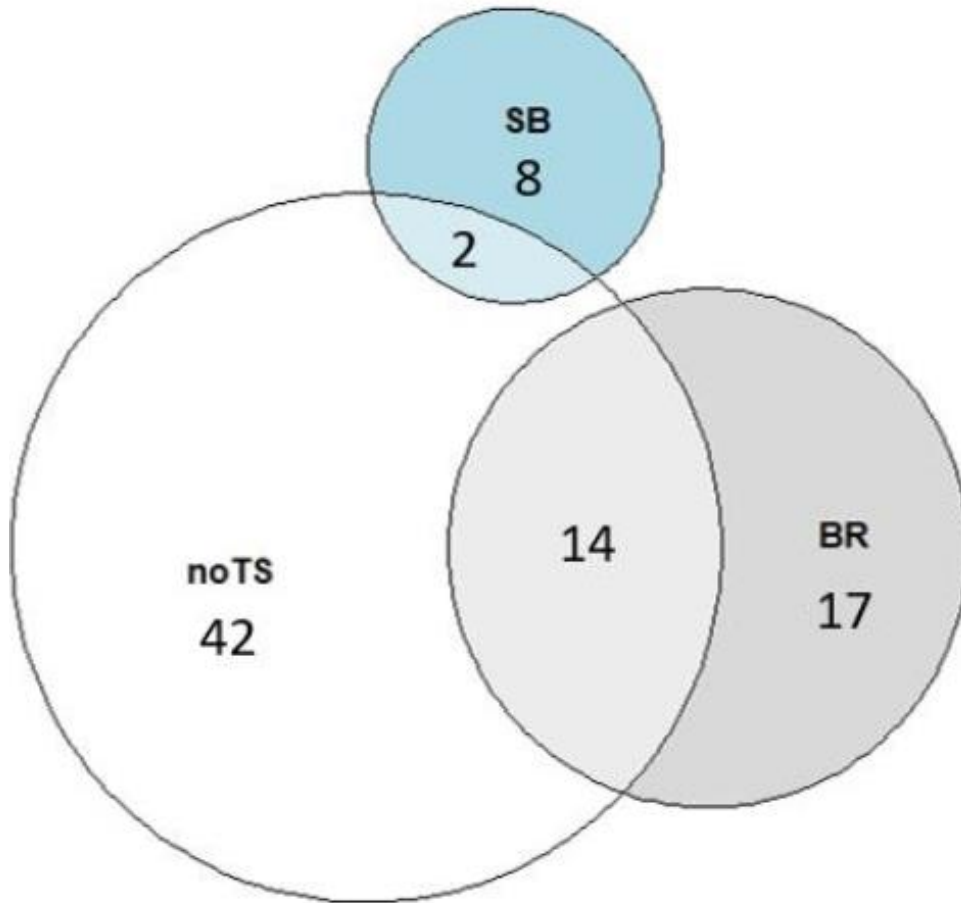
Item	All	
Tonic-clonic seizure		
Agreement, %	72.9	✓
κ interpretation	Fair to good	✓
Breathing		
Agreement, %	92.5	✓
κ interpretation	Excellent	✓
Spontaneous blinking		
Agreement, %	92.0	✓
κ interpretation	Fair to good	✓
Vocalisation		
Agreement, %	99.6	✗
κ interpretation	Poor	✗
Righting reflex		
Agreement, %	94.0	✗
κ interpretation	Poor	✗

κ not able to be computed.
No scoring variation.

Results: Association between ABIs

Stage 1: Immediately after stunning

Rabbits assessed: 4,112



Indicators were:

- no TS:** absence of tonic-clonic seizure
- BR:** presence of breathing
- SB:** presence of spontaneous blinking
- VC:** presence of vocalizations

No vocalisations

Results: Association between ABIs

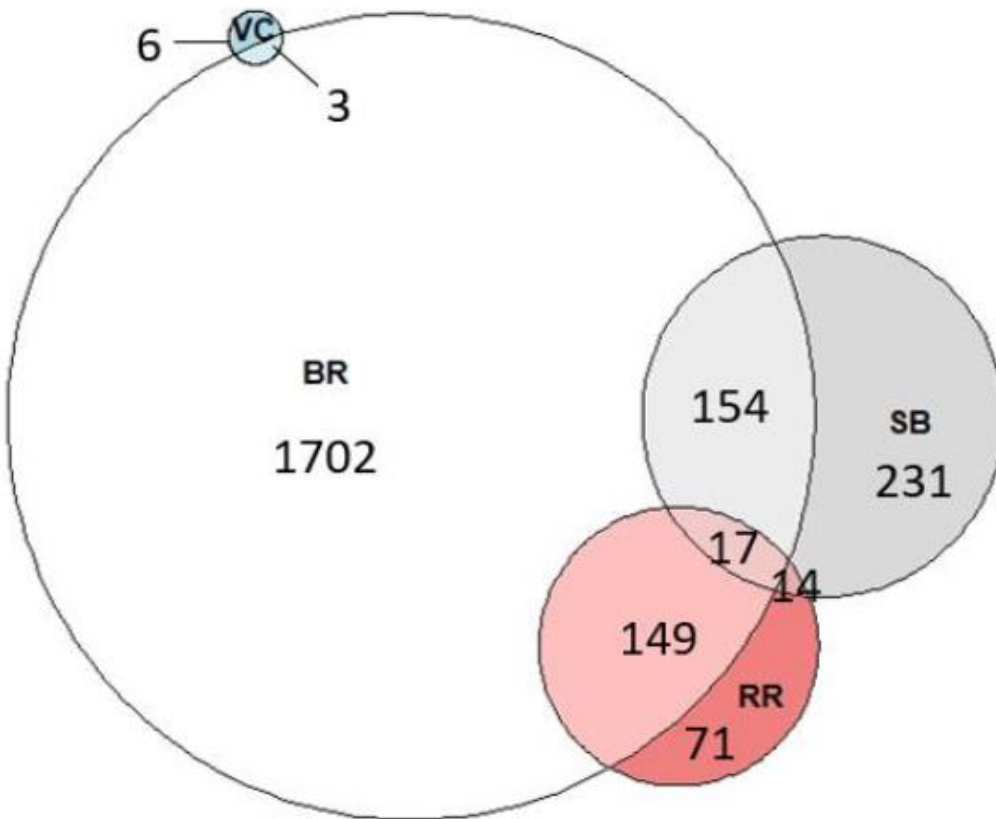
Stage 2: During bleeding

Rabbits assessed: 7,428

Indicators were:

- BR:** presence of breathing
- SB:** presence of spontaneous blinking
- VC:** presence of vocalizations
- RR:** presence of righting reflex

- Absence of tonic-clonic seizure at this stage does not imply consciousness
- RR only when the rabbit breath or blink
- RR is often confused with preagonal muscle movements that can occur in brain-dead animals



Results: Stunning efficiency

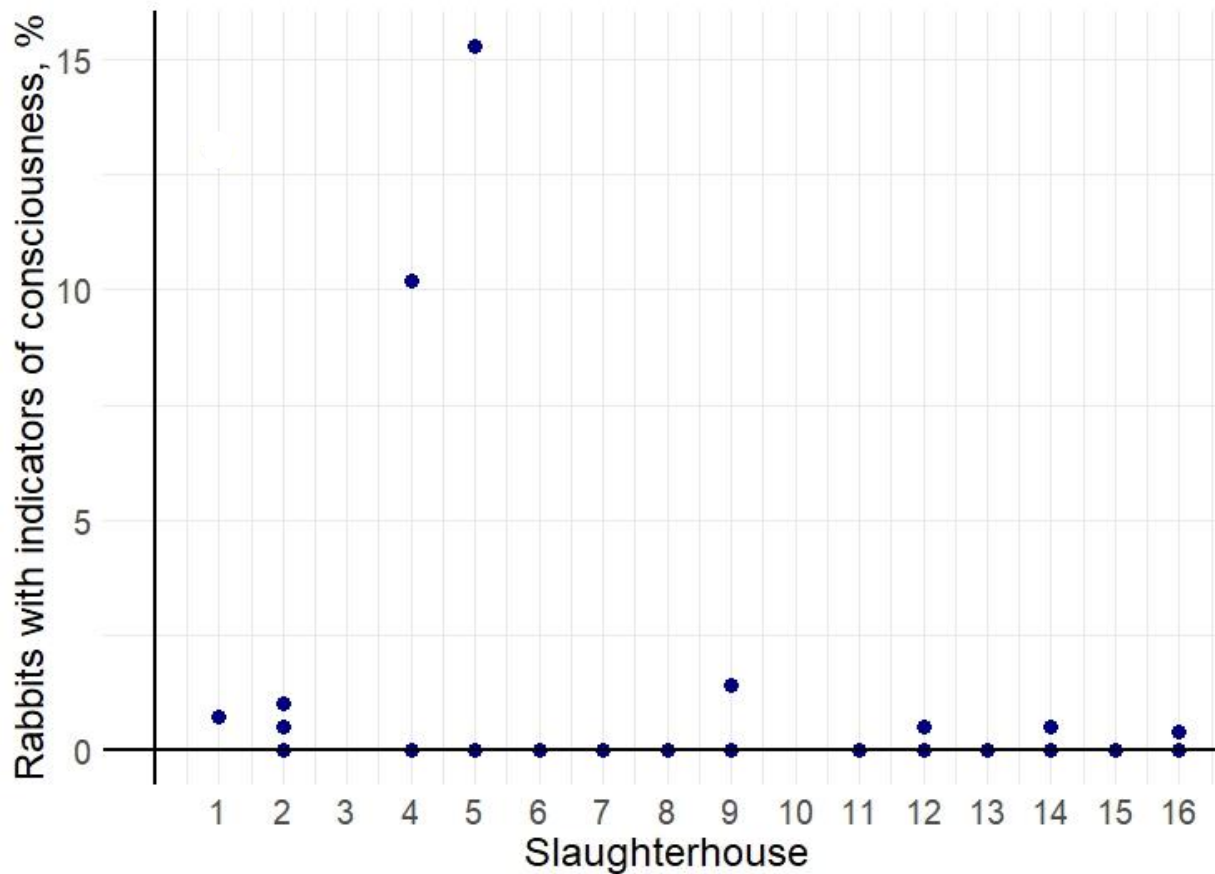
SH	Wet, Yes/No	Stunners, n	Stun-to-stick interval, s [min, max]	Batch	Current, mA	Frequency, Hz	Voltage, V	Time, ms
1	No	2	[NA, 10]	1	291±86	401	395±31	2380±306
				2	281±81	401	397±0	2391±283
2	NA	2	[NA, 11]	1	855±124	50	182±3	978±128
				2	854±125	50	181±3	972±147
				3	836±111	50	181±3	918±117
3	No	1	22	1	875±284	50	270±7	1102±194
				2	913±294	50	272±7	1153±460
4	No	3	[8, 15]	1	860±257	50	302±8	750±138
				2	858±287	50	301±8	739±129
				3	939±283	50	299±7	801±120
				4	834±271	50	292±10	721±117
5	No	4	[19, 36]	1	667	NA	351	1338
				2	577	NA	354	1272
6	No	1	15	1	437±128	50	180±0	495±258
				2	447±135	50	180±0	503±261
7	NA	2	2	1	610±171	50	145±4	567±121
				2	498±135	50	143±4	485±107
8	No	1	3	1	467±175	50	210±4	509±152

Results: Stunning efficiency

SH	Wet, Yes/No	Stunners, n	Stun-to-stick interval, s [min, max]	Batch	Current, mA	Frequency, Hz	Voltage, V	Time, ms
9	Yes	3	[7, 18]	1	723±254	50	936±316	250±8
				2	708±258	50	843±270	251±8
				3	696±244	50	739±239	251±8
10	Yes	3	0	1	411±90	300	156±69	669±136
				2	406±96	300	166±87	665±141
11	NA	1	3	1	138±17	150	95±34	NA
12	Yes	1	16	1	196±43	150	113±56	399±31
				2	184±57	150	127±74	386±47
13	No	3	[6, 25]	1	126±26	250	107±38	700±0
				2	133±22	250	97±33	700±0
14	Yes	3	[17, 33]	1	170±38	250	162±34	NA
				2	173±39	250	159±35	NA
				3	177±39	250	155±36	NA
15	Yes	4	[13, 22]	1	257±65	50	116±5	419±119
15	Yes	4	[13, 22]	2	262±69	50	117±5	461±131
16	No	3	[5, 20]	1	609±176	50	207±4	449±99
16	No	3	[5, 20]	2	566±161	50	209±6	437±94
16	No	3	[5, 20]	3	529±150	50	209±5	424±95
16	No	3	[5, 20]	4	557±154	50	209±5	444±92
16	No	3	[5, 20]	5	508±131	50	211±3	424±88



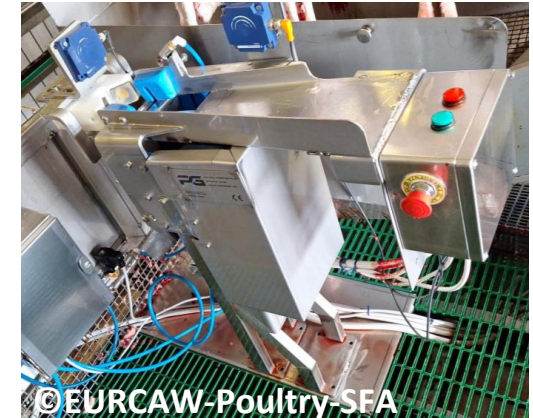
STAGE 1: IMMEDIATELY AFTER STUNNING



Efficient induction to unconsciousness was observed in some of the batches assessed (15 out of 25 batches)



STAGE 2: DURING BLEEDING

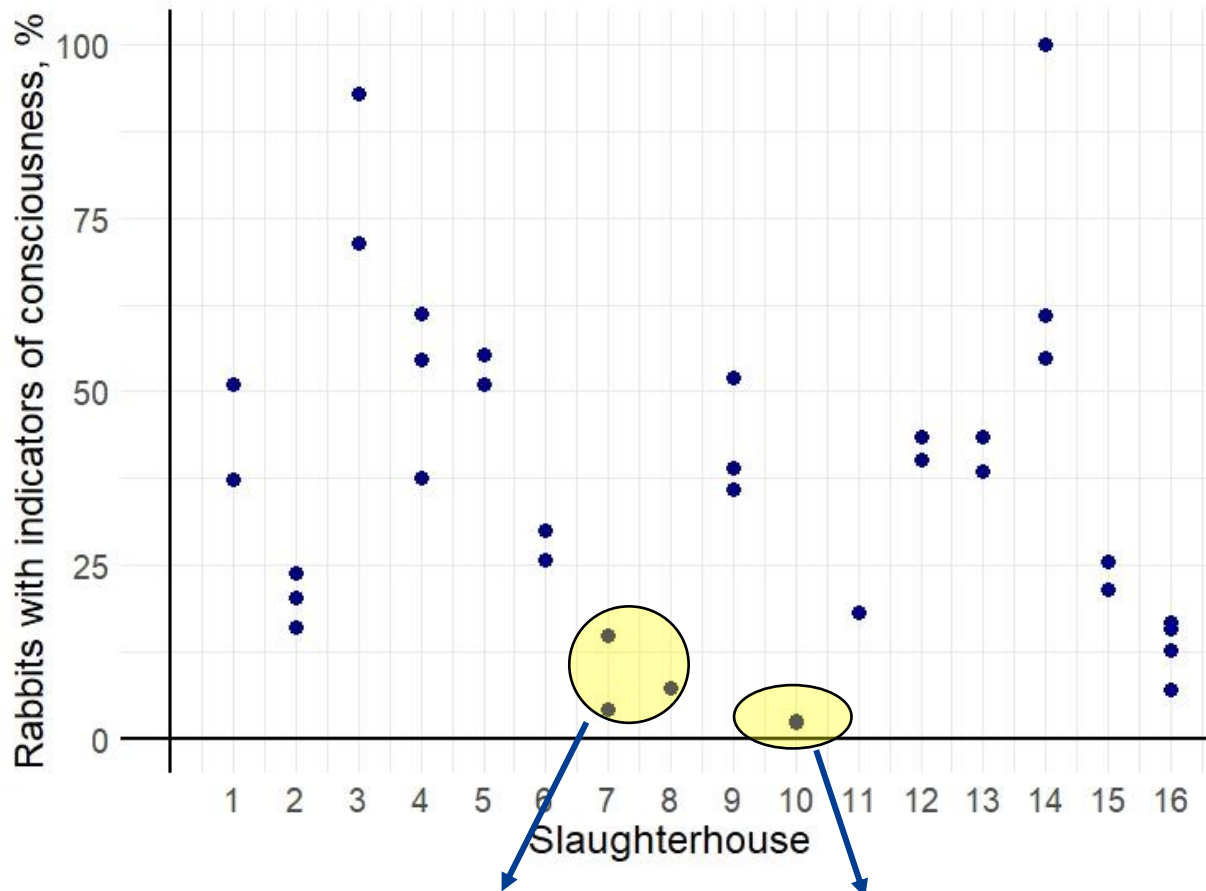


Unique stunning device
Stunner-bleeder

Stun-to-stick interval: < 1s
Prevalence: 2.3 and 2.7%



STAGE 2: DURING BLEEDING



A variable prevalence of rabbits were progressively recovering consciousness before death in ALL batches from ALL SHs

Stun-to-stick interval: 2 - 3s

Stun-to-stick interval: < 1s
Prevalence: 2.3 and 2.7%

Results: Key factors that contribute to effective stunning

- Factors influencing the efficiency of head-only electrical stunning in rabbits.

Predictors	Odds Ratios	95 % confidence interval	P-value
(Intercept)	1.81	1.53 – 2.15	<0.001
Stun-to-stick interval < 5 s	0.08	0.11 – 0.30	<0.001
Wetting the rabbit's head	0.66	0.57 – 0.77	<0.001
Electrical parameters			
> 200mA and 50Hz	0.42	0.30 – 0.58	<0.001
> 200mA and > 50Hz	0.61	0.52 – 0.71	<0.001

Protective factors:

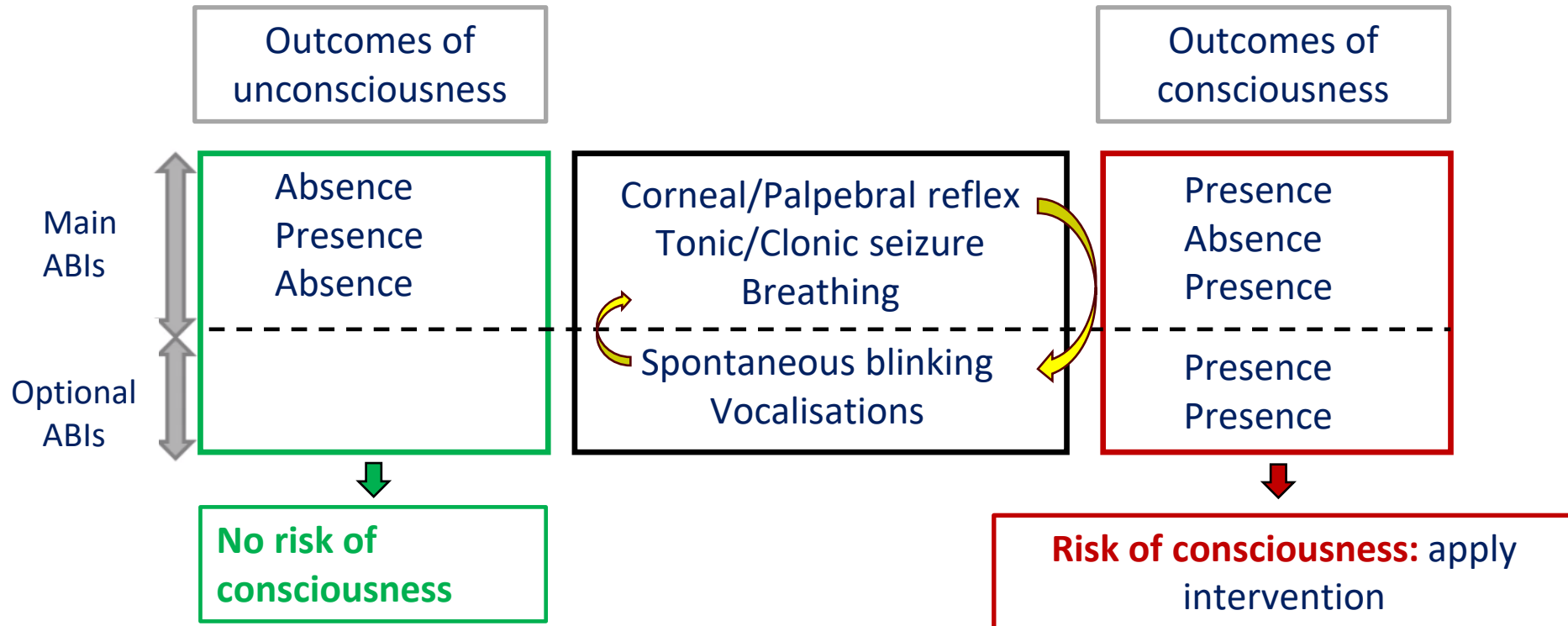
- Stun-to-stick interval below 5 s had the largest effect, reducing the odds by 92% (OR = 0.08)
- The use of high current and low frequency (> 200mA and 50Hz) showed reductions of 58% (OR = 0.42).
- Wetting the rabbit's head reduced the odds by 34% (OR = 0.66).

Conclusions

1. There is **considerable variability** in slaughterhouse designs, slaughter capacities, rabbit management practices, types of head-only electrical stunning devices used, electrical parameters applied, duration of head exposure to electrical tongs, stun-to-stick intervals, and type of neck cuts used.
2. This study identified **the most relevant** (i.e., valid, feasible and repeatable) **and prevalent ABIs** that should be used for assessing the state of consciousness in commercial slaughterhouses during official inspections.

Conclusions: Relevant ABIs

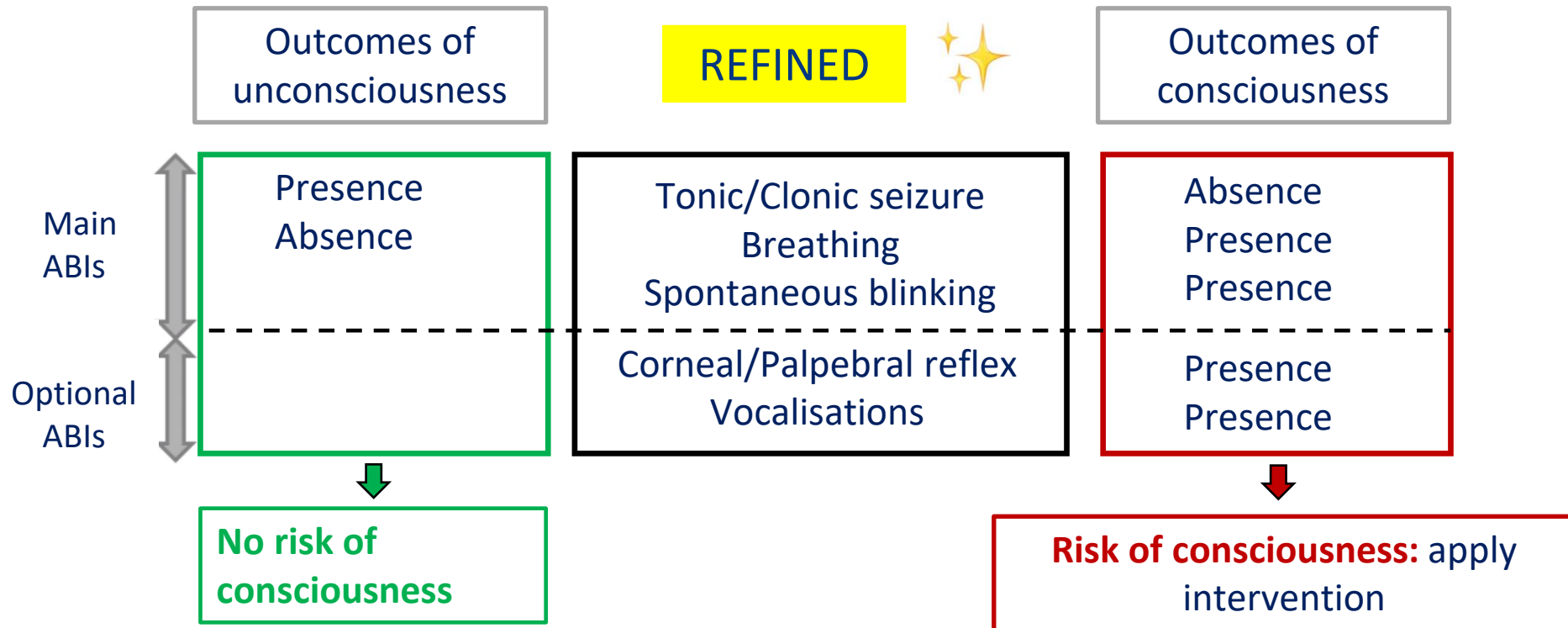
STAGE 1: IMMEDIATELY AFTER STUNNING



Toolbox: EFSA (2020)

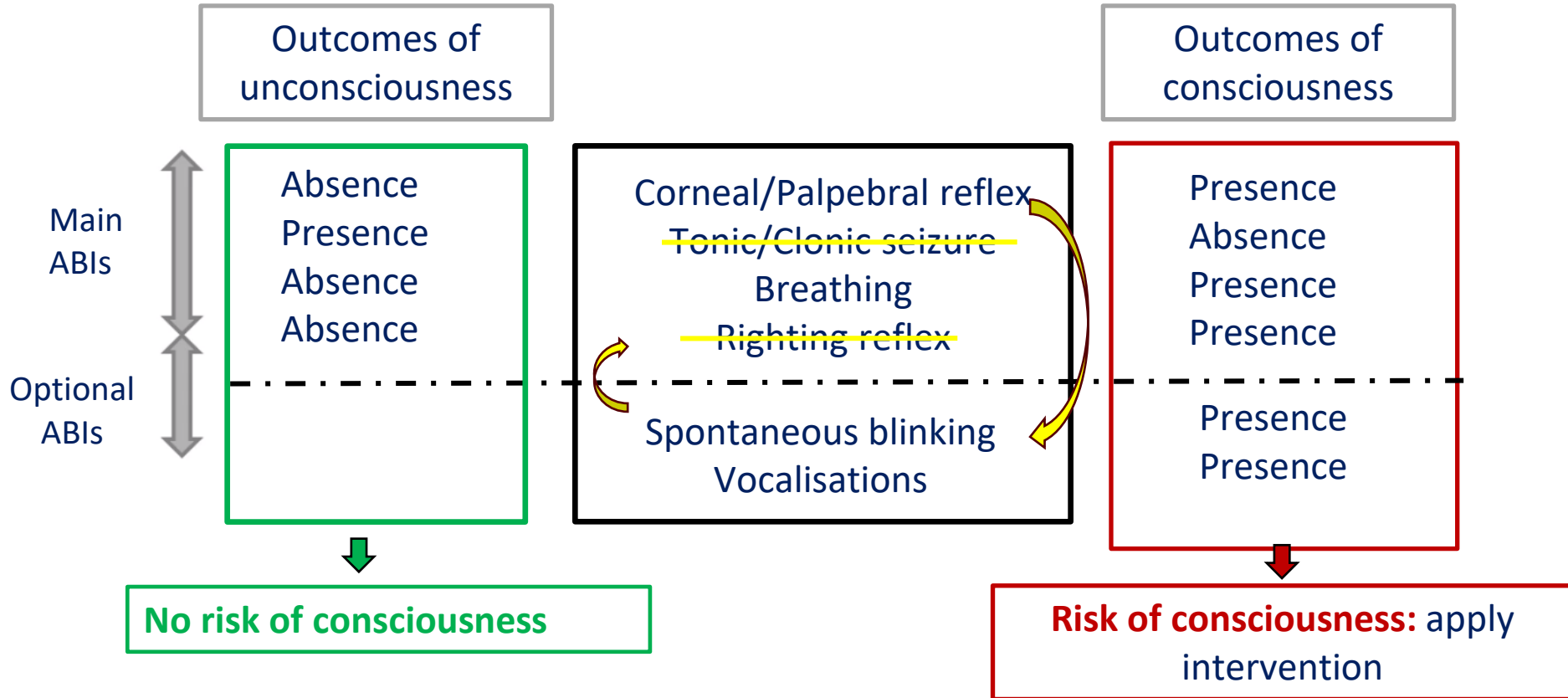
Main findings: Relevant indicators

STAGE 1: IMMEDIATELY AFTER STUNNING



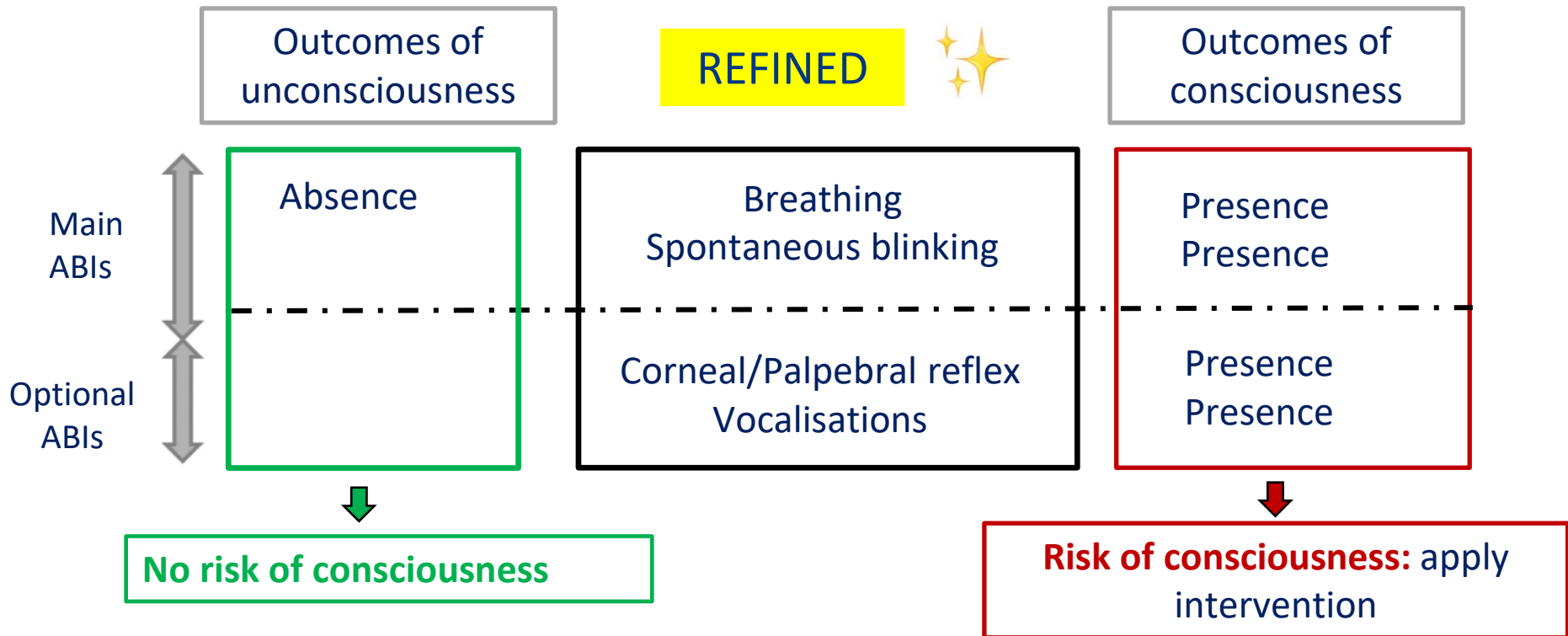


STAGE 2: DURING BLEEDING





STAGE 2: DURING BLEEDING



Conclusions

1. There is **considerable variability** in slaughterhouse designs, slaughter capacities, rabbit management practices, types of head-only electrical stunning devices used, electrical parameters applied, duration of head exposure to electrical tongs, stun-to-stick intervals, and type of neck cuts used.
2. This study identified **the most relevant** (i.e., valid, feasible and repeatable) **and prevalent ABIs** that should be used for assessing the state of consciousness in commercial slaughterhouses during official inspections.
3. Although unconsciousness is effectively induced in nearly all rabbits, **indicators of consciousness are frequently observed after neck-cutting**, suggesting that a variable but significant proportion of rabbits are progressively recovering consciousness before death **in all slaughterhouses**.

This highlights the importance of controls!!!

Conclusions

4. **Key factors** ranked in order of their contribution to effective stunning from greatest to least are:

- i. stun-to-stick interval of less than 5 s,
- ii. using current above 200 mA and frequencies not above 50 Hz, and
- iii. wetting the rabbits' heads.

The more these key factors are present in a SH, the higher the likelihood of effective stunning in rabbits.



This research was funded by the EURCAW-Poultry-SFA.
European Commission Grant number: SMP-FOOD-2023-EURL-EURC-AG-IBA

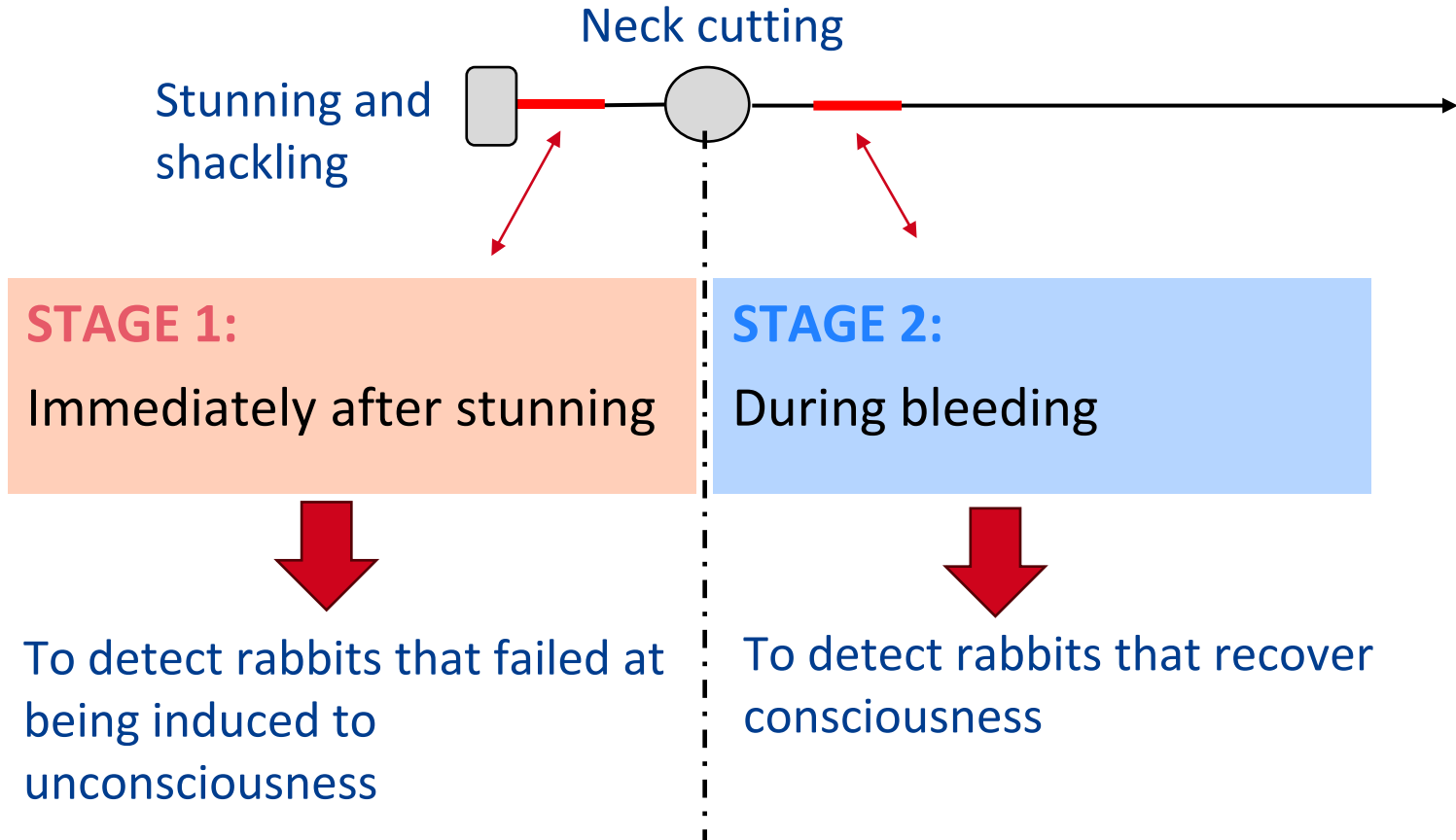
Methods and recommendations

Alexandra Contreras (IRTA) & Virginie Michel (ANSES)



Designated by
the EU Commission

1. Position



Method of assessment

- Observe each rabbit individually for a few seconds while they are in a ventral-lateral position in both stages, when feasible





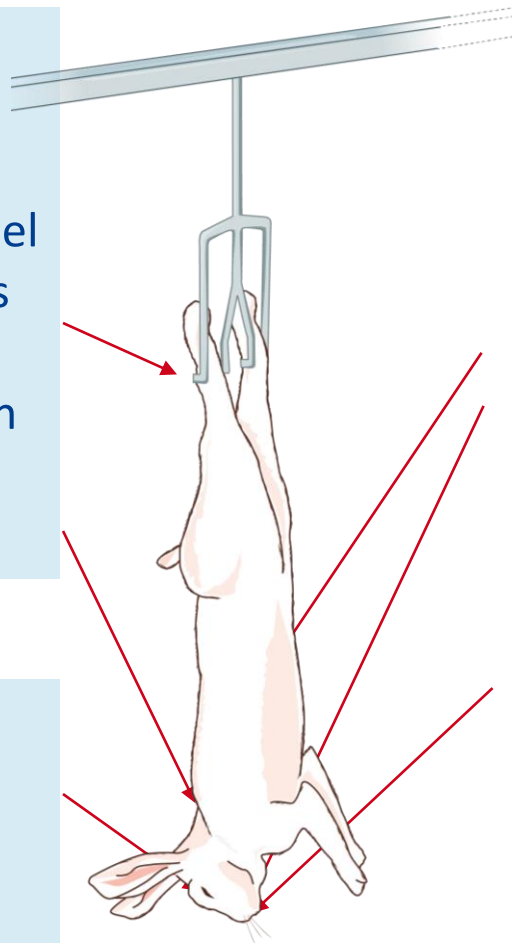
STAGE 1: IMMEDIATELY AFTER STUNNING

Absence of TONIC-CLONIC SEIZURE

Rabbit do not show arched and stiff neck (*i.e.* necks appear parallel to the ground) and paws and ears held tightly close to the body followed (or not) by kicking action and/or leg paddling that can be either rhythmic or erratic

Presence of SPONTANEOUS BLINKING

Rabbit opens/closes eyelid on its own (fast or slow) without stimulation.



Presence of BREATHING

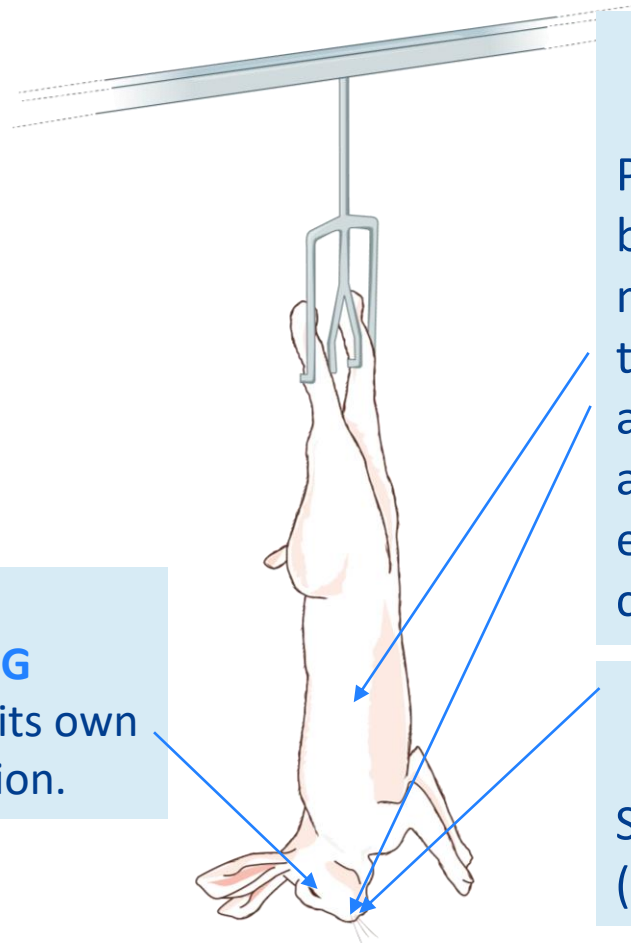
Presence of rhythmic breathing considered as a minimum of two openings of the mouth and thoracic or abdominal muscles associated to inhalation and expiration with similar cadence.

Presence of VOCALISATIONS

Single or repeated shrieking (screaming).



STAGE 2: DURING BLEEDING



Presence of BREATHING

Presence of rhythmic breathing considered as a minimum of two openings of the mouth and thoracic or abdominal muscles associated to inhalation and expiration with similar cadence.

Presence of VOCALISATIONS

Single or repeated shrieking (screaming).

Presence of SPONTANEOUS BLINKING

Rabbit opens/closes eyelid on its own (fast or slow) without stimulation.

STAGE 1: IMMEDIATELY AFTER STUNNING

- Absence of Tonic-clonic seizure
- Presence of Breathing
- Presence of Spontaneous blinking
- Presence of Vocalizations



VIDEOS

STAGE 2: DURING BLEEDING

- Presence of Breathing
- Presence of Spontaneous blinking
- Presence of Vocalizations

The presence of at least one indicator indicates the rabbit is conscious or regaining consciousness

Recommendations

Key factors for effective stunning:

1. Wetting the rabbits' heads prior stunning
2. Stun-to-stick interval of less than 5 s: **The shorter the better!!!**
3. Current >200 mA and frequencies =50 Hz: **The higher current the better!!!**
4. Remove regularly the accumulated fur and debris



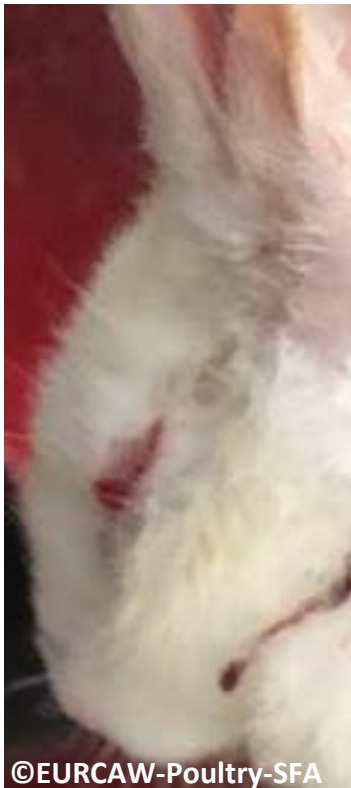
Recommendations

Use eye protectors to prevent burns: Adaptations for breeders:

Use electric stunning models that safeguard the rabbit's eyes from contact with the electrical tongs.

Breeders are more prone to ineffective stunning.

- Key electrical parameters.
- The size of electrical tongs should be adapted.



VIDEOS

Improvements on the wetting systems are needed



Stunner - bleeder device:



Pros:

- Wets the rabbits' heads just prior stunning and not during lairage
- Bleed the rabbit once the operator feel the tonic seizure and pushes a button
- Stun-to-stick interval < 1 s

Cons:

- Assessment of the state of consciousness is not possible immediately after stunning and before bleeding

Resulted in the lowest prevalence of rabbits regaining consciousness (2.3 – 2.7%). Better outcomes may be achieved by setting the stunner at 50 Hz.

Sampling method

Regulation 1099/2009



Article 5.1. Those checks shall be carried out on a sufficiently representative sample of animals and their frequency shall be established taking into account the outcome of previous checks and any factors which may affect the efficiency of the stunning process.

- To decide the frequency of the sampling: every batch of rabbits? Some batches?

At least 2 batches a day, at different period of the day (*Anses, 2021*)

- Random sampling in the batch will ensure representativity
- Sample of the batch according to «factors which may affect the efficiency of the stunning process”
- Sample size: depends on your objective: assess a prevalence of rabbits showing indicators of consciousness? Monitor consciousness through time? both? Consecutively (*Anses, 2021*)

Excel for sample size: [Online calculator tool](#)

**Thank you for your
attention**



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