Istituto Zooprofilattico Sperimentale del Mezzogiorno
Campania | Calabria

Biosecurity correlation with Antimicrobial Use and Animal Welfare in buffalo farm evaluated by ClassyFarm System

Departmental Unit of Animal Science, Welfare and Biosecurity
Italian National Reference Centre for Hygiene and Technologies of Water Buffalo Farming and Production (CReNBuf)

CReNBuf
Istituto Zooprofilattico Sperimentale del Mezzogiorno
National Reference Centre for Hygiene and Technologies of Water Buffalo Farming and Productions

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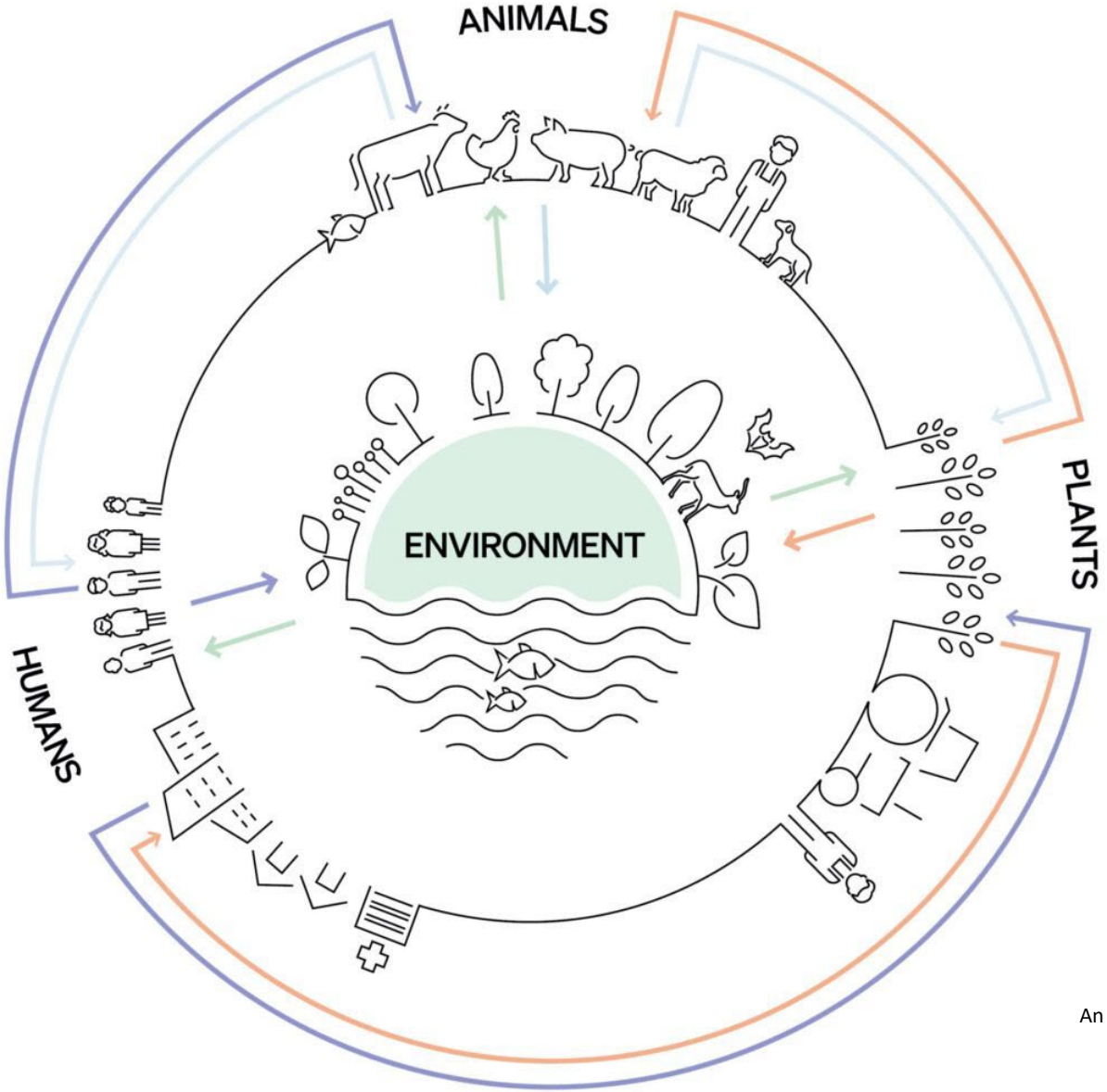
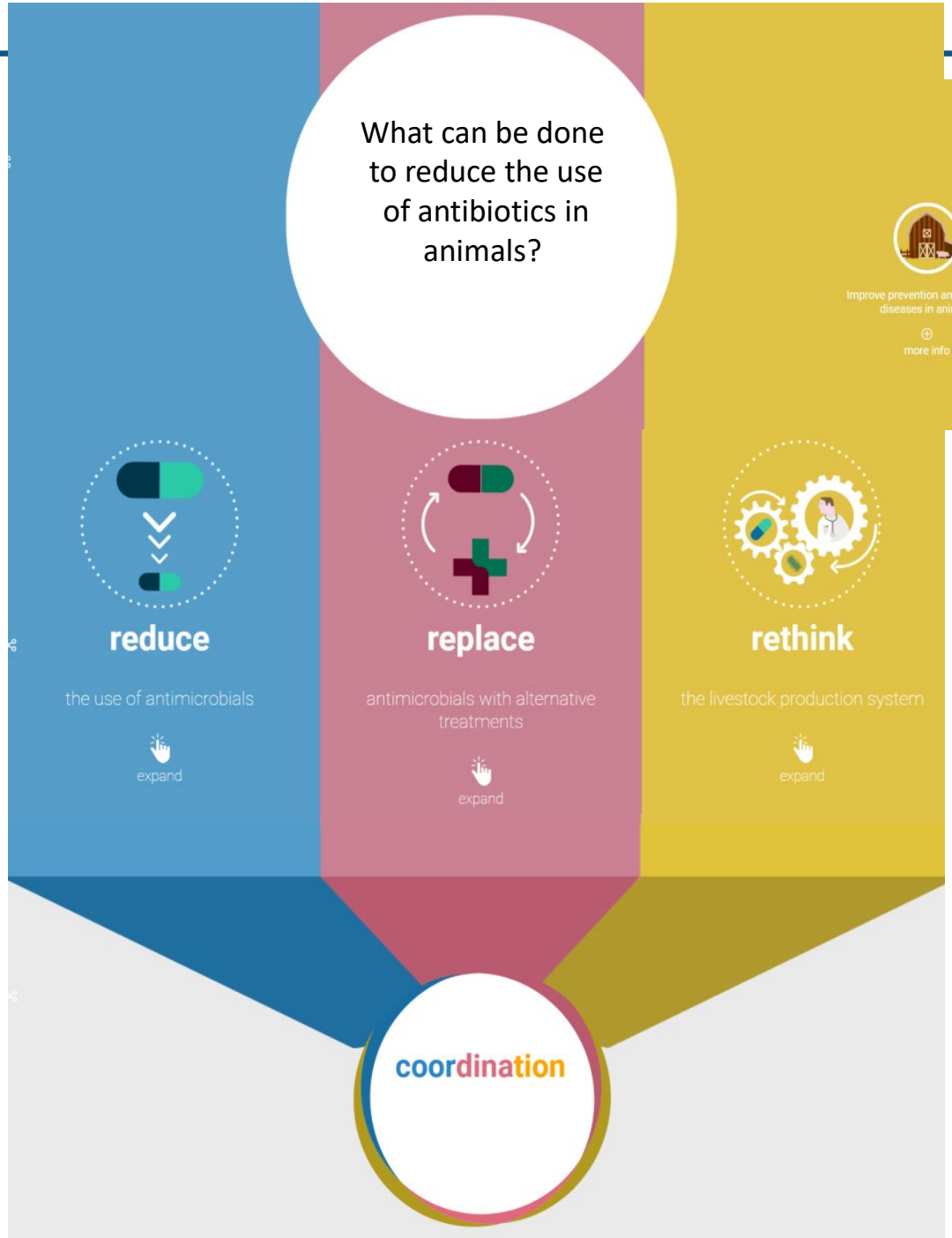
One Health and Zoonoses

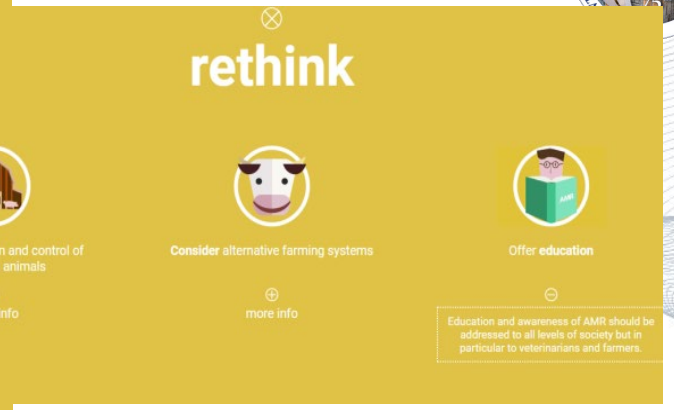


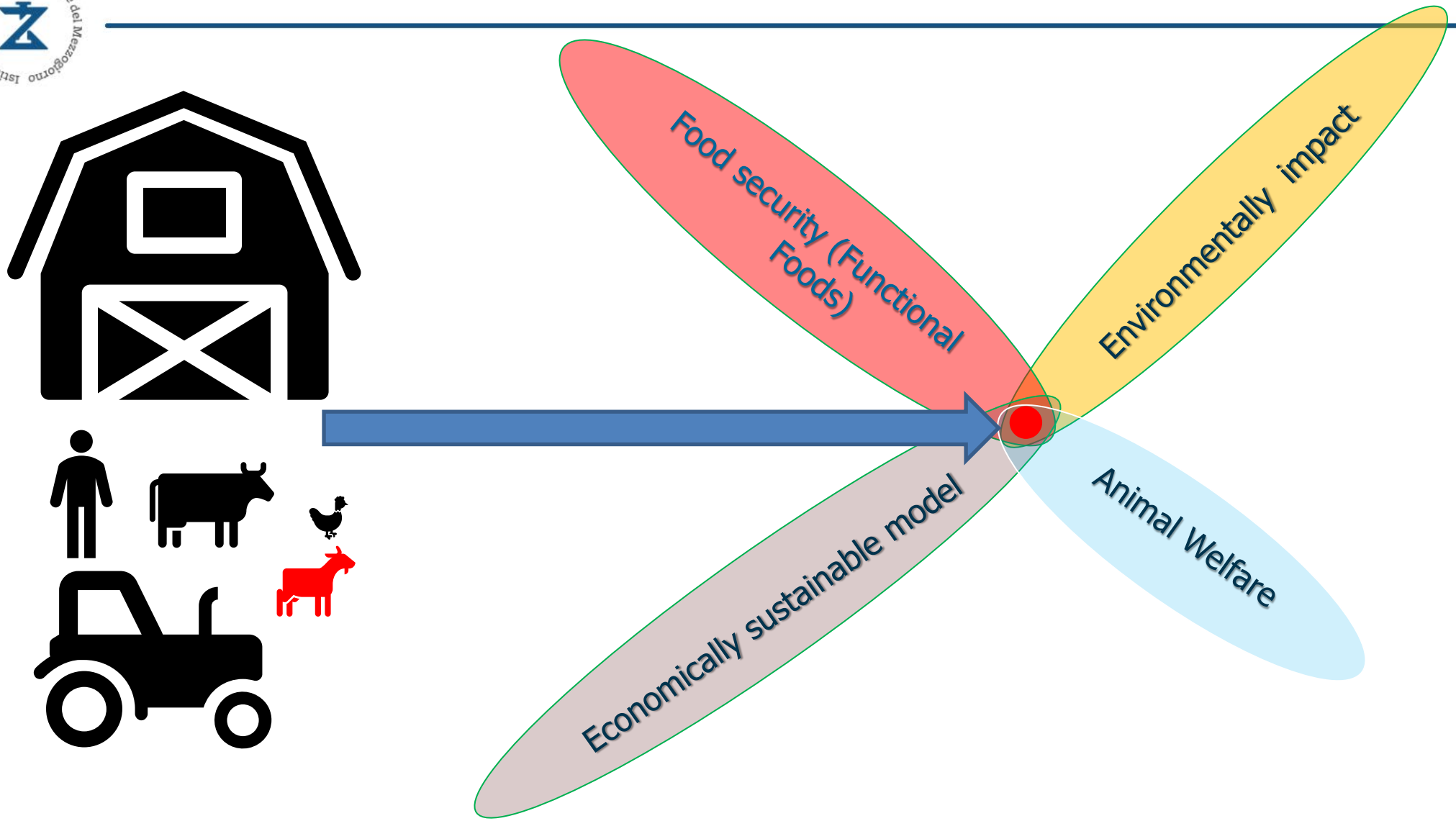
An illustration of the ecology of vector-borne diseases like the 2018 ebolavirus and 2019 coronavirus (Covid-19) by the artist Olaf Hajek.

https://www.woah.org/en/what-we-do/global-initiatives/one-health/

Present & Future






Food security (Functional Foods)
Environmentally impact
Animal Welfare
Economically sustainable model

Since 2013

A new Animal Health Strategy for the European Union (2007-2013)

Investiment in Pevention

Direct and indirect coasts

Reactive

«CURE»

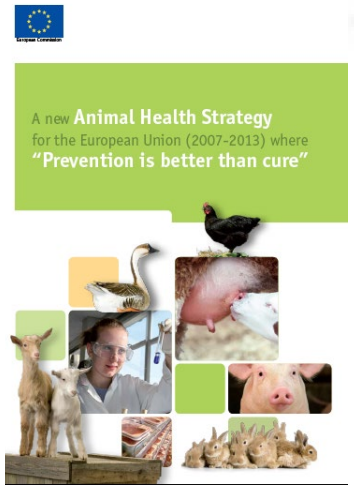
€ → €

Proactive

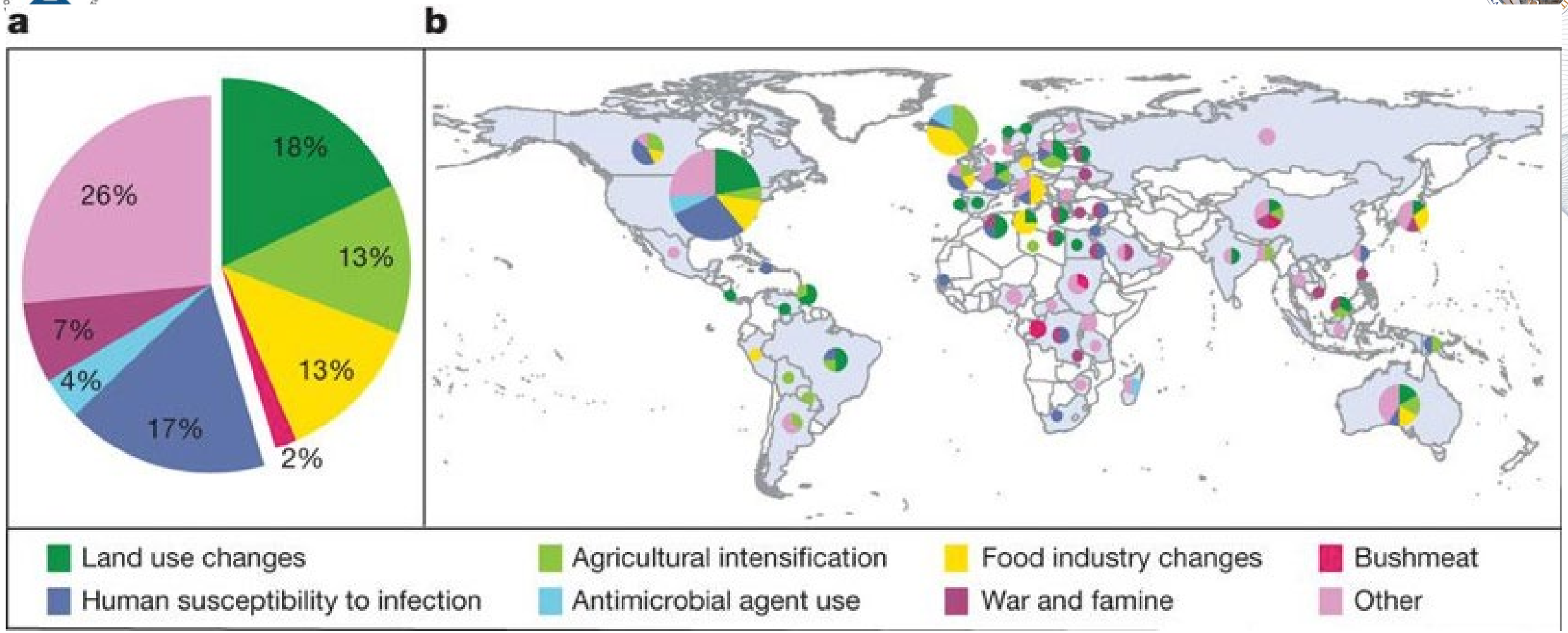
«prevention»

€ → €

G.R.Loria IZSS

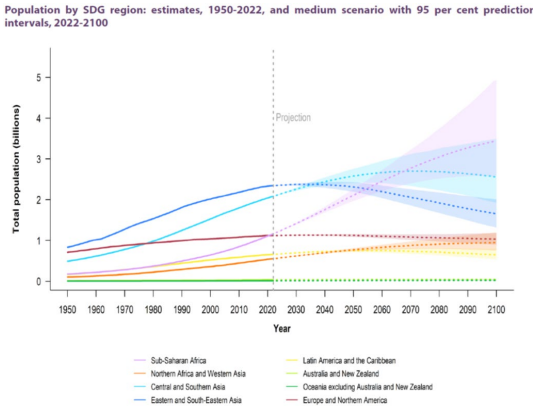


Reg.(UE) 429/2016

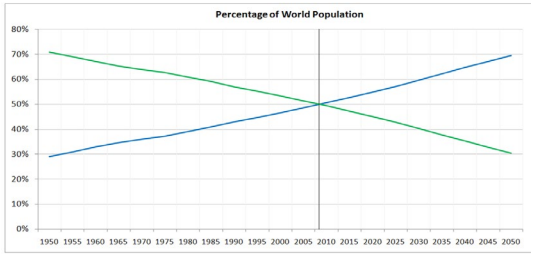


Drivers and locations of emergence events for zoonotic infectious diseases in humans from 1940–2005. Pie chart on the left (A) represents worldwide percentage of emerging events caused by each driver. Map on the right (B) shows, countries in which events took place and the drivers of emergence.

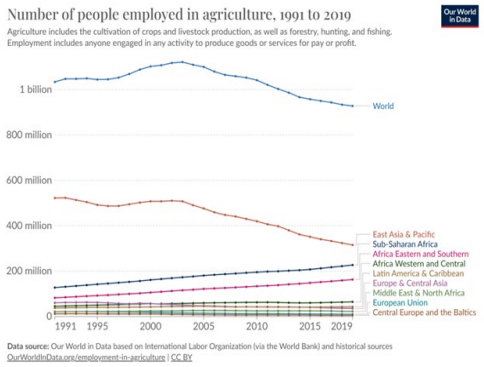
Source: Reproduced from Keesing, et al. (2010).



An important driver is given by the demographic pressure of man.



gradual but constant process of urbanization with a change of priority in human activity



reduction in the population employed in agriculture globally

The Drivers of Wildlife Interactions with Livestock

Global drivers of wildlife–livestock interactions

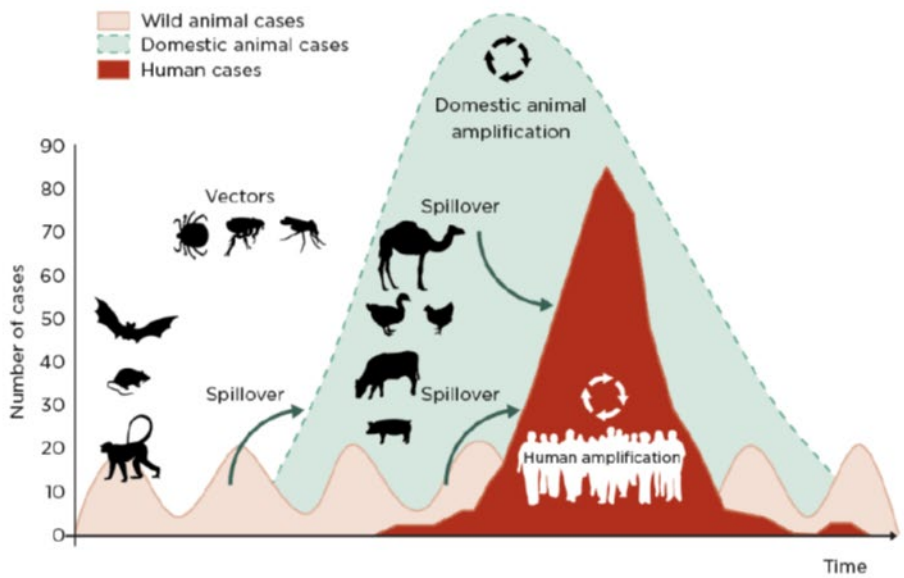
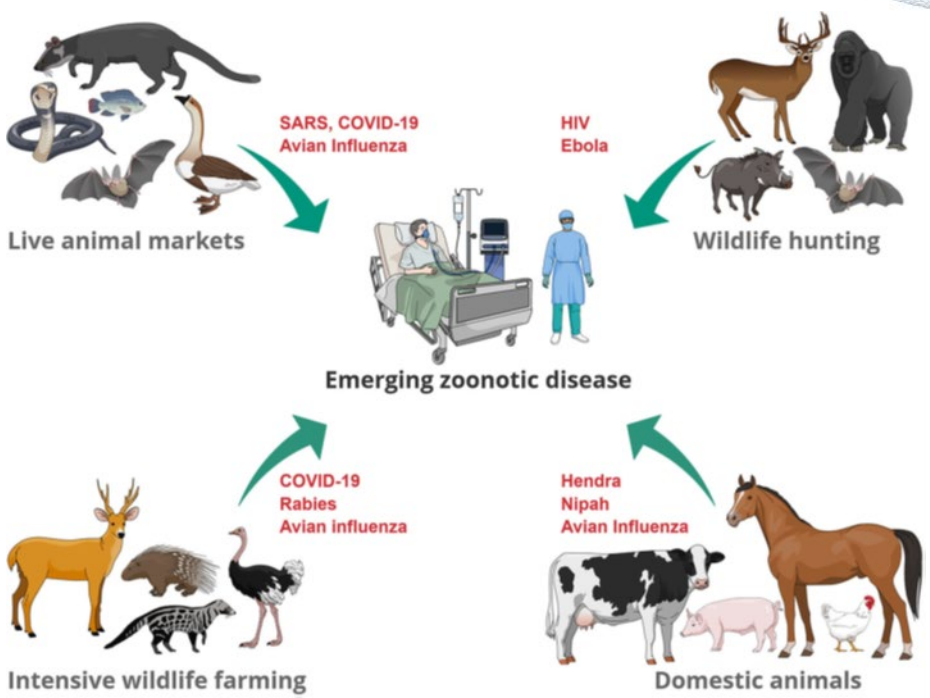


Figure 12: Transmission and amplification of zoonotic diseases. Transmission of a pathogen to people can occur directly from a wild animal or following an outbreak in livestock that amplifies the likelihood of transmissions to humans.

Source: Redrawn from Karesh, *et al.* (2012).



Magouras et al.2020. doi:10.3389/fvets.2020.582743

UN environment programme

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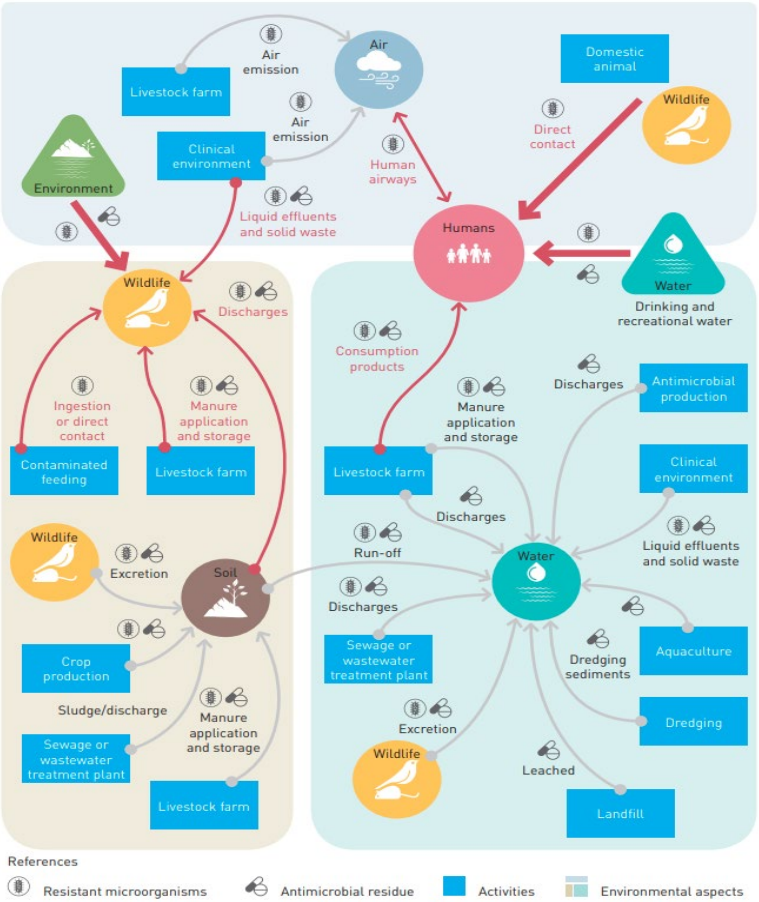
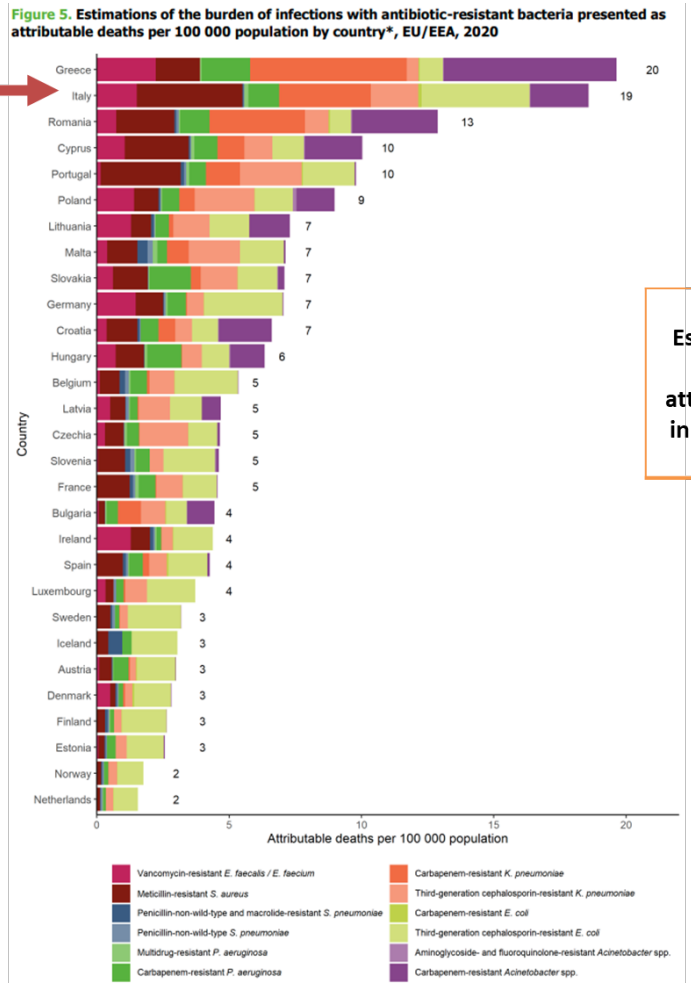
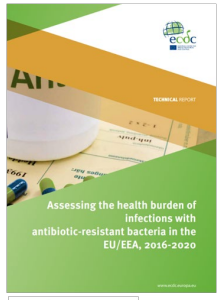


Italia



Estimated median number of attributable deaths in Europe (95% UI)	year 2020
	35 813 (31 395 - 40 584)

Stockholm, November 2022



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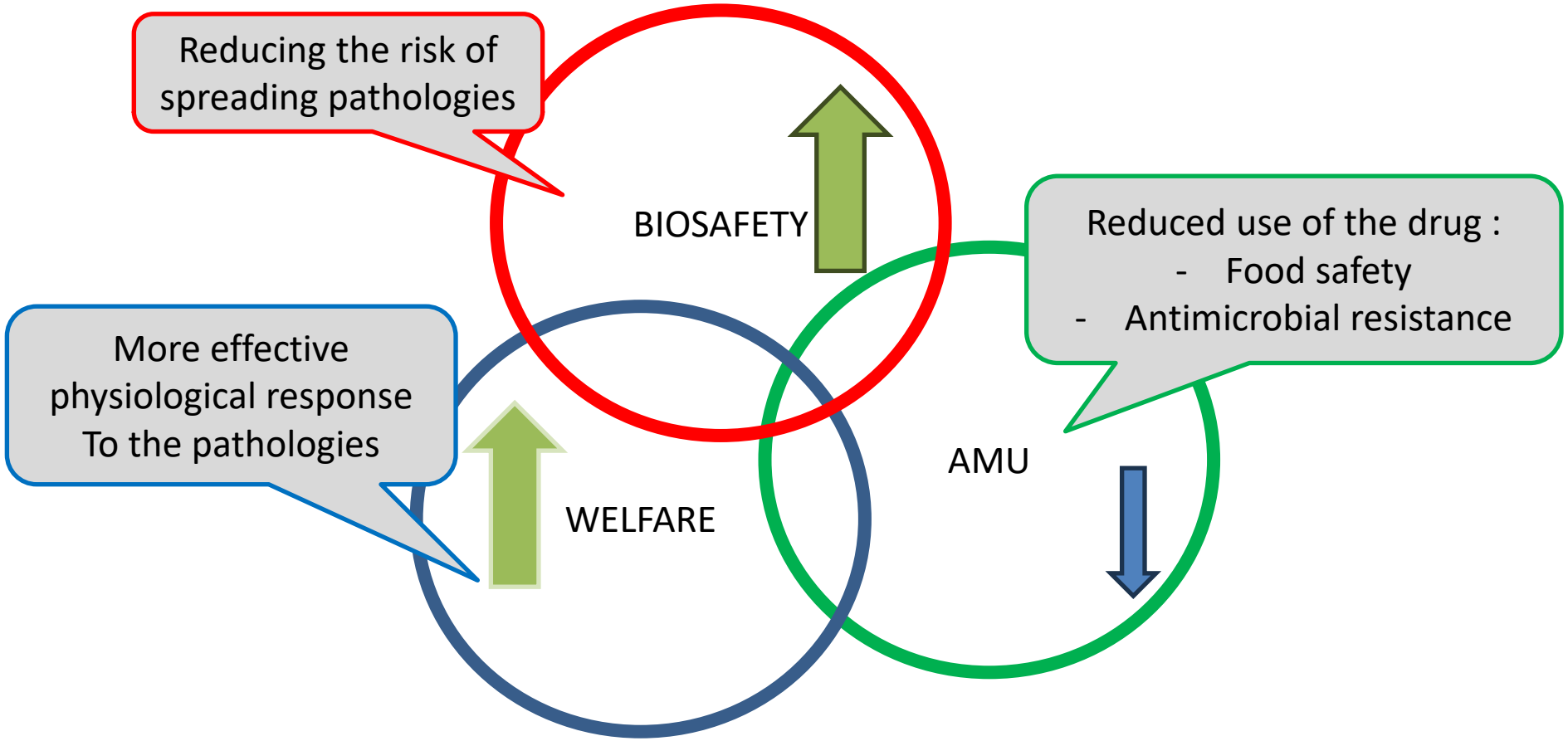
Bracing for Superbugs: Strengthening environmental action in the One Health response to antimicrobial resistance

Aim



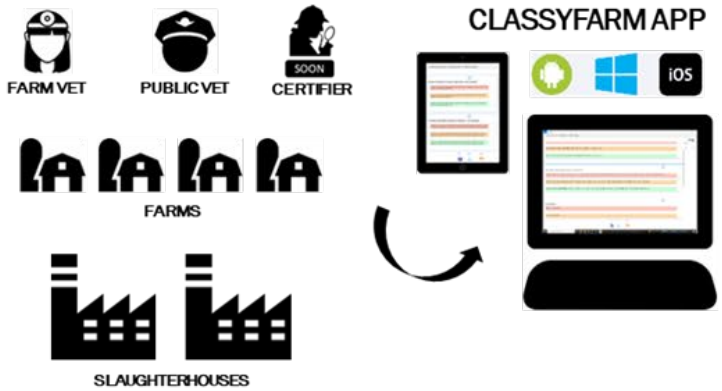
Bertocchi 2016

tools

OTHER SYSTEMS

ANTIMICROBIAL USAGE

FIELD ASSESSMENTS (VETs)



LABORATORY ANALYSIS

IIZZSS - AMR

CLASSYFARM DATABASE

INTERACTIVE DASHBOARDS

GEOGRAPHICAL-LEVEL

FARM-LEVEL

DOWNLOADABLE REPORTS

https://classyfarm.it/

What is it the animal welfare?

"The welfare of an individual is its state as regards its attempts to cope with its environment"
(Broom 1986)

The animal welfare scoring system

- EU and National Law on AW
- Literature review
- Efsa racomandation

Welfare Quality® Science and society improving animal welfare

INPUTS Environment

NON ANIMAL BASED measures

- Management
- Structures

Resoures BASED indicator
Parameters linked to managemento and housing tha can be associed with different negative or positive welafare consequence

EXE

- Magnitudo
- likelihood
- Uncertainty

OUTPUT ANIMAL

ANIMAL BASED measures

Work group

ANIMAL BASED indicator
Are able to mesure directly or indirectly negative welfare consequences of RBis

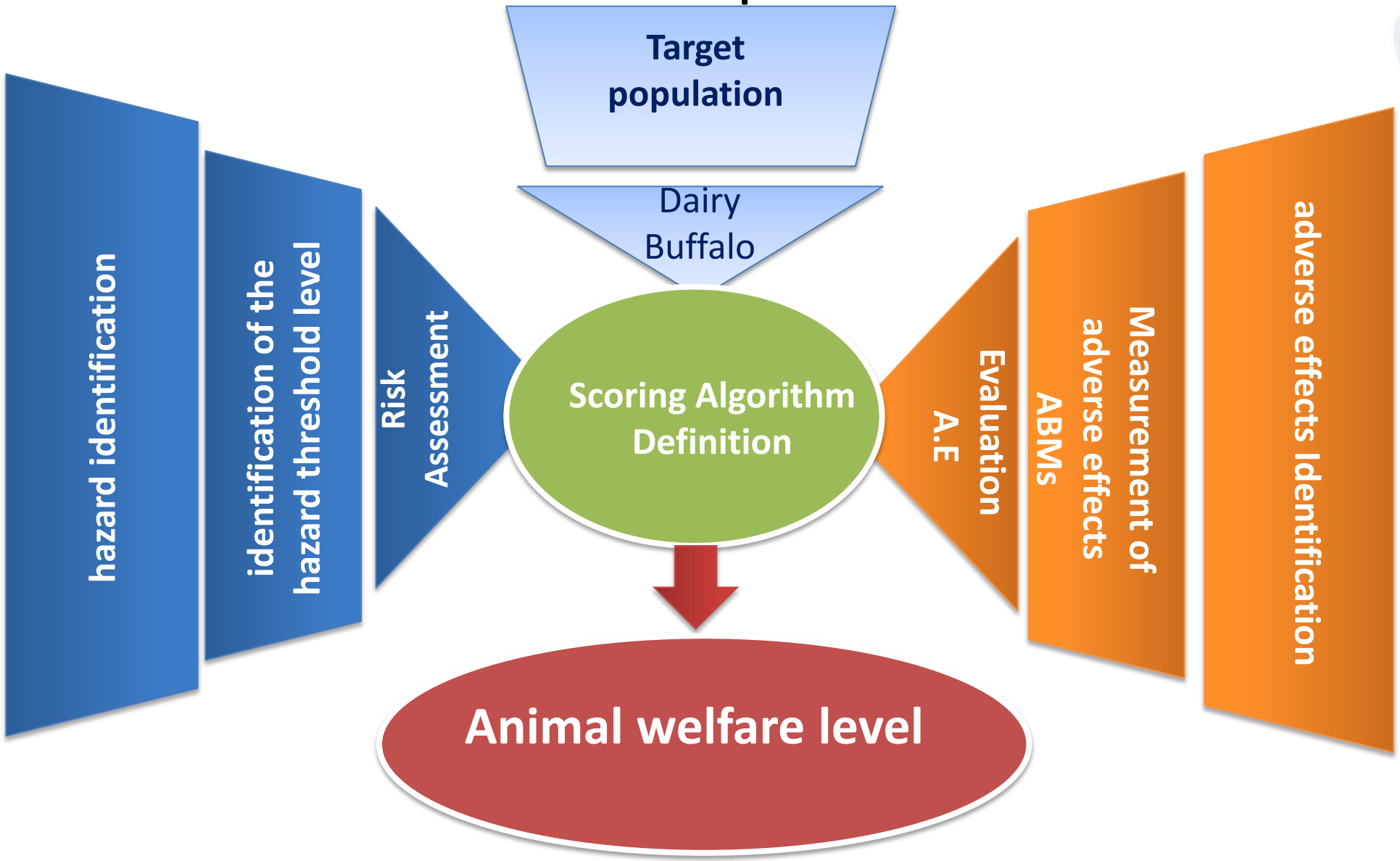
EXE

- Appropriatenes
- Magnitudo
- Severity
- Uncertainty

Hazards / Benefit → **Consequences on the animal**

Bertocchi Luigi,2016

Evaluation process



Bertocchi Luigi,2016

Composition of the thematic areas for the welfare assessment and Biosecurity in buffalo farm dairy free stall

Negativ level
Distress

There is no guarantee the respect of 5 freedom For all or part of the polopation
-Negative environmental condition
- Presence of Non-Physiological Adverse Effects

Threshold 1

Normal level
Nostress

Is guaranteed the respect of the 5 freedoms for the whole population
- Normal environmental condition
- Physiological presence of adverse effects

Threshold 2

Positiv level
Eustress

Very positive living conditions better than only 5 freedoms
-Optimum environmental condition
- Absence / Minimum Evidence of Adverse Effects

EXE

- Magnitudo
- likelihood
- Uncertainty

EXE

- Appropriatenes
- Magnitudo
- Severity
- Uncertainty

Areas	Theme	N. item
Area A	Management	32
Area B	Structures and equipments	30
Area C	Animal Based measures	17
	Significant risks and alarm systems	9
Biosecurity	Ruminant Biosecurity	15
	Total Evaluation Item	103

By processing the data present in the ClassyFarm system, the consumption of antimicrobials is expressed as standard days of treatment to which each animal raised (days/animal), in a given company, has been potentially exposed

Antimicrobial Use

Defined Daily Dose (DDDAit)*

$$\sum_{i=1}^{n} \frac{PA_i \text{ active ingredient used (mg)}}{DDDAit_i \text{ (mg) x animals (n)} \times \text{weight at risk(kg)}}$$

Study of Animal Welfare and Sustainability of the Dairy Buffalo Production Chain through a Multidisciplinary Approach.

N. identificativo progetto: **IZSME 08/18 RC**

U.O. 1 IMS Istituto Zooprofilattico Sperimentale del Mezzogiorno – Centro di Referenza Nazionale per l'Igiene e le Tecnologie dell'Allevamento e delle Produzioni Bufaline (CReNBuf)

U.O. 2 IMS IZSLER –Centro di Referenza Nazionale per il Benessere Animale (CReNBA)

U.O. 1 EMS Università degli Studi di Milano – Dipartimento di Medicina Veterinaria:

U.O. 2 EMS Università degli Studi di Napoli Federico II- Laboratorio di Urbanistica e Pianificazione del Territorio

U.O. 3 EMS Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria Centro di ricerca Zootecnia e Acquacoltura- CREA

Design study

382 farms

Average size: 374 heads (min. 65 max 1966)
Total heads: 142.868

Animal welfare ClassyFarm Checklist

- Management

Area A: 32 Items

- Housing and equipments

Area B: 30 Items

- Animal Based Measures
- Area C: 17 items

Biosecurity ClassyFarm Checklist

- 15 Items

Anti Microbial Use

- electronic prescription

$$\sum_{i=1}^{n} \frac{PA_i\ Mol.\ (mg)/DDDAit_i\ (mg)}{animals\ (n) \times weight\ at\ risk(kg)}$$

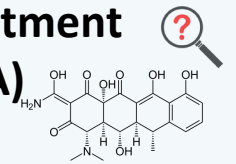
Animal Welfare value clusterization

AWL = X≤ 59%
AWM= 79% ≥ X ≥ 60%
AWH= X ≥80%

Heads number clusterization

Small = n °≤ 99
Medium= 100 ≤ n° ≤ 499
Big= n° ≥500

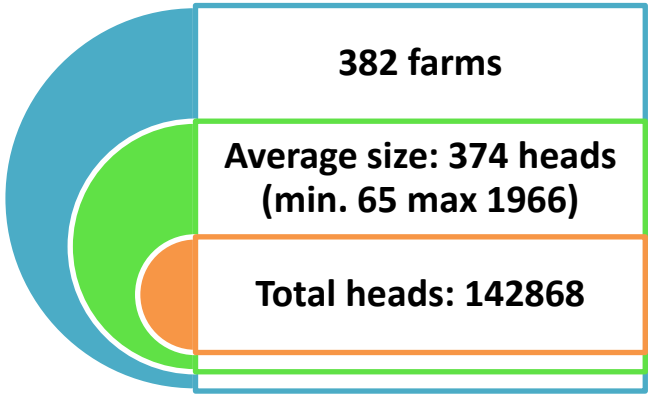
✓ **Animal category**
✓ **Cause of treatment**
✓ **Molecules (PA) (Critical)**

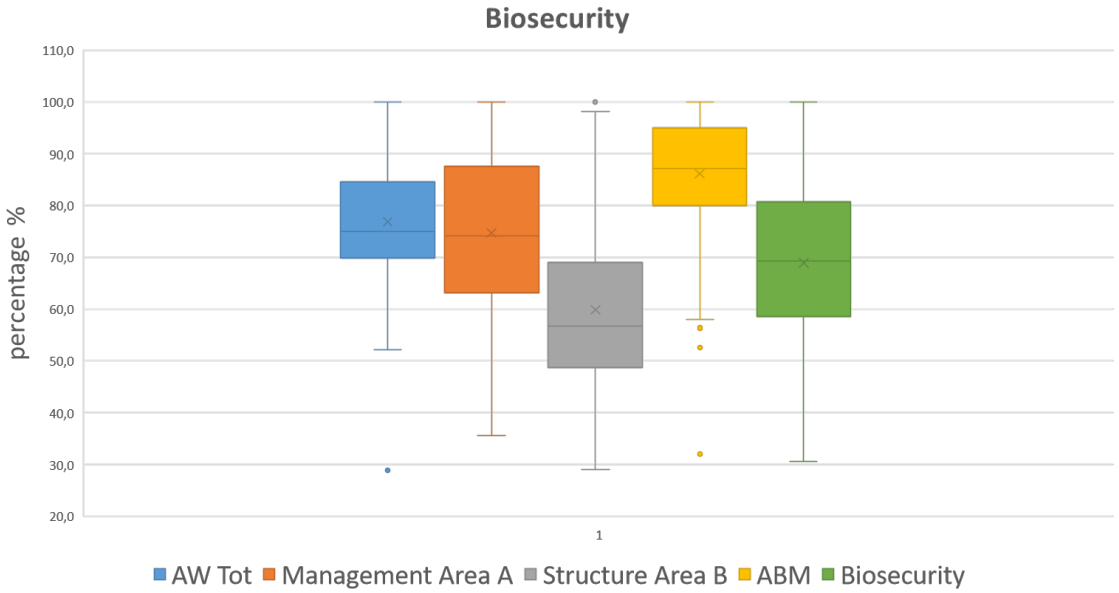


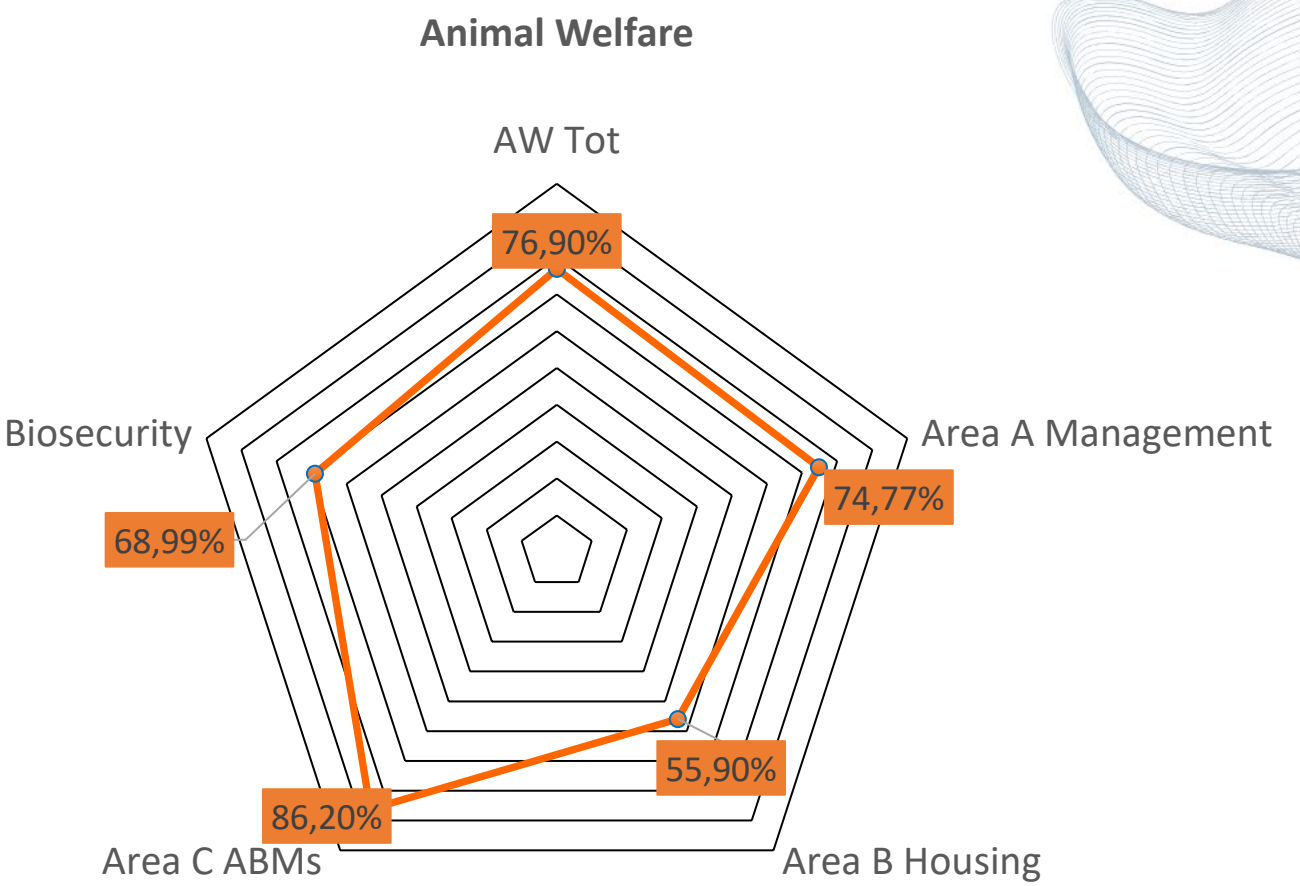
Statistical Analysis

R 4.4.1

- Anova
- Spearman Rank correlation coefficient


382 farms
Average size: 374 heads (min. 65 max 1966)
Total heads: 142868


Baseline distribution of the five sections :Animal Welfare Total, Area A Management, Area B Structure housing factors, Area C animal-based measures, Biosecurity
percentage %
110,0
100,0
90,0
80,0
70,0
60,0
50,0
40,0
30,0
20,0
1
AW Tot
Management Area A
Structure Area B
ABM
Biosecurity

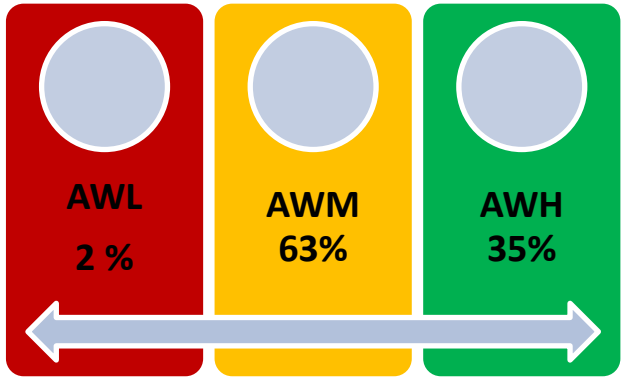

Animal Welfare
AW Tot
76,90%
Area A Management
74,77%
Area B Housing
55,90%
Area C ABMs
86,20%
Biosecurity
68,99%

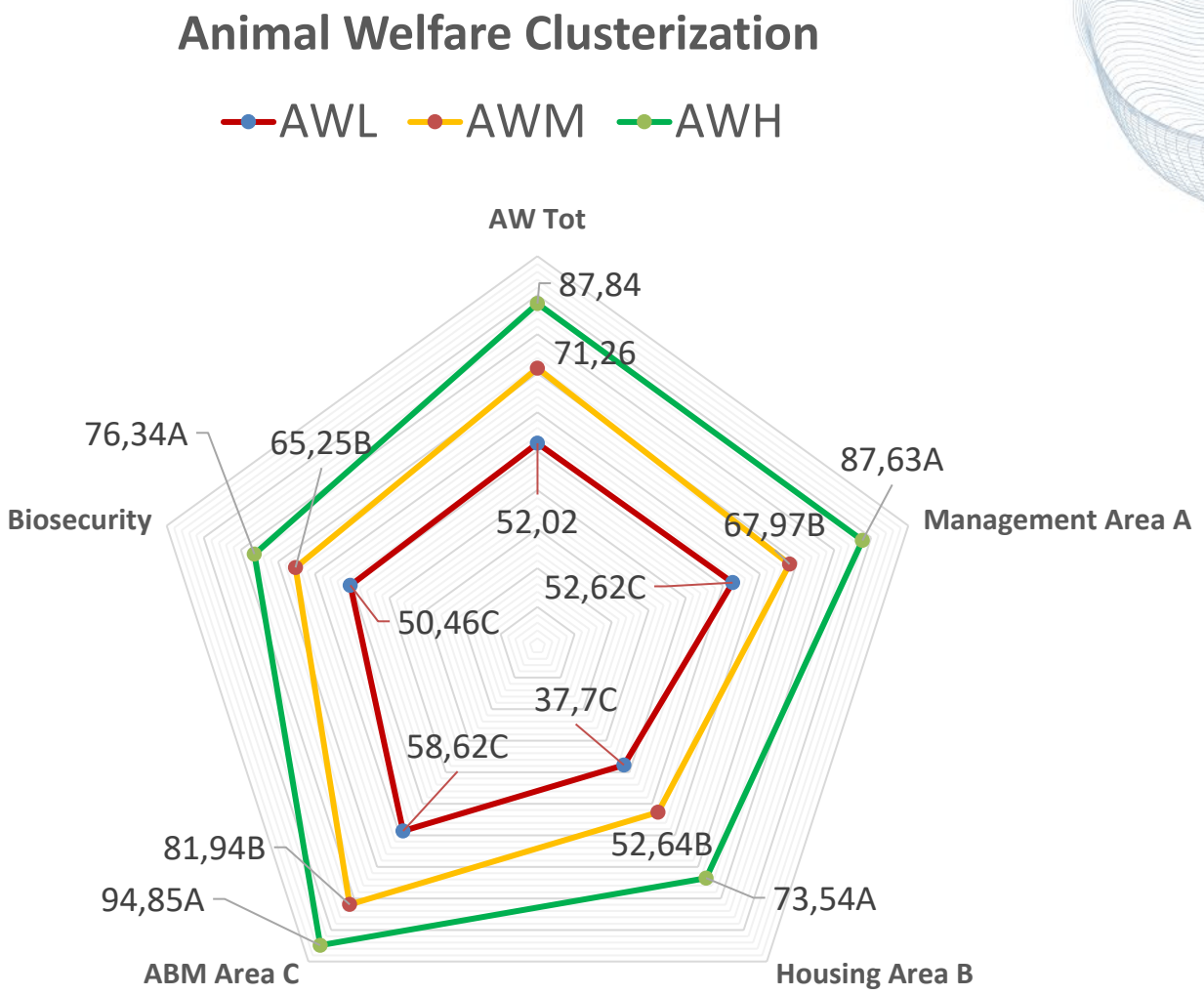
Value AW totale, Area A Management, Area B Structure, Area C ABMs e Biosecurity for 3 classes of animal welfare risk (AWH; AWM; AWL)

AWL = X≤ 59%

AWM= 79% ≥ X ≥ 60%

AWH= X ≥80%





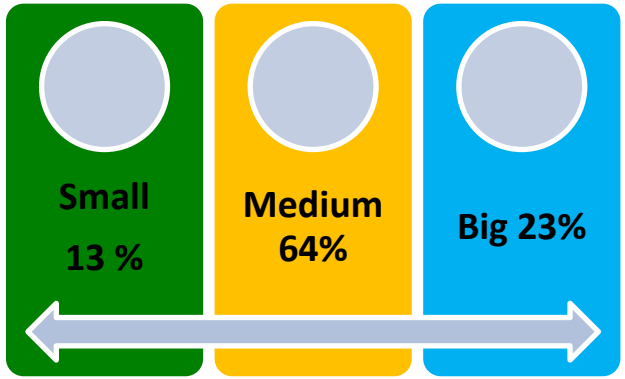
A≠B≠C =p< 0.001
a≠b =p< 0.05

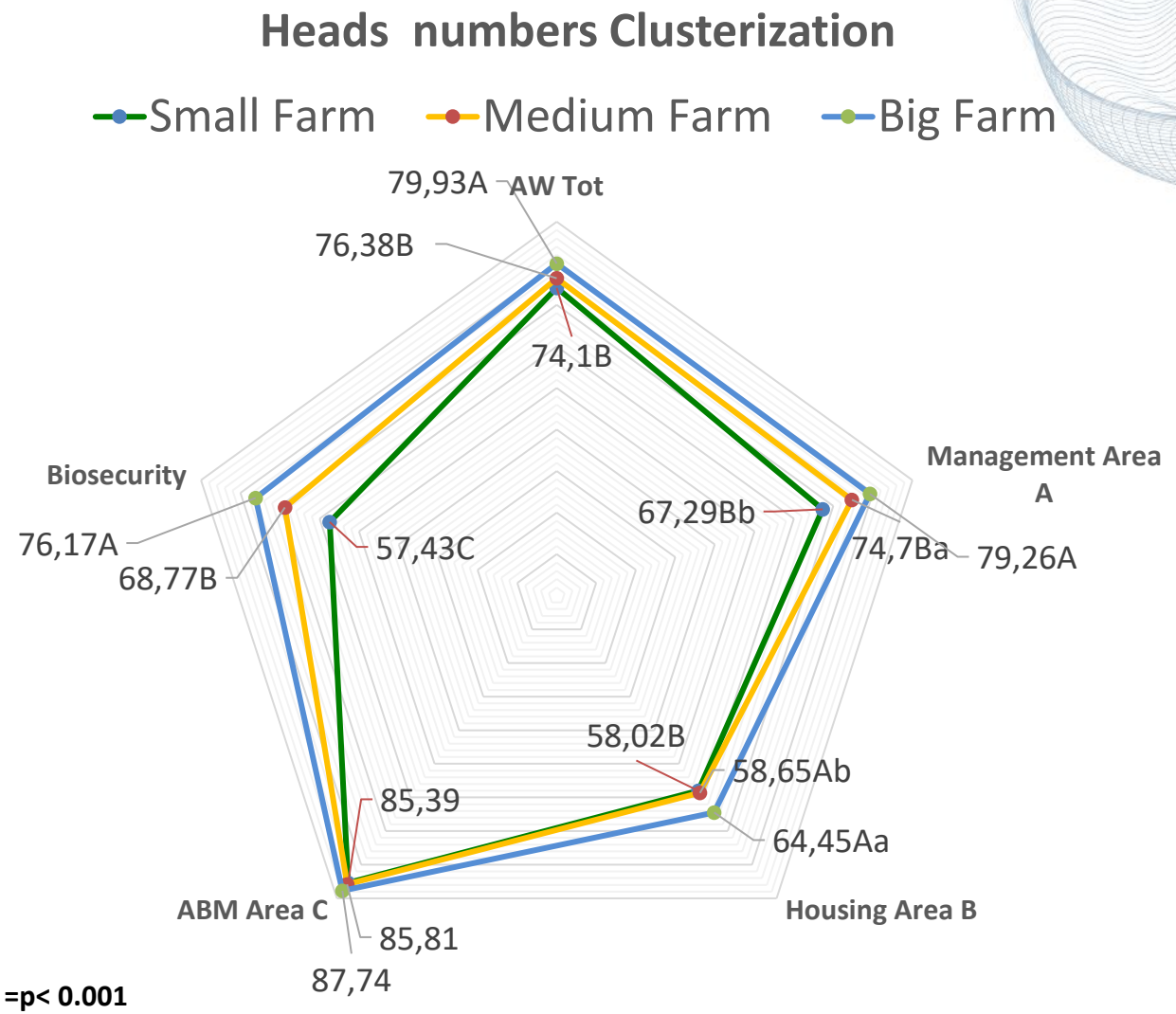
Value AW totale, Area A Management, Area B Housing, Area C ABMs e Biosecurity for 3 classes of animal heads consistency (Small; Medium; Big)

Small = n °≤ 99

Medium= 100 ≤ n° ≤ 499

Big= n° ≥500





A≠B≠C =p< 0.001
a≠b =p< 0.05

Antimicrobial Use

Defined Daily Dose (DDDAit)*

$$\sum_{i=1}^{n} \frac{PA_i \text{ active ingredient used (mg)}}{DDDAit_i \text{ (mg) x animals (n)} \times \text{weight at risk(kg)}}$$

DDDAit all farms

(Average ± SE)

0,40±0,04

DDDAit

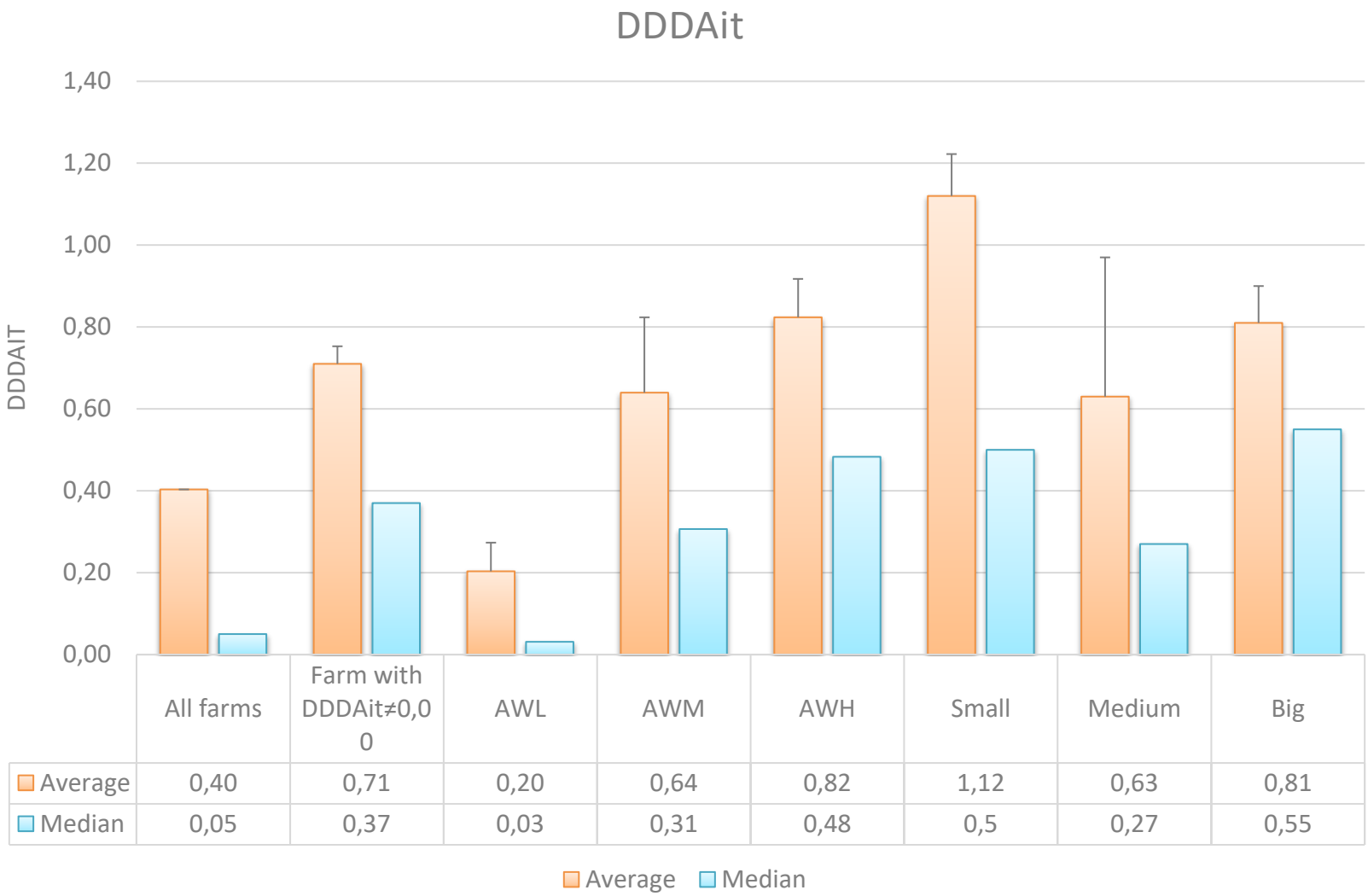
(Median)

0,05

% of farm with DDDAit

0,00

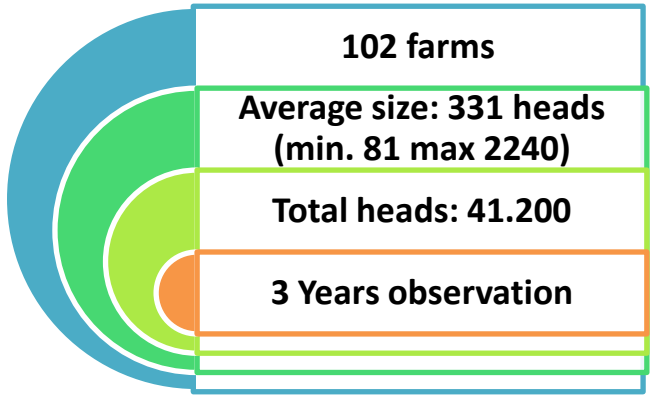
43%

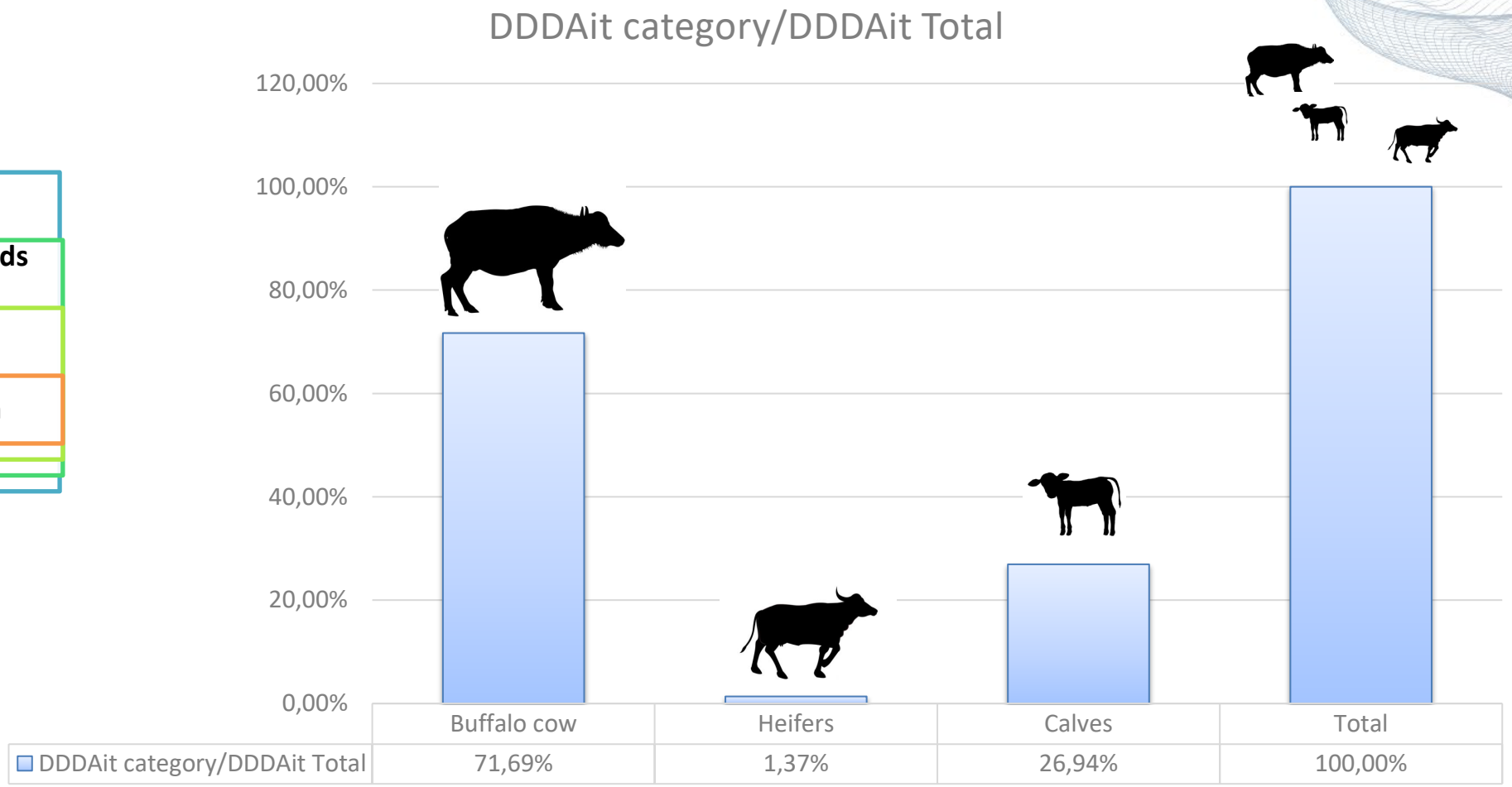


	All farms	Farm with DDDAit≠0,00	AWL	AWM	AWH	Small	Medium	Big
Average	0,40	0,71	0,20	0,64	0,82	1,12	0,63	0,81
Median	0,05	0,37	0,03	0,31	0,48	0,5	0,27	0,55

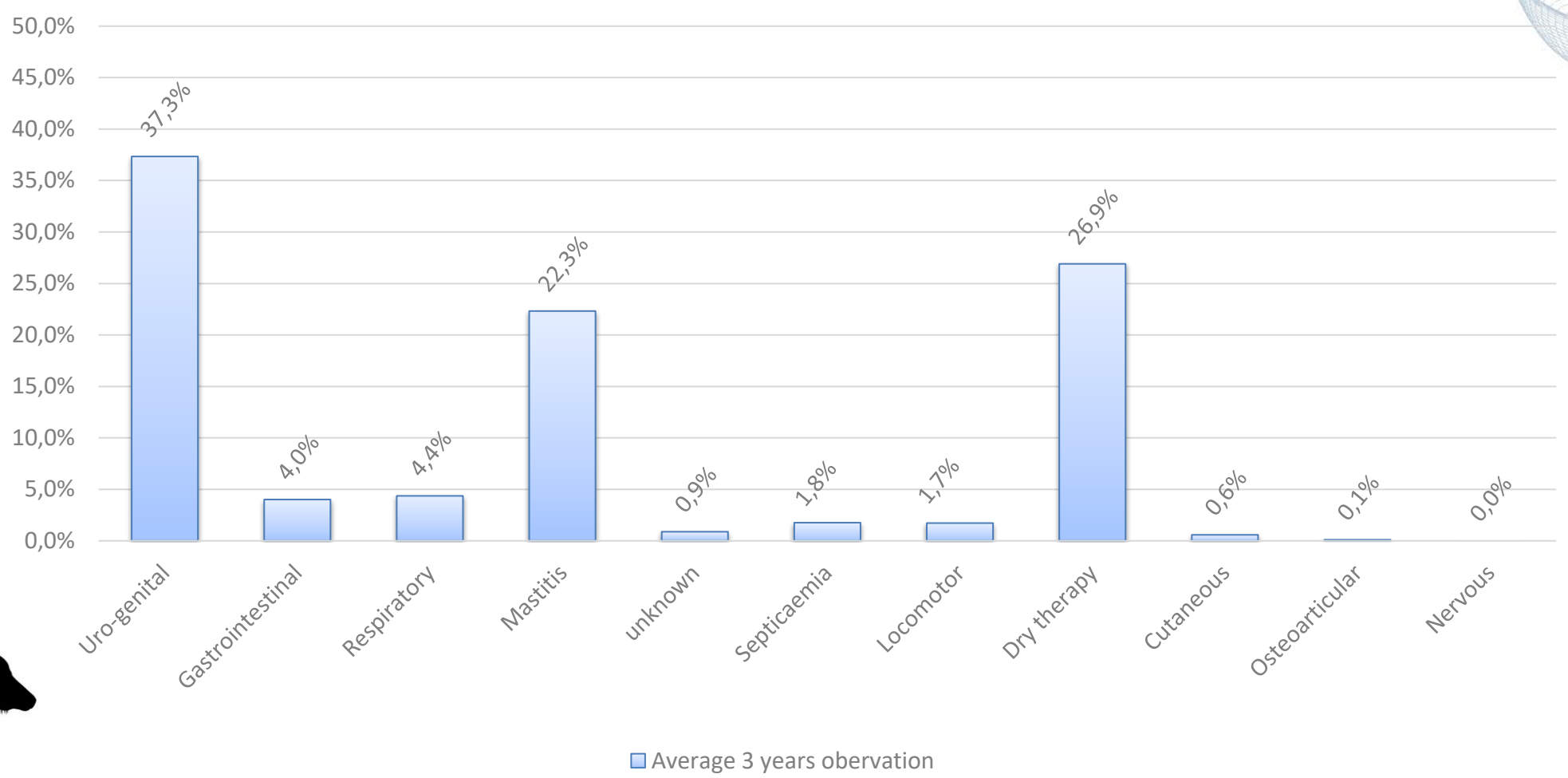
A≠B≠C =p< 0.001
a≠b =p< 0.05

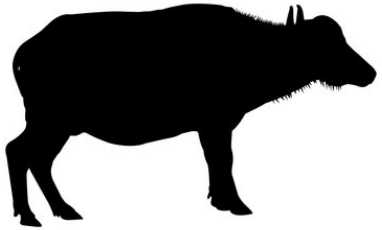
DDDAit % incidence for subject category: Buffaloes Cows, Heifers and calves;

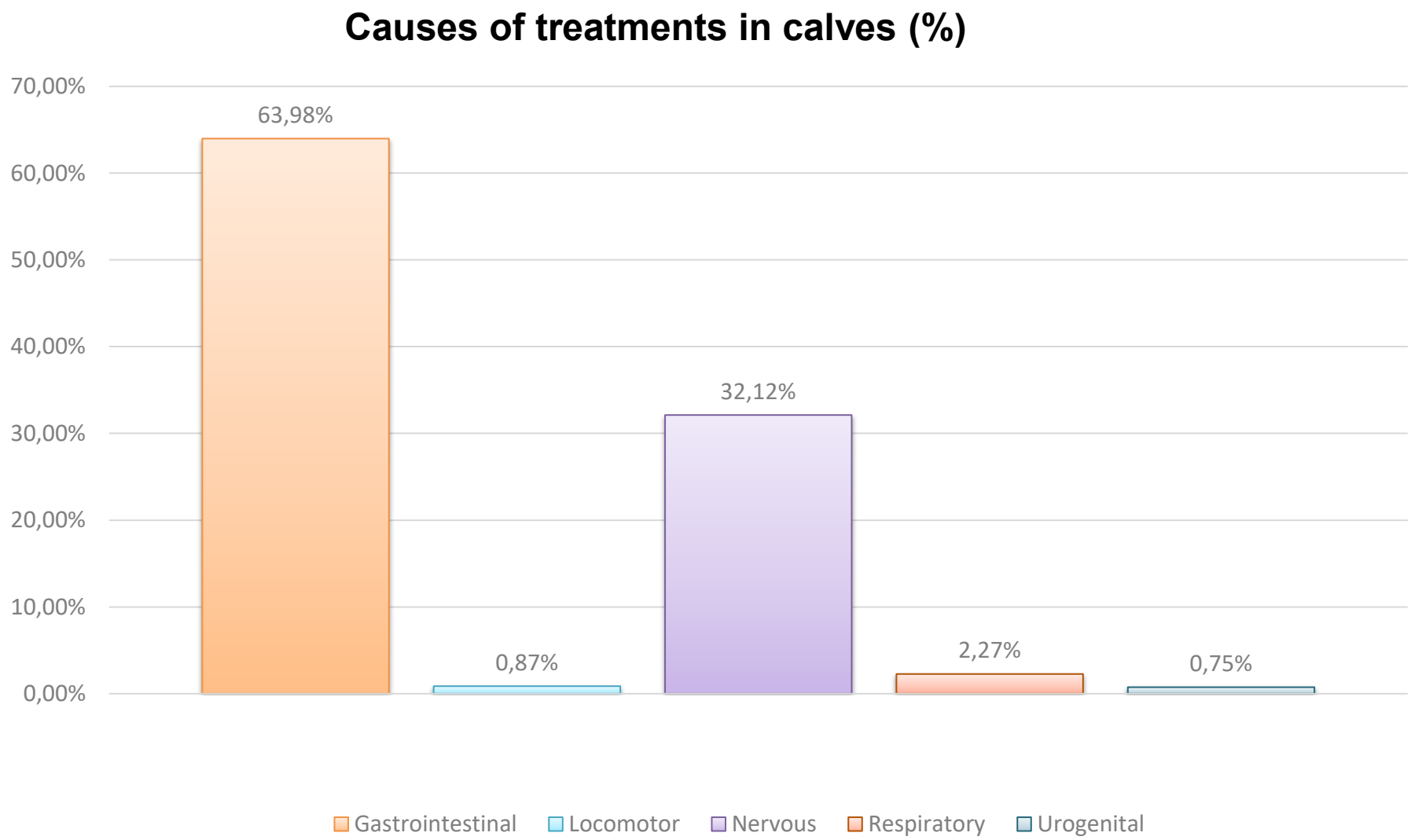




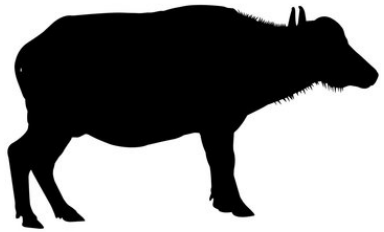
Incidence (%) of the causes of AMU treatment of Buffalo cows

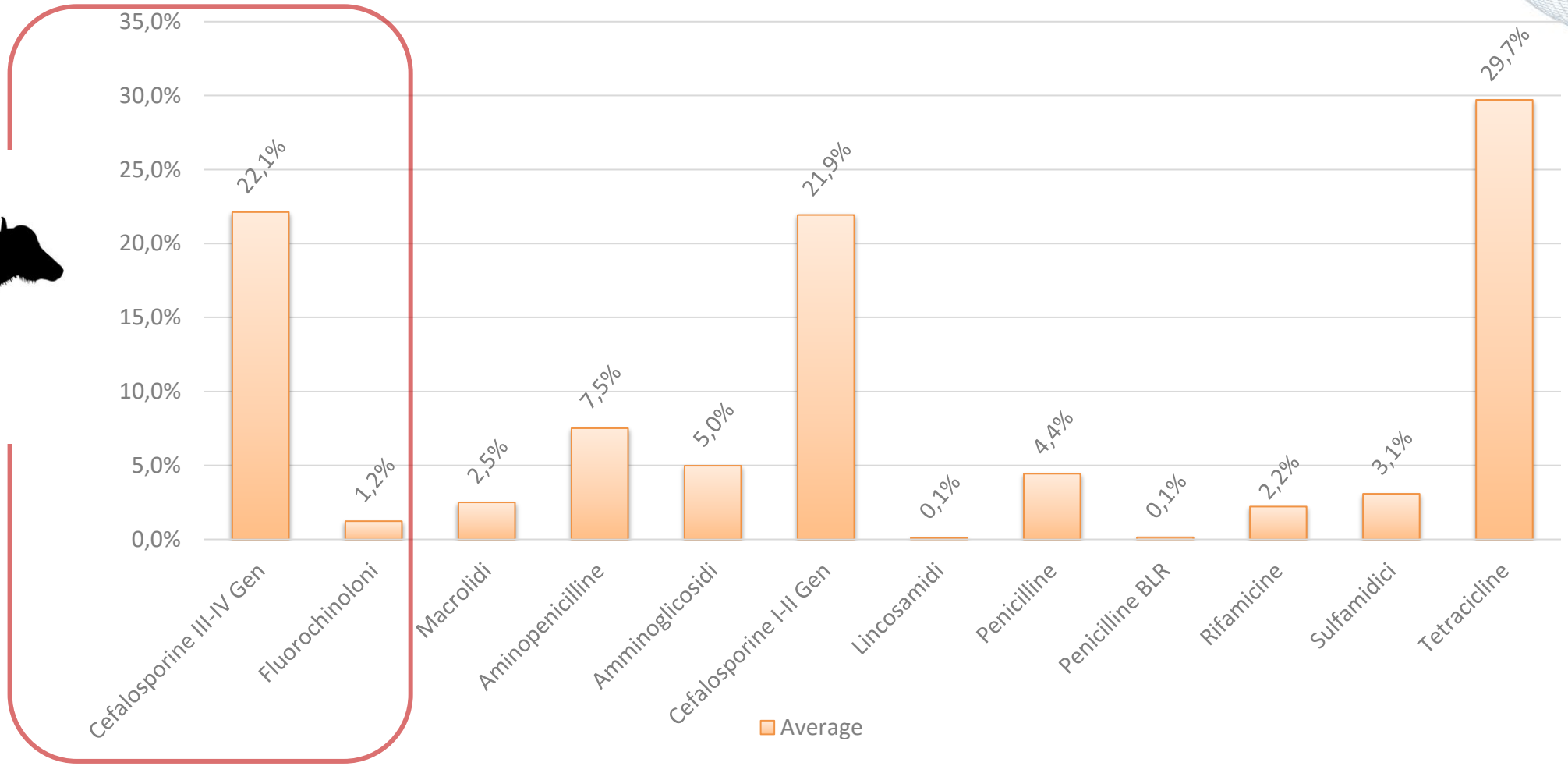




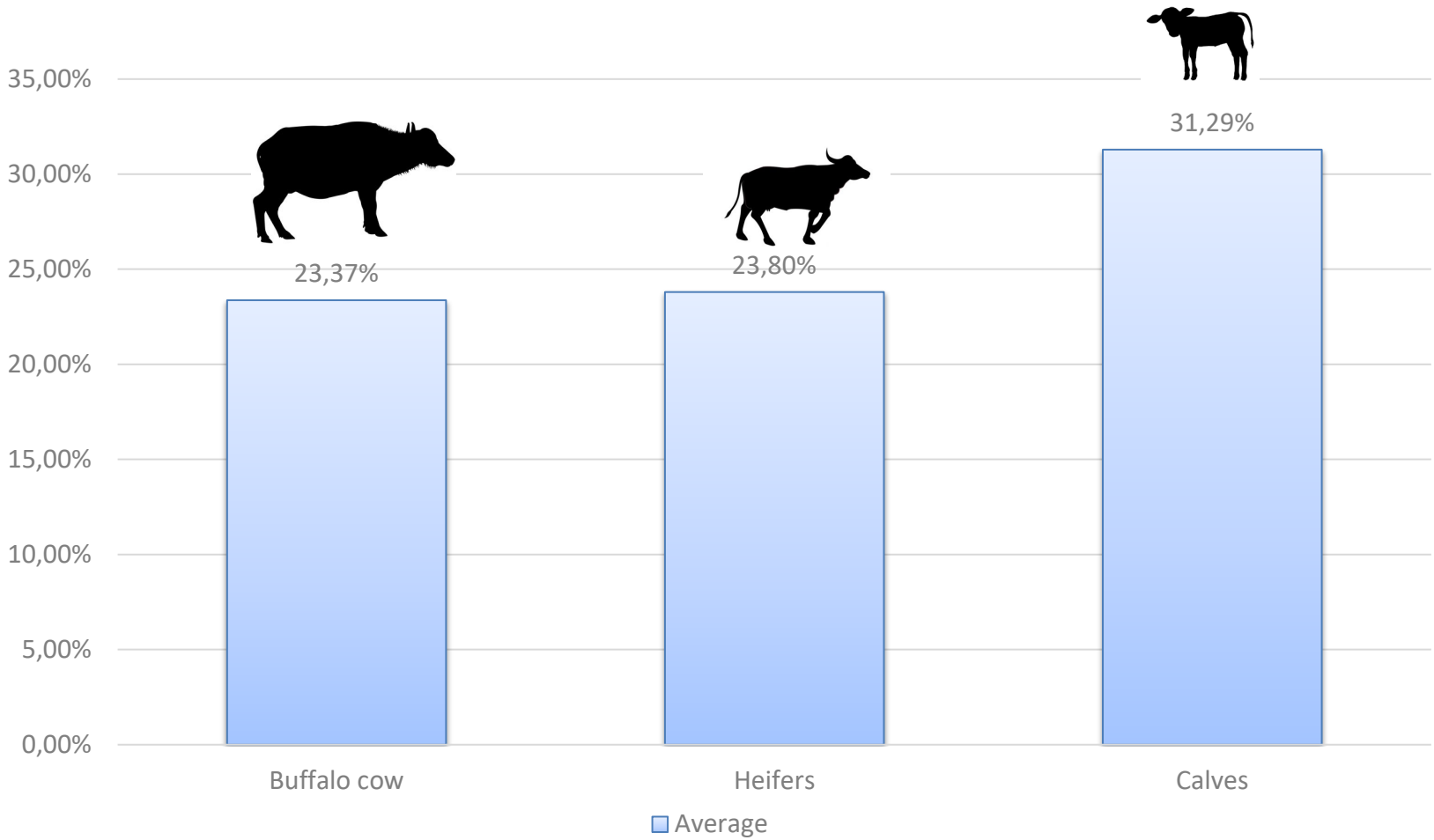

Causes of treatments in calves (%)
70,00%
60,00%
50,00%
40,00%
30,00%
20,00%
10,00%
0,00%
63,98%
0,87%
32,12%
2,27%
0,75%
Gastrointestinal
Locomotor
Nervous
Respiratory
Urogenital

AMU Molecules incidence in adult Buffaloes (%) Average AMU in 3 Years observation

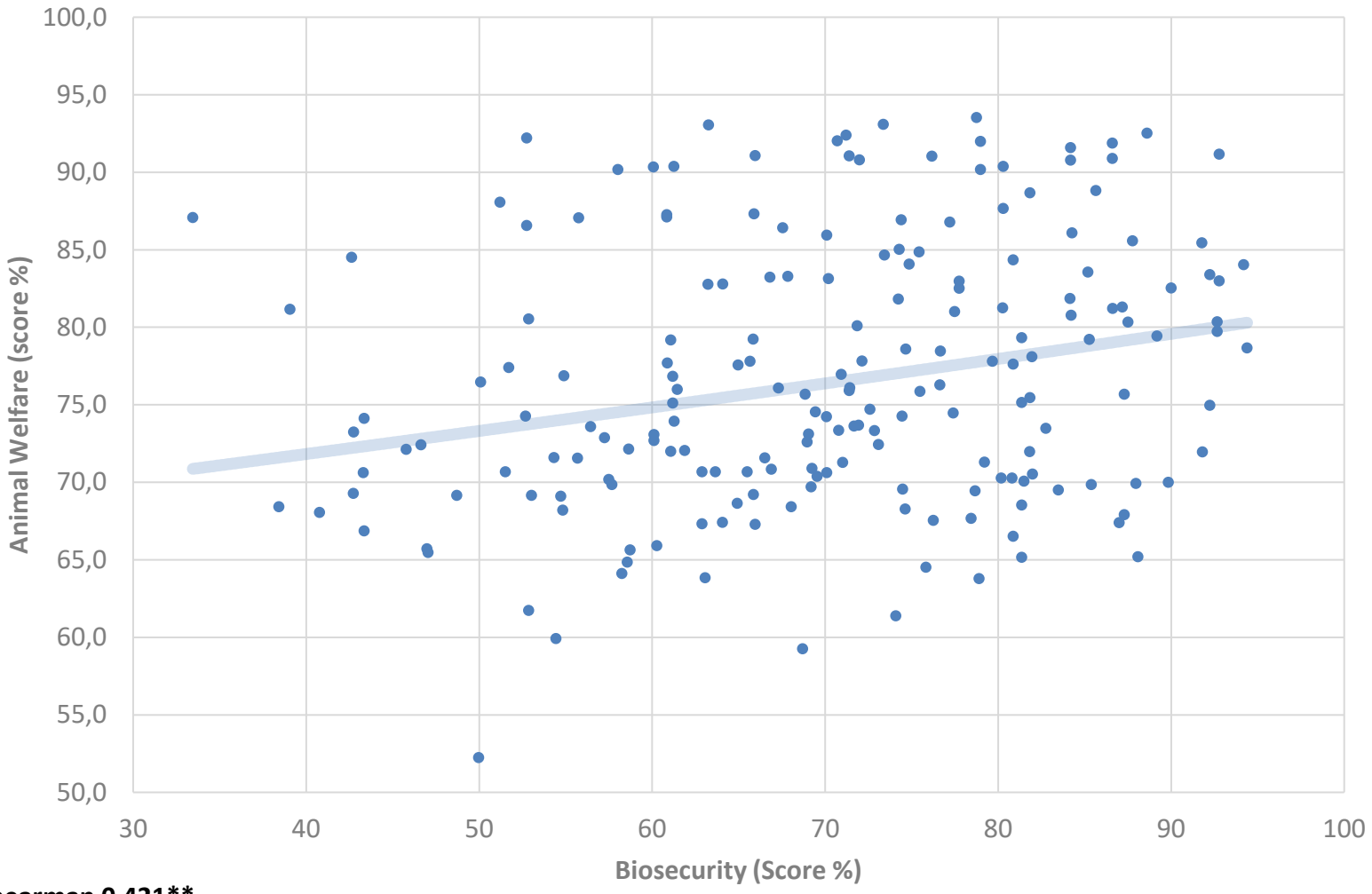




% Critical AMU DDDAit/DDDAit total for animal category



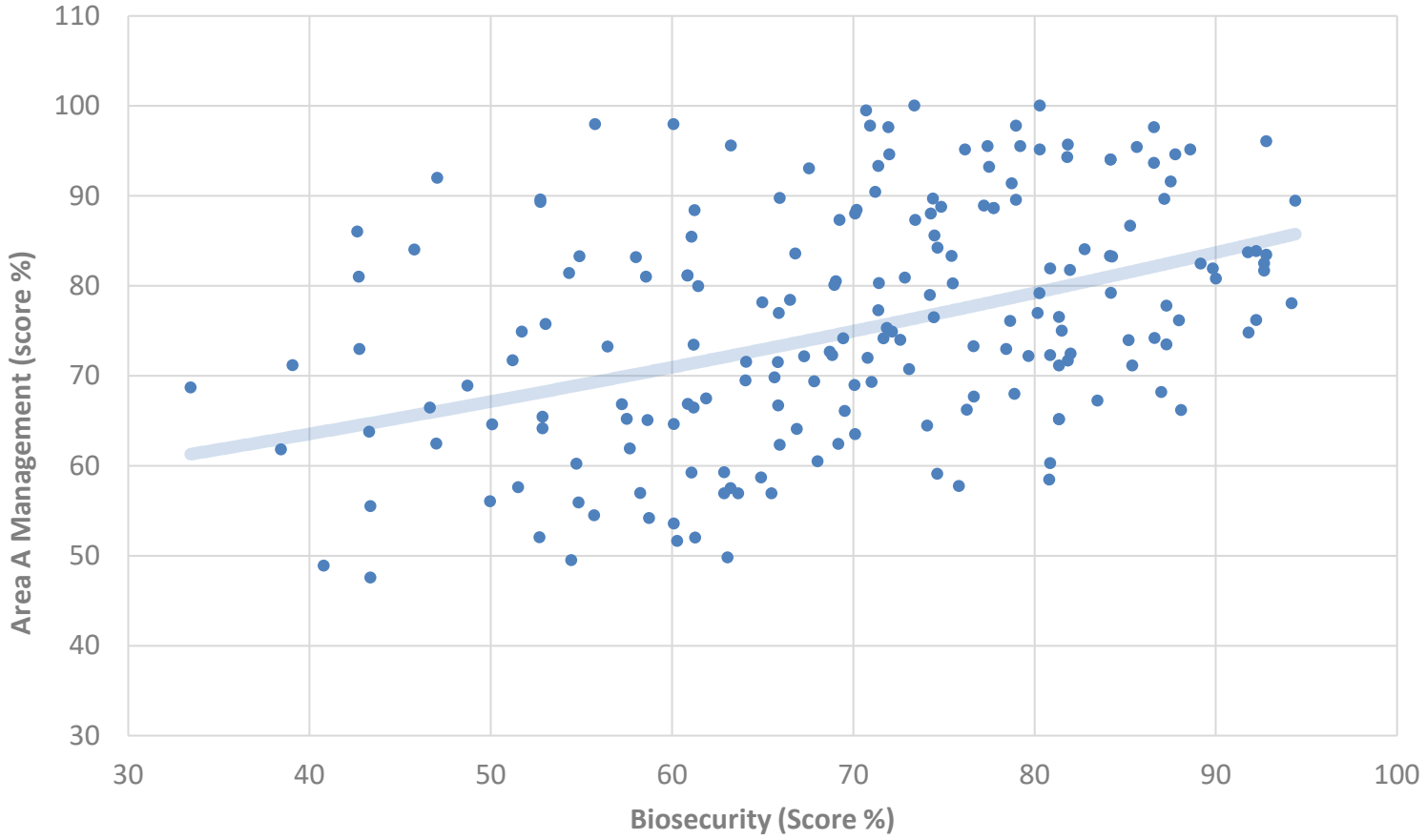
Correlation between Animal Welfare score and Biosecurity score



rho di Spearman 0,421**

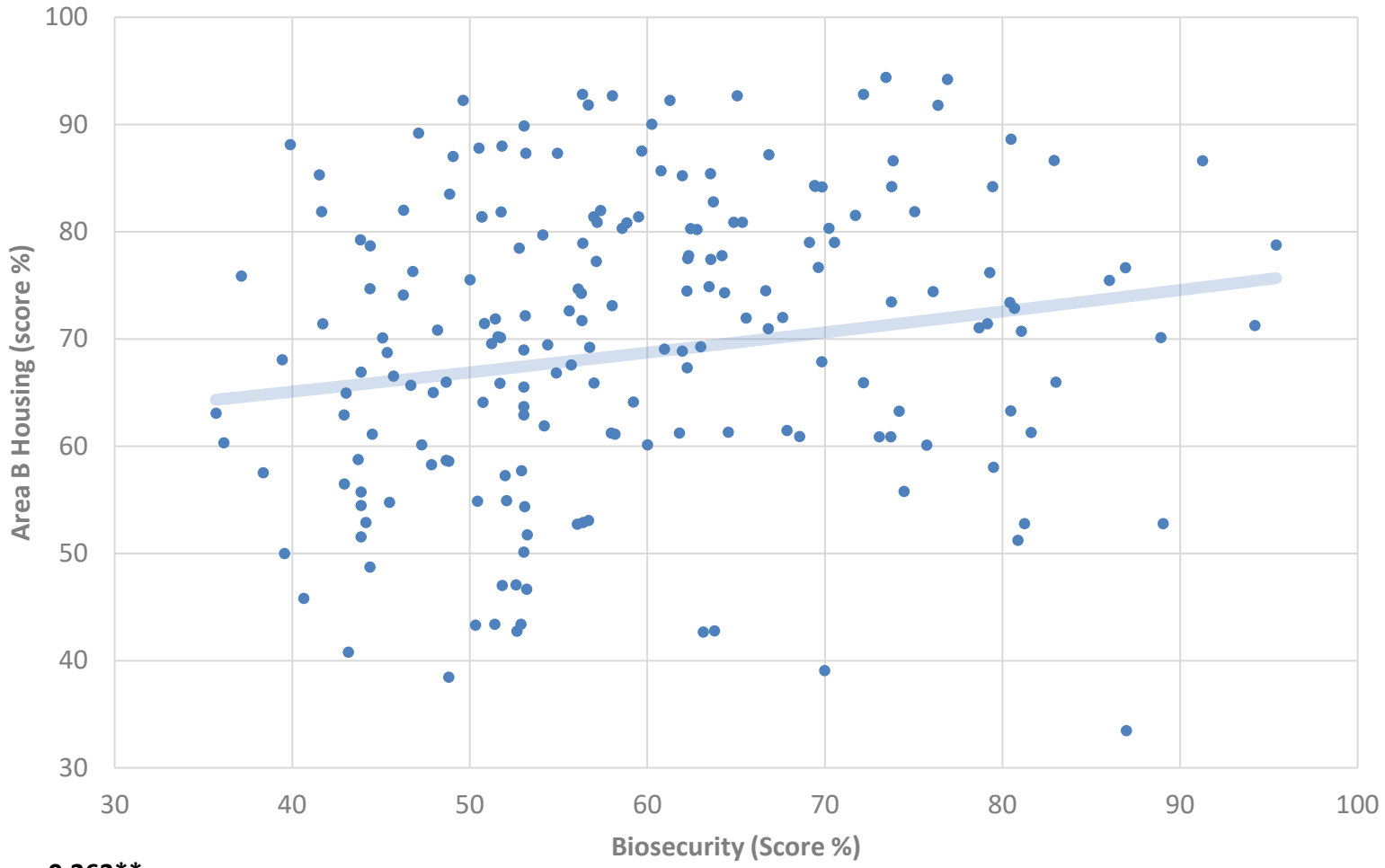
(=p< 0.001)**

Correlation between Management Area (A) score and Biosecurity score



rho di Spearman 0,615**
(=p< 0.001)**

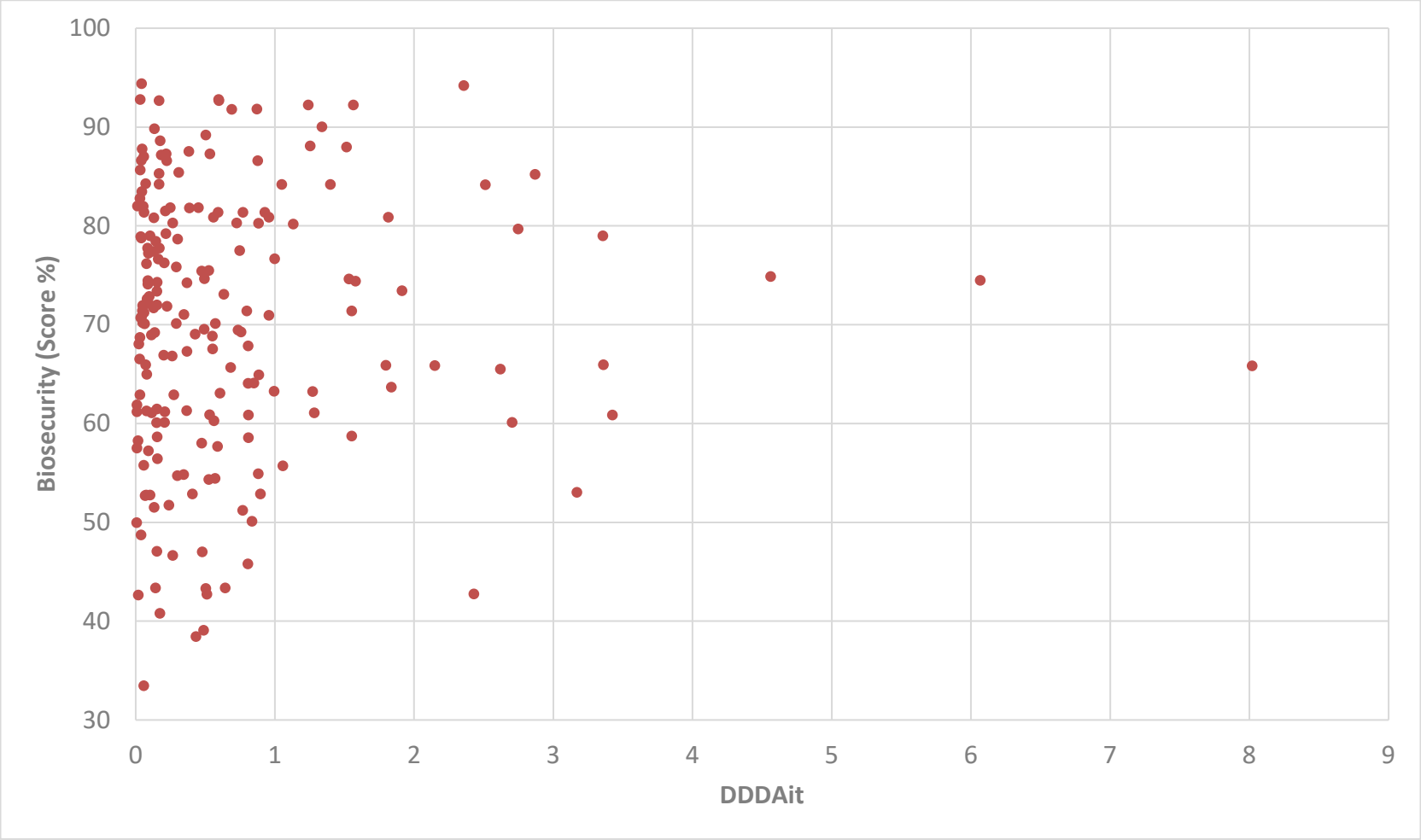
Correlation between Area (B) Housing score and Biosecurity score



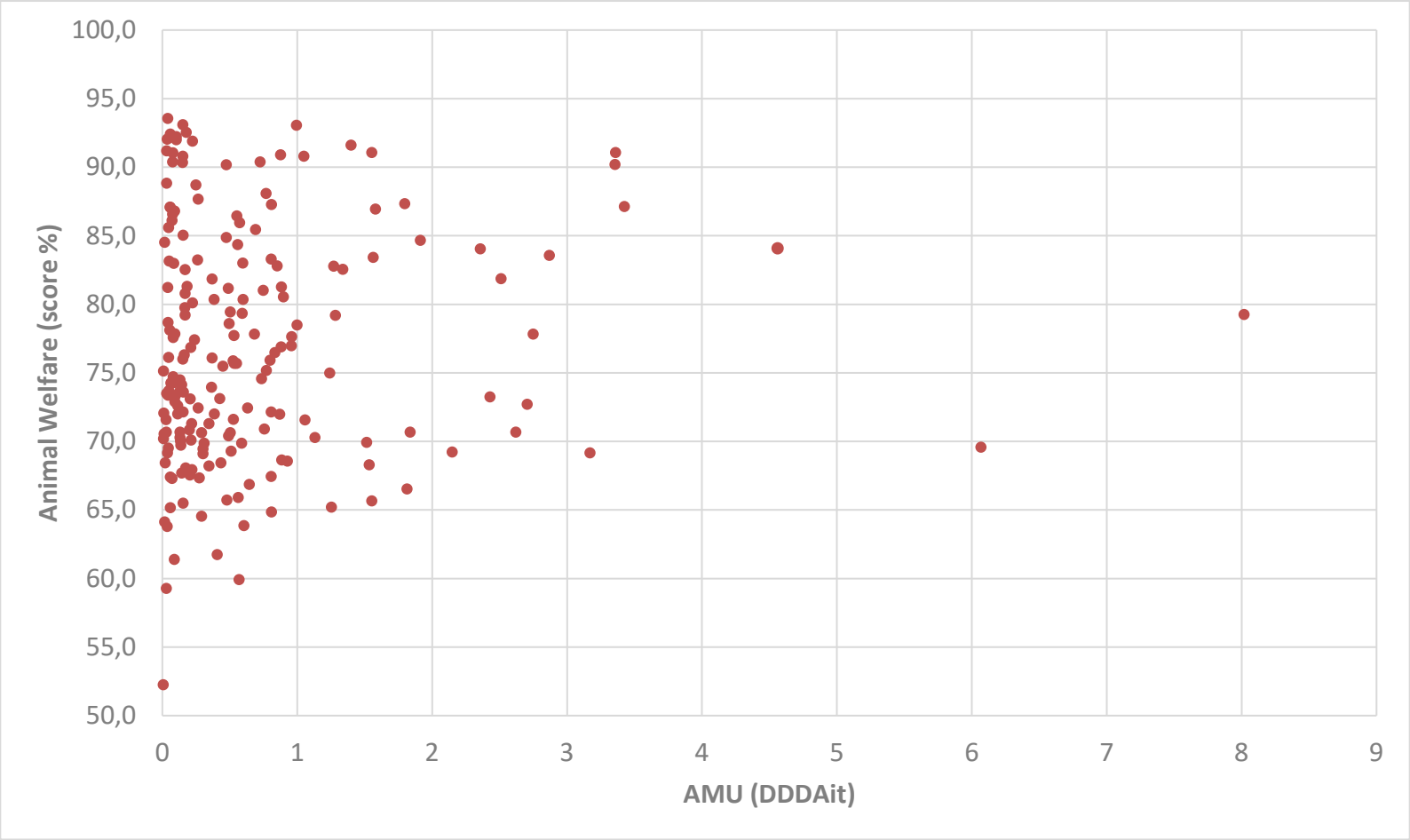
rho di Spearman 0,363**

(=p< 0.001)**

Correlation between Biosecurity score and AMU (DDDAit)



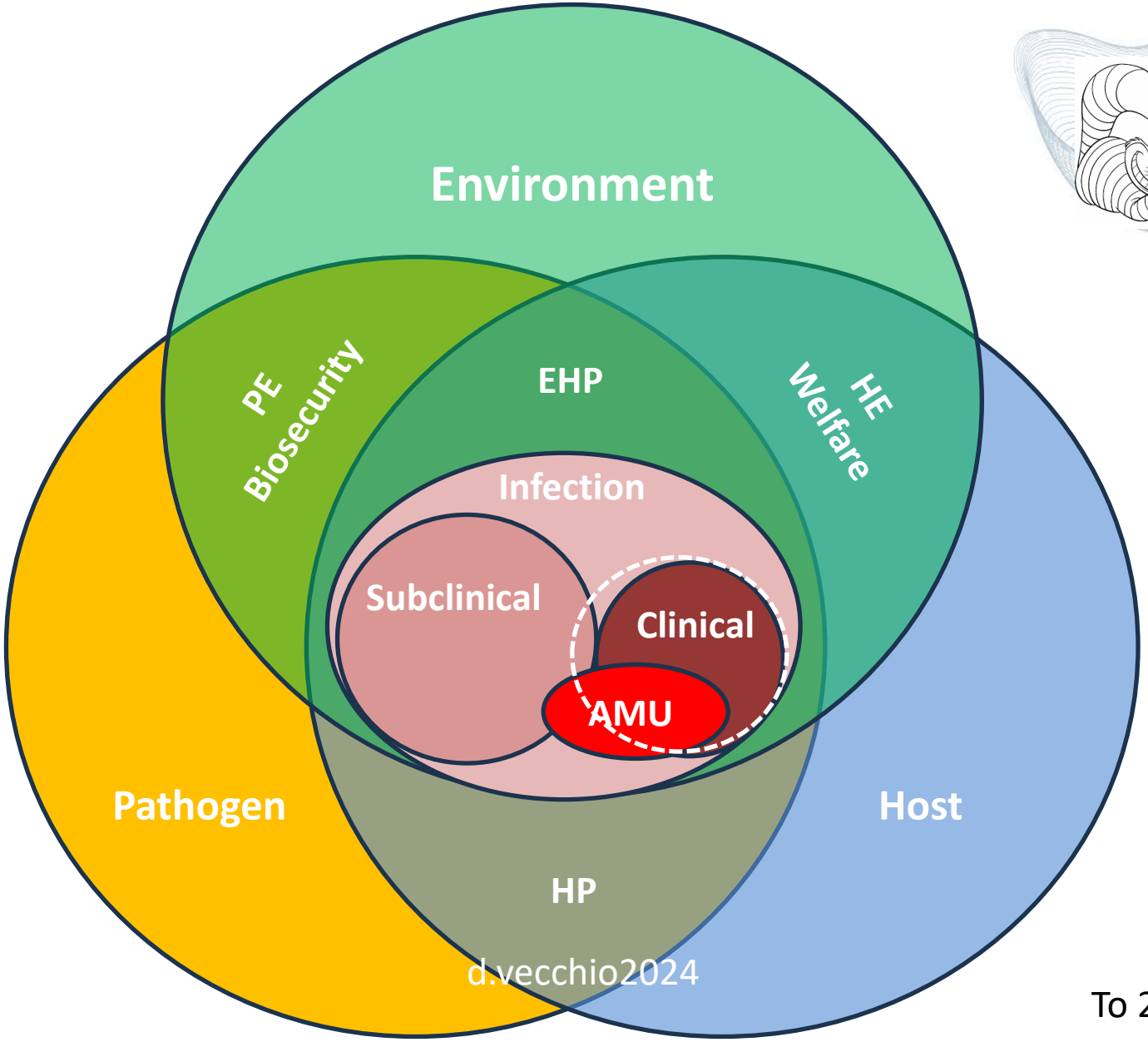
Correlation between animal welfare score and AMU (DDDAit)



Discussion: what's wrong?...nothing! Come with me

Biosecurity item
Animal welfare item
Pathogen's pressure
- (Negative reporting)
- Absence of Pathoges or absence of information?

Decisional process AMU *
- Observation stage
- Formal diagnosis process (Vet presence?)
- Breeder expectative on treatment
- Adequate
- Fast
- cheap of easy application
- Lab analysis?
- Treatment decision (vet presence)



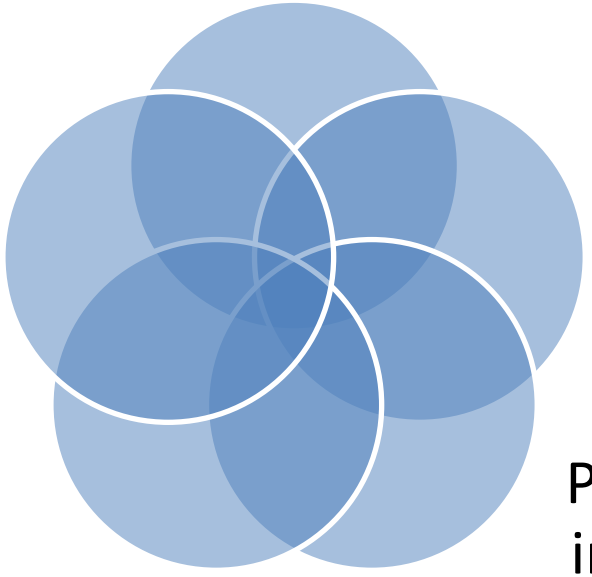
To 2034?

Take home message

- We evaluate a relative and not absolute level of biosecurity
- The environmental condition of management and housing represent predisposing causes and non determining ones for infection
- Given the same health condition, we have a great variability of decision regarding the amu by the operators. This is influenced by the presence of a vet, the training and the experience of the stable staff, the knowledge and information of the owner
- With a view to a positive result, it is essential to provide information and training to all the workers in the supply chain who participate in the process in various capacities. Particular attention must be focused on the breeder in order to stimulate a correct perception of the importance and purpose of the necessary activities (participatory budget)
- The link between biosecurity, animal welfare and AMU is represented by the breeder

Vulnerability of the system

REACTIVITY AND READINESS



Monitoring the critical point

Mitigating the risks

Preparing an intervention plan

“ Caminante no hay camino, se hace camino al andar”
[Antonio Machado]

...TO BE CONTINUED...

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Thanks for your attention

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