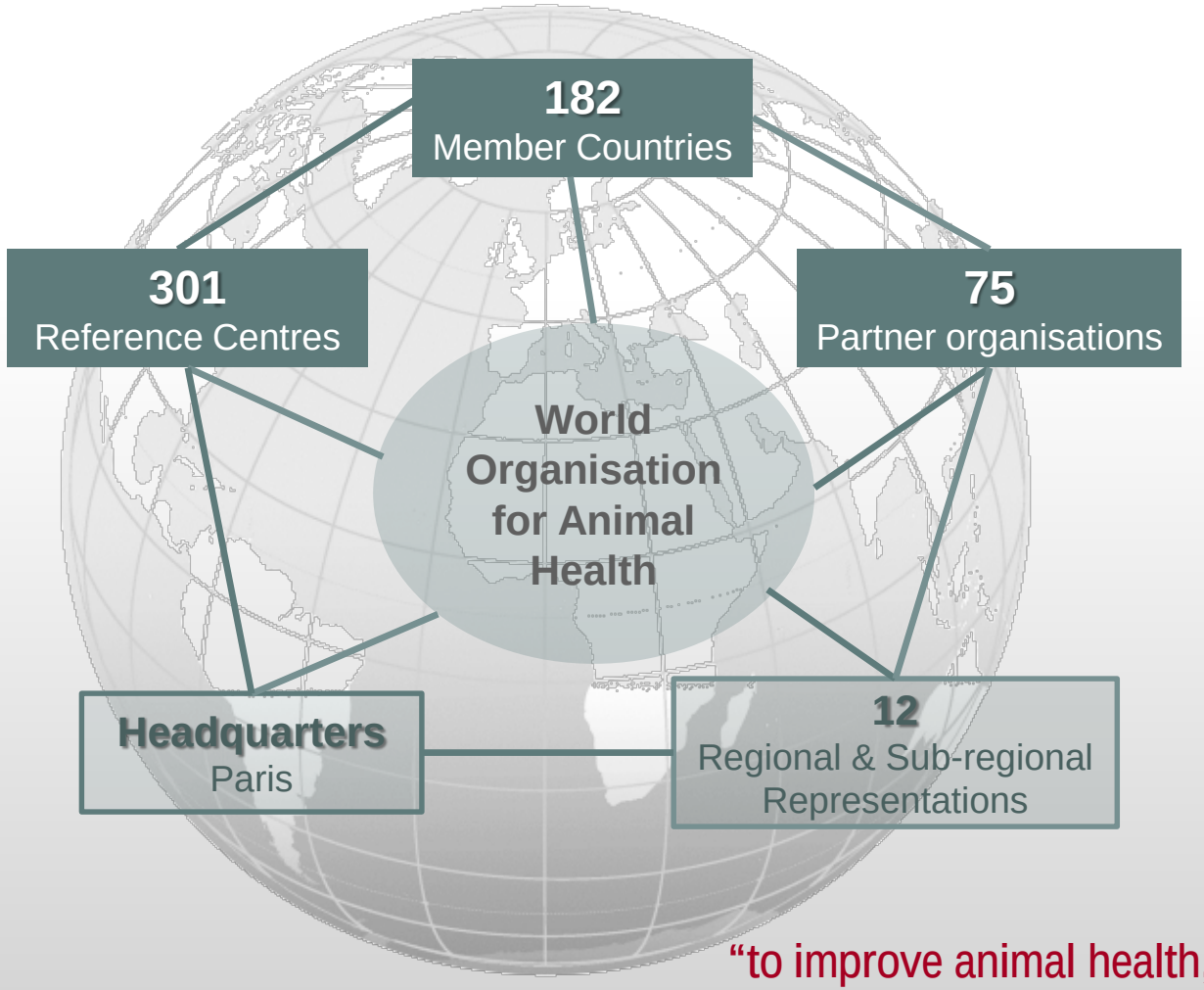
Elisabeth Erlacher-Vindel
Head of the Antimicrobial Resistance &
Veterinary Products Department

Prioritization of Vaccines to Reduce Antibiotic use in Animals

PACCARB Meeting
Washington, 30 January 2019

World Organisation for Animal Health (OIE)



"to improve animal health, veterinary public health and animal welfare worldwide"

OIE *ad hoc* Groups

The OIE convened two *ad hoc* Groups to provide guidance on prioritisation of diseases for which the use of vaccines could reduce antimicrobial use in animals:

- pigs, poultry and fish (April 2015)
  http://www.oie.int/en/standard-setting/specialists-commissions-working-groups/scientific-commission-reports/ad-hoc-groups-reports/

- cattle, sheep and goats (May 2018)
  http://www.oie.int/standard-setting/specialists-commissions-working-groups/scientific-commission-reports/ad-hoc-groups-reports/

6.1. Key principles adopted

In order to facilitate identification of infections where new or improved vaccines would have the maximum potential to reduce antibiotic use, a number of key considerations were agreed and applied:

1. Identification of the most prevalent and important bacterial infections in chickens, swine, and identification of fish species that are commonly farmed and associated with high antibiotic use, and associated prevalent bacterial infections in those species.
2. Identification of common non-bacterial infections in chicken, swine and fish (e.g. protozoal, viral) showing clinical signs that trigger empirical antibiotic treatment (e.g. for diarrhoea) and which also result frequently in bacterial co-infection.
3. An assessment of antibiotic use in response to the syndromic indication or diagnosed disease. This was categorised as high, medium or low in the context of considered use compared with the total use of antibiotics in that animal species.
4. The availability of a vaccine(s), and if available, their effectiveness.
5. The potential for a new or improved vaccine to reduce the need for antibiotic treatment.

Factors, other than vaccine design, which influence utilisation of a vaccine were considered out of scope.

Also considered out of scope were autogenous vaccines, primarily because of lack of broad applicability across time and space, registration variability and the absence of key efficacy data.

It was accepted that unless effective vaccines are available and widely used, their impact on reducing antibiotic use would be diminished.

6.2 Limitations

As a consequence of adopting the above criteria it became evident that there were many data gaps. For example, a current list of all available vaccines that have marketing authorisation, amount of antibiotic use for different infections, and relative incidence of different infections worldwide are not available. The conclusions of the report are therefore based on considerations weighted mostly on available expert opinion.

Key references consulted during the discussions are listed in Appendix IV of this report.

Disease identification and prioritisation

- Most prevalent and important **bacterial infections** associated with high antibiotic use.
- **Non-bacterial infections** (*e.g.* protozoal, viral) that:
  - show clinical signs triggering empirical antibiotic treatment (*e.g.* for diarrhoea); and/or
  - result in bacterial co-infection.
- Definition of guiding criteria for the **ranking** of diseases.

Disease prioritisation parameters	
Key Syndrome	Age or type of animal
Primary Pathogen(s) (disease)	Genus species
Antibiotic Use	Low / Medium / High
Commercial* vaccine exists	Yes / No
Major Constraints to use of vaccine or vaccine development	Various factors identified
Vaccine Research Priority	Low / Medium / High

* 'Commercial vaccine' does not include autogenous vaccines

Criteria for ranking research priorities

- **High priority:** The agent or the disease/syndrome results in a high use of antimicrobial agents and there are no readily available vaccines, or the vaccines are suboptimal in terms of efficacy or safety or practicality, or are cost-prohibitive.
- **Medium priority:** The agent or the disease/syndrome results in a medium use of antimicrobial agents and there are no readily available vaccines, or the vaccines are suboptimal in terms of efficacy or safety or practicality, or are cost-prohibitive.
- **Low priority:** The agent or the disease/syndrome results in a low use of antimicrobial agents, regardless of whether a vaccine is readily available and effective.

Table 1: Infections for which new or improved vaccines would significantly reduce the need for antibiotic use in chickens

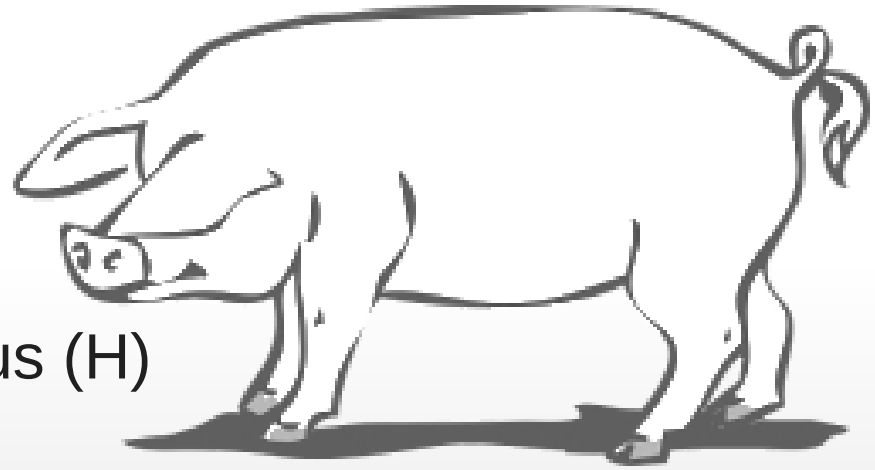
Key syndrome	Primary pathogen(s) (disease)	Antibiotic use	Commercial* Vaccine exists	Major contraints to use of vaccine / vaccine development	Vaccine research priority
Systemic (Broilers)	*Escherichia coli (Yolk sac infection, airsacculitis, cellulitis)*	High	Yes	• Omphalitis: a secondary bacterial infection - not a disease one can immunize against • Strain coverage limited • Airsacculitis, cellulitis: vaccines available, e.g. live aerosol vaccine. However, Serotype coverage limited and field efficacy variable	High
	Infectious Bursal Disease virus (secondary bacterial infection)	Medium	Yes	• Issues with vaccine application • Short window of opportunity to vaccinate • Maternal antibody interference	Medium
Systemic (Breeders, Layers)	*Escherichia coli (airsacculitis, cellulitis, salpingitis, and periotonitis)*	High	Yes	• Strain coverage limited	High
Enteric (Broilers, Breeders, and Layers)	*Clostridium perfringens*, type A *(necrotic enteritis)*	High	Yes	• Toxoid vaccine for layers providing only short-lasting passive immunity • Research needed to achieve active immunity • Improved and/or more convenient (mass vaccination) vaccine needed for broilers	High
	Coccidiosis (secondary bacterial infections	High	Yes	• Lack of cross-protection • Strains ust be matched to infectious agent • Current vaccines are not attenuated and can produce low dose infection • Sub-unit vaccines have not been successful	High
	Infectious Bronchitis virus (secondary bacterial infection)	Medium	Yes	• Issues with strain matching and strain coverage • High mutation rate of virus	Medium

Report of the meeting of the OIE *ad hoc* Group on Prioritisation of Diseases for which Vaccines could Reduce Antimicrobial Use in Animals

Poultry diseases

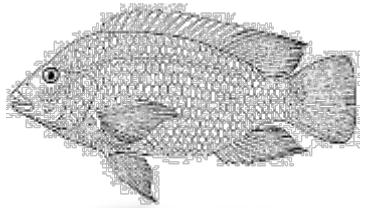
- *Escherichia coli* (Yolk sac infection, airsacculitis, cellulitis) (H)
- *Clostridium perfringens*, type A (necrotic enteritis) (H)
- Coccidiosis (secondary bacterial infections) (H)
- Infectious bronchitis virus (secondary bacterial infections) (H)
- Infectious bursal disease virus (secondary bacterial infections) (M)

Ad hoc Group Recommendation: Example of priority swine pathogens

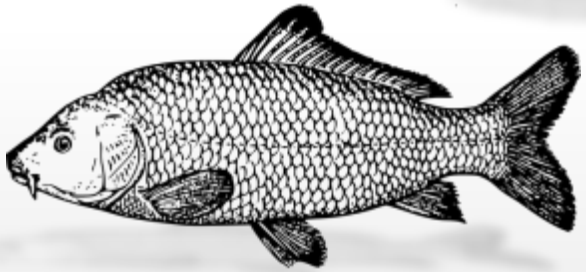


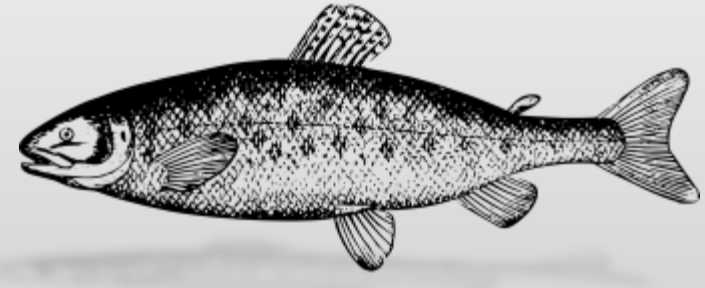
- *Streptococcus suis* (H)
- *Pasteurella multocida* (for pneumonic disease) (H)
- *Actinobacillus pleuropneumoniae* (H)
- Porcine reproductive and respiratory syndrome virus (H)
- Swine influenza virus (H)
- *E. coli* (H)
- *Brachyspira* spp. including *B. hyodysenteriae* and *B. pilosicoli* (H)
- Rotaviruses (secondary bacterial infections) (H)
- *Haemophilus parasuis* (M)

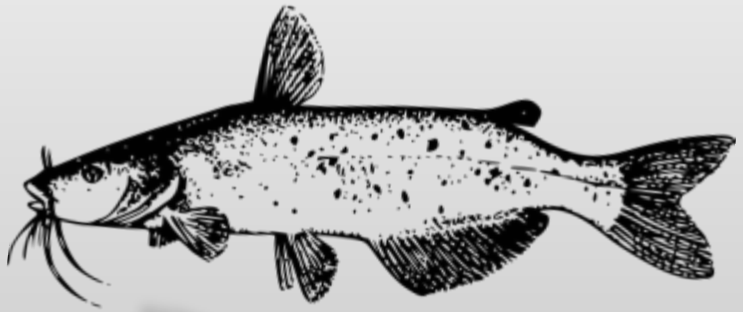
Ad hoc Group Recommendation: Priority fish pathogens



- *Aeromonas hydrophila* and other species (Freshwater cyprinids) (H)
- *Pseudomonas* spp. (Freshwater cyprinids) (H)
- *Vibrio* spp., (Marine fish) (H)
- *Photobacterium* spp. (Marine fish) (H)
- *Streptococcus* spp. (Marine fish) (H)
- *Edwardsiella ictaluri, E. tarda (*Catfish*) (H)*
- *A. hydrophila* and other species (Catfish) (H)
- *Streptococcus inae*, and *S. agalactiae (*Freshwater cichlids**)** *(M)*

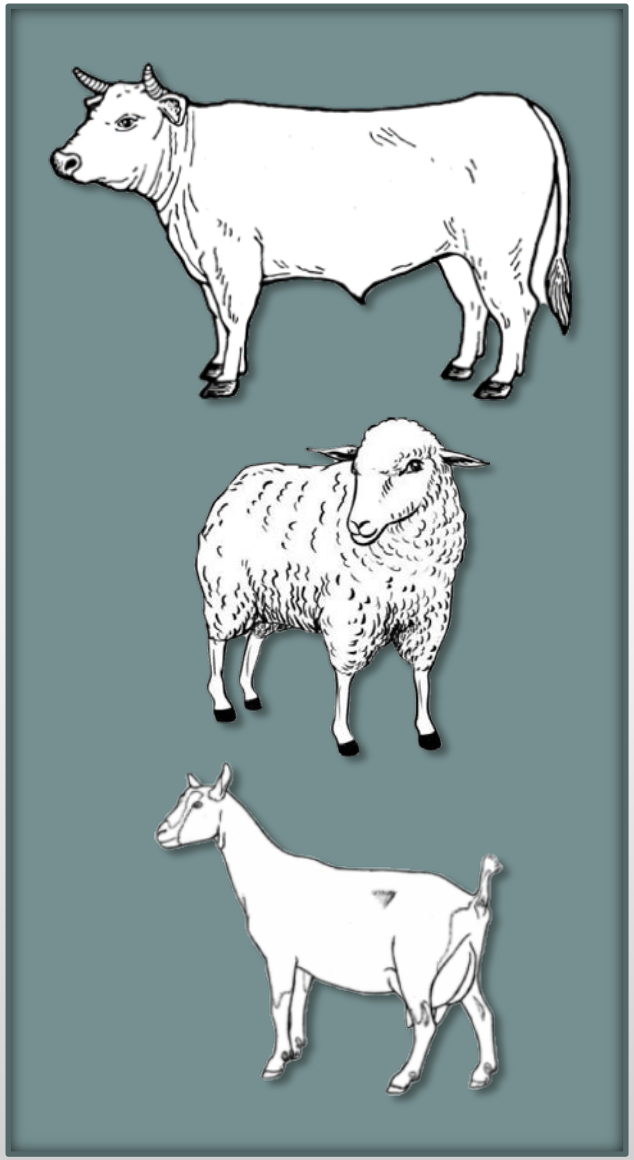






Ad hoc Group Recommendation were also developed for :

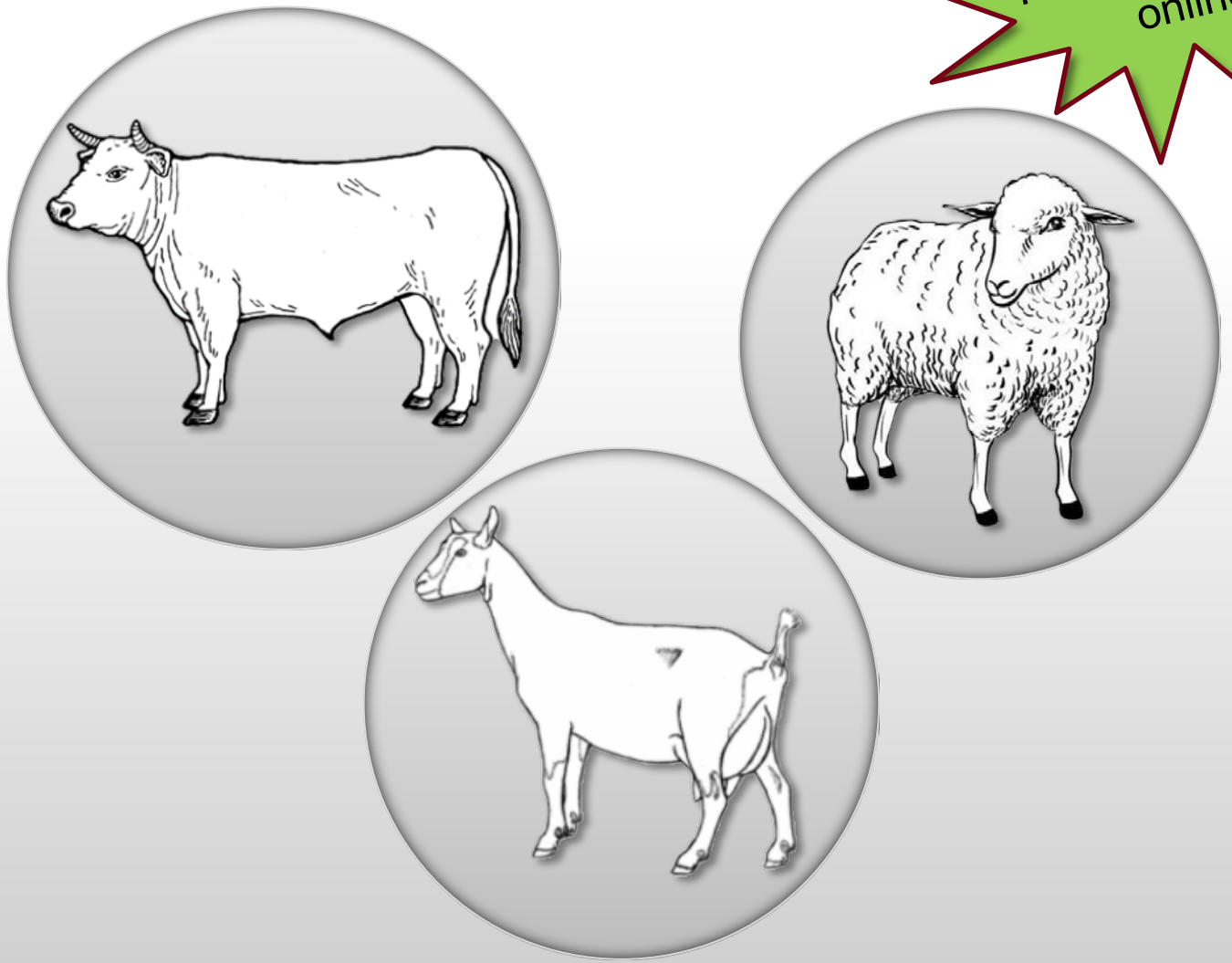
- High priority **cattle** pathogens
- High priority **sheep** pathogens
- High priority **goat** pathogens



High priority cattle, sheep and goat pathogens ranking follows syndromic indication

Reports available online

- Respiratory
- Mastitis
- Lameness
- Enteritic
- Systemic
- Reproductive
- Cutaneous
- Vector born



Outcome/Conclusions of the *ad hoc* Groups

- List of prioritised pathogens for all major species
- Identified important research gaps such as
  - Maternal antibody interference.
  - Cross-protection or inclusion of relevant strains in vaccine formulations.
  - Occurrence of immunological interference in multivalent vaccines.
  - Induction of mucosal immunity for respiratory, enteric and mastitis pathogens.
  - Innovative delivery systems to enable mass-vaccination.
- Recognised limitations due to lack of available information.

Thank you for your attention

12, rue de Prony, 75017 Paris, France
www.oie.int
media@oie.int - oie@oie.int

WORLD ORGANISATION FOR ANIMAL HEALTH
Protecting animals, preserving our future