ROLE OF WILDLIFE IN THE CONTROL OF DOMESTIC ANIMAL DISEASES

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In memoriam

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Aim

• Review methods to mitigate transmission of important pathogens from wildlife to domestic stock
Outline

• Ecology of pathogens: the interface between domestic and wild animals
• Surveillance of pathogens in populations of wild animals
• Options for the control of pathogen transmission
• Discussion and a role for the OIE
# Disease of domestic animals (39 country replies)

**Diseases present**
- Rabies
- Trichinellosis
- HP or LP AI
- Alveolar echinococcosis
- Bovine TB
- CSF (hog cholera)

**Diseases not present**
- Rift valley fever
- PPR

**Diseases either yet absent in wildlife or present in delimited areas**
- African Swine fever
- FMD
Risk definition: wildlife as reservoir

Source → Target/ Victim
Risk definition:
wildlife as reservoir

Source  Soil  Target/ Victim
Risk definition:
wildlife as reservoir

Source  Vector  Target/ Victim

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Europe 2012
liaison

- Link between source and target/
- Vehicle
Risk definition: cattle as reservoir

Source

Target/ Victim
Risk definition: cattle as reservoir

Spill over host. Local maintenance host

Reservoir/ Victim
Transmission = New cases

- Incidence
What about Prevalence?

• Maintenance
Maintenance
Spill-over

Victim

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Item 1: wildlife
The risk to be managed: Outbreaks in domestic animals
Risk management

- Risk assessment: survey, surveillance
- Action plan
- Control implementation
Outline

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Surveillance

• “In general, surveillance is aimed at demonstrating the absence of disease or infection, determining the presence or distribution of disease or infection or detecting as early as possible exotic or emerging diseases”
Kuiken et al. 2011

Fig. 1
Map of Europe depicting the level of wildlife health surveillance according to a self-evaluation of the participating countries ($n = 25$)

White: no data
Dark grey: comprehensive general wildlife health surveillance
Medium grey: partial general wildlife health surveillance (wide range of programmes but restricted in various ways)
Light grey: no general wildlife health surveillance, but some degree of targeted surveillance for a few specified diseases
Categories based on Leighton (13)
Map of Europe depicting the level of wildlife health surveillance according to self evaluation of the participating countries (n=39)
Member countries performing wildlife health surveillance

• In most countries (37/39) the government finances the surveillance
• + Research, Universities and Hunters
• At least >150 programs are running
• > 1000 persons at work
• >219,500 animals examined
  Including >25,000 sick animals

• 35/39 notify wildlife health situation
Training Data Base project (research)

To summarise and analyse how data are stored in Europe.
Difficulties arising in collecting surveillance data

Missing, incomplete or incorrect
  • Animal ID
  • Scientific name of animals
  • Geographical location of the animal,
  • Information sent as event, individual data lacking
  • Follow-up
Surveillance data

- Sparse
- Limited
- Irregular
- Biased

Surveillance is not epidemiology
Useful anyway to make a decision
Outline

• Ecology of pathogens: the interface between domestic and wild animals
• Surveillance of pathogens in populations of wild animals
• **Options for the control of pathogen transmission**
• Discussion and a role for the OIE
Control =

target source + transmission + victim
Control aims

As far as domestic animals are concerned

- Mitigate problems such as
  - Welfare
  - Food quality
  - Food availability
  - Food security
  - Food safety
  - Free trade
  - Fair trade
Control strategies

Control = target source + transmission + victim

Interrupt maintenance
Stop transmission
Protect victims

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Item 1: wildlife
Interrupt maintenance

The control targets persistence in host population

Lethal Non lethal
Lethal control
“why not?”

- The less hosts are carrying the pathogen, the best

General Sheridan

Lethal weapon
Elimination of healthy animals

• On 39 country replies
  • 12: effective (31%)
  • 4: economic (10%)
  • 6: easy (15%)
  • 19 temporary effect (49%)
  • 18 expensive (46%)
  • 29 difficult (74%)
Public opinion reluctance

- Considered inhumane
- But very contrasted opinion according to replies to the questionnaire:
  - 10/39, well accepted
  - 16/39 not well accepted
Logistic growth of host population

Disease threshold number

Logistic curve
Effect of culling

Disease threshold number

Population growth
“exponential” = growing fast
“flat” = stable

There: It doesn't work
Target sick or infected animals

Stop transmission by elimination of animals which are shedding the pathogen…
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Item 1: wildlife

Source (infected) \[\rightarrow\] transmission \[\rightarrow\] Victim
Elimination of sick animals

- On 39 country replies
  - 11: effective (28%)
  - 6: economic (15%)
  - 7: easy (18%)
  - 14 temporary effect (36%)
  - 12 expensive (31%)
  - 29 difficult (74%)
Public acceptance

• Elimination of sick or infected animals
  • 21 /39 consider it would be well accepted (54%)
  • 2 (5%) not well accepted
Badger bovine TB in UK

- Identification of the risk ~ 1973
- Gassing strategy (1975/1982)
  - Zuckerman review 1980
- Clean ring strategy (1982/1985)
  - Dunnet review 1986
- Interim strategy 1993
  - Live test trial
- Six points plan
Lethal control of badger TB

- Badger removal restricted to the part of the breakdown farm.
- + Live test
Problems regarding test sensitivity

Probability of obtaining at least one positive ELISA test from sampling a subgroup of ten badgers

After Krebs et al, 1997 MAAF publications, Regional Commission Europe 2012 Item 1: wildlife
Contraception

= culling before birth

• Management of “problem” animals
  • Deer
  • Feral horses

• Considered in theoretical models for disease control
  • Squirrel Pox
  • Wild boar CSF
Contraception

- Only for feral or easily approached by man: 16 (41%)
- Method not yet been perfected: 18 (46%)
- Unknown 17 (44%)
Use drugs or vaccine “why not?”

- Use therapy to combat the pathogen in the body of animals
Vaccination or medication

• **Wild reservoir**
  • Only for stray or feral: 10 (26%);
  • Not yet perfected: 32 (82%);
  • Unknown: 2 (5%);
  • Expensive: 21 (54%).

Vaccination of wildlife carried out in 30 (77%)
Pharmacology: Drug & vaccine delivery

- **Remote:**
  - attractive bait
  - dart

- **Efficiency:**
  - appropriate route
  - Mucosal immunity
  - Distance & precision

- Environmental safety
Medication: a case study

- Tb in captive Arabian Oryx

Greth et al. 1994
Vaccination: Case study

• 1st trial
  • Baer & al. 1971
• Limited field trial 1978 Swiss
  • Steck & al. 1982
• Experimental trials from 1983 onward in Europe
Bingo

Rabies cases & Baits

D'après : Stöhr & Meslin, 1996

Rabies get back 2,500km in 10 years
Others

- Brucellosis
  - Deer (USA)
- CSF
  - Wild boar (EU)
- Tb
  - Badger (UK)
  - Deer (USA)
  - Possum (NZ)
Drug/Vaccination: Advantages & disadvantages (Wildlife)

- Mass coverage: efficient
- Cost
  - Feasibility
  - Remote delivery
  - Toxic compound/“virulent” vaccine strains = danger for environment
  - Reservoir

Any of the campaigns are under an experimental design: NO ROUTINE
Limit persistence in the environment

The control targets essential resources of the maintenance host, the factors of persistence of the pathogen or of its vector.
Modification of the natural environment for disease control

- Measures can be used locally: 20 (51%)
- No knowledge: 23 (59%)
- Farmers are in favor: 3 (8%)
- Farmers are not in favor: 8 (21%)
Environmental management

- Limit resources
  - Such as feed
  - Shelter
- Create fragmentation & close corridor
  - Barrier
  - Edge effect
- Stop or mitigate indirect transmission or persistence
Modify natural habitat

- Habitat management and rat control
The natural elements, biotic & abiotic factors

Water/shore management
Avian cholera
Botulism
Toxoplasma

Carefully managed moorland burning helps control tick numbers
Habitat manipulation: Advantages & disadvantages (Wildlife)

- Long lasting when successful
  - Identify “nidus”

“More detailed understanding of ecology” Wobeser 2007

- Many examples of mistakes inducing diseases
- Few examples of successful management

➤ More efficient as preventive rather than curative
Stop transmission

The control aims at disrupting any route of pathogen transmission to victim species.
Vector control

Vectors

- are arthropods, which
  - inoculate
  - a pathogen
  - during an ecological relationship
  - e.g. female feeding before she develop eggs

Chemical control

kill eggs or larvae, or adults
Vector control

• Easy & harmless: 3 (8%)
• With strict precautions: 29 (74%)
• Only in farms or urban environment: 20 (51%)

Impact
• On bees 59%
• On birds 51%
• On aquatic animals 49%
• On bats 41%
Pets are liaison animals
Barriers

- Fences
  - Costly
  - Isolation of populations
Installing fences in the natural environment

- Can be effective: 23 (59%)
- May prevent movements (migration): 26 (67%)
- Expensive & difficult: 35 (90%)
Ultimate option
Protect the final target
Vaccination of domestic animals

- Easier: 37 (95%)
- Expensive (to be subsidized): (49%)
- Can hinder trade: 30 (77%)
- No disease free status: 15 (38%)
Confinement of susceptible domestic animals

- Effective: 36 (92%)
- Only applicable to rational farms: 19 (49%)
- Not for small scale farms/ free range: 16 (41%)
- Not applicable to new farm animals/ wild captive: 4 i.e. applicable!
New strategies: OIE concepts

Compartmentalization

Common management system

Natural, artificial, regulated delimitation

Zoning

Biosecurity

Suspect or infected

Disease-Free
Stopping transmission:  
(at both levels)

Advantage & disadvantage

- Prevention
  - Better prevent than cure
  - Long lasting
- Zoning & Compartmentalization:  
  still a concept
- To be implemented in practice

- The ultimate barrier
  - Nothing much to do afterward
- Rely on efficiency of numerous steps
  - fragile
Outline

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- **Discussion and a role for the OIE**
Implementation

- Methods used
  - Culling 17 (44%)
  - Elimination of sick or infected animals 17 (44%)
  - Contraception 00
  - Vector control 08 (21%)
  - Fences in natural habitat 09 (23%)
  - Confinement 21 (54%)
  - Vaccination of wildlife 24 (62%)
  - Vaccination of domestic 30 (77%)
  - Modification of natural environment 01 (3%)

- Rabies: 46%
- CSF: 08%
We are still defenseless…

• The control of diseases of livestock which are harbored or transmitted by wildlife needs new paradigms
Research is a priority

• 36/39 countries agree (92%)

• Priorities:
  1. Coordination of epidemiological studies
  2. Development of diagnostic tools
  3. Development of vaccines or treatments
Conclusion: the role of OIE

• The OIE should become more involved (92%)
  • Development of guidelines: 36 (92%)
  • More training for FP: 26 (67%)
  • Publication: 24 (62%)
  • Improve notification: 20 (51%)
  • Conferences: 20 (51%)
  • OIE reference center: 15 (38%)
List of countries who replied

ARMENIA AUSTRIA AZERBAIJAN BELGIUM BOSNIA H. BULGARIA CROATIA CYPRUS CZECH R. DENMARK ESTONIA FINLAND FRANCE GERMANY GREECE HUNGARY ICELAND IRELAND ISRAEL ITALY KASAKHSTAN LITHUANIA LUXEMBOURG MOLDOVA NETHERLAND NORWAY POLAND PORTUGAL ROUMANIA RUSIA SERBIA SLOVAKIA SLOVENIA SPAIN SWEDEN SWITZERLAND TURKEY UK UKRAINE

many thanks
Thank you for your attention

Thank you to:
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