Multi-Objective surveillance approaches: An inventory from 7 European countries

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Background

Faced with a plethora of available methods, ***surveillance designers*** usually lack tools that allow them to choose the best methods for specific scenarios. RISKSUR is a project involving 12 partners from 10 European countries. The objective of the project is to provide a new generation of methodologies and tools for cost-effective risk-based animal health surveillance systems for the benefit of livestock producers, decision makers and consumers.

Multi-objective surveillance allows designers to reduce costs by combining surveillance activities for several hazards, but it can be challenging to use risk-based approaches when multiple hazards must be accounted for.

Methods

As a first step to developing frameworks that can be useful for the design and implementation of multi-objective surveillance, an inventory of approaches used in seven RISKSUR partner countries was extracted from a survey of surveillance components in place. Countries were anonymised to comply with data protection issues.

The following definition was used:

"Surveillance component: *single surveillance activity used to investigate the occurrence of one or more hazards or health events in a specified population, which has a self-contained surveillance protocol that focuses on a particular data source."*

Multi-objective surveillance components: type MULTIPLE

The same samples are always tested for multiple specific and pre- identified hazards
Only ACTIVE surveillance components were considered:

Species	Sampling point	COUNTRY					
		A	B	C	E	F	G
Pigs	AI centres		AD, CSF, Bruc., PRRS	AD, CSF, Bruc.	AD, CSF, Bruc., PRRS	AD, CSF, Bruc.	AD, CSF, Bruc.
	Farm or abattoir	PRRS, AD	ASF, CSF, AD, PRRS	ASF, CSF and SVD		ASF, CSF, AD, Salm., SVD	
Cattle	AI centres		Bruc., EBL, BVD, BHV-1	Bruc., EBL; BVD, bTB, IBR	Bruc., EBL; BVD, BT, IBR, Lepto, Qfever, PTB		Bruc., IBR, bTB, BT
	AI centres		C.fetus,T.foetus	C.fetus, T.foetus	C.fetus,T.foetus		
	Farms	EBL, IBR	Bruc., C. burnetii, Chlam., Lepto				
	Farms Milk collection centres		EBL, Brucellosis		Bruc., EBL		
Small Rumin.	AI centres		BD, Bruc.	BD, Bruc.			
	Farms	Bruc., CAE	PTB, other mycobact.				
Poultry	Abattoir	AI, ND					
Equid.	AI centres		Eq. Arteritis, EIA, CEM	Eq. Arteritis, EIA, CEM			
Feed	Feed producer		Salm., Toxins, residues				
Insect Vector	Natural habitat			BT, others with same vector			
Wild boars	Natural habitat			CSF, AD, bTB, Bruc., trichinellosis		CSF, AD, SVD, FMD, trichinellosis	ASF, CSF, AD, PRRS
Wild carn-ivores	Natural habitat		Echinococcus multilocularis, Trichinella spiralis	Rabies, distemper, bTB, sarcoptic mange, echinococc., hidatidosis			
Wild cervids	Natural habitat			TEE, bTB, Bruc.			
Wild bovids	Natural habitat			Pestiviruses, Bruc., sarcoptic mange			

Multi-objective surveillance components: type MOTHER/CHILD

*The samples collected for investigation of a specific hazard (**Mother component**), are used to test for other specific and pre- identified hazards (**Child components**).*

Species	Sampling point	Mother	Child components by country				
			B	C	E	F	G
Pigs	Farm	**CSF**	AD				
	Farm + Abattoir	**PRRS**					AD, CSF, SVD, ASF, Bruc.
Wild pigs	Hunting ground	**CSF**	AD, Bruc., hepatitis E				
Cattle	Farm	**Brucella**		BT		BVD, IBR, Salm., Lepto, Neospora	
	Milk collection centres + Abattoir	**BVD**					IBR, EBL, Bruc., BT, Schmallenberg
	Farm	**EBL**		CBPP			
Small Ruminants	Farm	**Maedi-Visna**					Bruc. TB, PTB,
	Farm	**Bruc.**			Q fever		Q fever
Birds	"Wild"	**Avian Influenza**			West Nile		
Rodents	Natural habitat	**Tularemia**		Listeria			

AD = Aujeszky's disease
AI = avian influenza
ASF = African swine fever
BD = border disease
BHV-1 = bovine herpesvirus type 1 disease
Bruc. = brucellosis
BT = bluetongue
bTB = bovine tuberculosis
BVD = bovine viral diarrhea
C. burnetii = *Coxiella burnetii*
C.fetus = *Campylobacter fetus*
CAE = caprine arthritis and encephalitis
CEM = contagious equine metritis
Chlam = *Chlamydia* spp.
CSF = classical swine fever
EBL = enzootic bovine leukosis
EIA = equine infectious anemia
FMD = foot-and-mouth disease
IBR = infectious bovine rhinotracheitis
Lepto = leptospirosis
ND = Newcastle disease
PRRS = porcine reproductive and respiratory syndrome
PTB = paratuberculosis
Salm. = salmonellosis
SVD = swine vesicular disease
T.Foetus = *Trichomonas fetus*

Other surveillance designs identified as Multi-Objective:

Event-based: *Mandatory reporting events are investigated for a number of specific and pre-identified hazards:*

Common events triggering testing: Abortion; death in food producing animals and in wild animals.
Common tests: Pigs: brucellosis, CSF, PRRS and swine influenza;
Cattle: brucellosis, Q fever,

General purpose programs: Surveillance is not focused on a specific hazard, but on monitoring indicators of health:

Most commonly reported:
Scanning surveillance
Syndromic surveillance
Health improvement programs in poultry
Health improvement programs in pigs

Multi-hazard surveillance: *Surveillance is designed and executed in conjunction for a number of specific and pre- identified hazards*

Vector surveillance: covers more than one vector-borne disease
Active surveillance focused on one animal species, but several diseases:
Bees Fishes Molluscs Crustaceans

Abattoir surveillance *(potentially multi-objective)*:

Specific surveillance components with collection of data during slaughter (Ex.; tuberculosis or trichinellosis) were ***not*** considered multi-objective. However, many countries pointed out that abattoir surveillance can serve several surveillance programs/components.

Conclusions

The use of multi-objective surveillance was common among the European countries investigated . There are differences in the number and variety of threats investigated in conjunction, or which threat is the main purpose of sampling. However a number of common components were identified. The extent of multi-objective surveillance used must be considered when developing frameworks for designing surveillance, especially when risk-based strategies are to be used.

It was interesting to note that there were many different interpretations of the concept of "multi-objective" surveillance . It was initially intended to represent only relationships of the type "multiple" and "mother/child", but abattoir surveillance and general purpose surveillance were other types reported by the countries as "multi-objective". A terminology agreement is needed.

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