Research Brief

Mapping of surveillance systems, animal populations, trade flows, critical infrastructure and decision making processes in several European countries

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In the past twenty years, the European Union (EU) experienced several animal health crises that had dramatic adverse effects on the livestock sector and public health and resulted in significant disruptions to markets and the wider economy.

Consequently, there is a demand for more effective and efficient surveillance systems to avoid negative economic, social and political consequences resulting from animal disease and improve animal health and welfare. At the same time, many decision-makers are under pressure to reduce their budgets and therefore are interested in frameworks that help to take decisions on efficient resource use. The RISKSUR consortium presents an integrated assessment for informing surveillance design, based on mapping of surveillance system components in thirteen European countries (Belgium, Bulgaria, Czech Republic, Denmark, France, Germany, Great Britain, Ireland, Italy, the Netherlands, Spain, Sweden, and Switzerland) and analysis of related demographic, production, and trade characteristics. Moreover, data on critical infrastructure and existing decision-making processes for resource allocation to surveillance were collected in France, Germany, Great Britain, the Netherlands, Spain, Sweden, and Switzerland.

Primary and secondary data on surveillance systems, infrastructure and decision-making processes were collected and collated by RISKSUR researchers in the countries mentioned. Additionally, data on livestock and bee holdings in Europe, human and animal populations, gross domestic product, and farm values were collated from Eurostat. Data on trade was obtained from the EU's Trade Control and Expert System (TRACES) which records movements of live animals and livestock products in the EU.

All data were entered into a database, cleaned and analysed descriptively. The distribution of human and animal populations (heads/km^2), animal holding densities (holdings/km^2) and holding size densities were mapped at NUTS2 level. Absolute trade flows of live animals and animal products between countries were broken down by species and purpose and illustrated in tables and maps. The number of slaughterhouses, livestock markets, traders, transporters, laboratories, and veterinarians were compared to livestock demographics where applicable. Existing surveillance system components (SSC) were reported in terms of target hazard, species, surveillance protocol and design, geographic focus, purpose, inclusion of risk-based sampling, multi-objective nature, coordination and expenditures. Finally, decision-making processes and key decision-making criteria used by the relevant stakeholders were described. Key findings are summarised here.

Key attributes

The findings resulted from data collection in Belgium, Bulgaria, Czech Republic, Denmark, France, Germany, Great Britain, Netherlands, Italy, Ireland, Spain, Sweden and Switzerland.

The list of components collated resulted in a solid dataset, providing a comprehensive picture of the surveillance systems in these countries.

This analysis brought together key system attributes of selected countries, allowing a comparison between countries and systems.

Findings highlight areas for further research that can help design risk-based surveillance systems that are scientifically sound and acceptable to stakeholders.

Overview of human and animal populations in Europe

The analysis of population and production data is critical to be able to understand the basic composition, characteristics, and functioning of the structure that surveillance systems are trying to protect. Geographic areas with higher proportions of households keeping livestock are countries in the Baltic, East, Southeast and Balkan parts of the EU, Ireland (for cattle, sheep and equines), and Portugal (for broilers). The proportion of households involved in livestock keeping (along with the tendency for there to be more small herds/flocks when more households are involved) has implications for supply of veterinary services in general and surveillance in particular. For example, smallholders may be less likely to have regular contact with private veterinarians than larger more commercial farms, which would entail a more important or at least different role for public veterinary services in those countries compared to others. The infrastructure data showed that there were variations in densities and throughput between the seven countries included: for example the number of slaughterhouses per head of livestock species was highest in Germany for cattle, pigs and ruminants and in Sweden for poultry.

Surveillance systems

Overall, a total of 798 active or enhanced passive surveillance components were recorded and analysed for all thirteen countries. The primary surveillance purpose most frequently mentioned was "early detection/warning", followed by "detect cases to allow specific actions to be taken in animals or holdings which will facilitate control or eradication", and "substantiate freedom from disease or infection" (Figure 1). The least frequently mentioned surveillance purpose was to "describe changes that may threaten the health of populations".

When looking at the number of surveillance components reported by threat, disease, health event and country, most frequently recorded in the thirteen countries were salmonellosis (16%); brucellosis (10%), avian influenza (8%); classical swine fever (4%), bovine tuberculosis (4%), bluetongue (4%) and bovine spongiform encephalitis (2.5%). Species most frequently identified as targets for surveillance were cattle, pigs and poultry (Table 1). Half of the 51 "other species" entries included cattle and buffalos (N=6) or cattle, buffalos and bison (N=20), which can be explained by buffalo mozzarella cheese production in Italy and the Czech Republic, thereby further emphasising the predominance of surveillance components in large ruminants. The findings suggest that the single threats and species covered most frequently by surveillance likely reflect their economic importance and the expected high impact if disease occurs.

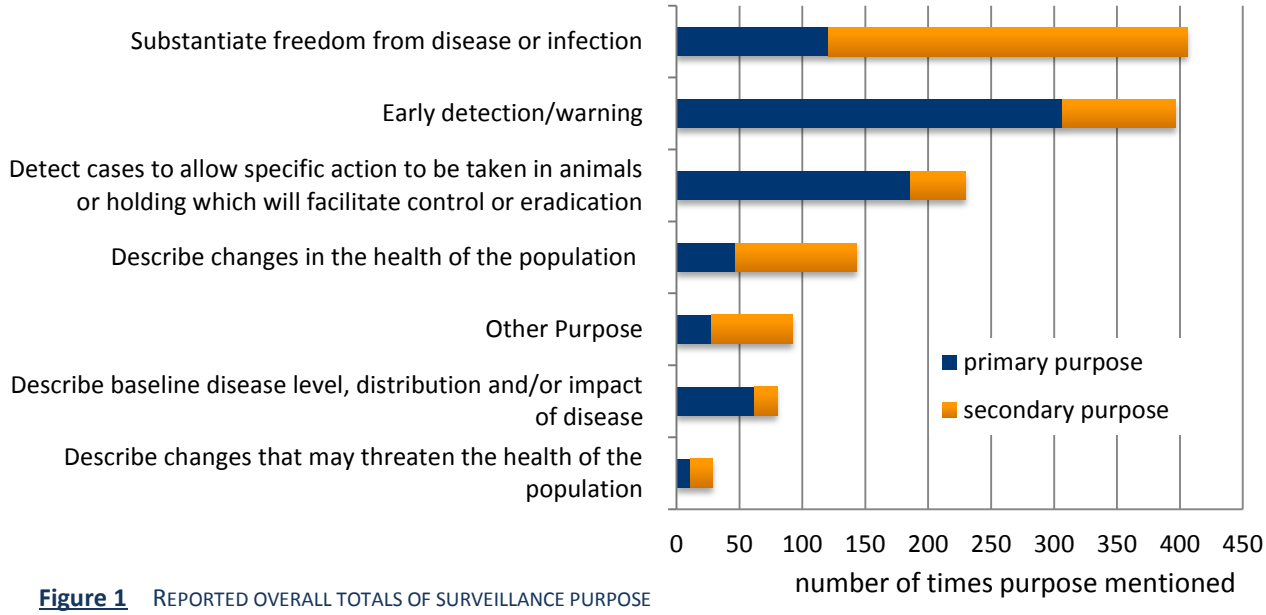

Figure 1 REPORTED OVERALL TOTALS OF SURVEILLANCE PURPOSE

TABLE 1 NUMBER OF SURVEILLANCE COMPONENTS RECORDED, BY TARGET SPECIES IN EACH COUNTRY (COUNTRIES WERE ANONYMISED. C= COUNTRY)

Species	TOTAL	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13
All species	**12**		1	1				6			2	1	1	
Avian[a]	**6**						1	2			1			2
Bats	**2**			1			1							
Bees	**3**		1									2		
Camelids and Deer	**2**							2						
Cattle	**187**	7	20	28	12	11	23	29	1	4	13	11	13	15
Equidae	**35**		7	6	3		2					11	6	
Feed	**4**		3				1							
Fish	**13**		3	2	1		2			1	1	1	2	
Insect vectors	**8**		1	2		1					1	1	2	
Multi	**71**		15	11	3	2	6	5	2		6	7	14	
Other	**51**			10	1		2					26	12	
Pigs	**128**	2	24	12	7	6	18	14		1	2	15	16	11
Poultry	**112**	8	18	10	1	4	16	9		1	12	14	10	9
Ruminants	**19**		3	4		3	1	2			1	3	2	
Small Ruminants	**94**	2	10	17	6	4	8	8		1	8	17	10	3
Wildlife	**51**		15	5	3	1	7	1			5	8	6	
TOTAL	**798**	**19**	**121**	**109**	**37**	**32**	**88**	**78**	**3**	**8**	**52**	**117**	**94**	**40**

[a] Includes all birds, i.e. domestic birds and wild birds

Most countries reported that the majority of components reported were publicly funded, but there were also countries where a considerable percentage of SSC was privately funded. Expenditure estimates were only available for 21% of all components. Thereby these results indicate that such data are not readily available and/or accessible.

For all countries, two-thirds of all components recorded were of risk-based sampling nature; the majority of them categorised based on risk without making a differentiation when selecting the units within this population (e.g. targeting the entire population of males in artificial insemination centres or all animals over 6 months of age).

The data also showed that 32% of all components were multi-objective. Multi-objective surveillance has the possibility of reducing overall expenditure, since the same sample is being tested for multiple pathogens.

Importantly, all countries relied on case definitions that included a laboratory diagnosis. This has considerable implications since it requires the provision of the necessary laboratory infrastructure to conduct surveillance and may constitute a significant cost factor. If surveillance systems are heavily dependent on such infrastructure, the fixed costs of these systems should be part of analyses assessing the economic value of surveillance.

Decision-making

The information from the 34 interviews conducted with decision-makers and technical advisors for France, Germany, Great Britain, the Netherlands, Spain, Sweden, and Switzerland showed that decision-making processes for public surveillance in the partner countries are highly variable with a multitude of institutions involved and a varying degree of collaboration and input from private bodies. The single most important decision criterion influencing the allocation of resources to surveillance was 'international legal requirement' (including EU obligations) followed by national legal requirement. In the group of decision-makers, economic decision-making criteria also ranked high. Technical advisors frequently mentioned 'disease situation in the country' and an 'impact' related criterion (impact on animal production/national economy/human health), and effectiveness criteria (e.g. 'timeliness', 'sensitivity'), in particular when asked what criteria are relevant when considering how to do surveillance. Several constraints to the resource allocation process were listed and most people interviewed said that they would like to have further information (e.g. epidemiological, economic information, standardisation and harmonisation) to take decisions on resource allocation to surveillance. The interviews also showed that a multitude of private-public partnerships are in use across countries ranging from sharing of testing costs, to outsourcing of the planning and implementation of surveillance to private bodies (but funded by government), to formal partnerships with 50:50 cost sharing of all surveillance costs.

Further activities

- A series of **Surveillance Surgery webinars** with presentations by key experts is hosted by RISKSUR. The online meeting format provides for participants the unique opportunity to place their inquiries directly and contribute information. Past sessions: African Swine Fever Surveillance/15 May 2014; Looking at society from animal health surveillance/26 June 2014. Three further sessions are in the planning stages.

- **Best practice workshop and guidelines:** The RISKSUR consortium is to hold a workshop with the goal to develop best practice guidelines for animal health surveillance on 30 September 2014 in The Hague, Netherlands. Stakeholders such as surveillance program designers and policy makers will interact with RISKSUR consortium members and members of the advisory board.

- RISKSUR is to organize a one-day **surveillance symposium** "Animal Health Surveillance 2.0". The symposium will take place at Het Pand in Ghent, Belgium, in conjugation with the annual meeting of the Society for Veterinary Epidemiology and Preventive Medicine on Tuesday, 24 March 2015.

Conclusions

- The mapping provides a useful **overview of populations and trade flows for all EU countries**, as well as of **surveillance systems** in thirteen countries. Furthermore, an overview of **infrastructure and decision-making processes** for seven countries is being given. All these can be used to inform further activities in RISKSUR
- Within RISKSUR, there is potential to address some of the **constraints mentioned by decision-makers** and their request for further information.
- RISKSUR can address the lack of evidence in an epidemiological and economic context, including social and political dimensions, in the **conceptual framework** and the **evaluation tool** it is developing.

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