SurF - a novel framework enabling multi-sector biosecurity surveillance evaluation

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Abstract

Surveillance for hazards to biosecurity is being conducted by New Zealand's competent authority (the Ministry for Primary Industries (MPI)) to support its biosecurity system. Surveillance evaluation should be an integral part of the surveillance life cycle, as it provides a means to identify and correct problems and to sustain and enhance the existing strengths of a surveillance system. The Surveillance Evaluation Framework (SurF) presented here was developed to provide a consistent generic framework within which the Ministry for Primary Industries (MPI) biosecurity surveillance portfolio, and all of its components, can be assessed. SurF is a novel cross-sectorial effort that aims to provide a common umbrella for surveillance evaluation in the animal, plant, environment and marine sectors. It supports the conduct of the following four distinct components of an evaluation project: (i) Motivation for the evaluation, (ii) Scope of the evaluation, (iii) Evaluation design and implementation, and (iv) Reporting and communication of evaluation outputs. Case studies, prepared by MPI subject matter experts, are included in the framework to guide users in their assessment. Three case studies in particular were used in the development of SurF in order to assure practical utility and to confirm usability of SurF across all included sectors. It is anticipated that the structured approach and information provided by SurF will not only be of benefit to MPI but also to other New Zealand stakeholders. Although SurF was developed for internal use by MPI, it could be applied to any surveillance system in New Zealand or elsewhere.

**Keywords:** *surveillance, evaluation, biosecurity*

Introduction

The New Zealand Ministry for Primary Industries (MPI) undertakes, and invests significantly in, a range of national biosecurity surveillance activities across the plant, animal, environmental and aquatic sectors (1). Biosecurity surveillance aims to inform the management of post-border risk from hazards such as infectious disease agents or introduced pests. It is thereby part of the larger biosecurity system aimed at reducing biosecurity risks and facilitating trade. These activities underpin New Zealand's ability to enable trade and to protect itself from biological risks through the early detection of pests and diseases, and the provision of evidence of pest or disease freedom. Given the importance of these activities to New Zealand stakeholders, it is essential that the performance of these programmes can be assessed to provide assurances regarding the quality of delivery and outputs of these programmes.

The continuous evolution of surveillance systems warrants regular re-evaluation of their effectiveness and underscores the importance of surveillance evaluation in the surveillance life cycle (Figure 1). To provide a consistent generic framework for the assessment of the MPI biosecurity surveillance portfolio, including all of its components, the Surveillance Evaluation Framework (SurF) was developed. This novel cross-sectorial effort aims to provide a common umbrella for surveillance evaluation in the animal, plant, environment and marine sectors.

Figure 1. Evaluation as part of the surveillance life cycle.
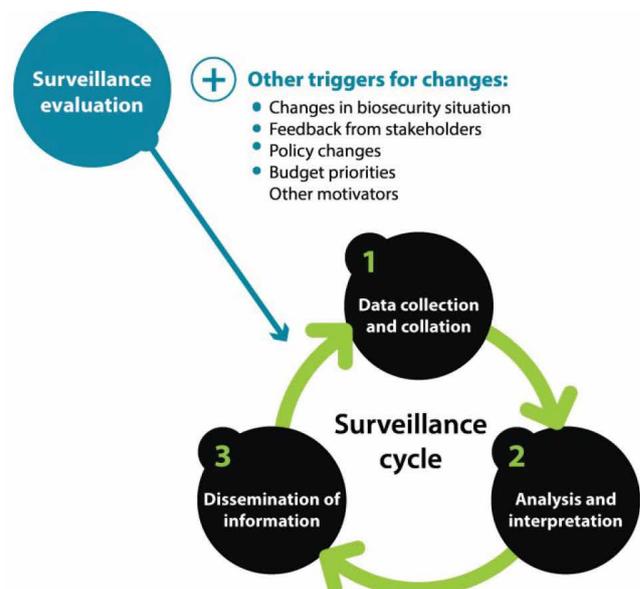
Materials and methods

In order to create a common evidence base for the planning and development of an evaluation framework in New Zealand, a scoping review methodology was used to rapidly map the key concepts underlying surveillance evaluation. Scoping reviews are considered a useful and increasingly popular method to collect and organise important background information and to gain an overview of the existing evidence base (2). The terminology proposed by Hoinville *et al.* (3) was used wherever possible to align with existing standards.

A surveillance evaluation framework was developed based on these findings. Three case studies were developed to test the developed framework and provide applied guidance to future users.

Results

Although a formal literature search was conducted, no evaluation frameworks specific to surveillance in the environmental, marine or plant sectors were identified by the scoping review. Current efforts are concentrated on the evaluation of public health and animal health surveillance; however, existing frameworks offer the flexibility to be adapted to support the wider context of New Zealand biosecurity surveillance. SurF was therefore built upon and adapted from previous work conducted nationally and internationally in the context of the evaluation of human and animal health surveillance. This included, in particular, the SERVAL Framework (4), the recently published guidelines by the European Centre for Disease Control (5), the Centers for Disease Control and Prevention Guidelines (6) and the EVA tool (7,8).

SurF consists of four components, each supporting a distinct phase in the evaluation:
1. Motivation for the evaluation
2. Scope of the evaluation
3. Evaluation design and implementation
4. Reporting and communication of evaluation outputs.

Each component describes the activities and decisions related to a phase within an evaluation project. Further, SurF includes a total of 29 different attributes (Table 1), which are divided into core and accessory attributes. Within SurF, attributes are grouped into five 'Functional Attribute Groups' based on the logic presented in Figure 2. Each group includes at least one core attribute. Core attributes assess essential aspects common to all surveillance systems, and it is recommended that they be included in all evaluations. If for any reason this is not done, justification should be provided. Further, SurF provides a visual output that allows for comparison of core performance between systems and within individual systems over time.

Three case studies, including the National Apiculture Surveillance Programme (NASP), Marine High Risk Site Surveillance Programme (MHRSS) and the Forestry High Risk Site Surveillance Programme (HRSS), were used to demonstrate how SurF can be used in ongoing surveillance activities. The case studies were also used in the development of SurF in order to assure practical utility and to confirm usability of SurF across all included sectors. As such they provide non-peer-reviewed example evaluations to illustrate the framework at use, ready at hand to support MPI users of the framework.

Table 1. List of attributes included in SurF (n=29). Core attributes are highlighted in bold.
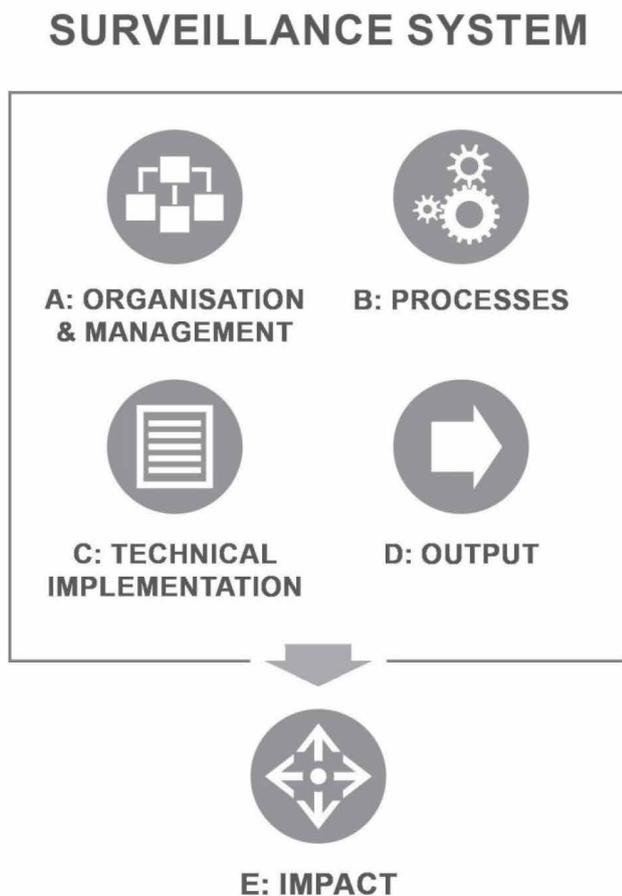
Functional Attribute Group	Attribute
A. Organisation & Management	1. Flexibility
	2. Organisation and management
	3. Performance indicators and evaluation
B. Processes	4. Data analysis
	5. Data and information collection
	6. Data management and storage
	7. Field and laboratory services
	8. Resource availability
	9. Technical competence and training
C. Technical Implementation	10. Acceptability and engagement
	11. Coverage
	12. Data completeness and correctness
	13. Interoperability
	14. Multiple utility
	15. RARR (Reliability, availability, repeatability, and robustness)
	16. Timeliness
D. Outputs	17. Historical data
	18. Negative predictive value
	19. Positive predictive value
	20. Precision
	21. Representativeness and bias
	22. Sensitivity
	23. Specificity
E. Impact	24. Benefit
	25. Decision support
	26. Efficiency
	27. External communication and dissemination
	28. Internal communication
	29. Utility

Discussion

The MPI evaluation framework was designed to ensure consistency in the evaluation of different biosecurity surveillance systems by providing a robust process that is not sector- or context-specific. This should also make results of evaluations comparable. SurF draws from existing surveillance frameworks and, when appropriate, adopts what has been developed elsewheres. Its greatest novelty lies in the extension to plant, environment and marine biosecurity surveillance and combining this with animal health biosecurity surveillance under a common umbrella.

The aim was to develop a generic framework to allow sufficient flexibility for use across the wide range of MPI surveillance systems and to compare and assess system performance. While the standardised assessment of core attributes provides consistency between the assessments of different systems, the choice of accessory attributes allows users to tailor the evaluation to unique contexts.

Figure 2. Logic of functional attribute groups (A–E) used in SurF.

References
1. **Acosta *et al*.** 2011 http//www.biosecurity.govt.nz/files/pests/surv-mgmt/surv/atlas-of-biosecurity-surveillance.pdf.
2. **Armstrong *et al*.** *J Public Health* 33(1), 147-50, 2011
3. **Hoinville *et al*.** *Prev Vet Med* 112, 1-12, 2013
4. **Drewe *et al*.** *Transbound Emerg Dis.* 62, 33-45, 2015
5. **European Centre for Disease Prevention and Control.** 2014 http//www.ecdc.europa.eu/en/publications/Publications/Data-quality-monitoring-surveillance-system-evaluation-Sept-2014.pdf.
6. **Centers for Disease Control and Prevention.** *Morb and Mortal Wkly Rep* 50, 1-35, 2001
7. **The RISKSUR Project Consortium.** *RISKSUR Task 1.4.* 2013 http://www.fp7-risksur.eu/sites/default/files/documents/Deliverables/RISKSUR%20(310806)_D1.4.pdf.
8. **The RISKSUR Project Consortium.** *RISKSUR Task 5.18.* 2015

SurF includes a large amount of flexibility in the selection of attributes, which differs from recently published animal surveillance frameworks that emphasise alignment of attributes with specific surveillance objectives e.g. freedom from disease (4,7,8). Further, a substantial number of attributes are included in SurF to accommodate the diversity and unique context of MPI's surveillance systems. Although SurF was developed for internal use by MPI, it can be applied to any surveillance system, including for example, surveillance conducted by regional or city councils in New Zealand.