Biosurveillance: a systems view

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Towards a global wastewater surveillance system for public health

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RAND

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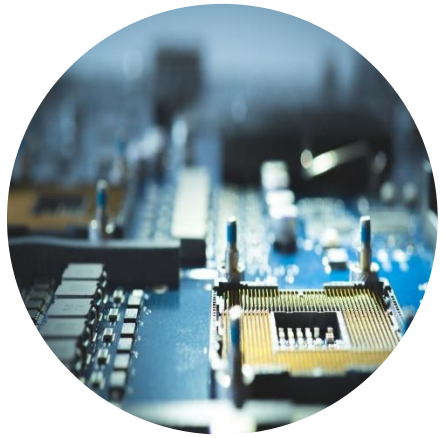
A global not-for-profit research organisation that helps to improve policy and decision making through research and analysis



Multidisciplinary research

Insights from multiple streams of work on biosurveillance

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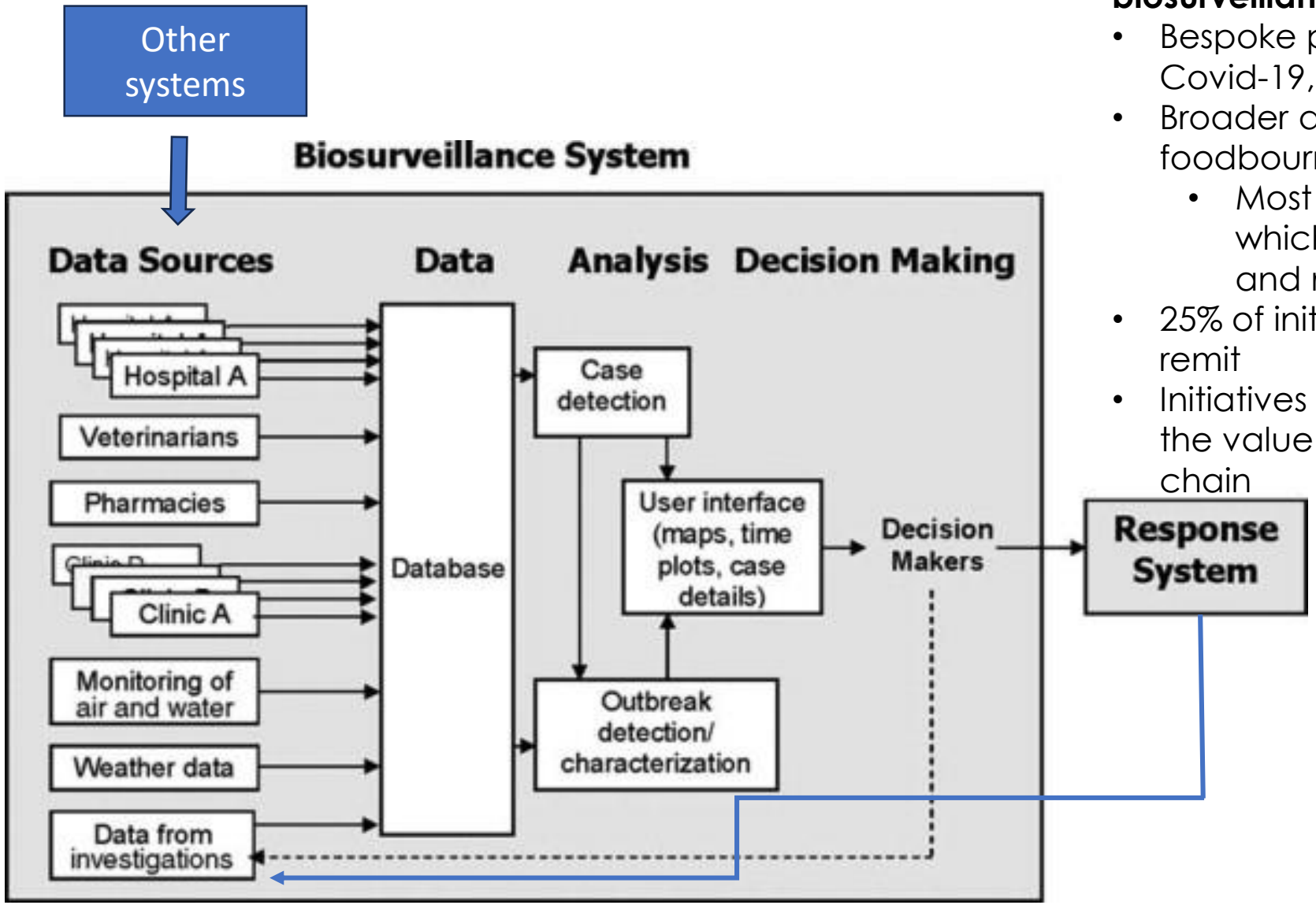
Biosurveillance system

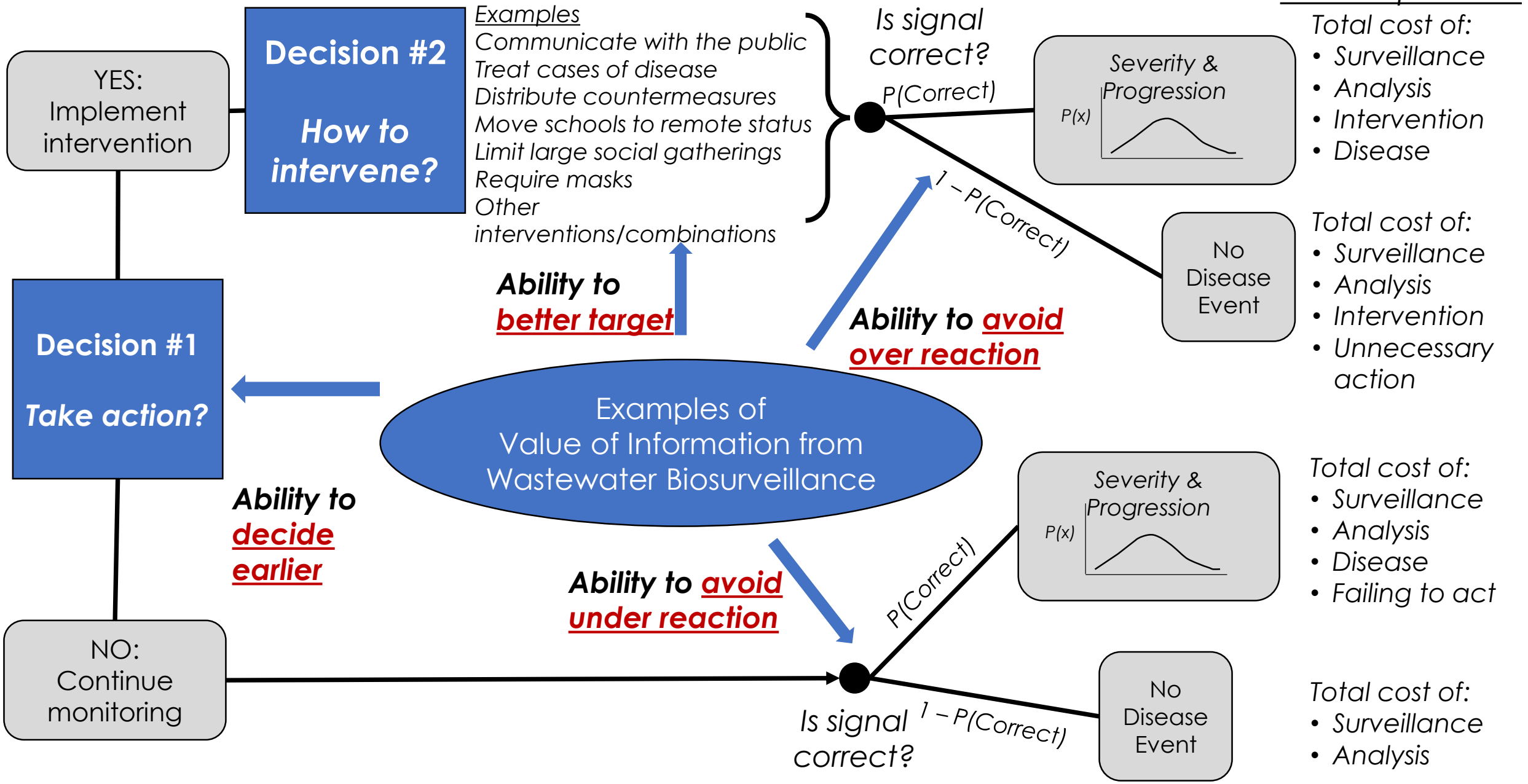


Global initiatives mapping exercise yielded insights on the range and types of work ongoing in biosurveillance:

- Bespoke pathogen surveillance ongoing e.g. Covid-19, Influenza
- Broader agnostic surveillance measures e.g. foodbourne, environmental, AMR
  - Most initiative cover a range of pathogens which has implications for sampling, testing and metagenomics infrastructure
- 25% of initiatives mapped were international in remit
- Initiatives are focussing on different aspects of the value chain whilst some straddle across the chain

Emerging evidence: pathogen-agnost biosurveillance is a lot cheaper than anticipated. These cost reductions car be achieved by using multiple other technologies (such as wearables, mPC other environmental indicators, etc.) to prioritize when to perform metagenom sequencing

Considering the Value of Information from the system



Factors influencing benefits of the system

- Technology performance
- Physical and digital infrastructure
- Data and information access
- Existence, effectiveness and cost of countermeasures
- Geography and Demography
- Transmission mechanisms and routes
- Pathogenicity
- Rapidity and consistency of response

Our evidence on gaps in knowledge and infrastructure

Data collection

- Supply chain (e.g. consumables, PPE)
- Connectivity (e.g. internet, physical access)
- Lack of metadata (e.g. source, location)

Information generation

- Siloed data sets (e.g. no interoperability)
- Political pressure (e.g. underreporting and economic repercussions)
- Physical samples crossing international borders (e.g. Nagoya Protocol)
- Full burden of disease on societies including how the burden is distributed and shared
- Full cost of countermeasures on economies and societies, including how the costs are distributed and shared

Decision-making

- Genomic surveillance is fragmented
- Fragmented threat detection (e.g. not scalable, lack of robust meta genomic approaches)
- Evaluations of response systems and strategies

Moving the dial on biosurveillance

Advancements of both technology and systems thinking and design is needed

- Capacity building for genomic surveillance
- Meta-genomic pilots and scalable threat detection
- Strengthening the information sharing and decision-making interface with the response mechanisms locally, nationally and globally and cross sectorally
- Technology pilots and testbeds
- Inclusion of end users/decision makers in technology and system testing
- Building holistic evaluations into testing
- Assessment of the costs and effectiveness of biosurveillance-informed response