

Early Recognition and Rapid Action in Zoonotic Emergencies

ERRAZE@WUR

BACKGROUND

The ongoing COVID-19 pandemic and resulting health and economic crisis has caused major disruptions in the functioning of food systems and revived the discussion on what forms balanced, effective and responsible crisis management.

As part of its thought leadership and its social responsibility in times of crisis, WUR is uniquely placed to contribute to the scientific knowledge base and data collection mechanisms required for early recognition and rapid response. In addition, WUR takes on the challenge to generate timely insights into the possible scenarios for the prevention of a crisis and during and after emergencies to enable our clients and stakeholders to make informed decisions. Lastly, WUR can provide a better understanding of the mechanisms of spillover, and tangible and practical tools to help reduce the risk of spillover events from occurring, prevent pathogen spread, or mitigate the impacts of a future pandemic.

In its research institutes and university, WUR brings together expertise in human, animal, plant and environmental health, the global agri-food system, economics, social sciences, food safety and security, ethics, and policy. Here, in the knowledge that COVID-19 will not be the last pandemic, we present WUR's ambition and capabilities towards a systemic and integrated global multi-stakeholder approach to the prevention and management of potentially pandemic diseases, across the four phases of crisis management.

PRE-SPILLOVER: PREVENTION OF SPILLOVER EVENTS

Agri-food systems exemplify the rapidly growing and changing interface between humans, the environment, wildlife and livestock. To reduce the chance of future spillover events occurring, WUR can leverage its knowledge and understanding of the global agri-food system, (wildlife) ecosystems, environmental resilience, human behavioural systems, and pathogens. Understanding the mechanisms underpinning the chain of events and the contributing factors to emergent pathogens, allows for the smart (re-)design of agri-food systems and consumer/producer behaviour, for the creation of sustainable interventions, and the fostering of biodiverse and healthy ecosystems, that reduce the likelihood of pathogen spillover and spread.

To create sustainable interventions, WUR will leverage its global partner networks to work in a broad national and international multi-stakeholder alliance, to:

- Use and further extend its existing knowledge of high risk areas for pathogen (re-)emergence (hotspots), utilising its understanding of both the potential pathogen pool as well as relevant socio-ecological factors. Various factors underlying spillover hotspots should be better understood, such as the risks brought by hunting, poorly regulated transport and trade in wet markets, or wildlife occurring in close proximity to people. This new knowledge will be shared with policy

makers, to underpin effective interventions that give account to cultural, social, economic, legal and policy aspects.

- Continue the identification of stressors to the natural ecosystem and its species that could enhance pathogen shedding by reservoir hosts and similarly identify prerequisites for a healthy and resilient system.
- Further develop model-based sustainable preventive measures to the agri-food system including built-in evaluations, taking into account social, economic and health factors. This may include for example mitigation of zoonosis risk by intervention strategies, including vaccinating urban wildlife or evidence-based vector control, but should be extended to include considerations to re-design weak-spots of the agri-food value chain.
- Use its experience and (inter-)national network to continue to inform contingency planning, as well as ongoing science communication to underpin awareness among industries and its workers in the agri-food value chain, as well as among consumers. Preventive measures can only be effectively implemented when there is support for them.

PRE-SPILLOVER: PREPARATION THROUGH EARLY WARNING, VACCINE PLATFORMS AND GENERIC THERAPEUTIC APPROACHES

Several 'peace time' actions can underpin pandemic preparedness. These include a range of activities that WUR contributes to, including surveillance – to enabling early warning -, and developing ready to use or plug and play vaccines and therapeutics.

WUR works across scales, from detailed knowledge of pathogen genomes and traits, to global assessments of potential shocks to the agri-food system, and back to the impact of such shocks on individuals. Leveraging the vast amounts of available data, and its experience with developing diagnostic tools, vaccines and vaccine platforms, and food-based immune-modulating therapeutics, WUR will:

- Further develop tools and methodologies for full characterisation of new and emerging pathogens, including pathogenic and clinical manifestations and range of susceptible hosts and potential reservoirs.
- Further develop its data analysis algorithms and tools, that allow for the integrated assessment of *in silico* surveillance of data, that is directly related to pathogens with pandemic potential, but also of non-traditional data such as trend data, and web-scrubbing.
- Use this *in silico* surveillance to move to smarter monitoring and sampling in field studies, including using eDNA for the identification of potential equilibrium shifts signaling potential emergence of pathogens.
- Continue the development of the required diagnostic technologies to enable catch-all surveillance and monitoring, including on site rapid and broad tests.
- Continue the development of several vaccine platforms, and extend its pipeline partnerships towards at-scale production and (pre-)clinical data-packages.
- Develop and extend knowledge of natural immune-modulatory dietary components, that may enhance vaccination responses, prevent infection (severity), or provide passive immunity in humans and livestock.

- Strengthen its implementation of FAIR data management, and the underpinning data infrastructure.

POST-SPILLOVER: RESPONSE; TRACKING AND PREVENTING PATHOGEN SPREAD BY DIAGNOSTICS AND EFFECTIVE CONTROL MEASURES, VACCINATION ROLL-OUT

Global efforts to reduce the impacts of emerging diseases are currently largely focused on post-emergence outbreak control. Successful outbreak control hinges on several key tools, which include testing, tracing, biosecurity, drug and vaccine availability, intervention strategies and control measures. WUR can provide significant inputs to strengthen several of these tools, and will:

- Further develop agile, appropriate and scalable diagnostic and data collection tools, including infectivity assays, utilising its vast experience and detailed understanding of plant, animal, and food-related pathogens, as well as infectious disease transmission dynamics.
- Develop new scenarios for biosecurity in varying global locations, across the global food system and models to underpin and evaluate their efficacy and cost-benefit impacts.
- Continue its contribution to the development of contingency plans that underpin crisis preparedness and effectivity, drawing on knowledge of effective communication, policy and institutional change, and the impact of, and options to guide and shape, human behaviour in crises.

POST-SPILLOVER: RECOVERY OF THE FOOD SYSTEM, THE ECONOMY, AND SOCIETY

Economic shocks resulting from outbreaks and pandemics occur in both high, middle and low income countries, but the burden is not evenly distributed within populations; people with a lower socio-economic status are observed to be affected most. WUR is able to rapidly assess the consequences of a crisis like the COVID-19 pandemic on local and global agri-food systems. Both for the short, medium and long term WUR has the tools for loss assessment and scenario analyses. Drawing on a systems approach to the agri-food system, and knowledge of the existing internal feedback mechanism and external spillover effects, WUR will:

- Capture changes in both producer and consumer behaviour, the simultaneous adjustments in markets and institutions, and the heterogeneous responses to policy incentives to generating agri-food system transitions.
- Inform policy and institutional change towards recovery by use of sophisticated models for scenario analyses.
- Contribute to resilient agri-food systems.