We are challenging the world to find novel solutions for the three essential areas of risk identification, response, and recovery to pandemics

To prevent and/or mitigate the next pandemic by ...

1 Identify: determine and limit the disease risk pool and spill over risk

... we need to know ...

... where outbreaks are likely to occur and why, to identify interventions to reduce risk and spill over, and to improve monitoring and surveillance

... by understanding[1]

1a How can we exploit genomic big data of one or multiple sets of pathogens to predict **the location, timing, and type of emerging risk**

1b **Which ecological, behavioural and other factors cause** the emergence of such risks, and what indicators can we derive to integrate into reporting and provide early warning?

1c **Which interventions and/or incentives** effectively and feasibly **reduce** risk and spill over?

2 Respond: decrease transmission and spread

... what measures are effective and at least societal and economic cost – both where and for whom – to reduce transmission and spread

2a What are **the optimal preventive interventions** (e.g. IPC/WASH, behavioural, etc.) to mitigate the impact of the next pandemic, and how can we maximise their uptake?

2b **How might we cut through the "infodemic"** during ongoing infectious disease emergencies to enable real-time data-driven responses both for policymakers and individuals?

2c **How might we** build positive feedback loops to **better capture and extract data-driven learnings** from this and future pandemics, and test the efficacy of different responses?

3 Recover: improve our health and economic system resilience

... and address the disproportionate health and economic impact of outbreaks and pandemics, particularly on vulnerable groups

3a **Which** health care, policy, or private-sector **interventions best protect population groups including the most vulnerable**, e.g. care home residents, front-line healthcare workers, or those most exposed to the economic consequences?

3b How can unintended **negative second-order consequences** of health emergency response be avoided or mitigated?

3c How can we ensure the **true costs of pandemic risk** are visible and integrated into global economic, financial systems and planning

These questions are illustrative and others will be necessary to complete what we need to know

1 Identify: determine and limit the disease risk pool and spill over risk

Sample Questions for Solution Teams

1a Predict the location, timing, and type of emerging risk

What are the pathogens with the highest risk for spill over to humans currently present in livestock/wild animals globally?

Identified e.g. by whole virome sequencing. Enables surveillance of animal populations and targeted pre-emptive measures against arising threats

When and where is the spill over of specific pathogens into human populations most likely to happen?

Enables pre-emptive sanitation of spill-over "hot spots" at limited cost

What is the most likely clinical & transmission pattern in humans for known and entirely new classes of pathogens (e.g. novel virus families) already present in animals?

Enables "hardening" healthcare and socioeconomic systems against changing and yet unknown, future pathogens

What are the vectors most likely to transmit the most dangerous known and novel pathogens in yet unaffected areas?

Allows for pre-emptive targeted measures against vectors before pathogens have even entered populations, breaking/suppressing spread

1b Identify factors that cause risk emergence

What does the best system integrating genomic, behavioural and climatic data for "heatmapping" of spill over risks look like?

Enables pre-emptive interventions to reduce risk in critical areas/times

What are the areas/environments with the highest risk for spill over of known/novel (e.g. Flaviviridae) pathogens?

Enables protection of areas with high spill-over risk for novel disease and/or guidance on pre-emptive protective individual behaviour

What is the critical individual behaviour that is promoting spill over for known and novel pathogens (human-human transmission and vector borne)?

Enables individualized recommendations for behaviour change to reduce spill over risks at low individual effort

What does the best system to identify spill over events with automated surveillance for typical changes in individual behaviour/biometric data look like?

Enables earlier identification/intervention of spill-over events than with current systems that rely on incidental observation of physicians on emergence of novel clinical patterns

1c Identify interventions to reduce risk and spill over

What are the policy interventions required to make the risk for spill over/emergence of infectious disease/drug resistance transparent to producers and consumers?

Guides individual production/consumer behaviour to risk reduction

What are the policy interventions required to price in zoonotic threat for animal-derived products and services?

Reshapes animal related businesses/activities to reduce the notorious risk of spill-over for novel pathogens and/or resistance to anti-infective drugs

What is the best system to measure the effectiveness of activities against vectors for infectious disease in a transparent, closed-loop/short time lag system?

Enables significant sustainable improvement of anti-vector measures by providing "always on" surveillance systems

What is the socioeconomic benefit of interventions targeted at (vectors of) known/novel animal pathogens?

Facilitates cost-utility calculations for e.g. purely veterinary disease and enables construction of "investment" cases to motivate private sector contribution

2 Respond: decrease transmission and spread

Sample questions for Solution Teams

2a Identify & incentivize preventive interventions

What behavioural interventions have the greatest effect on reducing emerging infectious disease spread per transmission pathway?

Identifies the most impactful behavioural interventions for future emerging infectious disease response (e.g. in a pathogen-agnostic manner categorized by most likely pathway)

Learning from COVID-19, which incentives ensure uptake and lasting compliance of behavioural interventions?

Ensures best use is made of the large volume of known existing behavioural interventions to translate into rapid impact in pandemic settings

Learning from COVID-19, which channels/what messaging work best to ensure public health messaging translates into behaviour change?

Ensures best use is made of existing messaging channels, e.g. different social media platforms, to translate messaging into behaviour change

What is the capacity of health security infrastructure built for the COVID-19 response that could be repurposed for future health emergencies and what would it cost to do so?

Supports cost-effective prevention and preparedness efforts by creating legacy use cases for newly purpose-built infrastructure (often from public funds)

2b Cut through the "infodemic"

Learning from COVID-19, what would an ideal health info system look like that provides policymakers with central information repositories, and ensures their factual accuracy?

Draws together learnings from comparing existing country-level information systems to improve and potentially automate gathering of accurate information in acute epidemics

What is the best new format to communicate scientific information (and associated uncertainties) to non-specialist decisionmakers in an emergency setting on a regular basis ?

Supports and harmonises the quality of evidence in policymaker response

What is the optimal set-up for "medical fact-checking" in rapid emergency settings, and how can misinformation be effectively combated for different target audiences?

Mitigates the harmful impact of deliberate or accidental misinformation

Which dissemination channels are most effective at communicating accurate public health information to marginalised or at-risk communities?

Helps to mitigate differential impact of health emergencies on at-risk communities

2c Establish feedback loops to improve response

Which sources need to be linked for the optimal database of COVID-19 policy response and economic indicators to facilitate econometric study of the impact of various responses?

May generate multiplier effect by enabling large field of researchers beyond the membership of the Challenge to create learnings for future emergencies

What drugs that we know today will have the best chance to be effective therapeutics against the most likely future pandemic threats (e.g. anti-infectives, immuno-modulators)?

Increases speed in developing therapeutic (or preventive) responses to emerging infectious disease, e.g. through better in silico modelling tools

How can COVID-19 teach us about feedback loops to allow disseminating organisations (e.g. social media) improve on the effectiveness of their public health messaging?

Allows to improve the impact of the response of private sector institutions who provide their infrastructure to health emergency response but are not themselves domain experts

Learning from COVID-19, which design implications arise for the health system of the future (e.g. effective intelligent capacity management elements); and what is their cost?

Ensures some of the most novel aspects of the COVID-19 response vis-a-vis prior health infrastructure management are retained and improved upon rather than viewed as one-off

THE TRINITY CHALLENGE

3 Recover: improve our health and economic system resilience

Sample questions for Solution Teams

3a Protect (vulnerable) populations

What is the optimal set of indicators to inform real-time decisions to determine need for, and length of, local lockdowns?

Would support both individuals vulnerable to infection and mitigate the consequences on the economically vulnerable

Which diagnostic algorithms ensure safe and secure release of elderly patients from the health system to nursing homes?

Would safeguard elderly populations and prevent infectious disease hot-spots in nursing homes

Which policies struck the optimal balance between health and economic impact, and how can we use e.g. machine learning to identify those in the future?

Would indicate data-driven learnings for policy responses to future pandemic scenarios

What remote patient monitoring technologies best reduce pressure on hospital capacity and limit the pathogen exposure of front-line healthcare?

Would leverage technology to free up critical care capacity, with significant use cases in non-pandemic "peacetime"

3b Avoid negative second-order consequences

How is patient capacity intelligently redirected to non-hotspot healthcare facilities to minimise patients missing cancer (or other) screenings during health emergencies?

Would help to mitigate avoidable long-term costs of acute outbreaks on preventable/treatable disease burden

Which other immunisation drives can be combined with distributing a COVID-19 vaccine, and what supporting infrastructure is needed?

Would help to prevent negative impact of COVID-19 on immunisation drives for other diseases

How much diagnostic capacity should be repurposed towards acute pandemic outbreaks vs. long-term care and which models can inform such trade-offs in future pandemics?

Would help to limit the negative impact on future pandemics on ongoing health emergencies such as the three diseases

How can COVID-19 disease surveillance and laboratory infrastructure be repurposed to make up for reduced antimicrobial resistance surveillance due to capacity diversion?

Would help to mitigate the long-term impact of COVID-19 on increased resistance pressure and reduced attention to antimicrobial resistance

3c Make true pandemic costs visible & act accordingly

Which financial instruments can incentivise global financial markets to be conscious of pandemic risks and integrate them into pricing mechanisms?

Would help to reduce incentives for collective risk-taking through pricing in to financial flows

Through which mechanisms can we ensure companies (and other actors) working in fields with high pandemic risk price in the externality costs of their production?

Would help to reduce incentives for individual actors' risk-taking behaviour where these risks are predominantly socialised/collectivised

What role can insurance (and reinsurance) companies play to recognise and make explicit pandemic risk in their actuarial calculations?

Would help to reduce collective risk-taking through increasing its costs, as well as creating incentives for early warning systems against potential sector hotspots of risky behaviour

Which regulatory changes best integrate risks to health security, e.g. local-level planning permits, health and safety inspections, etc.?

Would constrict individual actors' risk-taking behaviour through tighter external controls