

A WHO global framework to guide investigations into origins of potentially epidemic and pandemic pathogens

The Scientific Advisory Committee for the Origins of Novel Pathogens (SAGO) and WHO SAGO Secretariat



In outbreak situations involving a novel pathogen timely and coordinated response is crucial. The WHO Scientific Advisory Group for the Origins of Novel Pathogens recently released a global framework to guide future scientific investigations into the origin of emerging pathogens.

The risk of epidemics or pandemics caused by emerging or re-emerging pathogens remains a constant global threat. The COVID-19 pandemic^{1,2}, as well as recurrent outbreaks of Ebola, Marburg, mpox, and other viruses are stark reminders of this. When outbreaks occur, understanding the origins of the pathogens and their pathways into the human population is critical. This knowledge not only guides the immediate public health response by identifying at-risk populations and transmission dynamics, it also informs epidemic and pandemic preparedness efforts, reducing the likelihood of future re-emergence.

The need to understand the origins of novel pathogens

In November 2021, the World Health Organization (WHO) appointed 27 scientists with a diverse range of appropriate expertise (acting in an individual capacity) to advise the Organization on technical and scientific considerations regarding the origins of emerging and re-emerging pathogens. This Scientific Advisory Group for the Origins of Novel Pathogens (SAGO)³ was tasked to develop a standardized framework to assist member states in investigating the origins of emerging and re-emerging infectious pathogens as soon as they are identified. This will support national responses in quickly identifying

pathogens, implementing measures to contain the spread, where possible, and ensuring all relevant data is captured when investigating the origins. The framework encourages rapid reporting to national and international public health agencies (including WHO) and to the global community of scientific experts to allow for an effective global response. Such a comprehensive guide has not been available so far and aims to improve the investigation process of the emergence of future pathogens. The SAGO has continuously advocated for a transparent, comprehensive, and coordinated approach to investigations and research on novel pathogens and has advised on studies into the origins of SARS-CoV-2 and monkeypox virus⁴. With the support of the SAGO, WHO has launched this *global framework to define and guide studies into the origins of emerging and re-emerging pathogens with epidemic and pandemic potential*⁵, the components of which are described here.

About the framework

The framework proposes a multi-disciplinary, multi-stakeholder, *One Health* approach to ensure coordination and collaboration in better understanding the origins of a pathogen's initial emergence or re-emergence through a set of scientific investigations and research studies. The global framework outlines six key technical elements (Table 1) needed as part of the investigation and provides practical guidance on the required capacities and on specific recommended studies. The elements are complementary and should be conducted concurrently, depending on the circumstances of the emergence, as soon as a novel or re-emerging pathogen is detected.

The framework highlights the capacities required at a country level to effectively implement the six elements and advocates for capacity building in these areas, including surveillance systems and expertise required to detect zoonotic events, which account for the majority of novel pathogen emergence. Advice related to biosafety/

Table 1 | Six key elements to include in investigations of the origins of novel pathogens presented in the global framework

Six technical elements of the global framework
• Early investigations include investigations to discover the first identified cases/clusters/outbreaks to identify potential sources of exposure, identify the samples needed to be collected at the source, define the characteristics of the novel pathogen involved for establishment of diagnostic assays.
• Human studies to understand the epidemiology of the disease, including clinical presentation, modes of transmission, pathology and earliest presence in syndromic surveillance samples.
• Human/Animal interface studies to identify potential animal reservoirs, intermediate hosts, and reverse zoonoses.
• Environmental and Ecological studies to identify insect vectors or other sources of infection as well as earliest presence in the environment.
• Genomics and Phylogenetics studies to identify precursor strains, genomic characteristics, evolution in intermediate hosts and humans, and spatial distribution over time.
• Biosafety/Biosecurity studies to determine if a breach in laboratory or research activities may have been associated with the first cases of infection in humans.

Implementing the WHO Global Framework

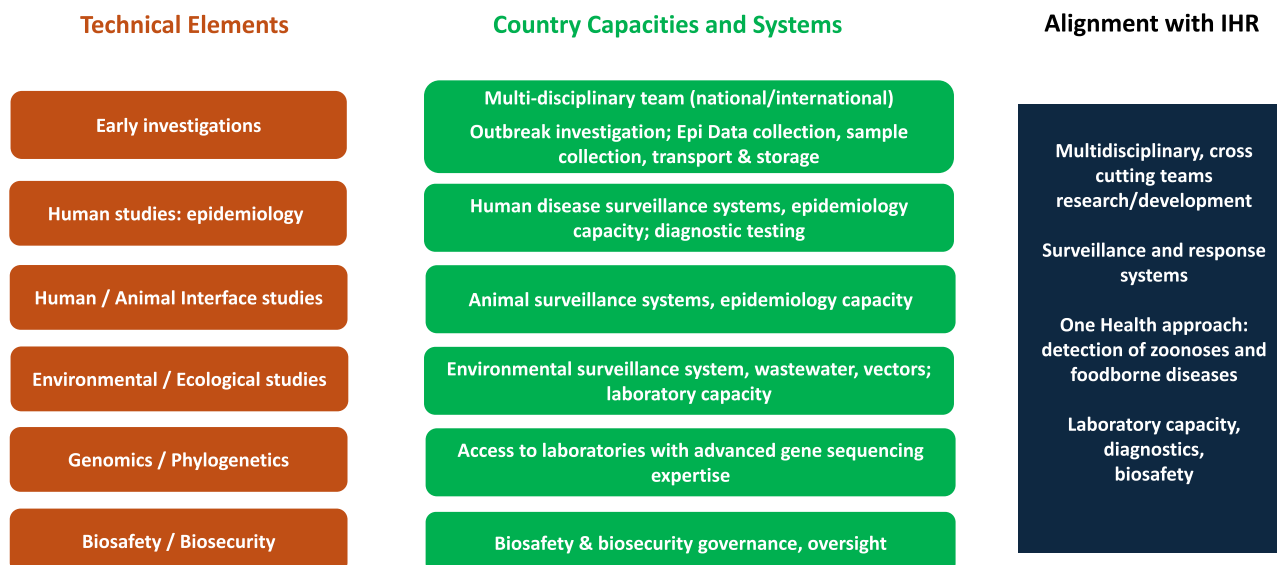


Fig. 1 | Implementing the WHO global framework to define and guide studies into the origins of novel pathogens. The six key elements of the framework are indicated relative to the capacities countries need to have in place and their

alignment with the International Health Regulations (IHR), emphasizing the importance of the One Health approach.

biosecurity investigations was also developed in consultation with WHO's Technical Advisory Group on Biosafety⁶. The framework provides recommendations on laboratory biosafety and biosecurity measures that should be in place in countries and on the scientific tools required to investigate if a pathogen is of either zoonotic origin or linked to possible laboratory-related events.

The framework recommends that these scientific investigations into the origins of a novel pathogen are implemented as soon as possible from the time the pathogen is detected and verified. It is imperative for countries to act swiftly to implement the framework, allowing multidisciplinary teams to investigate early cases and possible spillover events from zoonotic exposures. The framework further guides countries on the necessary surveillance systems that should be in place to identify the pathogen in humans, animals, and the environment, on laboratory capacities needed to detect and characterize pathogens as well as genomic investigations required to identify the closest precursor strains that can identify reservoir or intermediate hosts. The framework promotes a One Health approach to detect and respond to emerging and zoonotic diseases and is in line with International Health Regulations' core capacities (Fig. 1). Transparent investigations into the origins of novel pathogens require close cooperation between the local government, scientists, and international agencies.

Conclusion

SARS-CoV-2 was not the first novel pathogen to trigger a pandemic and it will not be the last. Identifying how these pathogens emerge is both a scientific imperative, to help prevent future epidemics and pandemics, and a moral imperative for the sake of those who have lost their lives to COVID-19 and other epidemics and pandemics. This framework is a tool for meeting those twin imperatives, towards making the world a safer place.

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Author contributions

M.V. wrote the manuscript; J.C.M., A.S., M.V.K., and J.G. provided comments and revised the manuscript; J.G. & M.V. prepared the figure. M.V., J.C.M., P.A., A.A., S.D.B., I.K.D., V.D., C.D., E.F., T.K.F., R.G., N.G., M.G., C.H., G.K.Z., N.L., S.L.Y., K.M., C.M., H.N.V., C.O., M.S., R.S., K.S., S.W., J.W., Y.Y., J.G., A.S., M.D.V.K. all contributed to compiling the “WHO Global Framework to define and guide studies into the origins of emerging and re-emerging pathogens with epidemic and pandemic potential” and critically reviewed and approved the final version of this manuscript for publication in *Nature Communications*.

Competing interests

The authors declare no competing interests.

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