

Why GAO did this study

Pandemics are global disease outbreaks that can greatly increase morbidity and mortality and cause significant economic and social disruptions. According to the scientific literature, most pandemics where the origin is known were caused by the natural transmission of a virus through animal-to-human contact; however, there is potential for a pandemic to originate from laboratory research.

GAO was asked to conduct a technology assessment on pandemic origins. This report describes: (1) key technologies available for pandemic origin investigations, (2) strengths and limitations of these tools and how researchers use them to investigate pandemic origins, and (3) cross-cutting challenges researchers face in trying to determine a pandemic's origin.

GAO reviewed peer-reviewed scientific literature and other documents, including reports from the Centers for Disease Control and Prevention, Office of the Director of National Intelligence, the Johns Hopkins Center for Health Security, World Health Organization, and select national laboratories; interviewed government, industry, and academic representatives; and convened a meeting of 27 experts in March 2022 with assistance from the National Academies of Sciences, Engineering, and Medicine.

GAO is identifying policy options in this report.

View [GAO-23-105406](#). For more information, contact Karen L. Howard at (202) 512-6888, howardk@gao.gov.

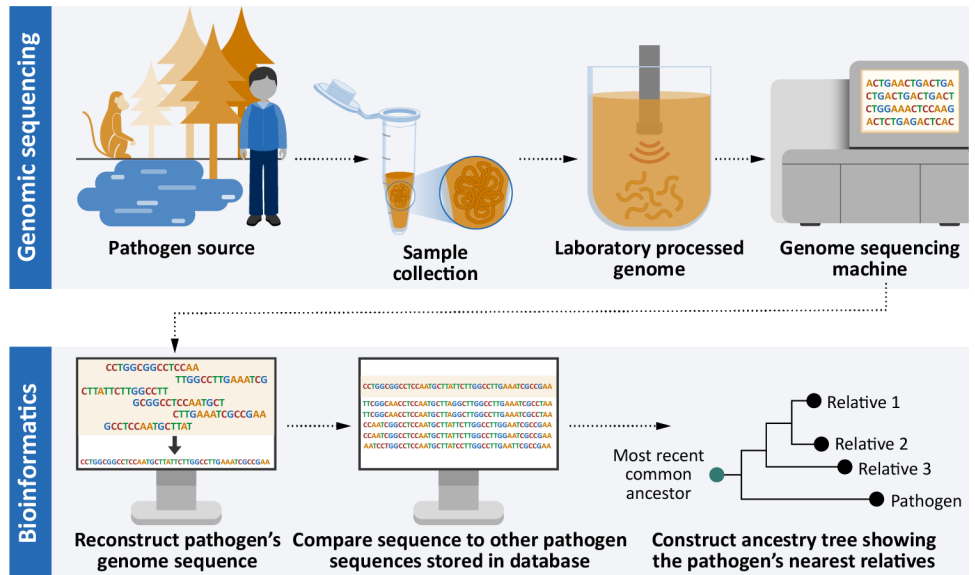
Pandemic Origins

Technologies and Challenges for Biological Investigations

What GAO found

Determining the likely origin of pandemics is challenging. Researchers may use several technologies to investigate a pandemic's origin. For example, researchers use technologies such as genomic sequencing, bioinformatics analysis, and genetic databases to generate, analyze, and compare a pathogen's genetic makeup against that of other pathogens. A key limitation of these technologies is that some laboratory-based genetic modifications may be indistinguishable from natural variations. Access to samples is critical for conducting genetic sequence analysis, which allows researchers to generate and analyze the data needed to support the likely origin of a pandemic.

Examples of technologies for pandemic origin investigations



Source: GAO. | GAO-23-105406

Researchers also use technologies such as serology (i.e., blood analysis) and epidemiological surveillance—tracking a disease as it moves through a population—to monitor pathogen infection and disease occurrence in human and animal populations. The resulting data can support pandemic origin investigations. However, for these technologies to be effective in determining a pandemic's likely origin, investigators need access to samples and data from infected or exposed individuals from early in an outbreak to reliably trace the disease back to the first human infection(s). Further, researchers may conduct laboratory-based pathogen studies to generate data to support known natural patterns or unusual patterns of spread indicative of a possible laboratory-related origin. However, some pathogens cannot be easily cultured in a laboratory setting, and some pathogens may require enhanced biosafety-level facilities.

However, experts told GAO that technologies are not the limiting factor for determining the likely origin of a pandemic. GAO identified three cross-cutting challenges that hinder pandemic origin investigations. These include a lack of sufficient access to samples and genetic sequence data; a lack of standardized processes for submitting, accessing, and using genetic sequence data stored in databases around the world; and a lack of a sufficient and skilled interdisciplinary workforce.

GAO identified five policy options that may help address the cross-cutting challenges. These policy options represent possible actions that policymakers—who may include Congress, federal agencies, state and local governments, academia, industry, and international organizations—could consider taking. See below for a summary of the policy options and relevant opportunities and considerations.

Policy Options to Address Three Cross-Cutting Challenges in Pandemic Origin Investigations

Policy Option	Opportunities	Considerations
<p>Establish multilateral agreements for accessing and sharing samples and genetic sequence data (report p. 21)</p> <p>Federal policymakers and others could encourage international preparedness in advance of future outbreaks by establishing multilateral agreements for accessing and sharing samples and genetic sequence data.</p>	<ul style="list-style-type: none"> Ensuring timely access to genetic information and samples in the critical beginning stages of a pandemic as well as throughout an origin investigation may help in the determination of a pandemic’s origin. Establishing standing agreements between nations before a pandemic occurs could assist in the determination of a pandemic’s origin. 	<ul style="list-style-type: none"> Countries may be unwilling to participate in multilateral, international agreements because of concerns related to national sovereignty, among other reasons. Identifying an appropriate responsible entity to determine and monitor whether countries are following agreed-upon standard processes may be time consuming and challenging.
<p>Develop standardized processes for genetic sequence database use (report p. 22)</p> <p>Federal policymakers and others could empower or establish a working group to develop standardized processes for database use to support pandemic origin investigations.</p>	<ul style="list-style-type: none"> Developing standardized processes for database use could help ensure consistency of submitted data and metadata across multiple databases, improve researchers’ access, and help researchers comprehensively compare genetic sequences. Implementing leading practices for genetic data integrity and associated metadata could help improve the quality of data in genetic sequence databases. 	<ul style="list-style-type: none"> Standardized processes may be difficult to develop as there are risk-benefit trade-offs. For example, access to certain novel pathogen sequences should be limited to trusted and credentialed individuals with a need to access those sequences. It may be challenging for multiple stakeholders to agree on what data are important.
<p>Improve current, or develop new, genetic sequence database tools (report p. 23)</p> <p>Policymakers could encourage the improvement of current, or development of new, genetic sequence database tools.</p>	<ul style="list-style-type: none"> Improved or new database interfaces could streamline researchers’ data submission, access, and use as well as improve data quality. Improved or new database interfaces could help address the projected future growth in genetic sequence data. 	<ul style="list-style-type: none"> Building new, or retooling current, database interfaces could be time- and labor-intensive. It may be challenging for groups of users to agree on what database interface features are important.
<p>Encourage the development, retention, and growth of a workforce with the critical skills needed for pandemic origin investigations (report p. 24)</p> <p>Policymakers could encourage mechanisms to provide training, workforce development, and capacity-building, including in areas considered hot spots of emerging infectious disease.</p>	<ul style="list-style-type: none"> Encouraging development of expertise in geographic areas where novel pathogens are likely to emerge could increase the overall global supply of skilled workers and help to ensure the workforce is not concentrated in any geographic region. A trained workforce skilled in origin investigations could contribute to other areas such as public health, or other types of related activities. 	<ul style="list-style-type: none"> Pandemic origin investigations tend to be episodic. As a result, it may be difficult to adequately plan for and consistently fund staffing in science fields related to pandemic origin investigations. Researchers may experience unwanted attention or pressure because of their involvement in pandemic origin investigations and leave the field or refuse to participate.
<p>Augment or develop a national strategy to better coordinate and collaborate domestically and internationally on pandemic origin investigations (report p. 25)</p> <p>Federal policymakers could better coordinate and collaborate with domestic and international partners by augmenting or developing a national strategy for pandemic origin investigations. This could be a standalone strategy or a component of existing strategies such as the National Biodefense Strategy.</p>	<ul style="list-style-type: none"> A national strategy could help address the challenges that hinder pandemic origin investigations. Federal coordination and collaboration leadership, guided by a national strategy, could increase preparedness for future pandemic origin investigations. Understanding pandemic origins could help mitigate health and economic costs associated with pandemics by, for example, facilitating surveillance that could identify future pandemics more quickly. 	<ul style="list-style-type: none"> Allocating resources and defining how federal agencies and others will collaborate may be challenging because of the number and types of entities with relevant expertise. During nonpandemic periods, other priorities and needs may arise and make it challenging to provide sustained resources and support needed for maintaining a national strategy.