



May 3, 2021

## Origins of SARS-CoV-2

In late 2019, a new coronavirus, SARS-CoV-2, was identified in Wuhan, China. The virus, which causes Coronavirus Disease 2019 (COVID-19), has contributed to significant morbidity (illness) and mortality (death), as well as severe public health and economic effects, among other impacts. Several Members of Congress have made public statements and introduced legislation calling for an investigation into the origin of SARS-CoV-2. Determining the origin and pathway by which a zoonotic disease (i.e., one that originated in animals) emerges and is transmitted to humans can help scientists prevent further outbreaks, inform the public health response, and aid in the development of therapeutics and vaccines. Further, such knowledge may guide the development of policies and practices that reduce the potential for the emergence of other zoonotic diseases. Scientists note that determining the origin of zoonotic diseases could take years, and in some cases, an origin may never be conclusively identified.

In May 2020, the 73<sup>rd</sup> World Health Assembly (WHA)—the governing body of the World Health Organization (WHO)—passed a resolution (WHA 73.1) requesting the WHO Director-General to identify the source of SARS-CoV-2 and the route of transmission to humans, among other things. WHO sent a team to China in July 2020 to develop a work plan and begin collecting and analyzing data, including

- studies of all-cause mortality and deaths from respiratory diseases, including pneumonia, in and around Wuhan in late 2019;
- testing of stored animal samples for SARS-CoV-2;
- national disease surveillance data; and
- reports of retail pharmacy purchases of medicines to reduce fevers and treat cold and flu symptoms.

From January 14 through February 10, 2021, a team of 34 experts—17 from China and 17 from other countries and organizations—traveled to Wuhan to collect and analyze existing and additional data. On March 30, 2021, WHO released its report on the mission, which summarized findings from site visits and discussions with Chinese local and national experts. The report presented four hypotheses on the origin of SARS-CoV-2 and assessed their likelihood of being the cause.

### Origin Hypotheses: Independent Team Findings

Hypotheses on SARS-CoV-2 origins follow and are illustrated in **Figure 1**. The team’s findings are italicized.

**(1) Introduction through an intermediate host**, a *“likely-to-very-likely”* hypothesis that an intermediate host species, infected by an animal reservoir host (the animal where the virus lives, grows, and multiplies), carried the virus and

transmitted it to humans. No intermediate hosts have been identified.

**(2) Direct zoonotic spillover**, a *“possible-to-likely”* pathway through which SARS-CoV-2 could have been transmitted from an animal reservoir host to a human. Bats are seen as a likely reservoir host, as several studies have identified high genetic similarity between SARS-CoV-2 and coronaviruses found in certain bat species found in China and elsewhere in South Asia.

**(3) Introduction through cold/food-chain products**, a *“possible”* hypothesis positing that people contracted SARS-CoV-2 through contact with contaminated food, potentially including frozen, imported foodstuffs. SARS-CoV-2 has been identified on frozen food, its packaging, and cold-chain products (items stored at controlled temperatures to preserve and extend shelf life).

**(4) Introduction through a laboratory incident**, an *“extremely unlikely”* hypothesis considering whether laboratory staff accidentally contracted and later spread SARS-CoV-2 while researching coronaviruses in bats. The WHO report did not consider a hypothesis that the virus was released intentionally, stating that it had been ruled out by other scientists.

Ultimately, the investigators did not identify the source of SARS-CoV-2 and recommended further studies. The team also called for regular administrative and internal reviews of high-level biosafety laboratories worldwide to address what they characterized as the need for more data.

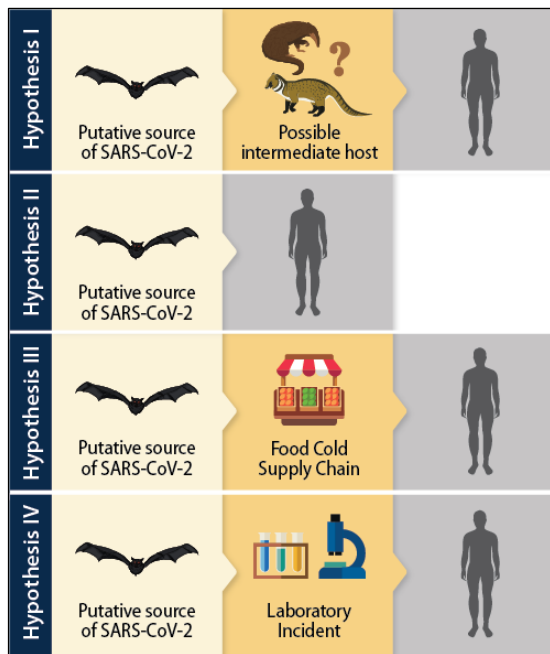
### U.S. Government Response to the Report

On March 30, 2021, the United States and 13 other countries issued a joint statement expressing concerns “that the international expert study on the source of the SARS-CoV-2 virus was significantly delayed and lacked access to complete, original data and samples.” The statement also called for immediate movement to a second phase of investigation and that future missions be free to produce independent and objective recommendations and findings. The signatories expressed continued support for WHO and urged further studies to determine SARS-CoV-2 origins.

### U.S. Efforts to Control Zoonotic Diseases

For decades, U.S. federal agencies have worked to strengthen international biosecurity and advance global pandemic preparedness. These efforts are aimed at averting the likelihood that scenarios listed in the hypotheses might occur. This section summarizes selected efforts related to the four hypotheses.

Figure 1. Possible SARS-CoV-2 Origins



**Source:** Graphics created by CRS from WHO, *WHO-Convended Global Study of Origins of SARS-CoV-2*, March 30, 2021.

**Scenarios 1 and 2.** Several U.S. agencies are involved in global control of zoonotic infectious diseases, primarily the U.S. Agency for International Development (USAID) and CDC. The agencies address connections among people, animals, and the environment, described as a One Health approach. They also collaborate with the U.S. Department of Agriculture (USDA) on livestock and poultry health and with the Department of the Interior, which monitors wildlife hosts and zoonotic pathogens, and emerging zoonotic diseases. On January 20, 2021, President Joseph R. Biden, Jr. issued an executive order establishing the National Security Council Directorate on Global Health Security and Biodefense, which oversees the Global Health Security Agenda (GHSA) Interagency Review Council. One task of this council is to monitor current and emerging biological threats, including emerging zoonotic pathogens.

**Scenario 3.** Many foreign countries do not have adequate food cold chains. Instead, perishable products from wet markets—where a variety of different meats, including wild game can, be sold in close proximity—may be transferred without refrigeration. Several USDA agencies, under the coordination of the Foreign Agricultural Service (FAS)—which leads U.S. global negotiations on international food standards—are engaged in improving cold chains worldwide, particularly for improving food safety and minimizing risks of zoonosis. In addition, USDA’s Food Safety and Inspection Service (FSIS) and Animal Plant Health Inspection Service (APHIS) certify foreign products and establishments that meet U.S. standards as being eligible to export their products to the United States.

**Scenario 4.** Several U.S. federal agencies are involved in improving partner countries’ biosafety and biosecurity (BS&S) and biosurveillance capabilities to reduce the threat of intentional, accidental, or natural spread of infectious disease. Department of Defense assistance, for example, aims to improve BS&S at laboratories housing pathogen

collections. The State Department’s Biosecurity Engagement Program works with scientists in partner countries to improve biosecurity practices.

### Issues for Congress

**Scenarios 1 and 2.** The transmission of zoonotic diseases is facilitated by close human-animal contact, which may occur via land clearing, live animal markets, hunting and consuming wild animals, and the wildlife trade. Several bills in the 117<sup>th</sup> Congress aim to improve global pandemic preparedness (e.g., H.R. 391, which also authorizes the aforementioned GHSA coordinating mechanism to ensure its continuation under future Administrations). Other bills (e.g., S. 37 and H.R. 151) would directly address zoonotic diseases by supporting a reduction in illegal and legal wildlife trade, seeking to curb deforestation and destruction of ecosystems, and enhancing international collaboration. An April 2021 statement from WHO and other U.N. agencies to reduce public health risks associated with wildlife markets and the sale of live wild animals may further increase congressional interest in these issues.

**Scenario 3.** The international community, including USDA, United Nations Food and Agriculture Organization, and the World Trade Organization, via its Market Facilitation Agreement, could facilitate global implementation of food safety regulations that include analysis and control of biological, chemical, and physical hazards from raw materials to finished products. Proponents of global regulations say that such policies could strengthen food safety standards. Proponents assert that greater global coordination on food regulations could reduce the risk of disease emergence and transmission in countries where current regulations are relatively lax. It is unclear whether FSIS is inspecting food for SARS-CoV-2, since FDA considers SARS-CoV-2 transmission through contaminated food or surfaces generally unlikely. Congress might consider the possibility that the virus could be transmitted through the cold food chain and expanding the capacity of FSIS to conduct inspections for zoonotic diseases from foods of certified foreign food exporters.

**Scenario 4.** Several Members of Congress have expressed concern about what they characterize as disjointed biosecurity efforts across the U.S. government. In response to this concern, P.L. 116-283, the National Defense Authorization Act for FY2021, directed the Office of Management and Budget (OMB), in conjunction with the Department of Health and Human Services (HHS), to develop a government-wide budget for biodefense. The act also directs the Secretaries of HHS, Defense, Agriculture, Homeland Security, and any other agencies, in consultation with the Assistant to the President for National Security Affairs and the OMB Director, to update the 2019 National Biodefense Implementation Plan. Congress may consider overseeing the effectiveness of these efforts.

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**IF11822**

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