The Origin and Implications of the COVID-19 Pandemic

An Expert Survey

February 2024

Global Catastrophic Risk INSTITUTE

NEMESYS INSIGHTS

Authors

Gary Ackerman, PhD,[1,2] Brandon Behlendorf, PhD,[2] Seth Baum, PhD,[1] Hayley Peterson,[2] Anna Wetzel,[2] and John Halstead, PhD[3]

[1] Global Catastrophic Risk Institute

[2] Nemesys Insights

[3] Independent Researcher

Acknowledgments

The survey was conducted by a team of survey experts at Nemesys Insights, LLC, under the auspices of the Global Catastrophic Risk Institute. The authors would like to thank the staff of Nemesys Insights, LLC, especially Jenna LaTourette and Douglas Clifford, for their work in implementing the survey, as well as Dr. Theodore Wilson and Dr. Saskia Popescu for their helpful comments on an earlier draft of this report. Any errors or omissions, however, remain the responsibility of the authors. GCRI and Nemesys Insights would also like to express their gratitude to Jacob Eliosoff and Stefan Göttsch for providing philanthropic financial support to this project.

Suggested Citation

Gary Ackerman, Brandon Behlendorf, Seth Baum, Hayley Peterson, Anna Wetzel, and John Halstead. ***The Origin and Implications of the COVID-19 Pandemic: An Expert Survey***. Global Catastrophic Risk Institute Technical Report 24-1 (February 2024).

About GCRI

The Global Catastrophic Risk Institute (GCRI) is a nonprofit, nonpartisan think tank. GCRI works on the risk of events that could significantly harm or even destroy human civilization at the global scale. As a think tank, GCRI bridges the world of scholarship and the world of professional practice in government, private industry, and other sectors. It aims to develop highly effective solutions for reducing the risk by leveraging both the best available scholarship and the demands of real-world decision-making.

About Nemesys Insights

Nemesys Insights, LLC is a strategic analysis and advisory company that applies a set of innovative decision tools and technologies to answer complex strategic questions. Nemesys Insights staff have extensive experience in risk analysis, foresight and conducting surveys and expert elicitations.

SURVEY CONTEXT

What Was the Goal of the Survey?

There have been many arguments about the origin of the SARS-CoV-2 virus in human populations, which led to the COVID-19 pandemic.[1] However, expert opinion on the topic has thus far been ad hoc, coming from the particular subset of experts who speak up in the debate and/or are approached by journalists. This subset of experts is not geographically representative, and their views may not always be divorced from the views of the organizations or countries with which they are affiliated. ***Therefore, the goal of this survey was to conduct a rigorous, geographically diverse, and anonymous survey of scientific experts regarding the origin of the COVID-19 pandemic.*** The survey addresses both the nature of COVID-19's origin and the implications for future pandemic prevention and preparedness.

Who Participated in the Survey?

The survey included researchers and practitioners in fields that would allow them to have a reasoned and knowledgeable scientific opinion on the origin of the SARS-COV-2 virus. These primarily included virologists and infectious disease epidemiologists, with a smaller proportion of biosafety/biosecurity professionals and evolutionary geneticists. The sample was drawn from six regions of the world, apportioned according to the estimated scientific output from each region in the fields of epidemiology and virology (as proxied by their rank in terms of scholarly publications). In order to minimize the potential effects of institutional or national pressures, as well as any risk of monitoring and retaliation from external authorities, all data was collected anonymously and the survey excluded participants from countries and territories rated as "not free" by Freedom House.[2] Out of 1,138 experts invited to participate, the survey ultimately collected usable data from 168 participants across 47 countries (15% completion rate), broken down as shown in Table 1.

Table 1. Sample by Expertise and Region

	Expertise			
Region	Epidemiology	Virology	Other*	**Overall**
Africa & Middle East	15	8	0	**23**
Asia	14	14	3	**31**
Europe	11	16	6	**33**
Latin America	12	12	0	**24**
North America	22	21	7	**50**
Oceania	4	3	0	**7**
Total	**78**	**74**	**16**	**168**

*Other includes Biosafety/Biosecurity experts, as well as Evolutionary Geneticists

How Was the Survey Conducted?

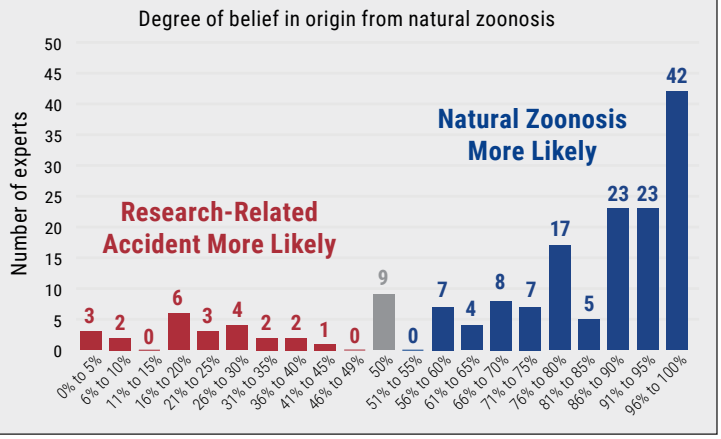
Survey participants meeting the criteria in the previous section were identified and invited to participate. A separate registration process enabled participants to be compensated for their participation, while preserving their anonymity during the actual survey. The survey did not seek to assign blame to any parties, and, as such, did not ask about the actions of any particular country or institution. Rather, the survey focused on distinguishing primarily between two categories of origin – **natural zoonosis** and **biomedical research-related accident** – as well as the implications for future pandemics under each origin scenario. In order to reduce bias and capture good scientific estimates based on the available evidence from the experts, the survey collected these estimates in multiple forms, and also randomized the order in which scenarios were presented. The survey also collected qualitative responses, which allowed for deeper exploration of certain questions. The analysis paid specific attention to potential differences between the epidemiology and virology expert communities, and between "developed" and "developing" countries.[3] **The sampling strategy, survey instrument, and analytical procedures employed are described fully in the accompanying Methodological and Analytical Annex.**

What Do the Experts Say About the Origin of COVID-19?

Most experts believe that COVID-19 was very likely to arise from a natural zoonosis, but experts also see at least some chance of a research-related accident.

When asked how likely it is that COVID-19 originated from natural zoonosis, experts gave an average likelihood of 77% (median=90%). In fact, four out of five experts stated that a natural zoonotic origin was more than 50% likely. However, consensus was not complete. Across all experts, the average likelihood they gave for a research-related accident origin was 21%. Overall, one out of five experts reported a 50% or greater chance for an origin other than natural zoonosis.

Most Experts Believe Natural Zoonotic Origin More Likely

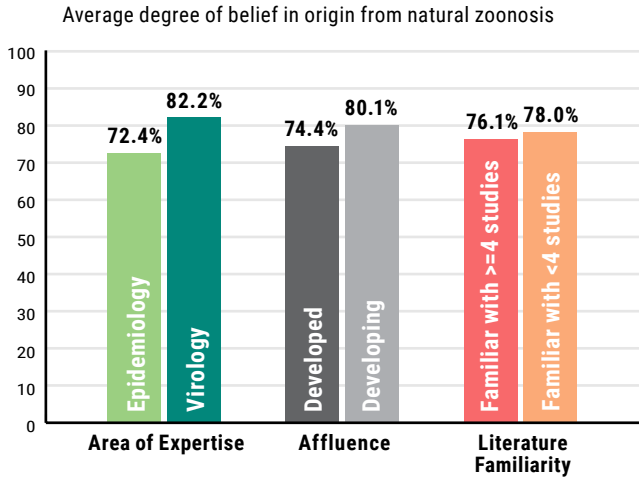


Experts from all geographic and academic categories share similar beliefs about COVID-19's origin.

As the graph at right shows, there were no statistically significant differences in beliefs about the origin of COVID-19 between experts:

1. With backgrounds in epidemiology vs. virology [Annex Table F1];
2. From developed vs. developing countries [Annex Table F2]; or,
3. Having different self-reported familiarity with the prior literature on COVID-19's origin [Annex Tables F3-F11].[4]

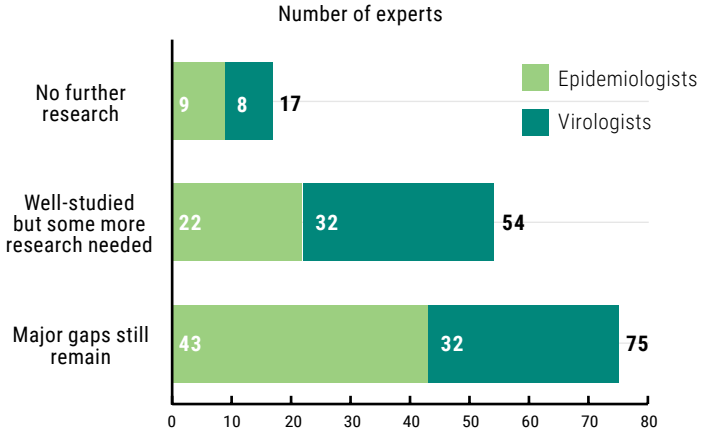
Similar Beliefs Across Expert Groups



Most experts believe more origin research is needed, but are divided on the extent of the need.

Only 12% of experts stated that no further research on COVID-19's origin is needed [Annex Table F14]. The remaining experts stated that further research on the issue is necessary, but were divided on whether major gaps still exist; 37% stated that the topic has been well studied but could benefit from some additional research, while 51% stated that major gaps remain. Epidemiologists were more likely to see major gaps in knowledge as compared to virologists (lighter vs. darker bars at right). Differences across developing/developed countries were insignificant [Annex Table F15].

Divided Opinions on Further Research



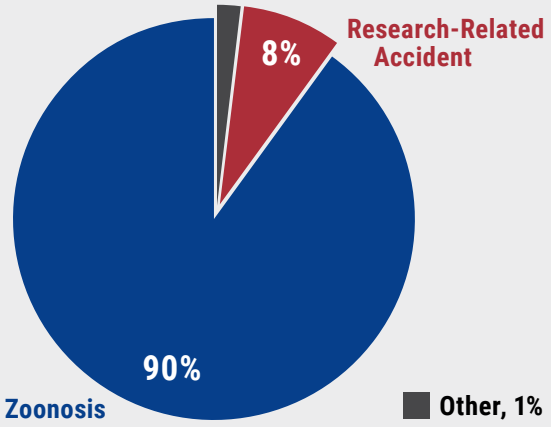
The chart does not include the 16 "Other" experts.

What Do the Experts Believe We Should Learn from COVID-19 for Future Pandemics?

A large majority of experts believe that the *next* pandemic will likely be natural zoonotic in origin.

Nine out of ten experts stated that the next pandemic is "most likely" to originate from natural zoonosis. Only 14 experts (8%) selected a research-related accident as "most likely", while 2 experts (1%) selected some other cause, as shown at right. The expectation of a natural origin was more common among virologists (96%) than epidemiologists (85%) [Annex Table F16]. Furthermore, 151 experts (90%) expressed at least moderately high confidence in their assessment. The findings were similar when experts were asked to provide a numerical probability instead of a qualitative assessment [Annex Table F17].

Natural Zoonosis Expected for Next Pandemic



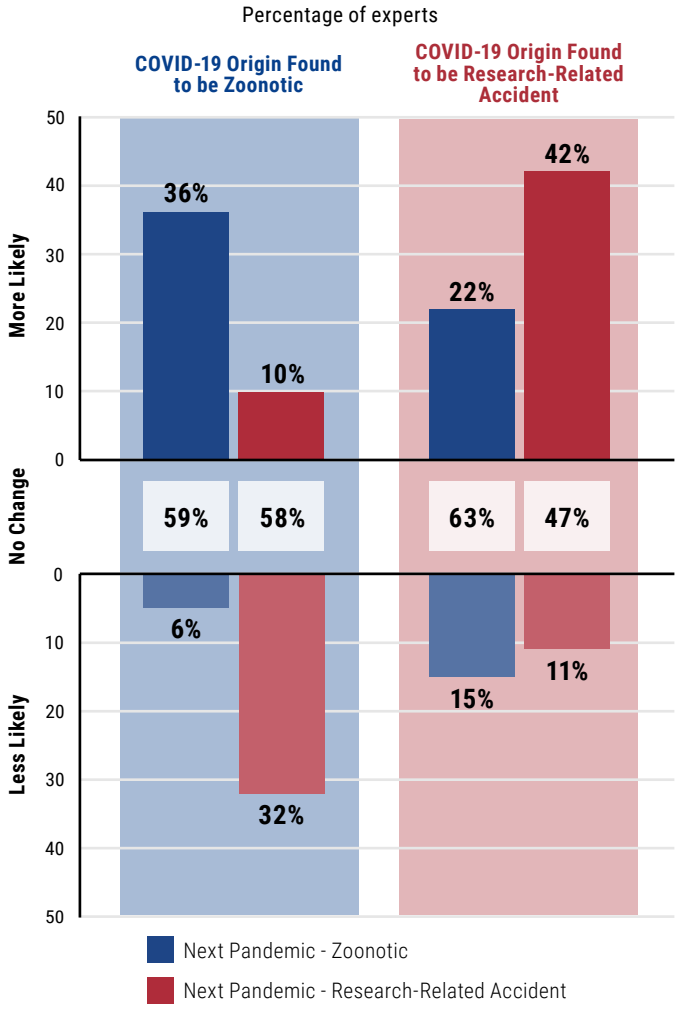
Due to rounding, proportions do not total 100%

Some expert beliefs would shift if the origin of COVID-19 is conclusively found.

One reason to continue studying the origin of COVID-19 is because further knowledge about it could inform beliefs and policies for future pandemics. Therefore, the survey asked experts to imagine that the origin of COVID-19 has been found, and to consider how that might change their beliefs about the origin of the next pandemic. If COVID-19 is found to be from a zoonotic origin, a slight majority of experts reported that there would be no change in their beliefs, as seen in the "No Change" portion of the graph at right [Annex Tables F20 and F21]. However, if COVID-19 is found to be caused by a research-related accident, then a slight majority of experts would change their beliefs about the likelihood of the next pandemic also being from a research-related accident, with 42% increasing their estimate of the likelihood of the next pandemic being from a research-related accident. In most cases, if COVID-19 is found to have a certain type of origin (natural zoonosis or research-related accident), then that same type of origin is overall believed to become more likely for the next pandemic. The exception is that if COVID-19 is found to be from a research-related accident. Then, for the next pandemic, natural zoonosis becomes more likely for a larger number of experts as compared to it becoming less likely (22% vs. 15%). In all of these cases, the survey does not ask how much more or less likely the origin of the next pandemic would be.

Origin Affects Beliefs About Next Pandemic

The graph below shows how expert beliefs about the origin of the next pandemic would shift if they were sure about the origin of COVID-19.



What Are the Governance Implications if More Was Known About COVID-19's Origin?

If the origin of COVID-19 is resolved, does this change beliefs about how future pandemics should be governed? The term governance is used here to describe the frameworks of authority and accountability that social entities use to manage projects, programs and problems.[5] It includes, but is not limited to, government policy. Respondents were asked whether a confirmed natural zoonosis or research-related accident origin, respectively, would influence their perspectives on three areas of pandemic-related governance:

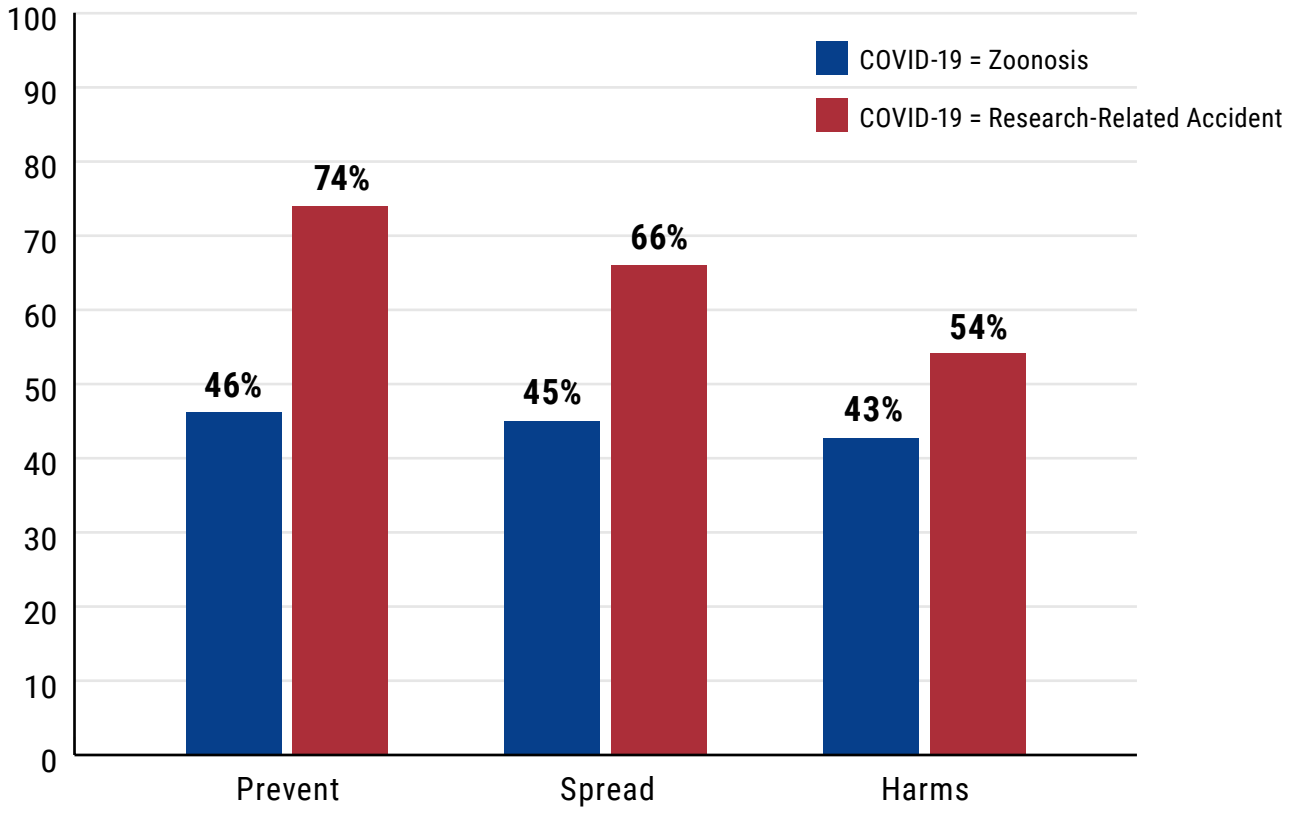
1. Preventing initial human infection by a pathogen with pandemic potential;
2. Preventing pandemic spread after the initial infection; and
3. Mitigating harms once a pandemic occurs.

Clarity on COVID-19's origin would change beliefs about governance measures for many experts, with larger changes if the origin is found to be a research-related accident.

If the origin was found to be natural zoonosis, then a majority of experts' governance beliefs do not change. However, if the origin was found to be a research-related accident, then most experts' governance beliefs do change, especially with respect to preventing initial infection and preventing pathogen spread, as shown below. For differences across expertise and developed/developing countries, see Annex Tables F24-F27.

Change in Beliefs About How to Govern Future Pandemics If COVID-19 Is Resolved

The graph below shows the percentage of experts whose governance beliefs change if the origin of COVID-19 is resolved.



Under both origin scenarios, a majority of the experts who responded suggested more aggressive governance measures, with recommended changes shown below.

Out of 168 total experts, 116 provided at least one specific governance suggestion, with an average of 94% across six survey items suggesting more aggressive governance measures.

	Most Frequently Suggested Changes in Governance Assuming Natural Zoonosis Origin (# of mentions in parentheses)	Most Frequently Suggested Changes in Governance Assuming Research-Related Accident Origin (# of mentions in parentheses)
Measures to Prevent Initial Human Infection	**Types of governance:** Oversight and Regulations (20); Monitoring and Surveillance Activities (15); Restrictions (10) **Targets of governance:** Wet Markets (10); Wildlife-Human Contact (10); Bush Meat/Illegal Animal Trade (7)	**Types of governance:** Oversight and Regulations (63); Monitoring and Surveillance Activities (8) **Targets of governance:** Lab Biosafety Protocols (34); Research with Dangerous Pathogens (16)
Measures to Prevent Initial Infection from Becoming Pandemic	**Types of governance:** Monitoring and Surveillance Activities (22); Investing & Resourcing (12) **Targets of governance:** Infected Individuals (10); International Community (10); General Public (8); Pathogens with Pandemic Potential (8)	**Types of governance:** Oversight and Regulations (40); Quarantining/Isolating (10); Reporting/Communicating (10) **Targets of governance:** Lab Biosafety Protocols (20); Research with Dangerous Pathogens (13); Transparency (10)
Measures to Mitigate the Harm Once Pandemic Occurs	**Types of governance:** Coordinating/ Cooperating (11); Monitoring and Surveillance Activities (10) **Targets of governance:** Epidemic Disease Containment Methods (11)	**Types of governance:** Oversight and Regulations (21); Reporting/Communicating (15) **Targets of governance:** Epidemic Disease Containment Methods (8); International Community (8); Lab Biosafety Protocols (8)

Of those respondents who would change governance measures based on the origin of COVID-19:

- With respect to preventing initial human infection, the most common types of governance were similar across origins (Oversight/Regulations and Monitoring/Surveillance), but the targets of governance measures reflected the assumed origin of COVID-19.
- Measures to prevent a pandemic from arising after initial infection differed appreciably for both types and targets of governance measures, depending on the assumed origin of COVID-19. These had a public health focus on detection across populations if a natural zoonosis origin was assumed, while a research accident origin assumption prompted a focus on measures to contain the infection to the research facility.
- For mitigating harms, an assumption of natural zoonosis elicited a greater number of more collaborative types of governance measures, while an assumption of a research origin for COVID-19 frequently prompted a more regulatory approach. However, irrespective of COVID-19 origin assumption, experts put emphasis on better epidemic containment measures as governance targets to prepare for the next pandemic.

[For more detailed descriptions of governance changes suggested by respondents see the discussion and tables in Annex Section E.]

What Are Some Notable Expert Recommendations Regarding Future Pandemics?

83 experts provided comments in response to an optional general question at the conclusion of the survey. Given the completely open-ended nature of this question, any recurrence of particular themes across the diverse set of experts is worth noting. The most frequent themes observed across experts are presented below (with the number of times each theme was observed in parentheses). For additional themes and explanation of how all the themes were derived, see Annex Table E1.

- Relates to Natural Zoonosis
- Relates to Research-Related Accidents

1. Implement Enhanced Controls When Handling Dangerous Pathogens (18) ●
There should be enhanced controls (in terms of biosafety and/or biosecurity) when handling dangerous pathogens in research or other facilities.

2. Focus on Preventing Natural Spillover (16) ●
Preventing future natural spillover events (zoonoses) must be a priority, with the threat made particularly acute by climate change and continued human encroachment on natural environments.

3. Strengthen Surveillance and Detection Capabilities (14) ● ●
There is a need for better surveillance and detection capabilities, both in zoonotic hotspots and at research facilities.

4. Enhance Communication and Transparency Efforts (13) ● ●
Better communication and transparency, between governments/researchers and the public, will be needed during future pandemics.

5. Preparedness and Response Training Should be a Top-Level Concern (12) ● ●
In order to improve upon the generally poor response performance of most countries during COVID-19, there needs to be better preparedness overall and especially response training, including at regional and global levels. These efforts need to involve senior government decision-makers and not only scientific researchers and medical personnel.

6. Biosafety Measures Should Not Strangle Research (10) ●
Security and safety measures around pathogen research that are excessively onerous would hinder future response capacity by dissuading research and thus leaving us more vulnerable.

7. Look Towards the Future*(9) ● ●
It is time to move on from the question of COVID-19's origin. Reasons provided include: the question has already been sufficiently answered; that there will never be a conclusive answer; and that the issue is irrelevant because it is necessary to improve prevention of both zoonotic disease and research accidents.

8. Pin-Point the Source* (8) ● ●
Pin-pointing the source of a pandemic is important, including thorough post-pandemic investigations.

** Both attitudes towards further exploring the origin question are almost equally represented as qualitative themes, which echoes the quantitative results presented previously.*

9. Limit Human-Wild Animal Interactions (7) ●
Stricter measures are required to control human-wild animal interactions, such as minimizing the use of wild animals for food and other products and enhanced safety measures when handling animals.

10. Prepare for Misinformation (7) ● ●
More effort should be made before and during future pandemics to understand the spread of fears and conspiracy theories and to control misinformation that will likely accompany a pandemic.

11. Science-Based Response and Investigation (7) ● ●
Pandemic response and determining disease origin must be evidence-based and determined by scientists without political interference.

CONCLUSION

Why is This Important?

This survey represents the first globally diverse, independent appraisal of scientific expert views on both the origin of the COVID-19 pandemic and the implications thereof for future pandemic prevention and response. The survey revealed that:

- Overall, experts judge the most likely origin of the pandemic to be a natural zoonotic event, but still consider a research-related accident to be at least a plausible origin.
- Experts across geographic and academic categories share similar beliefs about COVID-19's origin.
- Most experts believe more origin research is needed, with around half believing that major gaps still remain in understanding COVID-19's origin.
- Irrespective of COVID-19's origin, the vast majority of experts believe that a natural zoonotic outbreak will likely be the cause of the next pandemic.
- Beliefs about governance measures for future pandemics change more if COVID-19 is found to be from a research-related accident.

The experts also provided a set of clear recommendations for preventing, preparing for and responding to future pandemics, which generally align with many previous studies.

Please consult the accompanying Methodological and Analytical Annex for a complete description of the methodology used in the survey and more details on the findings presented in this report.

Endnotes

1 See, for example: Ostin, Lawrence and Gigi Gronvall. The Origins of Covid-19 — Why It Matters (and Why It Doesn't). ***The New England Journal of Medicine 388:25*** (June 22, 2023). URL: https://www.nejm.org/doi/full/10.1056/NEJMp2305081; Quammen, David. The Ongoing Mystery of Covid's Origin. ***The New York Times*** (August 18, 2023). URL: https://www.nytimes.com/2023/07/25/magazine/covid-start.html.

2 ***Countries and Territories.*** Freedom House (n.d.). URL: https://freedomhouse.org/countries/freedom-world/scores. This excludes several prominent countries, including China and Russia. The study's use of the Freedom House classification is for methodological purposes only and does not imply an endorsement of this classification. With respect to the anonymous nature of the survey, in addition to not reporting the names of the experts who participated, the survey platform was carefully designed to ensure that survey answers could not be attributed to the experts who provided them, even by the team running the survey. For more detail, see the Methodological and Analytical Annex, Section A.

3 The data set was too small to permit meaningful analysis of differences between geographic regions such as continents, so instead the data set was analyzed in terms of developing and developed countries. The classification of countries as "developing" or "developed" follows the classification scheme used by the United Nations. See: ***Classifications.*** UNCTAD Statistics. United Nations Conference on Trade and Development (UNCTAD) (n.d.). URL: https://unctadstat.unctad.org/EN/Classifications.html; ***World Economic Situation and Prospects 2023.*** The United Nations Department of Economic and Social Affairs (January 25, 2023). URL: https://www.un.org/development/desa/dpad/publication/world-economic-situation-and-prospects-2023/.

4 Even if experts claimed familiarity with a fake study (which was included as an attention check in the survey), this did not have any statistically significant impact on the overall perceptions of COVID-19's origin (Annex Table F13).

5 This definition is inspired by that given in Ruth Murray-Webster (ed.) ***Association for Project Management Body of Knowledge 7th Edition*** (Association for Project Management, 2019).