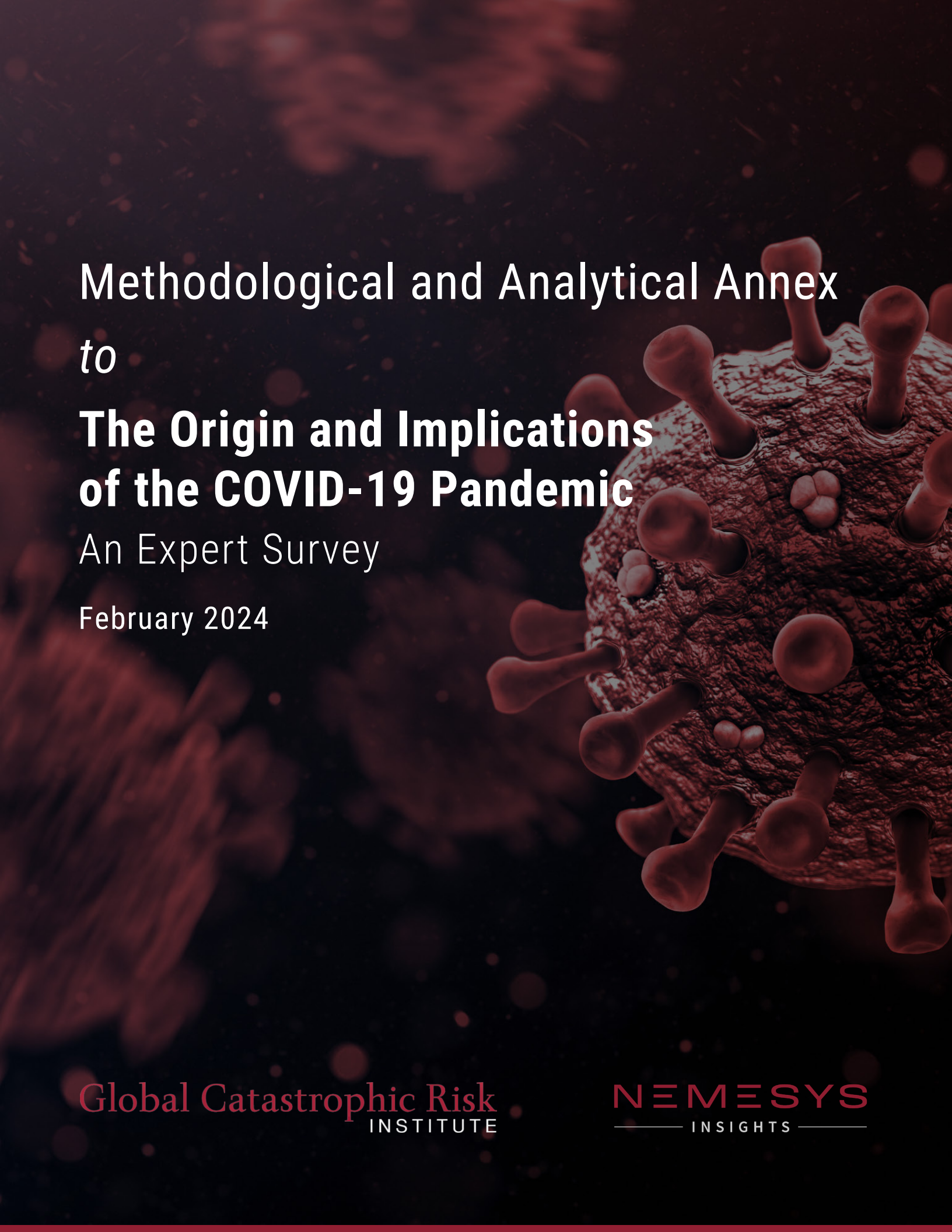

Methodological and Analytical Annex

to

The Origin and Implications of the COVID-19 Pandemic

An Expert Survey

February 2024

Global Catastrophic Risk INSTITUTE

NEMESYS INSIGHTS

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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.

Overview

This Annex is an accompaniment to the main report presenting the results of the expert survey on ***The Origin and Implications of the COVID-19 Pandemic.*** Its purpose is to provide a clear exposition of the methods employed to conduct and analyze the survey, as well as detailed results. The Annex consists of the following components:

A. Survey Sample

B. Recruitment Protocol

C. Survey Instrument

D. Quality Control Process

E. Qualitative Analysis Procedures and Results

F. Quantitative Analysis Procedures and Supplemental Tables

A. Survey Sample

Sample Parameters

Parameters for determining the sample were derived from the overall goal of the survey: ***To conduct a rigorous, anonymized survey of experts regarding scientific opinions on the origin and implications of the COVID-19 pandemic. The survey attempts to maximize global coverage and strives to minimize the introduction and impact of possible participant bias, while carefully handling cases in which these two goals may conflict with each other.***

Parameters for sampling were therefore as follows:

- **Expert Participants:** Respondents needed to be verified experts whose expertise could allow for a reasoned and knowledgeable scientific opinion on the origin and implications of the SARS-COV-2 virus.
- **Bias Minimization:** The survey could have no preconceived agenda with respect to outcomes and should make every effort to avoid framing, priming, nudging, or other heuristic devices to artificially skew the results.
- **Anonymous:** To encourage responses free of institutional or other pressures, the survey needed to be anonymous; moreover, it had to be viewed by respondents as being anonymous, which entails trust-building activities as part of the process.
- **Breadth of Sample:** The sample sought to maximize global coverage, including subsamples of experts from each geographic region of the world in rough proportion to the number of identifiable experts residing within that region. See discussion of the exclusion of "not free" countries and territories in the sampling strategy below.

Inclusion Criteria

Definition of "Expert":

1. The above parameter of "recognized experts whose expertise could allow for a reasoned and knowledgeable scientific opinion on the origin of the SARS-COV-2 virus" placed a high bar on the level of expertise required.
2. In order to meet this bar, respondents were limited to a mix of the following:
    a. **Virologists:** This was the first core subsample. These represent a specialty subset of microbiology focused on the study of viruses. Non-virologist microbiologists (such as those who study bacteria or fungi) were not included since they may only have a basic understanding of the complex biological processes underlying viral disease. *[Target proportion: at least 40% of overall sample].*
    b. **Infectious Disease Epidemiologists:** This was the second core subsample. Given that epidemiology is a broad field that includes the study of public health concerns ranging from gun violence to the effects of pollution, the survey required epidemiologists with expertise in the area of infectious disease and its spread. *[Target proportion: at least 40% of overall sample].*
    c. **Biorisk (Biosafety/Biosecurity) Professionals:** The survey sought to include at least some representation from professionals who focus on the safe handling of biological materials within laboratory facilities and/or those focused on the security of biological pathogens and facilities. *[Target proportion: ~15% of overall sample].*
    d. **Evolutionary Geneticists (or related scientists):** In order to allow for the inclusion of at least some responses from a broader range of scientists, a small proportion of the sample sought was made up of scientists studying the evolution of genes and genomes (and of how genetic variation leads to evolutionary change), with a preference for those researchers who focus on the evolution of viral genomes, viral phylogenetics and related topics. *[Target proportion: ~5% of overall sample].*

3. In addition to pre-survey identification, vetting and categorization according to the above schema, the level of expertise of all respondents with respect to the core subsamples (virology and infectious disease epidemiology) was requested, self-reported and recorded during the survey.

Anonymity

As noted above, a key parameter of the survey was anonymity. At the same time, participants needed to be compensated for their participation. In order to achieve these dual aims, the research team employed a secure online survey system which allowed for recording the identities of participants (in order to verify their eligibility for compensation), but did not append their survey responses to their names or any other personally identifiable information. Therefore, the research team was not able to determine which participants gave which responses. In addition, this report is not disclosing the identities of the survey participants nor any specific responses given by each participant. Instead, the only information being disclosed is aggregate information about the full set of survey responses.

Sampling Strategy

1. **Global Target Population:** The broadest understanding of the target population is all experts meeting the above criteria globally.
2. **Quota-based Sampling:** The survey utilized controlled quota-based sampling, for the following reasons:
    a. Derived from the primary goal of the survey was the desire to maximize proportionate coverage of expert insight from across the globe in order to address potential bias from samples drawn from primarily Western frames.
    b. As an expert survey, one of the analytical goals was to identify points of consensus in the global expert community regarding the origin of SARS-COV-2 and the implications thereof.
    c. By using quota sampling, once a proportionate number of experts had participated from a specific region, project resources could be recalibrated to support identification, vetting and recruitment of participants in less responsive regions.
    d. The identification of a population of experts from which to derive a proportionate sample is challenged by the lack of any global census or register for these specific scientific expertise areas. Scientific associations could represent a specific region, or contain a listing of those who have voluntarily joined that association, but those parameters could potentially bias the results in unknown ways. Thus, we did not have the assumptions necessary to execute a population-proportionate sample of bioscience experts globally.
3. **Inclusion Only of Experts from at Least "Partially Free" Countries and Territories:** The sample population was restricted to experts residing in countries or territories that are rated at least "partially free" by the Freedom House organization. A total of 138 countries and 2 territories were included (see Appendix A for a listing), and 57 countries and 13 territories were excluded.[1] These countries and territories were excluded for two reasons:
    a. A core aim of the study was to elicit an unbiased opinion from experts. Persons residing in countries or territories that lack basic substantive political rights and civil liberties may feel uncomfortable offering an unbiased opinion, especially if that opinion runs counter to that of the prevailing regime.
    b. Even if such respondents were to offer their own objective opinion, in many countries or territories lacking in freedom, governments monitor their citizens' usage of the internet. Therefore, despite the best efforts of the project team to guarantee the anonymity of respondents from such states, it is possible that their participation would be observed by the regime, thus putting them in either legal or physical danger.

4. **Stratified by Region:** From this truncated population, a sample was drawn that was stratified by region. This was not performed to examine differences between regions, but rather to ensure sufficient diversity in terms of culture and geographic spread, with the intention of avoiding a "developed world"[2] bias.
    a. Geographers employ multiple divisions of the world into regions, with no single classification being universally accepted. Project researchers therefore selected a categorization that they believed best met the objectives of the study with respect to providing sufficient cultural and geographical diversity, while limiting the number of regions. Researchers settled on the following regions:[3]
        i. Africa and the Middle East
        ii. Asia
        iii. Europe
        iv. Latin America and the Caribbean
        v. North America
        vi. Oceania
    b. Countries and territories were classified into regions following the regional classification scheme of the United States Office of Immigration Statistics.[4] However, overseas territories, colonies and other dependencies of another state were not included as separate entities, but were grouped with the parent country. The result was a list of 196 countries.
    c. While not a perfect separation into "developed" and "developing" areas of the world, an initial approximation of such a division could be obtained by combining North America + Europe + Oceania (generally consisting of a greater number of developed countries, what we label Group A) and comparing it to Africa/Middle East + Asia + Latin America/Caribbean (generally consisting of a greater number of developing countries, what we label as Group B). This was believed to be sufficient to guide the sampling process. During the post-survey analysis, a more fine-grained delineation between "developed" and "developing" countries was made.
    d. Within each region, researchers attempted to identify experts across as many countries and territories as possible, understanding that some countries and territories might have few or no suitable experts available to participate in the study.

5. **Target Sample Size.** Recognizing that non-response rates (especially among experts across varied geographic and cultural contexts) might be high, project personnel generated an estimate of the minimum number of respondents required to be able to conduct inferential statistical tests for differences between at least epidemiologists and virologists, and between "developed" and "developing" countries. This was likely to require at least 50 respondents within each category, which was set as the target sample size. The absolute number of responses required would, however, depend on the distribution of respondents across the different categories, but it was estimated that between 150 and 200 respondents would be the minimum required. It was recognized that this sample may not represent sufficient statistical power to make statistically robust generalizations, especially across all subsets of the data. Nonetheless, it was felt to be sufficient to provide relative confidence in the overall results obtained.

6. **Sampling Frame:** The research team determined that there is no globally comprehensive list of virologists, epidemiologists, or biosafety/biosecurity personnel, or even a standardized accounting of the number of such experts in each country. It was thus necessary to utilize a variety of methods for generating lists of potential experts for recruitment (see "Recruitment Protocol" section below).

7. **Stratification Weighting:** The research team considered four possible weighting schemes for regional stratification.

a. *Treat all regions equally:* This would result in each region being allotted ~17% of respondents. While this would ensure overall Group A-Group B region parity in terms of respondents, this would unjustifiably inflate the sample from Oceania (given its relatively small size and population), and similarly give Latin America as much weight as the far larger Asian region.

b. *Weight each region by its percentage of World GDP (at PPP):* While differentiating more between the regions (see Table A1 below), this apportionment, as expected, more heavily weights Group A and also reserves relatively few slots for respondents from Africa/the Middle East and Oceania, which would have limited the diversity of the sample.[5]

Table A1. Weighted Stratification by % of World GDP (at PPP)[5]

Region	Count of Country	Latest Combined GDP (at PPP)	% of Sample		
Africa & Middle East	32	$4,147,883,057,000	5%		
Asia	18	$26,251,898,000,000	29%		
Europe	44	$24,644,854,000,000	28%		
Latin America	28	$7,071,880,700,000	8%		
North America	3	$25,382,000,000,000	29%		
Oceania	14	$1,550,787,912,000	2%	Group A	58%
Total	**139**	**$89,049,303,669,000**	**100%**	Group B	42%

c. *Weight each region by its percentage of Global Population:* This approach unbalances the sample in the opposite direction, in that it vastly overweights the countries of Group B, especially Asia.

Table A2. Weighted by % of World Population[6]

Region	Count of Country	Latest Combined Population	% of Sample		
Africa & Middle East	32	744,557,266	15%		
Asia	18	2,517,546,759	52%		
Europe	44	598,494,496	12%		
Latin America	28	468,123,880	10%		
North America	3	508,057,383	10%		
Oceania	14	44,018,439	1%	Group A	24%
Total	**139**	**4,880,798,223**	**100%**	Group B	76%

d. *Weight each region by a proxy publication score:* The project team generated a weighting based on the rank score of publications in virology and epidemiology.[6] The SCImago research group provides data, including country rankings, with respect to publications in a number of scientific and other scholarly disciplines.[7] These include ranked lists, by country, of publications in both virology and epidemiology.[8] For each country, its rank was recorded and then converted into a score.[9] The scores for virology and epidemiology publications were then added to form a total score for each country. The average score for each region was then calculated,[10] as shown in Table A3. The result is a distribution that is roughly equal between developed and developing countries, largely avoids the unbalancing issues with the above approaches, and recognizes the predominance in publications of North America and Europe, as well as the increasing contribution of Asian countries.

Table A3. Weighted by Ranked Publication Scores in Epidemiology and Virology

(Avg / country in region)

Region	Count of Country	Avg (Epi + Vir Scores)	% of Sample		
Africa & Middle East	32	176	14%		
Asia	18	246	20%		
Europe	44	241	19%		
Latin America	28	139	11%		
North America	3	370	29%		
Oceania	14	83	7%	Group A	55%
Total	**139**	**1,255**	**100%**	Group B	45%

The research team ultimately selected the fourth option as the most useful with respect to the goals of the survey.

Final Recruited Sample

Tables A4 and A5 below compare the above target sample distribution across regions with the actual distribution of participants who ultimately completed the survey. The final sample met or was close to the target proportions in almost all cases. The greatest deviation was 3 additional percentage points for Latin America and the Caribbean and 3 fewer for Oceania, which did not appreciably impact the "developed" vs "developing" dichotomy utilized for the analysis.

Table A4. Final Recruited vs. Intended Sample by Expertise

Expertise	Target Sample %	No. of Respondents	Actual Sample %
Epidemiology	>40%	78	46%
Virology	>40%	74	44%
Other (Biosafety/Biosecurity; Evolutionary Genetics)	<20%	16	10%
Total	**100%**	**168**	**100%**

Table A5. Final Recruited vs. Intended Sample by Region

Region	Target Sample %	No. of Respondents	Actual Sample %
Africa & Middle East	14%	23	14%
Asia	20%	31	18%
Europe	19%	33	20%
Latin America	11%	24	14%
North America	29%	50	30%
Oceania	7%	7	4%
Total	**100%**	**168**	**100%**

Appendix A: List of Countries and Territories from which Survey Sample was Drawn (Freedom House Rating of "Free" or "Partially Free")

[Asterisks (*) denote "developed"[11] economies; number signs (#) denote territories]

Abkhazia#
Albania
Andorra
Antigua and Barbuda
Argentina
Armenia
Australia*
Austria*
Bahamas
Bangladesh
Barbados
Belgium*
Belize
Benin
Bhutan
Bolivia
Bosnia and Herzegovina
Botswana
Brazil
Bulgaria*
Cabo Verde
Canada*
Chile
Colombia
Comoros
Costa Rica
Côte d'Ivoire
Croatia*
Cyprus*
Czechia (Czech Republic)*
Denmark*
Dominica
Dominican Republic
Ecuador
El Salvador
Estonia*
Fiji
Finland*
France*
Gambia
Georgia
Germany*
Ghana
Greece*
Grenada
Guatemala
Guinea-Bissau
Guyana
Honduras
Hungary*
Iceland*
India
Indonesia
Ireland*
Israel
Italy*
Jamaica
Japan*
Kenya
Kiribati
Kosovo
Kuwait
Latvia*
Lebanon
Lesotho
Liberia
Liechtenstein
Lithuania*
Luxembourg*
Macedonia
Madagascar
Malawi
Malaysia
Maldives
Malta*
Marshall Islands
Mauritania
Mauritius
Mexico
Micronesia
Moldova
Monaco
Mongolia
Montenegro
Morocco
Mozambique
Namibia
Nauru
Nepal
Netherlands*
New Zealand*
Niger
Nigeria
Northern Cyprus#
Norway*
Pakistan
Palau
Panama
Papua New Guinea
Paraguay
Peru
Philippines
Poland*
Portugal*
Romania*
Saint Kitts and Nevis
Saint Lucia
Saint Vincent and the Grenadines
Samoa
San Marino
Sao Tome and Principe
Senegal
Serbia
Seychelles
Sierra Leone
Singapore
Slovakia*
Slovenia*
Solomon Islands
South Africa
South Korea
Spain*
Sri Lanka
Suriname
Sweden*
Switzerland*
Taiwan
Tanzania
Timor-Leste
Togo
Tonga
Trinidad and Tobago
Tunisia
Tuvalu
Ukraine
United Kingdom*
United States of America*
Uruguay
Vanuatu
Zambia

B. Recruitment Protocol

Potential Respondent Identification

The research team used a variety of information sources to identify experts. Some examples of these sources are:

- Local medical or epidemiological professional society websites.
- Both globally and regionally recognized academic journals that focus on epidemiology, virology, biorisk, and evolutionary genetics.
- Faculty and staff directories and websites at academic institutions.
- Professional social networking sites.
- News articles related to COVID-19, particularly those citing experts.
- Recommendations from other participants/invitees (snowball sampling).

The research team recorded each candidate's name, contact email, institution, and area of expertise.

Vetting

Once a candidate was identified, another member of the research team would conduct an independent assessment of the candidate's suitability for the study. This was done to ensure that the expert:

- Had an educational background that was consistent with their recorded expertise.
- Had worked in their field (i.e. published in peer-reviewed journals or held positions in clinical or research institutions).
- Had current, up-to-date knowledge (defined as activity within the field in the last 5 years).

Any doubts raised were noted and the candidates were flagged for follow-up adjudication or excluded as appropriate. For logistical purposes, the research team opted to prioritize outreach to successfully vetted candidates and defer follow-up with flagged candidates until other options were exhausted.

In order to maintain scientific independence within the sample, especially given concerns about undue governmental influence in previous COVID-19 origin assessments, participants recruited for this study could not be currently employed as a political official in their country's government (e.g., Deputy Minister of Health). This did not exclude researchers or frontline personnel working for a government agency or in a government-run hospital.

Any verification or exclusionary information was recorded by project researchers, and a final determination of the potential participant was made according to the following schema:

- Prioritized for outreach
- Further adjudication required
- Excluded from sample

Any participant labeled as "further adjudication required" was referred to one of the senior project leads for final determination.

Outreach

Candidates were contacted by a senior project lead or via automated mailing lists (see sample outreach message below), with subsequent follow-up carried out by another member of the research team as required. The team initially distributed the survey via mailing lists, but very low response rates forced a pivot to personalized outreach. This pivot yielded much higher response rates.

If a candidate indicated interest in participating, they were sent a personal, single-use link to the registration form. Those who completed the registration survey were automatically sent a similar link to the main survey. Up to three reminder emails, each several days after the previous, were sent to individuals who agreed to participate but had not yet completed the main survey. Several weeks before the survey closed, an automated distribution was sent to individuals who had not replied to prior outreach and who had not opted out of the mailing list.

Outcome

1,138 invitations were sent to invite candidates to take part in the survey. Over 800 candidates were contacted through personalized emails from a senior project lead, rather than by automated communication. Registration links were then sent to only those who responded and indicated interest in participating.

Ultimately, 214 individuals completed the registration, and 182 responses were collected.

Sample Outreach Communication:

Dear Dr. XXX,

My name is XXX and I am a researcher and professor in New York. I am currently coordinating a research study on policy implications regarding SARS-CoV-2 and future pandemics.

We are surveying researchers and practitioners in select areas (e.g., virology, epidemiology, biosecurity) and are trying hard to reach a diverse sample of experts from over 100 countries. We need several experts, especially from [Country], in order to obtain the appropriate statistical sample.

I would like to invite you to take part in our study, by taking a brief (10 minute) online expert opinion survey, which can be completed at your convenience. You do not need to be a specific expert on Sars-CoV-2; your general background will be sufficient to provide a fresh perspective.

The data you provide to the study will be completely anonymous and we can offer a participant incentive of US$60 for your time (which can be taken as a gift card or given directly to one of several charities). The study is being conducted by my research firm on behalf of the Global Catastrophic Risk Institute, a non-profit think tank dedicated to developing and communicating the best ways to confront humanity's gravest threats. The survey is an attempt to gain a better understanding about how to prevent future pandemics by seeing what experts believe can be learned from how the COVID-19 pandemic began.

Please let me know as soon as you can whether you would be willing to participate in this select study. I can then provide more details and send you a unique link to access the survey. My staff and I are, of course, happy to answer any questions that you might have.

Sincerely,

C. Survey Instrument

[ORDER RANDOMIZATION: In order to minimize ordering effects, two versions of the survey were presented randomly to participants, one with the Natural Zoonosis scenario provided first throughout and one with the Research-Related Accident scenario provided first throughout.]

[NOTE: Survey Introduction Section]

"This survey examines expert opinions about different hypotheses regarding the origin of the SARS-CoV-2 virus in human populations, which led to the COVID-19 pandemic. There have been many arguments from different sides on this matter, but there has not yet been a rigorous survey of competent experts from across the globe.

Objective: The objective of this brief survey is to gather your opinion, as an unbiased expert and based only on your scientific knowledge and understanding of the available evidence, about the likely origin of the SARS-CoV-2 virus.

Requirements: You have been pre-selected by the survey administrators based on your recognized expertise. Your participation in this survey consists of you answering – as honestly as you can – a series of questions about your expertise and your opinions. It is estimated that the survey should take no more than 10 minutes of your time.

Question: This survey seeks to explore, with global representation, expert opinions to distinguish primarily between two categories of origin: Natural Zoonosis and Biomedical Research-Related Accident.

Anonymity: All survey responses you provide are completely anonymous. This is intended to ensure that you feel comfortable offering your honest opinion. While we record whether or not you complete the survey (in order to verify your eligibility for compensation), your name and any other personally identifiable information will be completely separated from the survey responses that you provide. Once you complete the survey and have received your compensation, your name and other personally identifiable information will be stripped from the survey responses, which will be stored in a deidentified format. The aggregate results of the survey will be published without any individual references. Even your participation in the survey will remain undisclosed.

Organizers: This survey is being conducted under the auspices of the Global Catastrophic Risk Institute, a non-profit, nonpartisan policy institute seeking to develop and communicate the best ways to confront humanity's gravest threats. The survey is being administered by Nemesys Insights, LLC, a strategic advisory company, whose principals are PhD university professors with extensive expertise in conducting large-scale expert surveys. The project is supported by private philanthropy. All of the above share a motivation to pursue an unbiased and scientifically rigorous exploration of the topic of the COVID-19 origins.

Potential Risks to Survey Participants: The origin of COVID-19 is a controversial topic. In any survey on this topic, there is some risk that interested outside parties will seek to learn an individual's opinions and retaliate in some way against those individuals whose opinions these parties might disagree with. While this

risk is minimal, we work to remove it through the following measures: a) by utilizing a secure survey system; b) by anonymizing/deidentifying all participant inputs; and c) by excluding participants from countries where experts are likely to face political persecution for presenting their opinions (i.e., excluding from the survey countries rated by the Freedom House organization as being "Not Free" with respect to political rights and civil liberties).

Benefits: Gaining a better understanding of the origins of COVID-19 may allow society to design better policies and other governance measures to prevent or respond to future pandemics. Consulting experts on these topics in a geographically broad, anonymous survey free of institutional pressures can help improve this understanding. Your participation can therefore contribute to policy improvements in pandemic preparedness and response. In addition, you will be compensated for your time spent on completing the survey.

Contact: If you have any questions regarding this survey, or would like additional information about participation, please email info@nemesysinsights.com and someone will get back to you as soon as possible."

[New Page]

"Consent Form:

- I have read the information presented on the previous page about my participation in a survey on my opinions relating to the origins of COVID-19.
- I am aware that I may choose to exit the questionnaire at any time, although I will not receive compensation unless I complete the survey.
- I am aware that responses from the survey may be included in publications, with the understanding that my individual responses will be fully anonymized and not linked back to me in publications.
- I affirm that there are no legal or employment-related restrictions on my participation in this survey or my receiving compensation for my participation."

[Click Button: "I AGREE"]

[NOTE: Expertise Section]

QUESTION 1:

TYPE: Checkbox (only one), with textbox for "Other"
VARIABLE: Nominal

"In which academic or practical discipline do you have the most expertise?

- Virology
- Epidemiology
- Biosafety/Biosecurity
- Evolutionary Genetics
- Other (please specify) _____"

QUESTION 2a:

TYPE: Radio button "Likert-Type" Scale (0-6)
VARIABLE: Ordinal (Scale)

"For each of the following areas, please select where you would rate your expertise on the given scale:

Area	Level of Expertise
Virology	[Insert Likert Scale]
Epidemiology of Infectious Disease	[Insert Likert Scale]
Biosafety/Biosecurity	[Insert Likert Scale]
Evolutionary Genetics	[Insert Likert Scale]
Other _____	[Insert Likert Scale]

Likert scale labelled as follows:

0 – No Knowledge
1 – Fundamental Awareness (basic knowledge)
2 – Novice (limited experience)
3 – Intermediate (practical application)
4 – Advanced (applied theory)
5 – Expert (nationally-recognized authority)
6 – Leading Expert (globally-recognized authority)"

QUESTION 2b:

TYPE: Box that Accepts Only Zero or Positive Integers <60 for each of the following options
VARIABLE: Discrete (Years)

"For each of the following areas, please fill in how many years you have been actively researching or practicing in this area."

Area	# of Years Experience
Virology	[Insert Number Box]
Epidemiology of Infectious Disease	[Insert Number Box]
Biosafety/Biosecurity	[Insert Number Box]
Evolutionary Genetics	[Insert Number Box]
Other _____	[Insert Number Box]

[NOTE: Primary Question Section]

QUESTION 3:

TYPE: Percentage boxes next to each option. Checksum that total 100 or receive error message: "Please ensure that the probabilities total 100%.".
VARIABLE: Continuous

> "There are different hypotheses about the emergence of SARS-CoV-2 in human populations. Two possibilities are:
>
> > A: Natural zoonosis: SARS-CoV-2 emerged in human populations as the result of the infection of a person with coronavirus directly from a naturally-infected non-human animal. However, the human infection did not occur in the course of virological or biomedical research, either in a laboratory or during fieldwork.
> >
> > B: Biomedical research-related accident: SARS-CoV-2 emerged in human populations as the result of a biomedical research-related accident. This includes: the accidental infection of a laboratory worker with a natural coronavirus; the accidental infection of researchers with a natural coronavirus during biomedical fieldwork; or the accidental infection of a laboratory worker with an engineered coronavirus. However, the human infection did not occur as a natural infection directly from an animal in a non-biomedical research setting.
>
> Based on your existing expertise and knowledge, in your opinion, what is the relative likelihood (in terms of a percentage probability) that SARS-CoV-2 emerged via natural zoonosis, via a research-related accident, or via some other mechanism. Your answers must sum to 100.
>
> - Natural zoonosis ___ %
> - Biomedical research-related accident ____ %
> - Other (please specify) ___ %"

[NOTE: Implications Section]

> "We are also interested in understanding what experts like yourself believe about the potential origins of future pandemics, and how these beliefs may be affected by knowledge about the origin of SARS-CoV-2."

QUESTION 4a:

TYPE: Rank Order
VARIABLE: Ranking

"When considering the next pandemic, please rank order the following likely causes, from greatest likelihood to least likelihood:

- Natural Zoonosis
- Biomedical Research-Related Accident
- Other (please specify)"

QUESTION 4b:

TYPE: Likert
VARIABLE: Ordinal

"Based on your ranking above, how confident are you in that assessment?
[We have provided both verbal descriptors of confidence and their approximate equivalent on a scale of 1 to 10, with 1 being not confident at all and 10 being extremely confident]

- Low [1 to 2]
- Low-to-moderate [3 to 4]
- Moderate [5 to 6]
- Moderate-to-high [7 to 8]
- High [9 to 10]"

QUESTION 4c:

TYPE: Percentage boxes next to each option. Checksum that total 100 or receive error message: "Please ensure that the probabilities total 100%.".
VARIABLE: Continuous

"We would now like to get probability estimates from you on the following likely causes of the next pandemic. Please provide relative likelihood (in terms of a percentage probability) that the next pandemic will emerge via the following. Your answers must sum to 100:

- Natural Zoonosis ___ %
- Biomedical Research-Related Accident ___ %
- Other (please specify) ___ %"

QUESTION 4d:

TYPE: Likert
VARIABLE: Ordinal

"Based on your percentage estimates above, how confident are you in that assessment?
[We have provided both verbal descriptors of confidence and their approximate equivalent on a scale of 1 to 10, with 1 being not confident at all and 10 being extremely confident]

- Low [1 to 2]
- Low-to-moderate [3 to 4]
- Moderate [5 to 6]
- Moderate-to-high [7 to 8]
- High [9 to 10]"

QUESTION 5a:

TYPE: Likert Scale
VARIABLE: Ordinal (scale)

"Suppose you learned with certainty (>99.99% confidence) that SARS-CoV-2 emerged from {natural zoonosis/ biomedical research-related accident}.
[Note: randomly generated which option would be presented first]

In that case, to what extent would this new information about COVID origins change your perceived likelihood (as you provided above) that the next pandemic would originate from:

Origin	Change in Likelihood
Natural Zoonosis	[Insert Likert Scale]
Biomedical Research-Related Accident	[Insert Likert Scale]
Other (please specify)	[Insert Likert Scale]

Likert scale is:

1 = Much more unlikely
2 = More unlikely
3 = No change
4 = More likely
5 = Much more likely

QUESTION 5b:

TYPE: Likert Scale; Text
VARIABLE: Ordinal (scale); Qualitative

"Suppose that you know with certainty (>99.99% confidence) that SARS-CoV-2 emerged from {natural zoonosis/biomedical research-related accident}.
[Note: received same option as randomly generated in Q5a]

In that case, how much would this change your views on the governance measures that should be taken to accomplish each of the following objectives. If your views would change, please describe briefly how they would change.

a) Preventing a pathogen with pandemic potential from infecting any humans? [Insert Likert scale]

How Your Views on Governance Would Change: _____

b) If a pathogen with pandemic potential infects at least one human, preventing the pathogen from spreading into a pandemic? [Insert Likert scale]

How Your Views on Governance Would Change: _____

c) If the event becomes a pandemic, mitigating the overall harms? [Likert scale]

How Your Views on Governance Would Change: _____

Likert scale is:

0 = No change in my views on governance
1 = Small changes in my views on governance
2 = Moderate changes in my views on governance
3 = Substantial changes in my views on governance

QUESTION 6a

TYPE: Likert Scale
VARIABLE: Ordinal (scale)

"Suppose you learned with certainty (>99.99% confidence) that SARS-CoV-2 emerged from {natural zoonosis/ biomedical research-related accident}.
[Note: received the alternative option to that which was presented in Q5a]

In that case, to what extent would this new information about COVID origins change your perceived likelihood that the next pandemic would originate from:

Origin	Change in Likelihood
Natural Zoonosis	[Insert Likert Scale]
Biomedical Research-Related Accident	[Insert Likert Scale]
Other (please specify)	[Insert Likert Scale]

Likert scale is:

1 = Much more unlikely
2 = More unlikely
3 = No change
4 = More likely
5 = Much more likely

QUESTION 6b:

TYPE: Likert Scale; Text
VARIABLE: Ordinal (scale); Qualitative

"Suppose that you know with certainty (>99.99% confidence) that SARS-CoV-2 emerged from {natural zoonosis/biomedical research-related accident}.
[Note: received same option as presented in Q6a]

In that case, how much would this change your views on the governance measures that should be taken to accomplish each of the following objectives. If your views would change, please describe briefly how they would change.

a) Preventing a pathogen with pandemic potential from infecting any humans? [Insert Likert scale]

How Your Views on Governance Would Change: _____

b) If a pathogen with pandemic potential infects at least one human, preventing the pathogen from spreading into a pandemic? [Insert Likert scale]

How Your Views on Governance Would Change: _____

c) If the event becomes a pandemic, mitigating the overall harms? [Likert scale]

How Your Views on Governance Would Change: _____

Likert scale is:

0 = No change in my views on governance
1 = Small changes in my views on governance
2 = Moderate changes in my views on governance
3 = Substantial changes in my views on governance

[NOTE: Regulation and Investigations]

QUESTION 7:

TYPE: Select
VARIABLE: Nominal (partially ordinal)

"Which of the following do you believe regarding stricter regulation of biomedical research:

- Stricter regulation would reduce the expected damage from the next pandemic.
- Stricter regulation would have no effect on the expected damage from the next pandemic.
- Stricter regulation would increase the expected damage from the next pandemic."

QUESTION 8:

TYPE: Select
VARIABLE: Nominal (partially ordinal)

"Which of the following most closely matches your views about future potential investigations into the origins of SARS-CoV-2:

- No further investigations needed
- Further investigation may be needed, but the origins have been well-studied
- Further investigation is needed because major gaps still exist in the investigations that have already been done"

[NOTE: Closing Questions]

QUESTION 9:

TYPE: Multi-Choice Checkbox (allows for multiple choices); Note: order of items is randomized because there could be ordering effects.
VARIABLE: Set of Binaries

"Please indicate which, if any, of the following studies/reports you are familiar with:

- Andersen et al (2020) 'The Proximal Origins of SARS-CoV-2', Nature Medicine.
- Worobey et al (2022) 'The Huanan Seafood Wholesale Market in Wuhan was the early epicenter of the COVID-19 pandemic', Science
- Pekar et al (2022) 'The molecular epidemiology of multiple zoonotic origins of SARS-CoV-2', Science
- Joint Report: WHO-convened Global Study of Origins of SARS-CoV-2: China Part

- The DEFUSE grant proposal submitted to DARPA in 2018 by EcoHealth Alliance, the University of North Carolina Chapel Hill, Duke National University Singapore, and the Wuhan Institute of Virology
- The State Department fact sheet from 15th January 2021 alleging that three workers at the Wuhan Institute Virology fell ill with covid-like symptoms in the fall of 2019
- Liu et al (2023) 'Surveillance of SARS-CoV-2 at the Huanan Seafood Market', Nature
- Hanlen et al (2022) 'Microbiological origins of SARS-CoV-2', Proceedings of the National Academy of Sciences. [Note: this last option was a fake publication to check for respondent truthfulness/ competence/attention]

QUESTION 10:

TYPE: Optional long text field
VARIABLE: Qualitative Text

> "Is there anything else that you would like to comment on regarding the origins of SARS-CoV-2 or the implications for future pandemic prevention? [Optional]"

[NOTE: Thank You and Conclusion Section]

> "Thank you very much for your participation in this survey. Your answers have been recorded and will contribute to a better understanding of pandemics.
>
> Clicking the button below will take you to the compensation page of a third-party vendor where you will be presented with various choices and then receive your compensation.
>
> If you have any questions regarding this survey, please email surveyinfo@nemesysinsights.com."

D. Quality Control Process

The research team employed a systematic quality control protocol to identify and eliminate low-quality responses. A number of quantitative and qualitative measures were taken into consideration to evaluate each response. Quantitative concerns such as duration were used purely to highlight responses for further review, and not as definitive exclusionary criteria.

Quality control efforts began by identifying responses that met one or more of the following criteria:

- **Duration:** Responses with a duration of 1 standard deviation below the mean (excluding outliers) were flagged for additional review.
- **Reported expertise too low:** The respondent's highest self-reported expertise, in all of the expertise fields, was lower than the minimum threshold level of expertise for the study.
- **Other expertise:** The participant provided an Other expertise that did not align with the desired sample inclusion criteria.
- **Unanswered questions:** The number of questions which the participant was asked but did not answer, excluding "Other" fields.
- **Text response quality:** The nature of the participant's responses to free-text questions, raised concerns (e.g., consisted of gibberish or exact repetition of previous responses). This evaluation was made with consideration to the limitations of conducting an English language survey with a global sample.

These measures were taken together to inform an initial quality classification by a member of the research team. This classification consisted of the following categories:

- **Low quality** – The response has significant quality concerns and is unlikely to be usable.
- **Questionable quality** – The response has some quality concerns but may still be usable.
- **Usable quality** – The response has no quality concerns.
- **Incomplete response, blank response, or no consent** – The respondent did not complete enough of the survey to provide useful data.

The reviewer recorded the classification along with any relevant notes. Two project leads then independently reviewed each response and the preliminary classification before making a final determination as to whether to retain or remove the response. These determinations were compared and, if they agreed, taken as the final determination. If they did not agree, the leads discussed the merits of including or excluding the response with each other until an agreement could be reached.

Of 182 responses, 9 were removed on the basis of being incomplete, blank, or non-consenting, 4 for quality issues, and 1 for not meeting the requirement for expertise.

This procedure ultimately led to 168 responses being determined to be usable for subsequent analysis.

E. Qualitative Analysis Procedures and Results

The survey contained two areas where respondents could supply qualitative, text-based input. The first of these was a series of items [located under Questions 5b and 6b in the survey instrument] related to how governance measures would change under each scenario (assuming a zoonotic and a research-related accident COVID-19 origin, respectively), within the following areas of pandemic prevention and response:

1. Preventing a pathogen with pandemic potential from infecting any humans.
2. If a pathogen with pandemic potential infects at least one human, preventing the pathogen from spreading into a pandemic.
3. If the event becomes a pandemic, mitigating the overall harms.

There were thus a total of six governance items that could be answered qualitatively. It should be noted that these qualitative answers were only required if the respondent had not answered the first part of each item (a quantitative measure of the amount governance should change) with a value of 0 (i.e., no changes in governance). Response rates varied by item, with an average of 72 qualitative responses received under the zoonosis scenario and 106 under the research-related accident scenario.

The second qualitative portion was an optional, open-ended question at the end of the survey asking respondents to provide any comments regarding the origin of SARS-CoV-2 or the implications thereof for future pandemic prevention. 84 respondents provided comments.

Governance Questions Analysis Procedures and Results

1. Each suggested change in governance measure across the six items was coded inductively into three components:
    a. **Action:** the component of the suggested governance measure that contained a recommended action, e.g., "Monitoring", "Restricting", "Oversight"
    b. **Scope:** the subject or topic of the suggested action, e.g., "Wildlife", "Laboratory Procedures", "Infected Individuals"
    c. **Direction:** whether the Action when applied to the Scope was being recommended to be increased (or made more rapid), decreased, or sustained.
2. The first step in accomplishing this coding involved a senior researcher reviewing all of the text entries for each of the six items and keeping a list of Action and Scope entries from each entry. However, where the Action or Scope was conceptually similar to an item already on the list, it was not added to the list, so that only unique concepts for Action and Scope were added. Once all entries had been considered, the final list was refined by combining categories that were judged to be substantively similar and supplying a label that appropriately represented each category. The result was 27 unique Action and 45 unique Scope categories.
3. The list of inductively derived categories was then distributed to two other researchers, who then independently coded each entry under each of the six items according to the derived Action, Scope and Direction categories, following their best judgement.
    a. For example, "I would favor more intensive monitoring of work in laboratories working with pandemic-potential pathogens" could be coded as:
        i. Action: Monitoring
        ii. Scope: Research (with Dangerous Pathogens)
        iii. Direction: Increased

If the coder believed that the existing categories did not capture a particular governance recommendation, they could add a new category to the list for either Action or Scope.

4. Once both coders had completed their initial coding, the coders and the senior researcher as a group reviewed all those cases where the two coders did not agree and adjudicated a final coding for these entries.
5. It should be noted that a particular respondent could supply more than one recommendation for a change in governance. In such cases, each different recommendation was coded separately according to the above process. The result was a set of ~275 separate coding triples across the 168 participants for each of the six items.
6. The frequency with which particular concepts were mentioned (both in terms of Action, Scope and Direction considered both individually and in various combinations) was then determined and used to identify the most prominent governance concepts among the qualitative responses, summarized on page 5 of the main report.
7. The tables below show the individual frequency distributions of concepts, individually and in terms of Action + Scope combinations. Before each set of tables, a brief qualitative summary is provided.

I. Preventing a pathogen with pandemic potential from infecting any humans.

a. Natural Zoonosis COVID-19 Origin Assumption

- Nineteen different governance actions were represented in the data across 87 comments. Most common actions involved various Monitoring and Surveillance Activities (15), Oversight and Regulations, and general Restrictions on various behaviors. Investing/Resourcing, Banning, and Assessing/Identifying were also actions that were reflected in five or more comments each.
- The scope of the above actions covered 31 different subjects, represented across 90 different comments. The most common subjects of the above actions were Wet Markets and Wildlife/Human Contact, with Farmed/Domesticated Animals, Bush Meat/Illegal Animal Trade, and Ecosystems also receiving 5 or more mentions each.
- The vast majority of participants sought to increase the above actions.
- Out of 72 specific recommendations for governance, most were unique, but the most common repeated ones involved Regulating Wet Markets (5 participants), followed by measures to Restrict Wildlife/Human Contact (4 participants), and ensuring Monitoring/Surveillance of Farmed/Domesticated Animals (4).
- Other interesting areas mentioned: One Health Approaches; Education/Training.

Actions

Oversight/Enforcing Regulations/Mandating	20
Monitoring/Surveillance	15
Restricting	10
Investing/Resourcing	6
Assessing/Identifying	5
Banning	5
Educating /Training	4
Reporting/Communicating	4
Developing	3
Screening/Detection/Testing	3

Awareness Raising	2
Conducting	2
Conserving/Preserving	2
Preserving	2
Coordinating/Cooperating	1
Exercising/Planning	1
Making Equitable	1
Standardizing	1

Scope

Live Food Markets (Wet Markets)	10
Wildlife/Human Contact	10
Bush Meat/Illegal Animal Trade	7
Ecosystems	5
Farmed/Domesticated Animals	5
General Public (incl. Local Communities)	5
Environmental Degradation (e.g., deforestation, agriculture)	4
General	4
One Health (medical, veterinary, environmental)	4
Pathogens with Pandemic Potential	4
International Community (incl. UN, WHO)	3
Laboratory Biosafety Protocols	3
Transparency/Reporting	3
Areas of Likely Zoonosis	2
Epidemic Disease Containment Methods (General)	2
Epidemiological Data	2
Preparedness Resources	2
Research (Bioscience, e.g. general virology)	2
Animal Populations	1
Focal Outbreaks of Emerging Viruses	1
Gain-of-Function Research/Genetically Engineered Pathogens	1
High-Containment Labs (negative pressure, BSL3 & BSL4)	1
Intl. Committee/Task Force	1
New Detection/Surveillance Tools	1
Population Control	1
Public Health Infrastructure	1
Research (with Dangerous Pathogens)	1
Vaccine/Drug Development	1
Wildlife/Livestock Contact	1
Wildlife Field Research	1
Wildlife Vectors (e.g., Bats)	1

Direction

Increased	62
Sustained	3
Decreased	1
More Rapid	1

Action + Scope Combination

Oversight/Enforcing Regulations/Mandating Live Food Markets (Wet Markets)	5
Monitoring/Surveillance Farmed/Domesticated Animals	4
Restricting Wildlife/Human Contact	4
Banning Bush Meat/Illegal Animal Trade	3
Monitoring/Surveillance General Public (incl. Local Communities)	3
Oversight/Enforcing Regulations/Mandating Wildlife/Human Contact	3
Assessing/Identifying Laboratory Biosafety Protocols	2
Banning Live Food Markets (Wet Markets)	2
Conserving/Preserving Ecosystems	2
Educating/Training General Public (incl. Local Communities)	2
Monitoring/Surveillance General	2
Monitoring/Surveillance Pathogens with Pandemic Potential	2
Monitoring/Surveillance Wildlife/Human Contact	2
Oversight/Enforcing Regulations/Mandating Bush Meat/Illegal Animal Trade	2
Preserving Ecosystems	2
Restricting Bush Meat/Illegal Animal Trade	2
Restricting Environmental Degradation (e.g., deforestation, agriculture)	2
Environmental Degradation (e.g., deforestation, agriculture)	1
Transparency/Reporting	1
Assessing/Identifying Epidemic Disease Containment Methods (General)	1
Assessing/Identifying Pathogens with Pandemic Potential	1
Assessing/Identifying Wildlife/Human Contact	1
Awareness Raising Ecosystems	1
Awareness Raising Farmed/Domesticated Animals	1
Conducting Epidemiological Data	1
Conducting Research (Bioscience, e.g. general virology)	1
Coordinating/Cooperating One Health (medical, veterinary, environmental)	1
Developing International Community (incl. UN, WHO)	1
Developing Intl. Committee/Task Force	1
Developing Preparedness Resources	1
Educating/Training Areas of Likely Zoonosis	1
Educating/Training Wildlife Field Research	1
Exercising/Planning Pathogens with Pandemic Potential	1
Investing/Resourcing Epidemic Disease Containment Methods (General)	1
Investing/Resourcing Laboratory Biosafety Protocols	1
Investing/Resourcing New Detection/Surveillance Tools	1
Investing/Resourcing One Health (medical, veterinary, environmental)	1

Investing/Resourcing Public Health Infrastructure	1
Investing/Resourcing Research (Bioscience, e.g. general virology)	1
Live Food Markets (Wet Markets)	1
Making Equitable Vaccine/Drug Development	1
Mandating International Community (incl. UN, WHO)	1
Mandating Transparency/Reporting	1
Monitoring/Surveillance Focal Outbreaks of Emerging Viruses	1
Monitoring/Surveillance Wildlife Vectors (e.g., Bats)	1
Oversight/Enforcing Regulations/Mandating Areas of Likely Zoonosis	1
Oversight/Enforcing Regulations/Mandating Environmental Degradation (e.g., deforestation, agriculture)	1
Oversight/Enforcing Regulations/Mandating General	1
Oversight/Enforcing Regulations/Mandating High-Containment Labs (negative pressure, BSL3 & BSL4)	1
Oversight/Enforcing Regulations/Mandating International Community (incl. UN, WHO)	1
Oversight/Enforcing Regulations/Mandating Preparedness Resources	1
Oversight/Enforcing Regulations/Mandating Research (with Dangerous Pathogens)	1
Oversight/Enforcing Regulations/Mandating Wildlife/Livestock Contact	1
Reporting/Communicating Epidemiological Data	1
Reporting/Communicating Gain-of-Function Research/Genetically Engineered Pathogens	1
Reporting/Communicating One Health (medical, veterinary, environmental)	1
Reporting/Communicating Transparency/Reporting	1
Restricting Live Food Markets (Wet Markets)	1
Restricting Population Control	1
Screening/Detection/Testing Animal Populations	1
Screening/Detection/Testing General	1
Screening/Detection/Testing Live Food Markets (Wet Markets)	1
Standardizing One Health (medical, veterinary, environmental)	1

b. <u>Research-Related Accident COVID-19 Assumption</u>

- Twenty different governance actions were represented in the data across 59 comments. The most common action involved Oversight/Enforcing Regulations/Mandating (59 participants). Other somewhat frequent actions were: Monitoring/Surveillance (8), Reporting/Communicating (7) and Developing (6).
- The scope of the above actions covered 23 different subjects, represented across 134 different comments. The most common subjects of the above actions were Laboratory Biosafety Protocols (34 participants), Research with Dangerous Pathogens (16 participants) and High-Containment-Labs (BSL3/BSL4) (12). Gain-of-Function Research (8), Laboratory Biosecurity Protocols (8), Transparency/Reporting (7) and Laboratory Biosafety Accidents (7) also received multiple comments.
- The vast majority of participants (104/112) sought to increase the above actions/governance measures.
- There were 76 different specific recommendations for governance, with several being offered by multiple participants. Increasing Oversight/Enforcing Regulations/Mandating Laboratory Biosafety Protocols (12 participants) and increasing Oversight/Enforcing Regulations/Mandating Laboratory for Research with Dangerous Pathogens (11 participants) were the most prominent. Also repeated by multiple participants were increasing Oversight/Enforcing Regulations specifically for High-Containment Labs (6) and for Gain-of-Function Research (6).
- Other interesting areas mentioned more than once were coordination and cooperation across the international community (e.g., WHO) (4 participants), increased monitoring and surveillance in general (7) and better reporting and communicating across stakeholders (incl. the general public).

Actions

Oversight/Enforcing Regulations/Mandating	63
Monitoring/Surveillance	8
Reporting/Communicating	7
Developing	6
Coordinating/Cooperating	5
Standardizing	5
Assessing/Identifying	4
Restricting	4
Conducting	3
Educating/Training	3
Forensic Auditing	3
Investigating	3
Holding Accountable	2
Quarantining/Isolating	2
Banning	1
Conserving/Preserving	1
Empowering	1
Investing/Resourcing	1
Relocating	1

Scope

Laboratory Biosafety Protocols	34
Research (with Dangerous Pathogens)	16
High-Containment Labs (negative pressure, BSL3 & BSL4)	12
International Community (incl. UN, WHO)	9
Gain-of-Function Research/Genetically Engineered Pathogens	8
Laboratory Biosecurity Protocols	8
General	7
Laboratory Biosafety Accidents	7
Transparency/Reporting	7
Research (Bioscience, e.g. general virology)	5
Intl. Committee/Task Force	3
Pathogens with Pandemic Potential	3
Scientific Ethics/Responsible Conduct	3
Biosafety Training/Certification	2
Lab Worker Health	2
BW Preparedness	1
Cross-border Travel	1
Epidemic Disease Containment Methods (General)	1
Lab Worker Stresses	1
Live Food Markets (Wet Markets)	1
Political Ideologies	1
Public Health Infrastructure	1
US-sponsored Dual-Use Research in Other Countries	1

Direction

Increased	104
Sustained	5
Decrease	1
More Rapid	1

Action + Scope Combination

Oversight/Enforcing Regulations/Mandating Laboratory Biosafety Protocols	16
Oversight/Enforcing Regulations/Mandating Research (with Dangerous Pathogens)	11
Laboratory Biosafety Protocols	7
Oversight/Enforcing Regulations/Mandating Gain-of-Function Research/Genetically Engineered Pathogens	6
Oversight/Enforcing Regulations/Mandating High-Containment Labs (negative pressure, BSL3 & BSL4)	6
Oversight/Enforcing Regulations/Mandating General	6
Coordinating/Cooperating International Community (incl. UN, WHO)	4
Oversight/Enforcing Regulations/Mandating Research (Bioscience, e.g. general virology)	4
Assessing/Identifying Laboratory Biosafety Protocols	3
Developing Intl. Committee/Task Force	3
Oversight/Enforcing Regulations/Mandating Transparency/Reporting	3
Reporting/Communicating Research (with Dangerous Pathogens)	3
Developing Laboratory Biosafety Protocols	2
Forensic Auditing Laboratory Biosafety Accidents	2
Laboratory Biosecurity Protocols	2
Monitoring/Surveillance Lab Worker Health	2
Monitoring/Surveillance Research (with Dangerous Pathogens)	2
Oversight/Enforcing Regulations/Mandating International Community (incl. UN, WHO)	2
Oversight/Enforcing Regulations/Mandating Laboratory Biosecurity Protocols	2
Oversight/Enforcing Regulations/Mandating Pathogens with Pandemic Potential	2
Reporting/Communicating Transparency/Reporting	2
Standardizing International Community (incl. UN, WHO)	2
Assessing/Identifying General	1
Banning Gain-of-Function Research/Genetically Engineered Pathogens	1
Biosafety Training/Certification	1
Conducting Laboratory Biosafety Protocols	1
Conducting Laboratory Biosecurity Protocols	1
Conducting Scientific Ethics/Responsible Conduct	1
Conserving/Preserving Research (Bioscience, e.g. general virology)	1
Coordinating/Cooperating Transparency/Reporting	1
Developing Laboratory Biosecurity Protocols	1
Educating/Training Laboratory Biosafety Accidents	1
Educating/Training Laboratory Biosafety Protocols	1
Educating/Training Laboratory Biosecurity Protocols	1
Empowering International Community (incl. UN, WHO)	1
Forensic Auditing High-Containment Labs (negative pressure, BSL3 & BSL4)	1
Holding Accountable Scientific Ethics/Responsible Conduct	1
Holding Accountable Transparency/Reporting	1
Investigating Laboratory Biosafety Accidents	1

Investigating Laboratory Biosafety Protocols	1
Investigating Laboratory Biosecurity Protocols	1
Investing/Resourcing BW Preparedness	1
Laboratory Biosafety Accidents	1
Monitoring/Surveillance High-Containment Labs (negative pressure, BSL3 & BSL4)	1
Monitoring/Surveillance Lab Worker Stresses	1
Monitoring/Surveillance Laboratory Biosafety Protocols	1
Monitoring/Surveillance Pathogens with Pandemic Potential	1
Oversight/Enforcing Regulations/Mandating Cross-border Travel	1
Oversight/Enforcing Regulations/Mandating Epidemic Disease Containment Methods (General)	1
Oversight/Enforcing Regulations/Mandating Public Health Infrastructure	1
Oversight/Enforcing Regulations/Mandating Scientific Ethics/Responsible Conduct	1
Oversight/Enforcing Regulations/Mandating US-sponsored Dual-Use Research in Other Countries	1
Quarantining/Isolating High-Containment Labs (negative pressure, BSL3 & BSL4)	1
Quarantining/Isolating Laboratory Biosafety Accidents	1
Relocating High-Containment Labs (negative pressure, BSL3 & BSL4)	1
Reporting/Communicating Laboratory Biosafety Accidents	1
Reporting/Communicating Laboratory Biosafety Protocols	1
Restricting Gain-of-Function Research/Genetically Engineered Pathogens	1
Restricting High-Containment Labs (negative pressure, BSL3 & BSL4)	1
Restricting Live Food Markets (Wet Markets)	1
Restricting Political Ideologies	1
Standardizing Biosafety Training/Certification	1
Standardizing High-Containment Labs (negative pressure, BSL3 & BSL4)	1
Standardizing Laboratory Biosafety Protocols	1

II. If a pathogen with pandemic potential infects at least one human, preventing the pathogen from spreading into a pandemic.

a. Natural Zoonosis COVID-19 Origin Assumption

- 21 different governance actions were represented in the data across 98 comments. Most common actions involved various Monitoring and Surveillance Activities (22), followed by Investing/Resourcing activities (12). Quarantining/Isolating (9), Coordinating/Cooperating (8) and Reporting/Communicating (8) actions were also prominent.
- The scope of the above actions covered 30 different subjects, represented across 98 different comments. The distribution of topics was quite broad, with Infected Individuals and the International Community each mentioned by 10 participants. Other prominent subjects were Pathogens with Pandemic Potential (8), the General Public (including local communities) (8), Bioscience Research (6). Interestingly, Epidemic Disease Containment Methods were only mentioned by 5 participants.
- The vast majority of participants sought to increase the above actions (69/80), while 11 participants sought to implement their recommended governance actions more rapidly.
- There were 78 specific recommendations for governance, with the vast majority being offered by one or at most two participants. The one exception was Coordinating/Cooperating across the International Community (mentioned by 6 participants) and Quarantining/Isolating Infected Individuals (8, although the latter was split between those who wanted to do more of this and those who wanted to accomplish this more rapidly).

Actions

Monitoring/Surveillance	22
Investing/Resourcing	12
Quarantining/Isolating	9
Coordinating/Cooperating	8
Reporting/Communicating	8
Oversight/Enforcing Regulations/Mandating	7
Investigating	4
Assessing/Identifying	3
Conducting	3
Developing	3
Educating/Training	3
Empowering	3
Restricting	3
Screening/Detection/Testing	3
Awareness Raising	2
Banning	1
Conserving/Preserving	1
Epidemic Disease Containment Methods (General)	1
Exercising/Planning	1
Trust Building	1

Scope

Infected Individuals/People Displaying Unexpected Symptoms	10
International Community (incl. UN, WHO)	10
General Public (incl. Local Communities)	8
Pathogens with Pandemic Potential	8
Research (Bioscience, e.g. general virology)	6
Epidemic Disease Containment Methods (General)	5
General	5
Farmed/Domesticated Animals	4
Public Health Infrastructure	4
Focal Outbreaks of Emerging Viruses	3
One Health (medical, veterinary, environmental)	3
Transparency/Reporting	3
Wildlife/Human Contact	3
Areas of Likely Zoonosis	2
Ecosystems	2
Epidemiological Data	2
Live Food Markets (Wet Markets)	2
Local Government	2
New Detection/Surveillance Tools	2
Research (with Dangerous Pathogens)	2
Vaccine/Drug Development	2
Wildlife Vectors (e.g., Bats)	2

Bush Meat/Illegal Animal Trade	1
Cross-border Travel	1
Doctors/Healthcare Workers	1
Environmental Degradation (e.g., deforestation, agriculture)	1
High-Containment Labs (negative pressure, BSL3 & BSL4)	1
Lockdowns (incl. at city, country level)	1
More Rapid	1
Treatment Options (e.g., neutralizing antibodies)	1

Direction

Increased	69
More Rapid	11

Action + Scope Combination

Quarantining/Isolating Infected Individuals/People Displaying Unexpected Symptoms	8
Coordinating/Cooperating International Community (incl. UN, WHO)	6
Monitoring/Surveillance Pathogens with Pandemic Potential	4
Investing/Resourcing Research (Bioscience, e.g. general virology)	3
Monitoring/Surveillance Farmed/Domesticated Animals	3
Monitoring/Surveillance General Public (incl. Local Communities)	3
Reporting/Communicating International Community (incl. UN, WHO)	3
Conducting Research (Bioscience, e.g. general virology)	2
Investigating Pathogens with Pandemic Potential	2
Investing/Resourcing Epidemic Disease Containment Methods (General)	2
Monitoring/Surveillance General	2
Monitoring/Surveillance One Health (medical, veterinary, environmental)	2
Monitoring/Surveillance Wildlife Vectors (e.g., Bats)	2
Oversight/Enforcing Regulations/Mandating Research (with Dangerous Pathogens)	2
Restricting Wildlife/Human Contact	2
[Blank]Vaccine/Drug Development	1
Assessing/Identifying Epidemic Disease Containment Methods (General)	1
Assessing/Identifying Focal Outbreaks of Emerging Viruses	1
Assessing/Identifying Pathogens with Pandemic Potential	1
Awareness Raising Ecosystems	1
Awareness Raising Wildlife/Human Contact	1
Banning Live Food Markets (Wet Markets)	1
Conducting Transparency/Reporting	1
Conserving/Preserving Ecosystems	1
Coordinating/Cooperating Epidemic Disease Containment Methods (General)	1
Coordinating/Cooperating Transparency/Reporting	1
Developing New Detection/Surveillance Tools	1
Developing Public Health Infrastructure	1
Developing Treatment Options (e.g., neutralizing antibodies)	1
Educating/Training Farmed/Domesticated Animals	1
Educating/Training High-Containment Labs (negative pressure, BSL3 & BSL4)	1

Educating/Training Local Government	1
Empowering General Public (incl. Local Communities)	1
Empowering International Community (incl. UN, WHO)	1
Empowering Public Health Infrastructure	1
Epidemic Disease Containment Methods (General)More Rapid	1
Exercising/Planning Lockdowns (incl. at city, country level)	1
Investigating Epidemiological Data	1
Investigating Focal Outbreaks of Emerging Viruses	1
Investing/Resourcing Areas of Likely Zoonosis	1
Investing/Resourcing General Public (incl. Local Communities)	1
Investing/Resourcing Local Government	1
Investing/Resourcing New Detection/Surveillance Tools	1
Investing/Resourcing One Health (medical, veterinary, environmental)	1
Investing/Resourcing Public Health Infrastructure	1
Investing/Resourcing Vaccine/Drug Development	1
Monitoring/Surveillance Bush Meat/Illegal Animal Trade	1
Monitoring/Surveillance Cross-border Travel	1
Monitoring/Surveillance Focal Outbreaks of Emerging Viruses	1
Monitoring/Surveillance Infected Individuals/People Displaying Unexpected Symptoms	1
Monitoring/Surveillance Live Food Markets (Wet Markets)	1
Monitoring/Surveillance Public Health Infrastructure	1
Oversight/Enforcing Regulations/Mandating Areas of Likely Zoonosis	1
Oversight/Enforcing Regulations/Mandating Epidemic Disease Containment Methods (General)	1
Oversight/Enforcing Regulations/Mandating General	1
Oversight/Enforcing Regulations/Mandating General Public (incl. Local Communities)	1
Oversight/Enforcing Regulations/Mandating Transparency/Reporting	1
Quarantining/Isolating General	1
Reporting/Communicating Doctors/Healthcare Workers	1
Reporting/Communicating Epidemiological Data	1
Reporting/Communicating General Public (incl. Local Communities)	1
Reporting/Communicating Infected Individuals/People Displaying Unexpected Symptoms	1
Reporting/Communicating Research (Bioscience, e.g. general virology)	1
Restricting Environmental Degradation (e.g., deforestation, agriculture)	1
Screening/Detection/Testing	1
Screening/Detection/Testing General	1
Screening/Detection/Testing Pathogens with Pandemic Potential	1
Trust Building General Public (incl. Local Communities)	1

b. Research-Related Incident COVID-19 Assumption

- 24 different governance actions were represented in the data across 119 comments. The most common action involved Oversight/Enforcing Regulations/Mandating (35 participants), followed by Quarantining/ Isolating (10) and Reporting/Communicating (10). Other somewhat frequent actions were: Monitoring/ Surveillance (9), Assessing/Identifying (9) and Standardizing (9).
- The scope of the above actions covered 25 different subjects, represented across 125 different comments. The most common subjects of the above actions were Laboratory Biosafety Protocols (20 participants), Research with Dangerous Pathogens (13 participants) and Transparency/Reporting (10). Several other subjects received multiple mentions, including: Infected Individuals (8); International Community (7); Lab Worker Health (7); Laboratory Biosafety Accidents (7); High-Containment Labs (8) and general Epidemic Disease Containment Methods (6).
- While the vast majority of participants (87/105) sought to increase the above actions/governance measures, there were 8 who sought only to sustain existing levels and 10 that sought to implement the governance measures more rapidly.
- There were 95 different specific recommendations for governance, with only a handful suggested by more than 3 participants. These include: general improvements in laboratory Biosafety Protocols (5), increasing Oversight of these Protocols (7) and increasing Oversight of Research with Dangerous Pathogens (8).
- This question placed more emphasis than the previous one on Assessing/Identifying either various features of an outbreak or the risk of various activities.

Actions

Oversight/Enforcing Regulations/Mandating	40
Quarantining/Isolating	10
Reporting/Communicating	10
Assessing/Identifying	9
Monitoring/Surveillance	9
Standardizing	9
Assessing Risk	4
Coordinating/Cooperating	4
Restricting	4
Educating/Training	3
Conducting	2
Holding Accountable	2
Investigating	2
Investing/Resourcing	2
Biosafety Training/Certification	1
Conserving/Preserving	1
Developing	1
Empowering	1
Exercising/Planning	1
Forensic Auditing	1
Laboratory Biosafety Accidents	1
Laboratory Biosecurity Protocols	1
Screening/Detection/Testing	1

Scope

Laboratory Biosafety Protocols	20
Research (with Dangerous Pathogens)	13
Transparency/Reporting	10
General	8
High-Containment Labs (negative pressure, BSL3 & BSL4)	8
Infected Individuals/People Displaying Unexpected Symptoms	8
International Community (incl. UN, WHO)	7
Lab Worker Health	7
Laboratory Biosafety Accidents	7
Epidemic Disease Containment Methods (General)	6
Pathogens with Pandemic Potential	4
Research (Bioscience, e.g. general virology)	4
Gain-of-Function Research/Genetically Engineered Pathogens	3
Increased	3
Laboratory Biosecurity Protocols	3
Public Health Infrastructure	3
General Public (incl. Local Communities)	2
Vaccine/Drug Dissemination	2
Biosafety Training/Certification	1
Cross-border Travel	1
Doctors/Healthcare Workers	1
Focal Outbreaks of Emerging Viruses	1
Lockdowns (incl. at city, country level)	1
Scientific Ethics/Responsible Conduct	1
US-sponsored Dual-Use Research in Other Countries	1

Direction

Increased	87
More Rapid	10
Sustained	8

Action + Scope Combination

Oversight/Enforcing Regulations/Mandating Laboratory Biosafety Protocols	8
Oversight/Enforcing Regulations/Mandating Research (with Dangerous Pathogens)	8
Quarantining/Isolating Infected Individuals/People Displaying Unexpected Symptoms	6
Laboratory Biosafety Protocols	5
Oversight/Enforcing Regulations/Mandating High-Containment Labs (negative pressure, BSL3 & BSL4)	4
Assessing/Identifying Laboratory Biosafety Protocols	3
Coordinating/Cooperating International Community (incl. UN, WHO)	3
Oversight/Enforcing Regulations/Mandating General	3
Oversight/Enforcing Regulations/Mandating Transparency/Reporting	3
Reporting/Communicating Transparency/Reporting	3
Educating/Training Lab Worker Health	2
Investigating Laboratory Biosafety Accidents	2

Monitoring/Surveillance General	2
Monitoring/Surveillance Lab Worker Health	2
Oversight/Enforcing Regulations/Mandating International Community (incl. UN, WHO)	2
Oversight/Enforcing Regulations/Mandating Laboratory Biosecurity Protocols	2
Reporting/Communicating Research (with Dangerous Pathogens)	2
Standardizing Laboratory Biosafety Protocols	2
Assessing/Identifying Epidemic Disease Containment Methods (General)	1
Assessing/Identifying Focal Outbreaks of Emerging Viruses	1
Assessing/Identifying General	1
Assessing/Identifying Infected Individuals/People Displaying Unexpected Symptoms	1
Assessing/Identifying Lab Worker Health	1
Assessing/Identifying Pathogens with Pandemic Potential	1
Assessing Risk Gain-of-Function Research/Genetically Engineered Pathogens	1
Assessing Risk General	1
Assessing Risk Public Health Infrastructure	1
Assessing Risk Research (with Dangerous Pathogens)	1
Biosafety Training/Certification Increased	1
Conducting Research (with Dangerous Pathogens)	1
Conducting Vaccine/Drug Dissemination	1
Conserving/Preserving Research (Bioscience, e.g. general virology)	1
Coordinating/Cooperating Transparency/Reporting	1
Developing Laboratory Biosafety Protocols	1
Educating/Training High-Containment Labs (negative pressure, BSL3 & BSL4)	1
Empowering Public Health Infrastructure	1
Exercising/Planning Epidemic Disease Containment Methods (General)	1
Forensic Auditing Laboratory Biosafety Accidents	1
Holding Accountable Epidemic Disease Containment Methods (General)	1
Holding Accountable Transparency/Reporting	1
Investing/Resourcing Epidemic Disease Containment Methods (General)	1
Investing/Resourcing Public Health Infrastructure	1
Laboratory Biosafety Accidents Increased	1
Laboratory Biosecurity Protocols Increased	1
Monitoring/Surveillance High-Containment Labs (negative pressure, BSL3 & BSL4)	1
Monitoring/Surveillance Infected Individuals/People Displaying Unexpected Symptoms	1
Monitoring/Surveillance Laboratory Biosafety Accidents	1
Monitoring/Surveillance Laboratory Biosafety Protocols	1
Monitoring/Surveillance Pathogens with Pandemic Potential	1
Oversight/Enforcing Regulations/Mandating Doctors/Healthcare Workers	1
Oversight/Enforcing Regulations/Mandating Gain-of-Function Research/Genetically Engineered Pathogens	1
Oversight/Enforcing Regulations/Mandating General Public (incl. Local Communities)	1
Oversight/Enforcing Regulations/Mandating Lab Worker Health	1
Oversight/Enforcing Regulations/Mandating Laboratory Biosafety Accidents	1
Oversight/Enforcing Regulations/Mandating Lockdowns (incl. at city, country level)	1
Oversight/Enforcing Regulations/Mandating Research (Bioscience, e.g. general virology)	1
Oversight/Enforcing Regulations/Mandating Scientific Ethics/Responsible Conduct	1
Oversight/Enforcing Regulations/Mandating US-sponsored Dual-Use Research in Other Countries	1

Oversight/Enforcing Regulations/Mandating Vaccine/Drug Dissemination	1
Quarantining/Isolating Epidemic Disease Containment Methods (General)	1
Quarantining/Isolating General	1
Quarantining/Isolating Lab Worker Health	1
Quarantining/Isolating Laboratory Biosafety Accidents	1
Reporting/Communicating General Public (incl. Local Communities)	1
Reporting/Communicating International Community (incl. UN, WHO)	1
Reporting/Communicating Laboratory Biosafety Accidents	1
Reporting/Communicating Pathogens with Pandemic Potential	1
Reporting/Communicating Research (Bioscience, e.g. general virology)	1
Restricting Cross-border Travel	1
Restricting Gain-of-Function Research/Genetically Engineered Pathogens	1
Restricting High-Containment Labs (negative pressure, BSL3 & BSL4)	1
Restricting Research (with Dangerous Pathogens)	1
Screening/Detection/Testing Pathogens with Pandemic Potential	1
Standardizin gBiosafety Training/Certification	1
Standardizing Epidemic Disease Containment Methods (General)	1
Standardizing High-Containment Labs (negative pressure, BSL3 & BSL4)	1
Standardizing International Community (incl. UN, WHO)	1
Standardizing Laboratory Biosecurity Protocols	1
Standardizing Research (Bioscience, e.g. general virology)	1
Standardizing Transparency/Reporting	1
Transparency/Reporting	1

III. If the event becomes a pandemic, mitigating the overall harms.

a. Natural Zoonosis COVID-19 Origin Assumption

- 17 different governance actions were represented in the data across 74 comments. The most prominent actions were Coordinating/Cooperating (11 participants) and various Monitoring and Surveillance Activities (10), followed by Reporting/Communicating (8) and Investing/Resourcing activities (8).
- The scope of the above actions covered 31 different subjects, represented across 76 different comments. The most frequent subjects fell under the rubric of "Epidemic Disease Containment Methods" (11 participants), with the next most frequent being various mentions of activities involving the International Community (6), and Vaccine/Drug Development, Manufacturing and Dissemination (5,1, and 4 participants respectively).
- As with most of the other questions, the vast majority of participants sought to increase the above actions (44/61), while 11 participants sought to implement their recommended governance actions more rapidly and 4 sought to sustain existing actions.
- There were 66 specific recommendations for governance under this question, with only a single specific recommendation being repeated 4 times, and none more than that. There were 4 participants who mentioned Reporting/Communicating Epidemiological Data as a recommendation.

Actions

Coordinating/Cooperating	11
Monitoring/Surveillance	10
Investing/Resourcing	8
Reporting/Communicating	8
Oversight/Enforcing Regulations/Mandating	7
Conducting	6
Developing	6
Restricting	4
Assessing/Identifying	2
Awareness Raising	2
Conserving/Preserving	2
Educating/Training	2
Exercising/Planning	2
Quarantining/Isolating	2
Empowering	1
Making Equitable	1

Scope

Epidemic Disease Containment Methods (General)	11
International Community (incl. UN, WHO)	6
Vaccine/Drug Development	5
Epidemiological Data	4
General	4
General Public (incl. Local Communities)	4
Vaccine/Drug Dissemination	4
Cross-border Travel	3
Ecosystems	3
Research (Bioscience, e.g. general virology)	3
Transparency/Reporting	3
Farmed/Domesticated Animals	2
Lockdowns (incl. at city, country level)	2
Political Ideologies	2
Public Health Infrastructure	2
Treatment Options (e.g., neutralizing antibodies)	2
Wildlife/Human Contact	2
Areas of Likely Zoonosis	1
Biosafety Training/Certification	1
Bush Meat/Illegal Animal Trade	1
Doctors/Healthcare Workers	1
Infected Individuals/People Displaying Unexpected Symptoms	1
Laboratory Biosafety Protocols	1
Live Food Markets (Wet Markets)	1
New Detection/Surveillance Tools	1
One Health (medical, veterinary, environmental)	1
Other Diseases	1

Pathogens with Pandemic Potential	1
Preparedness Resources	1
Vaccine/Drug Manufacturing	1
Wildlife Vectors (e.g., Bats)	1

Direction

Increased	44
More Rapid	11
Sustained	4
Decreased	2

Action + Scope Combination

Reporting/Communicating Epidemiological Data	4
Coordinating/Cooperating Epidemic Disease Containment Methods (General)	3
Coordinating/Cooperating International Community (incl. UN, WHO)	3
Developing Epidemic Disease Containment Methods (General)	3
Assessing/Identifying Epidemic Disease Containment Methods (General)	2
Conducting Research (Bioscience, e.g. general virology)	2
Conducting Vaccine/Drug Development	2
Conserving/Preserving Ecosystems	2
Coordinating/Cooperating Transparency/Reporting	2
Coordinating/Cooperating Vaccine/Drug Development	2
Exercising/Planning Lockdowns (incl. at city, country level)	2
Monitoring/Surveillance Farmed/Domesticated Animals	2
Monitoring/Surveillance General	2
Reporting/Communicating International Community (incl. UN, WHO)	2
Restricting Cross-border Travel	2
Restricting Political Ideologies	2
Epidemic Disease Containment Methods (General)	1
Awareness Raising Ecosystems	1
Awareness Raising General Public (incl. Local Communities)	1
Conducting Vaccine/Drug Dissemination	1
Conducting Vaccine/Drug Manufacturing	1
Coordinating/Cooperating One Health (medical, veterinary, environmental)	1
Developing Preparedness Resources	1
Developing Treatment Options (e.g., neutralizing antibodies)	1
Developing Vaccine/Drug Dissemination	1
Educating/Training General Public (incl. Local Communities)	1
Educating/Training Wildlife/Human Contact	1
Empowering Public Health Infrastructure	1
Epidemic Disease Containment Methods (General)	1
Investing/Resourcing	1
Investing/Resourcing Doctors/Healthcare Workers	1
Investing/Resourcing Epidemic Disease Containment Methods (General)	1
Investing/Resourcing New Detection/Surveillance Tools	1
Investing/Resourcing Public Health Infrastructure	1

Investing/Resourcing Research (Bioscience, e.g. general virology)	1
Investing/Resourcing Treatment Options (e.g., neutralizing antibodies)	1
Investing/Resourcing Vaccine/Drug Dissemination	1
Laboratory Biosafety Protocols	1
Making Equitable Vaccine/Drug Dissemination	1
Monitoring/Surveillance Cross-border Travel	1
Monitoring/Surveillance General Public (incl. Local Communities)	1
Monitoring/Surveillance Live Food Markets (Wet Markets)	1
Monitoring/Surveillance Other Diseases	1
Monitoring/Surveillance Pathogens with Pandemic Potential	1
Monitoring/Surveillance Wildlife Vectors (e.g., Bats)	1
Oversight/Enforcing Regulations/Mandating Areas of Likely Zoonosis	1
Oversight/Enforcing Regulations/Mandating Biosafety Training/Certification	1
Oversight/Enforcing Regulations/Mandating Bush Meat/Illegal Animal Trade	1
Oversight/Enforcing Regulations/Mandating General	1
Oversight/Enforcing Regulations/Mandating International Community (incl. UN, WHO)	1
Oversight/Enforcing Regulations/Mandating Transparency/Reporting	1
Oversight/Enforcing Regulations/Mandating Wildlife/Human Contact	1
Quarantining/Isolating General	1
Quarantining/Isolating Infected Individuals/People Displaying Unexpected Symptoms	1
Reporting/Communicating General Public (incl. Local Communities)	1
Reporting/Communicating Vaccine/Drug Development	1

b. Research-Related Incident COVID-19 Assumption

- 22 different governance actions were represented in the data across 90 comments. The most common action involved Oversight/Enforcing Regulations/Mandating (19 participants), followed by Reporting/ Communicating (15). Interestingly, Quarantining/Isolating was not nearly as prominently featured (only mentioned by four participants) as in the previous question. Other somewhat frequent actions were: Monitoring/Surveillance (7), Coordinating/Cooperating (7) and Restricting (7).
- The scope of the above actions covered 29 different subjects, represented across 98 different comments. None of the subjects was mentioned by 10 or more participants, with the most frequently mentioned being: Epidemic Disease Containment Methods (8), the International Community (8) and Laboratory Biosafety Protocols (8 participants); altogether research of various types was the subject of governance in 11 comments.
- While the vast majority of participants (65/83) sought to increase the above actions/governance measures, there were 8 who sought only to sustain existing levels and 10 that sought to implement the governance measures more rapidly.
- There were 79 different specific recommendations for governance, with only a handful suggested by more than 3 participants. These include increasing Cooperation/Coordination across the international Community, increasing Oversight/Enforcing Regulations/Mandating with respect to Laboratory Biosafety Protocols (5), and increasing Oversight/Enforcing Regulations/Mandating of research with Dangerous Pathogens (4).
- There were also multiple recommendations referring to improving Reporting and Communications with respect to various subjects (15).

Actions

Oversight/Enforcing Regulations/Mandating	21
Reporting/Communicating	15
Coordinating/Cooperating	7
Monitoring/Surveillance	7
Restricting	7
Developing	5
Quarantining/Isolating	4
Investing/Resourcing	3
Making Equitable	3
Assessing/Identifying	2
Assessing Risk	2
Conducting	2
Exercising/Planning	2
Forensic Auditing	2
Investigating	2
Awareness Raising	1
Conserving/Preserving	1
Empowering	1
Holding Accountable	1
Standardizing	1
Trust Building	1

Scope

Epidemic Disease Containment Methods (General)	8
General	8
International Community (incl. UN, WHO)	8
Laboratory Biosafety Protocols	8
General Public (incl. Local Communities)	6
Research (Bioscience, e.g. general virology)	6
High-Containment Labs (negative pressure, BSL3 & BSL4)	5
Infected Individuals/People Displaying Unexpected Symptoms	5
Research (with Dangerous Pathogens)	5
Laboratory Biosafety Accidents	4
Laboratory Biosecurity Protocols	4
Cross-border Travel	3
Epidemiological Data	3
Public Health Infrastructure	3
Gain-of-Function Research/Genetically Engineered Pathogens	2
Intl. Committee/Task Force	2
Lockdowns (incl. at city, country level)	2
Political Ideologies	2
Transparency/Reporting	2
Treatment Options (e.g., neutralizing antibodies)	2
Vaccine/Drug Dissemination	2

Biosafety Training/Certification	1
Doctors/Healthcare Workers	1
Focal Outbreaks of Emerging Viruses	1
Lab Worker Health	1
Pathogens with Pandemic Potential	1
Preparedness Resources	1
US-sponsored Dual-Use Research in Other Countries	1
Vaccine/Drug Development	1

Direction

Increased	65
More Rapid	10
Sustained	8

Action + Scope Combination

Coordinating/Cooperating International Community (incl. UN, WHO)	5
Oversight/Enforcing Regulations/Mandating Laboratory Biosafety Protocols	5
Epidemic Disease Containment Methods (General)	4
Oversight/Enforcing Regulations/Mandating Research (with Dangerous Pathogens)	4
Reporting/Communicating General Public (incl. Local Communities)	4
Monitoring/Surveillance General	3
Oversight/Enforcing Regulations/Mandating High-Containment Labs (negative pressure, BSL3 & BSL4)	3
Quarantining/Isolating Infected Individuals/People Displaying Unexpected Symptoms	3
Restricting Cross-border Travel	3
Exercising/Planning Lockdowns (incl. at city, country level)	2
Reporting/Communicating Epidemiological Data	2
Reporting/Communicating General	2
Reporting/Communicating International Community (incl. UN, WHO)	2
Restricting Political Ideologies	2
Assessing/Identifying Epidemic Disease Containment Methods (General)	1
Assessing/Identifying Focal Outbreaks of Emerging Viruses	1
Assessing Risk General	1
Assessing Risk Laboratory Biosafety Accidents	1
Awareness Raising General Public (incl. Local Communities)	1
Conducting Epidemic Disease Containment Methods (General)	1
Conducting Research (Bioscience, e.g. general virology)	1
Conserving/Preserving Research (Bioscience, e.g. general virology)	1
Coordinating/Cooperating Epidemic Disease Containment Methods (General)	1
Coordinating/Cooperating Research (Bioscience, e.g. general virology)	1
Developing Epidemic Disease Containment Methods (General)	1
Developing Intl. Committee/Task Force	1
Developing Preparedness Resources	1
Developing Public Health Infrastructure	1
Developing Treatment Options (e.g., neutralizing antibodies)	1
Empowering Public Health Infrastructure	1

Forensic Auditing Laboratory Biosafety Accidents	1
Forensic Auditing Laboratory Biosecurity Protocols	1
Holding Accountable High-Containment Labs (negative pressure, BSL3 & BSL4)	1
Investigating Epidemiological Data	1
Investigating Intl. Committee/Task Force	1
Investing/Resourcing Laboratory Biosafety Protocols	1
Investing/Resourcing Public Health Infrastructure	1
Investing/Resourcing Research (Bioscience, e.g. general virology)	1
Laboratory Biosafety Protocols	1
Laboratory Biosecurity Protocols	1
Making Equitable Treatment Options (e.g., neutralizing antibodies)	1
Making Equitable Vaccine/Drug Development	1
Making Equitable Vaccine/Drug Dissemination	1
Monitoring/Surveillance Infected Individuals/People Displaying Unexpected Symptoms	1
Monitoring/Surveillance Laboratory Biosafety Accidents	1
Monitoring/Surveillance Laboratory Biosafety Protocols	1
Monitoring/Surveillance Pathogens with Pandemic Potential	1
Oversight/Enforcing Regulations/Mandating Doctors/Healthcare Workers	1
Oversight/Enforcing Regulations/Mandating Gain-of-Function Research/Genetically Engineered Pathogens	1
Oversight/Enforcing Regulations/Mandating General	1
Oversight/Enforcing Regulations/Mandating International Community (incl. UN, WHO)	1
Oversight/Enforcing Regulations/Mandating Lab Worker Health	1
Oversight/Enforcing Regulations/Mandating Laboratory Biosecurity Protocols	1
Oversight/Enforcing Regulations/Mandating Research (Bioscience, e.g. general virology)	1
Oversight/Enforcing Regulations/Mandating Transparency/Reporting	1
Oversight/Enforcing Regulations/Mandating US-sponsored Dual-Use Research in Other Countries	1
Quarantining/Isolating General	1
Reporting/Communicating Infected Individuals/People Displaying Unexpected Symptoms	1
Reporting/Communicating Laboratory Biosafety Accidents	1
Reporting/Communicating Laboratory Biosecurity Protocols	1
Reporting/Communicating Research (Bioscience, e.g. general virology)	1
Reporting/Communicating Research (with Dangerous Pathogens)	1
Restricting Gain-of-Function Research/Genetically Engineered Pathogens	1
Restricting High-Containment Labs (negative pressure, BSL3 & BSL4)	1
Standardizing Biosafety Training/Certification	1
Transparency/Reporting	1
Trust Building General Public (incl. Local Communities)	1
Vaccine/Drug Dissemination	1

Open-Ended Comments Analysis Procedures and Results

1. The analysis of the 83 open-ended comments was thematic in nature, with an initial step consisting of reviewing each response and identifying the theme(s) expressed in that response.
2. Each new theme identified was given a preliminary descriptive label and added to the list of existing themes. If a given response contained an already listed theme, it was denoted as containing that theme.
3. Using this method, 24 preliminary themes were identified, and each qualitative response annotated with the themes it represented.
4. Upon review of the 24 themes, it was determined that three pairs among the preliminary themes were sufficiently similar that they could be combined into an overarching theme, which left 21 distinct themes.
5. Each preliminary theme label was then refined to provide a clear exposition of the relevant theme and the frequency with which each theme appeared was determined. Table E1 below presents the refined theme label, the frequency with which that theme appeared in the open-ended comments (which corresponds to the number of respondents whose comments reflected that theme), and the theme number, which represents the order in which the theme was identified during the above process.

Table E1. Themes Represented in Open-Ended Respondent Comments

Theme Number	Refined Theme Label	Frequency
1	There should be enhanced controls (in terms of biosafety and/or biosecurity) when handling dangerous pathogens in research or other facilities.	18
19	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.	16
13	There is a need for better surveillance and detection capabilities, both in zoonotic hotspots and research facilities.	14
5	Better communication and transparency, both between governments/researchers and with the public, will be needed during future pandemics.	13
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.	12
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.	10
11	It is time to move on from the question of COVID-19 origins, with reasons given including: that 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.	9
4	Pin-pointing the source of a pandemic is important, including thorough post-pandemic investigations.	8
2	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.	7
6	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.	7
20	Pandemic response and determining disease origins must be evidence-based and determined by scientists without political interference.	7
9	Population resistance (such as vaccine hesitancy) and leakage from even the strictest lockdowns imply that it will be difficult to improve preparedness and response to pandemics even after the example of COVID-19.	5

3	More attention should be paid to health equity during pandemics, by paying attention to the needs of vulnerable or marginalized populations.	4
7	SARS-CoV-2 was not designed or intentionally released.	3
8	It is unlikely that all countries will have either the resources or motivation to apply stricter laboratory biosafety controls. Biosafety governance varies widely across jurisdictions and facilities and there is unlikely to be a one-size-fits-all solution without a binding international treaty that sets broad standards and enforces compliance.	3
15	The COVID-19 pandemic has raised issues for biological weapons control, including the need for updating the monitoring and enforcement powers of the Biological and Toxin Weapons Convention (BWC).	3
16	It is necessary to research and develop new, broadly acting vaccines and therapeutics before the next pandemic.	3
21	We must also pay attention to the possibility of human-originating pandemics stemming from the reemergence or increased virulence of an existing human pathogen resulting from the effects of global poverty, antibiotic resistance and so forth.	2
14	There is a need for greater accountability (within countries and/or in the global community) for prevention, preparedness and response failures.	1
17	The “lab leak” theory for SARS-CoV-2 has not been adequately appreciated.	1
18	Novel treatments against pandemic disease must not be muzzled.	1
Total		147

F. Quantitative Analysis Procedures and Supplemental Tables

Procedures Employed

In order to assess the distribution of responses by participants to the specific questions on the survey, we employed several descriptive and correlative statistical procedures.

1. We report means and standard deviations for all likelihood/probability estimates provided by responses. For ordinal and categorical responses, we provide counts and row percentages to assess these distributions across respondents.
2. We focused on two key distinctions between respondents: expertise and economic status of their countries of current residence.
    a. For expertise, we leveraged primarily the expertise among respondents ascribed by Nemesys Insights at recruitment. We compared ascribed expertise against self-identified primary expertise and found consistent congruence between the two categories. Where there were differences (i.e. respondents who were ascribed as epidemiologists but viewed themselves primarily as virologists), it was usually because respondents retained substantial expertise in both areas and/or worked at the intersection of epidemiology and virology. In these cases, researchers assessed such factors as the degree of expertise self-reported and the number of years experience in each domain to determine a final coding for primary area of expertise. In most cases, the ascribed expertise was used and denoted in comparison sections of tables below.
    b. For country economic status, each of the countries where the expert resided (or in some cases had recently resided and for an extended period) was coded according to the United Nations 2023 designation of "Developed" versus "Developing"[12]. Based on this coding classification, we obtained 80 respondents (48% of sample) from developing countries, and 88 respondents (52% of sample) from developed countries. This aligns closely with our intended sampling frame of 55% from developed countries and 45% from developing countries (see Section A above).
3. To assess whether a comparison among expertise or economic status was statistically significant, we used an array of common statistical tests. For comparisons of means across two groups, we used Welch's t-test for unequal variances, as we do not expect that the variance across both categories is equal. For ordinal-level rank data, across two groups we used Wilcoxon rank sum test, and across three groups we used the Kruskal-Wallis test. For comparison of means across three groups, we used one-way ANOVA. Finally, testing for independence vs. dependence between categorical variables was conducted using chi-square tests of independence. All tests were conducted using a significance level of 0.05.
4. Finally, for tests of statistical significance across three potential origins of COVID-19 (natural zoonotic, research-related accident, and "other"), given the linear dependence of this outcome data, we do not conduct statistical analyses on the "other" category, as that category is a linear combination of the other two categories (e.g., 100-category 1-category 2). There are no additional degrees of freedom at that point.

The following tables provide the results of all of the aforementioned analyses, as referenced in the main report.

Annex Table F1. Probability of COVID-19 Origin, by Expertise**

		Ascribed Expertise			
Probability of COVID-19 Origin	Overall, N = 168[1]	Epidemiology, N = 78[1]	Other, N = 16[1]	Virology, N = 74[1]	p-value[2]
Natural Zoonotic	77.1 (26.0)	72.4 (29.4)	76.6 (25.7)	82.2 (21.3)	0.071
Research-Related Accident	21.5 (25.3)	25.3 (28.0)	23.4 (25.7)	16.9 (21.6)	0.12
Other Cause	1.4 (8.6)	2.3 (12.1)	0.0 (0.0)	0.9 (3.5)	

[1] Mean (SD)

[2] One-way analysis of means (not assuming equal variances); does not include the overall column.

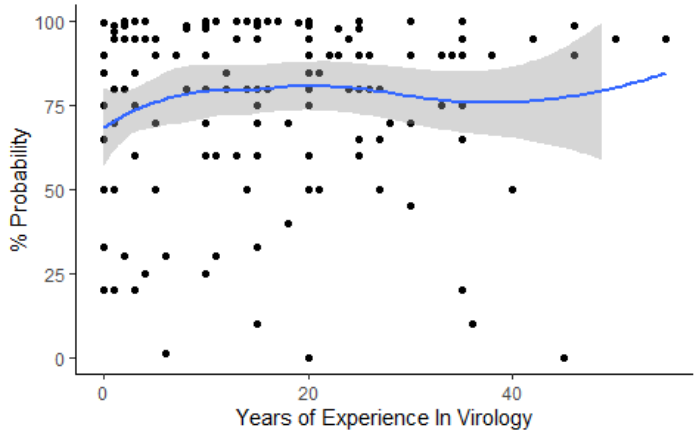
Annex Table F2. Probability of COVID-19 Origin, by Geographic Category**

Probability of COVID-19 Origin	Overall, N = 168[1]	Developing, N = 80[1]	Developed, N = 88[1]	p-value[2]
Natural Zoonotic	77.1 (26.0)	80.1 (23.1)	74.4 (28.3)	0.2
Research-Related Accident	21.5 (25.3)	19.1 (23.3)	23.6 (26.9)	0.3
Other Cause	1.4 (8.6)	0.8 (3.4)	2.0 (11.4)	

[1] Mean (SD)

[2] Welch's Unequal Variance t-test

Annex Figure F1. Probability of COVID-19 Origin, by Years of Experience in Virology**[1]



Annex Figure F2. Probability of COVID-19 Origin, by Years of Experience in Epidemiology**[2]

[1] Shaded region refers to confidence interval

[2] Shaded region refers to confidence interval

Annex Table F3. Familiarity with COVID-19 Studies and Reports, by Expertise**

		Ascribed Expertise			
Studies / Reports	Overall, N = 168[1]	Epidemiology, N = 78[1]	Other, N = 16[1]	Virology, N = 74[1]	p-value[2]
Andersen et al (2020) 'The Proximal Origins of SARS-CoV-2', Nature Medicine	92 (57%)	41 (55%)	7 (44%)	44 (61%)	0.4
Worobey et al (2022) 'The Huanan Seafood Wholesale Market in Wuhan was the early epicenter of the COVID-19 pandemic', Science	102 (63%)	48 (65%)	9 (56%)	45 (63%)	0.8
Pekar et al (2022) 'The molecular epidemiology of multiple zoonotic origins of SARS-CoV-2', Science	89 (55%)	37 (50%)	7 (44%)	45 (63%)	0.2
Joint Report: WHO-convened Global Study of Origins of SARS-CoV-2: China Part	98 (60%)	52 (70%)	12 (75%)	34 (47%)	0.008
The DEFUSE grant proposal submitted to DARPA in 2018 by EcoHealth Alliance, the University of North Carolina Chapel Hill, Duke National University Singapore, and the Wuhan Institute of Virology	36 (22%)	14 (19%)	3 (19%)	19 (26%)	0.5
The State Department fact sheet from 15th January 2021 alleging that three workers at the Wuhan Institute Virology fell ill with COVID-like symptoms in the fall of 2019	55 (34%)	24 (32%)	8 (50%)	23 (32%)	0.4
Liu et al (2023) 'Surveillance of SARS-CoV-2 at the Huanan Seafood Market', Nature	98 (60%)	49 (66%)	11 (69%)	38 (53%)	0.2
I am familiar with none of these studies	18 (11%)	8 (11%)	1 (6.3%)	9 (13%)	0.8
Fake Study (Hanlen et al, 2022)	54 (33%)	23 (31%)	8 (50%)	23 (32%)	0.3

[1] Frequency (%)

[2] Pearson's Chi-squared test

Annex Table F4. Probability of COVID-19 Origin, by Andersen et al (2020) Familiarity**

Probability of COVID-19 Origin	Overall, N = 162[1]	Not Familiar, N = 70[1]	Familiar, N = 92[1]	p-value[2]
Natural Zoonotic	77.7 (26.0)	78.1 (25.1)	77.3 (26.8)	0.8
Research-Related Accident	20.9 (25.2)	21.4 (25.2)	20.4 (25.3)	0.8
Other Cause	1.5 (8.7)	0.5 (2.5)	2.3 (11.4)	

[1] Mean (SD)

[2] Welch's Unequal Variance t-test

Annex Table F5. Probability of COVID-19 Origin, by Worobey et al (2022) Familiarity**

Probability of COVID-19 Origin	Overall, N = 162[1]	Not Familiar, N = 60[1]	Familiar, N = 102[1]	p-value[2]
Natural Zoonotic	77.7 (26.0)	78.4 (25.8)	77.2 (26.2)	0.8
Research-Related Accident	20.9 (25.2)	21.0 (26.0)	20.8 (24.8)	>0.9
Other Cause	1.5 (8.7)	0.6 (2.9)	2.0 (10.8)	

[1] Mean (SD)

[2] Welch's Unequal Variance t-test

Annex Table F6. Probability of COVID-19 Origin, by Pekar et al (2022) Familiarity**

Probability of COVID-19 Origin	Overall, N = 162[1]	Not Familiar, N = 73[1]	Familiar, N = 89[1]	p-value[2]
Natural Zoonotic	77.7 (26.0)	79.3 (22.7)	76.3 (28.4)	0.5
Research-Related Accident	20.9 (25.2)	20.2 (22.9)	21.4 (27.0)	0.8
Other Cause	1.5 (8.7)	0.5 (2.7)	2.3 (11.5)	

[1] Mean (SD)

[2] Welch's Unequal Variance t-test

Annex Table F7. Probability of COVID-19 Origin, by WHO-Convened Global Study Familiarity**

Probability of COVID-19 Origin	Overall, N = 162[1]	Not Familiar, N = 64[1]	Familiar, N = 98[1]	p-value[2]
Natural Zoonotic	77.7 (26.0)	78.7 (24.9)	77.0 (26.8)	0.7
Research-Related Accident	20.9 (25.2)	20.1 (25.3)	21.3 (25.2)	0.8
Other Cause	1.5 (8.7)	1.2 (3.8)	1.7 (10.8)	

[1] Mean (SD)

[2] Welch's Unequal Variance t-test

Annex Table F8. Probability of COVID-19 Origin, by 2018 DARPA DEFUSE Grant Proposal Familiarity**

Probability of COVID-19 Origin	Overall, N = 162[1]	Not Familiar, N = 126[1]	Familiar, N = 36[1]	p-value[2]
Natural Zoonotic	77.7 (26.0)	78.0 (25.1)	76.4 (29.3)	0.8
Research-Related Accident	20.9 (25.2)	21.1 (24.9)	20.1 (26.8)	0.8
Other Cause	1.5 (8.7)	0.9 (4.1)	3.6 (16.9)	

[1] Mean (SD)

[2] Welch's Unequal Variance t-test

Annex Table F9. Probability of COVID-19 Origin, by 2021 State Department Fact Sheet Familiarity**

Probability of COVID-19 Origin	Overall, N = 162[1]	Not Familiar, N = 107[1]	Familiar, N = 55[1]	p-value[2]
Natural Zoonotic	77.7 (26.0)	79.8 (23.5)	73.5 (30.0)	0.2
Research-Related Accident	20.9 (25.2)	19.4 (23.6)	23.6 (28.1)	0.3
Other Cause	1.5 (8.7)	0.8 (3.1)	2.9 (14.3)	

[1] Mean (SD)

[2] Welch's Unequal Variance t-test

Annex Table F10. Probability of COVID-19 Origin, by Liu et al (2023) Familiarity**

Probability of COVID-19 Origin	Overall, N = 162[1]	Not Familiar, N = 64[1]	Familiar, N = 98[1]	p-value[2]
Natural Zoonotic	77.7 (26.0)	77.5 (24.3)	77.8 (27.1)	>0.9
Research-Related Accident	20.9 (25.2)	21.9 (24.6)	20.2 (25.7)	0.7
Other Cause	1.5 (8.7)	0.7 (2.9)	2.0 (11.0)	

[1] Mean (SD)

[2] Welch's Unequal Variance t-test

Annex Table F11. Probability of COVID-19 Origin, by Familiarity with Number of Origin Studies**

Number of Studies Familiar	0, N = 24[1]	1, N = 18[1]	2, N = 22[1]	3, N = 25[1]	4, N = 17[1]	5, N = 30[1]	6, N = 9[1]	7, N = 23[1]
Natural Zoonotic	76.8 (25.3)	75.8 (25.2)	75.5 (27.0)	83.0 (22.2)	76.8 (23.6)	77.0 (25.9)	80.7 (21.2)	72.7 (35.0)

[1] Mean (SD)

Annex Table F12. Familiarity with COVID-19 Studies and Reports, by Geographic Category**

Studies / Reports	Overall, N = 168[1]	Developing, N = 80[1]	Developed, N = 88[1]	p-value[2]
Andersen et al (2020) 'The Proximal Origins of SARS-CoV-2', Nature Medicine	92 (57%)	33 (43%)	59 (69%)	0.001
Worobey et al (2022) 'The Huanan Seafood Wholesale Market in Wuhan was the early epicenter of the COVID-19 pandemic', Science	102 (63%)	38 (49%)	64 (75%)	0.001
Pekar et al (2022) 'The molecular epidemiology of multiple zoonotic origins of SARS-CoV-2', Science	89 (55%)	39 (51%)	50 (59%)	0.4
Joint Report: WHO-convened Global Study of Origins of SARS-CoV-2: China Part	98 (60%)	43 (56%)	55 (65%)	0.3
The DEFUSE grant proposal submitted to DARPA in 2018 by EcoHealth Alliance, the University of North Carolina Chapel Hill, Duke National University Singapore, and the Wuhan Institute of Virology	36 (22%)	9 (12%)	27 (32%)	0.004
The State Department fact sheet from 15th January 2021 alleging that three workers at the Wuhan Institute Virology fell ill with COVID-like symptoms in the fall of 2019	55 (34%)	17 (22%)	38 (45%)	0.004
Liu et al (2023) 'Surveillance of SARS-CoV-2 at the Huanan Seafood Market', Nature	98 (60%)	40 (52%)	58 (68%)	0.050
I am familiar with none of these studies	18 (11%)	9 (12%)	9 (11%)	>0.9
Fake Study (Hanlen et al, 2022)	54 (33%)	18 (23%)	36 (42%)	0.017

[1] Frequency (%)

[2] Two sample test for equality of proportions

Annex Table F13. Probability of COVID-19 Origin, by Familiarity with Non-Existent Study**

Probability of COVID-19 Origin	Overall, N = 168[1]	Not Familiar, N = 108[1]	Familiar, N = 54[1]	p-value[2]
Natural Zoonotic	77.7 (26.0)	77.2 (25.9)	78.6 (26.4)	0.7
Research-Related Accident	20.9 (25.2)	22.1 (26.0)	18.4 (23.6)	0.4
Other Cause	1.5 (8.7)	0.8 (3.1)	3.0 (14.5)	

[1] Mean (SD)

[2] Welch's Unequal Variance t-test

Annex Table F14. Perception of Future Investigations of COVID-19 Origin, by Expertise**

		Ascribed Expertise			
	Overall, N = 168[1]	Epidemiology, N = 78[1]	Other, N = 16[1]	Virology, N = 74[1]	p-value[2]
Future Investigations of COVID-19 Origin					0.4
No further investigation is needed	19 (12%)	9 (12%)	2 (13%)	8 (11%)	
Further investigation may be needed, but the origins have been well-studied	60 (37%)	22 (30%)	6 (38%)	32 (44%)	
Further investigation is needed because major gaps still exist in the investigations that have already been done	83 (51%)	43 (58%)	8 (50%)	32 (44%)	
Missing	6	4	0	2	

[1] Frequency (%)

[2] Kruskal-Wallis rank sum test

Annex Table F15. Perception of Future Investigations of COVID-19 Origin, by Geographic Category**

	Overall, N = 168[1]	Developing, N = 80[1]	Developed, N = 88[1]	p-value[2]
Future Investigations of COVID-19 Origin				>0.9
No further investigation is needed	19 (12%)	9 (12%)	10 (12%)	
Further investigation may be needed, but the origins have been well-studied	60 (37%)	29 (38%)	31 (36%)	
Further investigation is needed because major gaps still exist in the investigations that have already been done	83 (51%)	39 (51%)	44 (52%)	
Missing	6	3	3	

[1] Frequency (%)

[2] Wilcoxon rank sum test

Annex Table F16. Next Pandemic Assessment, by Expertise**

		Ascribed Expertise			
Next Pandemic Assessment	Overall, N = 168[1]	Epidemiology, N = 78[1]	Other, N = 16[1]	Virology, N = 74[1]	p-value[2]
Next Pandemic Origin = Natural Zoonotic					0.052
Most Likely	152 (90%)	66 (85%)	15 (94%)	71 (96%)	
Likely	15 (8.9%)	11 (14%)	1 (6.3%)	3 (4.1%)	
Least Likely	1 (0.6%)	1 (1.3%)	0 (0%)	0 (0%)	
Next Pandemic Origin = Research-Related Accident					0.010
Most Likely	14 (8.3%)	11 (14%)	1 (6.3%)	2 (2.7%)	
Likely	116 (69%)	55 (71%)	12 (75%)	49 (66%)	
Least Likely	38 (23%)	12 (15%)	3 (19%)	23 (31%)	
Next Pandemic Origin = Other Cause					0.11
Most Likely	2 (1.2%)	1 (1.3%)	0 (0%)	1 (1.4%)	
Likely	37 (22%)	12 (15%)	3 (19%)	22 (30%)	
Least Likely	129 (77%)	65 (83%)	13 (81%)	51 (69%)	
Confidence in Next Pandemic Assessment					0.074
Low-to-Moderate	2 (1.2%)	2 (2.6%)	0 (0%)	0 (0%)	
Moderate	15 (8.9%)	8 (10%)	3 (19%)	4 (5.4%)	
Moderate-to-High	72 (43%)	38 (49%)	5 (31%)	29 (39%)	
High	79 (47%)	30 (38%)	8 (50%)	41 (55%)	

[1] Frequency (%)

[2] Kruskal-Wallis rank sum test

Annex Table F17. Next Pandemic Probability, by Expertise**

		Ascribed Expertise			
Next Pandemic Prediction	Overall, N = 168[1]	Epidemiology, N = 78[1]	Other, N = 16[1]	Virology, N = 74[1]	p-value[2]
Probability = Natural Zoonotic	79 (21)	73 (24)	81 (17)	85 (16)	0.004
Probability = Research-Related Accident	14 (19)	21 (23)	14 (16)	8 (12)	<0.001
Probability = Other Cause	7 (12)	6 (11)	4 (11)	7 (12)	0.6
Confidence in Next Pandemic Probability					0.2
Low	1 (0.6%)	1 (1.3%)	0 (0%)	0 (0%)	
Low-to-Moderate	4 (2.4%)	4 (5.2%)	0 (0%)	0 (0%)	
Moderate	19 (11%)	10 (13%)	3 (19%)	6 (8.2%)	
Moderate-to-High	89 (54%)	41 (53%)	6 (38%)	42 (58%)	
High	53 (32%)	21 (27%)	7 (44%)	25 (34%)	

[1] Mean (SD); Frequency (%)

[2] One-way analysis of means (not assuming equal variances), does not include the overall column; Kruskal-Wallis rank sum test

Annex Table F18. Next Pandemic Ranking, by Economic Status**

Next Pandemic Prediction	Overall, N = 168[1]	Developing, N = 80[1]	Developed, N = 88[1]	p-value[2]
Next Pandemic Origin = Natural Zoonotic				0.7
Most Likely	152 (90%)	73 (91%)	79 (90%)	
Likely	15 (8.9%)	7 (8.8%)	8 (9.1%)	
Least Likely	1 (0.6%)	0 (0%)	1 (1.1%)	
Next Pandemic Origin = Research-Related Accident				>0.9
Most Likely	14 (8.3%)	7 (8.8%)	7 (8.0%)	
Likely	116 (69%)	55 (69%)	61 (69%)	
Least Likely	38 (23%)	18 (23%)	20 (23%)	
Next Pandemic Origin = Other Cause				0.8
Most Likely	2 (1.2%)	0 (0%)	2 (2.3%)	
Likely	37 (22%)	18 (23%)	19 (22%)	
Least Likely	129 (77%)	62 (78%)	67 (76%)	
Confidence in Next Pandemic Assessment				0.8
Low-to-Moderate	2 (1.2%)	0 (0%)	2 (2.3%)	
Moderate	15 (8.9%)	5 (6.3%)	10 (11%)	
Moderate-to-High	72 (43%)	40 (50%)	32 (36%)	
High	79 (47%)	35 (44%)	44 (50%)	

[1] Frequency (%)

[2] Wilcoxon rank sum test

Annex Table F19. Next Pandemic Probability, by Geographic Category**

Next Pandemic Prediction	Overall, N = 168[1]	Developing, N = 80[1]	Developed, N = 88[1]	p-value[2]
Probability = Natural Zoonotic	79 (21)	77 (22)	81 (20)	0.2
Probability = Research-Related Accident	14 (19)	17 (20)	13 (18)	0.2
Probability = Other Cause	7 (12)	7 (11)	6 (12)	>0.9
Confidence in Next Pandemic Probability				>0.9
Low	1 (0.6%)	1 (1.3%)	0 (0%)	
Low-to-Moderate	4 (2.4%)	0 (0%)	4 (4.6%)	
Moderate	19 (11%)	7 (8.9%)	12 (14%)	
Moderate-to-High	89 (54%)	49 (62%)	40 (46%)	
High	53 (32%)	22 (28%)	31 (36%)	

[1] Mean (SD); Frequency (%)

[2] One-way analysis of means (not assuming equal variances), does not include the overall column; Wilcoxon rank sum test

Annex Table F20. Shift in Certainty for Next Pandemic if Natural Zoonotic Origin is Confirmed, by Expertise**

		Ascribed Expertise			
Change in Next Pandemic Assessment	Overall, N = 168[1]	Epidemiology, N = 78[1]	Other, N = 16[1]	Virology, N = 74[1]	p-value[2]
Natural Zoonotic Origin is now...					0.8
Much more unlikely	9 (5.6%)	5 (6.9%)	1 (6.3%)	3 (4.2%)	
More unlikely	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
No change	94 (59%)	38 (53%)	11 (69%)	45 (63%)	
More likely	27 (17%)	18 (25%)	1 (6.3%)	8 (11%)	
Much more likely	30 (19%)	11 (15%)	3 (19%)	16 (22%)	
Missing	8	6	0	2	
Research-Related Accident Origin is now...					0.5
Much more unlikely	26 (16%)	13 (18%)	1 (6.3%)	12 (17%)	
More unlikely	26 (16%)	11 (15%)	3 (19%)	12 (17%)	
No change	93 (58%)	41 (56%)	9 (56%)	43 (60%)	
More likely	12 (7.5%)	5 (6.8%)	3 (19%)	4 (5.6%)	
Much more likely	4 (2.5%)	3 (4.1%)	0 (0%)	1 (1.4%)	
Missing	7	5	0	2	
Other Origin is now...					0.6
Much more unlikely	7 (8.9%)	5 (13%)	0 (0%)	2 (5.7%)	
More unlikely	4 (5.1%)	1 (2.6%)	0 (0%)	3 (8.6%)	
No change	60 (76%)	28 (74%)	5 (83%)	27 (77%)	
More likely	7 (8.9%)	3 (7.9%)	1 (17%)	3 (8.6%)	
Much more likely	1 (1.3%)	1 (2.6%)	0 (0%)	0 (0%)	
Missing	89	40	10	39	

[1] Frequency (%)

[2] Kruskal-Wallis rank sum test

Annex Table F21. Shift in Certainty for Next Pandemic if Research-Related Accident Origin is Confirmed, by Expertise**

		Ascribed Expertise			
Change in Next Pandemic Assessment	Overall, N = 168[1]	Epidemiology, N = 78[1]	Other, N = 16[1]	Virology, N = 74[1]	p-value[2]
Natural Zoonotic Origin is now...					0.7
Much more unlikely	9 (5.5%)	4 (5.2%)	0 (0%)	5 (6.9%)	
More unlikely	16 (9.7%)	10 (13%)	1 (6.3%)	5 (6.9%)	
No change	104 (63%)	45 (58%)	11 (69%)	48 (67%)	
More likely	18 (11%)	10 (13%)	2 (13%)	6 (8.3%)	
Much more likely	18 (11%)	8 (10%)	2 (13%)	8 (11%)	
Missing	3	1	0	2	
Research-Related Accident Origin is now...					0.071
Much more unlikely	6 (3.6%)	3 (3.9%)	0 (0%)	3 (4.2%)	
More unlikely	12 (7.3%)	3 (3.9%)	1 (6.3%)	8 (11%)	
No change	79 (48%)	34 (44%)	10 (63%)	35 (49%)	
More likely	49 (30%)	22 (29%)	5 (31%)	22 (31%)	
Much more likely	19 (12%)	15 (19%)	0 (0%)	4 (5.6%)	
Missing	3	1	0	2	
Other Origin is now...					0.2
Much more unlikely	6 (7.7%)	3 (8.1%)	0 (0%)	3 (8.8%)	
More unlikely	5 (6.4%)	2 (5.4%)	0 (0%)	3 (8.8%)	
No change	59 (76%)	29 (78%)	5 (71%)	25 (74%)	
More likely	6 (7.7%)	2 (5.4%)	2 (29%)	2 (5.9%)	
Much more likely	2 (2.6%)	1 (2.7%)	0 (0%)	1 (2.9%)	
Missing	90	41	9	40	

[1] Frequency (%)

[2] Kruskal-Wallis rank sum test

Annex Table F22. Shift in Certainty for Next Pandemic if Natural Zoonotic Origin is Confirmed, by Geographic Category**

Change in Next Pandemic Assessment	Overall, N = 168[1]	Developing, N = 80[1]	Developed, N = 88[1]	p-value[2]
Natural Zoonotic Origin is now...				0.016
Much more unlikely	9 (5.6%)	7 (9.2%)	2 (2.4%)	
More unlikely	0 (0%)	0 (0%)	0 (0%)	
No change	94 (59%)	32 (42%)	62 (74%)	
More likely	27 (17%)	17 (22%)	10 (12%)	
Much more likely	30 (19%)	20 (26%)	10 (12%)	
Missing	8	4	4	
Research-Related Accident Origin is now...				0.070
Much more unlikely	26 (16%)	15 (19%)	11 (13%)	
More unlikely	26 (16%)	18 (23%)	8 (9.5%)	
No change	93 (58%)	35 (45%)	58 (69%)	
More likely	12 (7.5%)	7 (9.1%)	5 (6.0%)	
Much more likely	4 (2.5%)	2 (2.6%)	2 (2.4%)	
Missing	7	3	4	
Other Origin is now...				0.4
Much more unlikely	7 (8.9%)	4 (12%)	3 (6.7%)	
More unlikely	4 (5.1%)	1 (2.9%)	3 (6.7%)	
No change	60 (76%)	23 (68%)	37 (82%)	
More likely	7 (8.9%)	6 (18%)	1 (2.2%)	
Much more likely	1 (1.3%)	0 (0%)	1 (2.2%)	
Missing	89	46	43	

[1] Frequency (%)

[2] Wilcoxon rank sum test

Annex Table F23. Shift in Certainty for Next Pandemic if Research-Related Accident Origin is Confirmed, by Geographic Category**

Change in Next Pandemic Assessment	Overall, N = 168[1]	Developing, N = 80[1]	Developed, N = 88[1]	p-value[2]
Natural Zoonotic Origin is now...				0.3
Much more unlikely	9 (5.5%)	8 (10%)	1 (1.2%)	
More unlikely	16 (9.7%)	8 (10%)	8 (9.3%)	
No change	104 (63%)	37 (47%)	67 (78%)	
More likely	18 (11%)	16 (20%)	2 (2.3%)	
Much more likely	18 (11%)	10 (13%)	8 (9.3%)	
Missing	3	1	2	
Research-Related Accident Origin is now...				0.5
Much more unlikely	6 (3.6%)	5 (6.3%)	1 (1.2%)	
More unlikely	12 (7.3%)	9 (11%)	3 (3.5%)	
No change	79 (48%)	28 (35%)	51 (59%)	
More likely	49 (30%)	23 (29%)	26 (30%)	
Much more likely	19 (12%)	14 (18%)	5 (5.8%)	
Missing	3	1	2	
Other Origin is now...				0.8
Much more unlikely	6 (7.7%)	3 (9.1%)	3 (6.7%)	
More unlikely	5 (6.4%)	3 (9.1%)	2 (4.4%)	
No change	59 (76%)	23 (70%)	36 (80%)	
More likely	6 (7.7%)	2 (6.1%)	4 (8.9%)	
Much more likely	2 (2.6%)	2 (6.1%)	0 (0%)	
Missing	90	47	43	

[1] Frequency (%)

[2] Wilcoxon rank sum test

Annex Table F24. Shift in Governance Measures for Next Pandemic if Natural Zoonotic Origin is Confirmed, by Expertise**

		Ascribed Expertise			
Change in Governance Measures	Overall, N = 168[1]	Epidemiology, N = 78[1]	Other, N = 16[1]	Virology, N = 74[1]	p-value[2]
To Prevent Initial Infection					0.063
No change in my views on governance	88 (54%)	45 (61%)	10 (63%)	33 (46%)	
Small changes in my views on governance	21 (13%)	8 (11%)	3 (19%)	10 (14%)	
Moderate changes in my views on governance	34 (21%)	17 (23%)	2 (13%)	15 (21%)	
Substantial changes in my views on governance	19 (12%)	4 (5.4%)	1 (6.3%)	14 (19%)	
Missing	6	4	0	2	
To Prevent Spread					<0.001
No change in my views on governance	89 (55%)	50 (68%)	10 (63%)	29 (40%)	
Small changes in my views on governance	19 (12%)	7 (9.5%)	2 (13%)	10 (14%)	
Moderate changes in my views on governance	34 (21%)	14 (19%)	3 (19%)	17 (24%)	
Substantial changes in my views on governance	20 (12%)	3 (4.1%)	1 (6.3%)	16 (22%)	
Missing	6	4	0	2	
To Mitigate Harms					0.006
No change in my views on governance	93 (57%)	50 (68%)	10 (63%)	33 (46%)	
Small changes in my views on governance	12 (7.4%)	4 (5.4%)	2 (13%)	6 (8.3%)	
Moderate changes in my views on governance	31 (19%)	16 (22%)	2 (13%)	13 (18%)	
Substantial changes in my views on governance	26 (16%)	4 (5.4%)	2 (13%)	20 (28%)	
Missing	6	4	0	2	

[1] Frequency (%)

[2] Kruskal-Wallis rank sum test

Annex Table F25. Shift in Governance Measures for Next Pandemic if Natural Zoonotic Origin is Confirmed, by Geographic Category**

Change in Governance Measures	Overall, N = 168[1]	Developing, N = 80[1]	Developed, N = 88[1]	p-value[2]
To Prevent Initial Infection				<0.001
No change in my views on governance	88 (54%)	31 (40%)	57 (67%)	
Small changes in my views on governance	21 (13%)	8 (10%)	13 (15%)	
Moderate changes in my views on governance	34 (21%)	25 (32%)	9 (11%)	
Substantial changes in my views on governance	19 (12%)	13 (17%)	6 (7.1%)	
Missing	6	3	3	
To Prevent Spread				<0.001
No change in my views on governance	89 (55%)	32 (42%)	57 (67%)	
Small changes in my views on governance	19 (12%)	8 (10%)	11 (13%)	
Moderate changes in my views on governance	34 (21%)	23 (30%)	11 (13%)	
Substantial changes in my views on governance	20 (12%)	14 (18%)	6 (7.1%)	
Missing	6	3	3	
To Mitigate Harms				0.005
No change in my views on governance	93 (57%)	34 (44%)	59 (69%)	
Small changes in my views on governance	12 (7.4%)	7 (9.1%)	5 (5.9%)	
Moderate changes in my views on governance	31 (19%)	23 (30%)	8 (9.4%)	
Substantial changes in my views on governance	26 (16%)	13 (17%)	13 (15%)	
Missing	6	3	3	

[1] Frequency (%)

[2] Wilcoxon rank sum test

Annex Table F26. Shift in Governance Measures for Next Pandemic if Research-Related Accident Origin is Confirmed, by Expertise**

		Ascribed Expertise			
Change in Governance Measures	Overall, N = 168[1]	Epidemiology, N = 78[1]	Other, N = 16[1]	Virology, N = 74[1]	p-value[2]
To Prevent Initial Infection					0.8
No change in my views on governance	43 (26%)	27 (36%)	5 (31%)	11 (15%)	
Small changes in my views on governance	34 (21%)	8 (11%)	2 (13%)	24 (33%)	
Moderate changes in my views on governance	43 (26%)	17 (22%)	6 (38%)	20 (28%)	
Substantial changes in my views on governance	44 (27%)	24 (32%)	3 (19%)	17 (24%)	
Unknown	4	2	0	2	
To Prevent Spread					0.6
No change in my views on governance	55 (34%)	29 (38%)	7 (44%)	19 (26%)	
Small changes in my views on governance	32 (20%)	11 (14%)	2 (13%)	19 (26%)	
Moderate changes in my views on governance	40 (24%)	17 (22%)	5 (31%)	18 (25%)	
Substantial changes in my views on governance	37 (23%)	19 (25%)	2 (13%)	16 (22%)	
Unknown	4	2	0	2	
To Mitigate Harms					0.2
No change in my views on governance	75 (46%)	40 (53%)	7 (44%)	28 (39%)	
Small changes in my views on governance	22 (13%)	10 (13%)	1 (6.3%)	11 (15%)	
Moderate changes in my views on governance	30 (18%)	12 (16%)	4 (25%)	14 (19%)	
Substantial changes in my views on governance	37 (23%)	14 (18%)	4 (25%)	19 (26%)	
Unknown	4	2	0	2	

[1] Frequency (%)

[2] Kruskal-Wallis rank sum test

Annex Table F27. Shift in Governance Measures for Next Pandemic if Research-Related Accident Origin is Confirmed, by Geographic Category**

Change in Governance Measures	Overall, N = 168[1]	Developing, N = 80[1]	Developed, N = 88[1]	p-value[2]
To Prevent Initial Infection				<0.001
No change in my views on governance	43 (26%)	14 (18%)	29 (34%)	
Small changes in my views on governance	34 (21%)	13 (16%)	21 (25%)	
Moderate changes in my views on governance	43 (26%)	21 (27%)	22 (26%)	
Substantial changes in my views on governance	44 (27%)	31 (39%)	13 (15%)	
Unknown	4	1	3	
To Prevent Spread				0.020
No change in my views on governance	55 (34%)	22 (28%)	33 (39%)	
Small changes in my views on governance	32 (20%)	12 (15%)	20 (24%)	
Moderate changes in my views on governance	40 (24%)	22 (28%)	18 (21%)	
Substantial changes in my views on governance	37 (23%)	23 (29%)	14 (16%)	
Unknown	4	1	3	
To Mitigate Harms				0.005
No change in my views on governance	75 (46%)	28 (35%)	47 (55%)	
Small changes in my views on governance	22 (13%)	10 (13%)	12 (14%)	
Moderate changes in my views on governance	30 (18%)	18 (23%)	12 (14%)	
Substantial changes in my views on governance	37 (23%)	23 (29%)	14 (16%)	
Unknown	4	1	3	

[1] Frequency (%)

[2] Wilcoxon rank sum test

Endnotes

1 The 57 countries excluded for being "not free" are Afghanistan, Algeria, Angola, Azerbaijan, Bahrain, Belarus, Brunei, Burkina Faso, Burundi, Cambodia, Cameroon, Central African Republic, Chad, China, Cuba, Democratic Republic of the Congo, Djibouti, Egypt, Equatorial Guinea, Eritrea, Eswatini, Ethiopia, Gabon, Guinea, Haiti, Iran, Iraq, Jordan, Kazakhstan, Kyrgyzstan, Laos, Libya, Mali, Myanmar, Nicaragua, North Korea, Oman, Qatar, Republic of the Congo, Russia, Rwanda, Saudi Arabia, Somalia, South Sudan, Sudan, Syria, Tajikistan, Thailand, Turkey, Turkmenistan, Uganda, United Arab Emirates, Uzbekistan, Venezuela, Vietnam, Yemen, and Zimbabwe. The 10 territories excluded for being "not free" are Crimea, Eastern Donbas, Gaza Strip, Indian Kashmir, Pakistani Kashmir, South Ossetia, Tibet, Transnistria, West Bank, and Western Sahara. Even if a disputed or semi-autonomous territory was classified as "free" or "partly free" by Freedom House, but one or more of the country or countries that exercise control over it or claim it is classified as "not free", out of an abundance of caution for the welfare of its inhabitants, these territories were excluded. Thus, the following territories were also excluded: Hong Kong, Nagorno-Karabakh, and Somaliland. See: ***Countries and Territories.*** Freedom House (n.d.). URL: https://freedomhouse.org/countries/freedom-world/scores; ***Freedom in the World.*** Freedom House (n.d.). URL: https://freedomhouse.org/reports/freedom-world/freedom-world-research-methodology.

2 ***Classifications.*** UNCTAD Statistics. United Nations Conference on Trade and Development (UNCTAD) (n.d.). URL: https://unctadstat.unctad.org/EN/Classifications.html.

3 These are similar but not identical to those utilized by the World Bank (***Countries and Economies.*** The World Bank (n.d.). URL: https://data.worldbank.org/country) and represent a concatenated form of the regions recognized by the United States Office of Immigration Statistics (***Geographic Regions.*** U.S. Department of Homeland Security (n.d.). URL: https://web.archive.org/web/20231216170655/https://www.dhs.gov/ohss/about-data/geographic-regions).

4 ***Geographic Regions.*** U.S. Department of Homeland Security (n.d.). URL: https://web.archive.org/web/20231216170655/https://www.dhs.gov/ohss/about-data/geographic-regions. Disputed territories recognized by Freedom House (see note 1 above) were classified by the country or countries claiming the territory. While some of the territories are near the boundaries of geographic regions, none of them were found to be claimed by countries from multiple regions.

5 ***Country Comparisons – Real GDP.*** The CIA World Factbook (2023). URL: https://www.cia.gov/the-world-factbook/field/real-gdp-purchasing-power-parity/country-comparison/.

6 ***Country Comparisons – Population.*** The CIA World Factbook (2023). URL: https://www.cia.gov/the-world-factbook/field/population/country-comparison/.

7 ***SCImago Journal & Country Rank.*** SCImago (n.d.). URL: https://www.scimagojr.com/.

8 The SCImago index also provides the raw number of publications, but this is so heavily weighted towards the top-tier countries, that it would unbalance the sample. Moreover, the ranking includes general epidemiology, rather than infectious disease epidemiology specifically, which could be a limitation of this approach.

9 This was accomplished by the simple method of subtracting the rank from the number of countries in the overall population plus one (197), to arrive at a score for each country that reflected its ranking. Countries that did not appear in the SCImago rankings were assigned a score of zero.

10 The average, rather than total score was used to account for the vastly different number of countries in each region.

11 ***World Economic Situation and Prospects 2023.*** The United Nations Department of Economic and Social Affairs. Statistical Annex, pp.115-118 (January 25, 2023). URL: https://www.un.org/development/desa/dpad/publication/world-economic-situation-and-prospects-2023/.

12 Ibid.