2021

GHS INDEX
GLOBAL **HEALTH SECURITY** INDEX

GHS INDEX **METHODOLOGY**

Prepared by Economist Impact

Index developed with

ECONOMIST IMPACT

20 YEARS OF NTI
BUILDING A SAFER WORLD

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Contents

Executive Summary

In October 2019, the first edition of the Global Health Security (GHS) Index was published. An initiative of the Nuclear Threat Initiative (NTI) and the Center for Health Security at the Johns Hopkins Bloomberg School of Public Health, with Economist Impact, the GHS Index was based on the extensive knowledge and existing understanding of what factors influenced country preparedness to prevent, detect, and respond to infectious disease threats. Only a few months later, a novel coronavirus emerged and tested the established understanding with a real-life global pandemic.

Although the world will be assessing the factors that mitigated and propelled the trajectory of the COVID-19 pandemic for years to come, the 2021 Global Health Security Index team sought to take stock of the current knowledge of what factors matter most through a combination of expert consultations, reviews of academic literature, media scans, and quantitative analysis based on the existing data sets related to COVID-19 impact as of early 2021. On the basis of these conversations and studies, the GHS Index framework has evolved to reflect our findings from the first iteration of the Index as well as what we've learned from the COVID-19 pandemic to date. As the availability of reliable global data to track the spread and impact of COVID-19 improves and additional studies are conducted, we anticipate that there will be additional information that will need to be incorporated into future editions of the Index. Although the Index has been adapted to lessons learned from this latest pandemic, the intent was to create an Index that applies to future infectious disease threats more broadly, including deliberate, accidental, and naturally occurring outbreaks.

The 2021 Global Health Security Index includes research for the same 195 countries included in the inaugural edition. Country research was conducted from August 2020 through June 2021. Economist Impact conducted the research for this Index through a combination of qualitative assessments of publicly available country information and examinations of existing quantitative data sets. Given the complex nature of global health security, Economist Impact developed a multidimensional analytical framework, commonly known as a *benchmarking index*, in order to create an objective, country-level assessment tool. A multidimensional framework is a useful way of measuring performance that cannot be directly observed, such as a country's economic competitiveness or, in this case, a country's health security conditions. Indices, in such cases, have been shown to be effective in several ways: (a) they can aggregate a wide range of related data and evaluate it in a consistent manner; (b) they can track outcomes over time; and (c) they can spur countries to improve performance, especially relative to other countries in the index. In this way, indices can be a useful tool for public policy reforms.

Indices, however, are not without their limitations. The GHS Index, as with other models, should be viewed not as a predictive measure, but as an assessment for understanding the existing capacities of countries to prevent, detect, and respond to outbreaks, whether deliberate, accidental, or naturally occurring. The actual impacts of an infectious disease threat (health, economic, social) are shaped by many factors, including political decision making, the type of disease, its mode of infection, and even random chance.

Although there are many factors that influence real-world country capacity, the GHS Index can only include factors that can be measured and that produce transparent, available data that allows them to be observed. For this specific index, Economist Impact also relied on data sources and information that was publicly available (rather than gathered through expert interviews or internal knowledge), which further limited possible data sources. This decision was made for two reasons: one, to reduce the reporting burden by individual countries and two, to incentivize countries to publicly share their capacities with the rest of the world.

Using the Global Health Security Index Model

The indicators in the 2021 Global Health Security Index are embedded in an interactive model (available as an Excel workbook at www.GHSIndex.org) that offers a wide range of analytical tools, thereby allowing a deeper investigation into measures of global health security. For example, users can filter countries by region, population, or income level, or directly compare any two countries. The model also includes data from the 2019 Global Health Security Index, allowing users to view country performance for both Index years (note: data for 2019 have been re-scored to accommodate changes made to the Index in 2021). A user can also examine correlations between indicators. Individual country profiles, which include the consulted sources and scoring justifications, are also included in the 2021 Global Health Security Index model, thus permitting a deeper dive into the health security conditions in a given country.

The GHS Index model is designed to allow the users flexibility in how they analyze the data. Although the GHS Index model relies on a neutral weighting scheme for analysis, the weights assigned to each indicator can be changed by the user to reflect different assumptions about the importance of categories and indicators.

Finally, the model allows the final scores to be benchmarked against external factors that may potentially influence global health security, such as gross domestic product (GDP) per capita, the United Nations Development Programme's (UNDP) Human Development Index, and many other relevant factors. The background indicators also include two COVID-19-specific metrics collected by the Economist Impact team: assessing if the country has made publicly available de-identified COVID-19 health surveillance data and contact tracing data.

Overview of Changes to the 2021 Index

In light of discussions and research conducted since the launch of the 2019 Global Health Security Index, the Index framework has been revised to account for new lessons and considerations for what global health security preparedness entails. The Index is meant to measure health security capacities at a national level and, while the response to the COVID-19 pandemic stressed the importance of external factors such as political and socio-economic decision making, the performance of a particular country depends on whether capacities are leveraged in preparation for and in response to a pandemic.

The 2021 Index includes a number of indicators that have been revised or added into the framework. This Index includes a total of 171 individual metrics (or questions), compared with 140 in 2019. The 2021 GHS Index includes new and revised questions on zoonotic disease spillover events, scaling testing capabilities for known and novel pathogens, financing, risk communications and misinformation, disinformation and rumors, among others.

Category 2 (Detect) was also reorganized from four indicators in 2019 to six indicators in 2021. Notably, Category 2 now includes a new indicator on contact tracing and case investigation, which had not been measured in the 2019 framework but proved to be deeply important during the COVID-19 pandemic.

A number of questions were revised to include COVID-19-sensitive scoring schemes. For example, rather than asking if a country has a particular plan or policy in place and scoring on a yes-no binary choice, the question was revised to include a middle-tier score accounting for situations in which a country might have a plan or policy in place, but only for a specific disease. In 2021, most countries that receive a middle-tier score under this scoring scheme have plans or policies in place specific to COVID-19; however, this scoring scheme also applies to countries that have specific policies in place for other pathogens such as pandemic influenza.

There are additional aspects of preparedness that have not been incorporated into the GHS Index owing to challenges with data availability or shifting understanding of what is driving preparedness. These factors will be reassessed for inclusion in future iterations of the Index, along with additional lessons from the COVID-19 pandemic.

For a full overview of the new and revised questions, please see the section "Select New and Revised Indicators" on page 25.

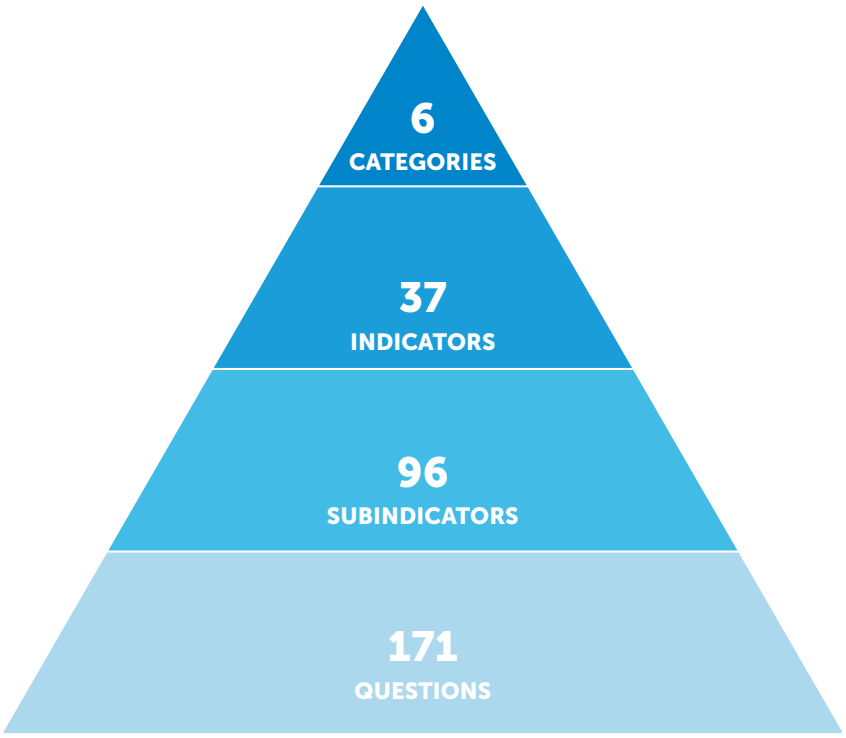
A final change of note is the approach toward the default weighting scheme. In the 2019 GHS Index, the default weighting scheme relied on expert weights, while for the 2021 GHS Index, the default weighting scheme uses neutral weights (which has also been applied to the 2019 data in the GHS Index model). The COVID-19 pandemic has changed—and is continuing to change—expert understanding of what country capabilities are most important to have to address a pandemic. The world will continue to learn the lessons from this pandemic, and expert understanding will respond. Previously, the GHS Index had given less weight to certain categories than to others; Category 4 (Health Systems) and Category 6 (Risk) have proved to be tremendously important in shaping individual country response to the COVID-19 pandemic and were given less weight previously. A best practice in index methodology development is that in the absence of certain knowledge of which factors matter most, all factors should be treated similarly. Therefore, for report analysis and final scoring, each category of the 2021 Index has been assigned equal importance (neutral weights).

Scoring Criteria and Categories

The 2021 Global Health Security Index consists of 171 questions grouped into 37 indicators across six overarching categories (*see Figure A1*). The Index includes research for 195 countries that compose the States Parties[1] to the International Health Regulations (IHR [2005]).[2]

The overall score (0–100) for each country is a weighted sum of the six categories. Each category is scored on a scale of 0 to 100, in which 100 represents the most favorable health security conditions and 0 represents the least favorable conditions. A score of 100 does not indicate that a country has perfect national health security conditions; likewise, a score of 0 does not mean that a country has no capacity. Instead, the scores of 100 and 0 represent the highest or lowest possible score, respectively, as measured by the Global Health Security Index criteria. Each category is normalized on the basis of the sums of its underlying indicators and subindicators, and an identical weight is then applied. The default weights used in the ranking are based on neutral (or identical) weights. The weights in the model, however, are dynamic and can be changed by users.

FIGURE A1. GLOBAL HEALTH SECURITY INDEX FRAMEWORK



[1] As of April 16, 2013, there are 196 States Parties to the International Health Regulations (IHR [2005]), including the Holy See. The Holy See, as the supreme body of government of the Roman Catholic Church, is a sovereign juridical entity under international law, but it was not included in the country-specific research for this Index in light of the Vatican Constitution's express provision of Italian laws on contagious diseases (see John R. Morss, "The International Legal Status of the Vatican/Holy See Complex," *European Journal of International Law* 26, no. 4 [2015]: 927–946, https://academic.oup.com/ejil/article/26/4/927/2599610). Therefore, for the purposes of this report, we will refer to the assessed "States Parties" as "195 countries."

[2] The World Health Organization International Health Regulations (IHR [2005]) are the foundational international standards for health. IHR is a binding legal instrument to address cross-border public health risks. The goal of IHR is to prevent, protect, control, and respond without disrupting international trade and traffic, and the contents of which were used as the guiding regulation behind many of the indicators included in the Global Health Security Index.

The six categories are as follows:

1. **PREVENTION:** *Prevention of the emergence or release of pathogens*, including those constituting an extraordinary public health risk in keeping with the internationally recognized definition of a Public Health Emergency of International Concern.[3] Indicators in this category assess antimicrobial resistance (AMR), zoonotic disease, biosecurity, biosafety, dual-use research and culture of responsible science, and immunization.

2. **DETECTION AND REPORTING:** *Early detection and reporting for epidemics of potential international concern*,[4] which can spread beyond national or regional borders. Indicators in this category assess laboratory systems strength and quality, laboratory supply chains, real-time surveillance and reporting, surveillance data accessibility and transparency, case-based investigation, and epidemiology workforce.

3. **RAPID RESPONSE:** *Rapid response to and mitigation of the spread of an epidemic.* Indicators in this category assess emergency preparedness and response planning, exercising response plans, emergency response operation, linking public health and security authorities, risk communication, access to communications infrastructure, and trade and travel restrictions.

4. **HEALTH SYSTEM:** *Sufficient and robust health system to treat the sick and protect health workers.* Indicators in this category assess health capacity in clinics, hospitals, and community care centers; supply chain for health system and healthcare workers; medical countermeasures and personnel deployment; healthcare access; communications with healthcare workers during a public health emergency; infection control practices, and capacity to test and approve new countermeasures.

5. **COMPLIANCE WITH INTERNATIONAL NORMS:** *Commitments to improving national capacity, financing plans to address gaps, and adhering to global norms.* Indicators in this category assess IHR reporting compliance and disaster risk reduction; cross-border agreements on public animal health and emergency response; international commitments; completion and publication of WHO Joint External Evaluation (JEE) and the World Organisation for Animal Health (OIE) Performance of Veterinary Services (PVS) Pathway assessments; financing; and commitment to sharing of genetic and biological data and specimens.

6. **RISK ENVIRONMENT:** *Overall risk environment and country vulnerability to biological threats.* Indicators in this category assess political and security risks; socio-economic resilience; infrastructure adequacy; environmental risks; and public health vulnerabilities that may affect the ability of a country to prevent, detect, or respond to an epidemic or pandemic and increase the likelihood that disease outbreaks will spill across national borders.

Each indicator within the six categories contains up to seven underlying subindicators. Principal components analysis (PCA) was also conducted on the model to ensure the relevance and robustness of the chosen indicators and categories. Further details describing the use of PCA can be found on page 24.

The categories, indicators, and subindicators are shown in Table A1.

[3] World Health Organization, "IHR Procedures Concerning Public Health Emergencies of International Concern (PHEIC)," www.who.int/ihr/procedures/pheic/en/.

[4] Ibid.

TABLE A1. GLOBAL HEALTH SECURITY INDEX FRAMEWORK BY CATEGORIES, INDICATORS, AND SUBINDICATORS

1	PREVENTION OF THE EMERGENCE OR RELEASE OF PATHOGENS
1.1	**Antimicrobial resistance (AMR)**
1.1.1	AMR surveillance, detection, and reporting
1.1.2	Antimicrobial control
1.2	**Zoonotic disease**
1.2.1	National planning for zoonotic diseases/pathogens
1.2.2	Surveillance systems for zoonotic diseases/pathogens
1.2.3	International reporting of animal disease outbreaks
1.2.4	Animal health workforce
1.2.5	Private sector and zoonotic disease
1.3	**Biosecurity**
1.3.1	Whole-of-government biosecurity systems
1.3.2	Biosecurity training and practices
1.3.3	Personnel vetting: Regulating access to sensitive locations
1.3.4	Transportation security
1.3.5	Cross-border transfer and end-user screening
1.4	**Biosafety**
1.4.1	Whole-of-government biosafety systems
1.4.2	Biosafety training and practices
1.5	**Dual-use research and culture of responsible science**
1.5.1	Oversight of research with especially dangerous pathogens, toxins, pathogens with pandemic potential, and/or other dual-use research
1.5.2	Screening requirements for providers of genetic material
1.6	**Immunization**
1.6.1	Vaccination rates

2	EARLY DETECTION AND REPORTING EPIDEMICS OF POTENTIAL INTERNATIONAL CONCERN
2.1	**Laboratory systems strength and quality**
2.1.1	Laboratory capacity for detecting priority diseases
2.1.2	Laboratory quality systems
2.2	**Laboratory supply chains**
2.2.1	Specimen referral and transport system
2.2.2	Laboratory cooperation and coordination
2.3	**Real-time surveillance and reporting**
2.3.1	Indicator and event-based surveillance and reporting systems
2.3.2	Interoperable, interconnected, electronic real-time reporting systems
2.4	**Surveillance data accessibility and transparency**
2.4.1	Coverage and use of electronic health records
2.4.2	Data integration between human, animal, and environmental health sectors
2.4.3	Transparency of surveillance data
2.4.4	Ethical considerations during surveillance
2.4.5	International data sharing
2.5	**Case-based investigation**
2.5.1	Case investigation and contact tracing
2.5.2	Point of entry management
2.6	**Epidemiology workforce**
2.6.1	Applied epidemiology training program, such as the field epidemiology training program, for public health professionals and veterinarians (e.g., Field Epidemiology Training Program and Field Epidemiology Training Program for Veterinarians)
2.6.2	Epidemiology workforce capacity

TABLE A1. GLOBAL HEALTH SECURITY INDEX FRAMEWORK BY CATEGORIES, INDICATORS, AND SUBINDICATORS continued

3	RAPID RESPONSE TO AND MITIGATION OF THE SPREAD OF AN EPIDEMIC
3.1	**Emergency preparedness and response planning**
3.1.1	National public health emergency preparedness and response plan
3.1.2	Private sector involvement in response planning
3.1.3	Non-pharmaceutical interventions planning
3.2	**Exercising response plans**
3.2.1	Activating response plans
3.2.2	Private sector engagement in exercises
3.3	**Emergency response operation**
3.3.1	Emergency response operation
3.4	**Linking public health and security authorities**
3.4.1	Public health and security authorities are linked for rapid response during a biological event
3.5	**Risk communication**
3.5.1	Risk communication planning
3.5.2	Public health systems communication
3.6	**Access to communications infrastructure**
3.6.1	Internet users
3.6.2	Mobile subscribers
3.6.3	Female access to a mobile phone
3.6.4	Female access to the Internet
3.7	**Trade and travel restrictions**
3.7.1	Trade restrictions
3.7.2	Travel restrictions

4	SUFFICIENT AND ROBUST HEALTH SYSTEM TO TREAT THE SICK AND PROTECT HEALTH WORKERS
4.1	**Health capacity in clinics, hospitals, and community care centers**
4.1.1	Available human resources for the broader healthcare system
4.1.2	Facilities capacity
4.2	**Supply chain for health system and healthcare workers**
4.2.1	Routine healthcare and laboratory system supply
4.2.2	Stockpiling for emergencies
4.2.3	Manufacturing and procurement for emergencies
4.3	**Medical countermeasures and personnel deployment**
4.3.1	System for dispensing medical countermeasures (MCMs) during a public health emergency
4.3.2	System for receiving foreign health personnel during a public health emergency
4.4	**Healthcare access**
4.4.1	Access to healthcare
4.4.2	Paid medical leave
4.4.3	Healthcare worker access to healthcare
4.5	**Communications with healthcare workers during a public health emergency**
4.5.1	Communication with healthcare workers
4.6	**Infection control practices**
4.6.1	Healthcare-associated infection (HCAI) monitoring
4.7	**Capacity to test and approve new medical countermeasures**
4.7.1	Regulatory process for conducting clinical trials of unregistered interventions
4.7.2	Regulatory process for approving medical countermeasures

TABLE A1. GLOBAL HEALTH SECURITY INDEX FRAMEWORK BY CATEGORIES, INDICATORS, AND SUBINDICATORS continued

5	**COMMITMENTS TO IMPROVING NATIONAL CAPACITY, FINANCING PLANS TO ADDRESS GAPS, AND ADHERING TO GLOBAL NORMS**
5.1	**International Health Regulations (IHR) reporting compliance and disaster risk reduction**
5.1.1	Official IHR reporting
5.1.2	Integration of health into disaster risk reduction
5.2	**Cross-border agreements on public and animal health emergency response**
5.2.1	Cross-border agreements
5.3	**International commitments**
5.3.1	Participation in international agreements
5.3.2	Voluntary memberships
5.4	**Joint External Evaluation (JEE) and Performance of Veterinary Services (PVS) Pathway**
5.4.1	Completion and publication of a JEE assessment and gap analysis
5.4.2	Completion and publication of a PVS assessment and gap analysis
5.5	**Financing**
5.5.1	National financing for epidemic preparedness
5.5.2	Financing under Joint External Evaluation (JEE) and Performance of Veterinary Services (PVS) reports and gap analyses
5.5.3	Financing for emergency response
5.5.4	Accountability for commitments made at the international stage for addressing epidemic threats
5.6	**Commitment to sharing of genetic and biological data and specimens**
5.6.1	Commitment to sharing genetic data, clinical specimens, and/or isolated specimens (biological materials) in both emergency and nonemergency research

6	OVERALL RISK ENVIRONMENT AND COUNTRY VULNERABILITY TO BIOLOGICAL THREATS
6.1	**Political and security risk**
6.1.1	Government effectiveness
6.1.2	Orderly transfers of power
6.1.3	Risk of social unrest
6.1.4	Illicit activities by non-state actors
6.1.5	Armed conflict
6.1.6	Government territorial control
6.1.7	International tensions
6.2	**Socio-economic resilience**
6.2.1	Literacy
6.2.2	Gender equality
6.2.3	Social inclusion
6.2.4	Public confidence in government
6.2.5	Local media and reporting
6.2.6	Inequality
6.3	**Infrastructure adequacy**
6.3.1	Adequacy of road network
6.3.2	Adequacy of airports
6.3.3	Adequacy of power network
6.4	**Environmental risks**
6.4.1	Urbanization
6.4.2	Land use
6.4.3	Natural disaster risk
6.5	**Public health vulnerabilities**
6.5.1	Access to quality healthcare
6.5.2	Access to potable water and sanitation
6.5.3	Public healthcare spending levels per capita
6.5.4	Trust in medical and health advice

Index Constraints and Other Important Factors

In researching the 2021 Global Health Security Index, Economist Impact relied solely on publicly available sources, such as laws, regulations, policy documents, and government websites. This research approach has the benefit of creating a fully transparent and repeatable methodology that does not create an additional reporting burden for country officials; however, it also presents some challenges. As a result, the 2021 Global Health Security Index may not capture certain preparations that countries have made to improve their health security status in certain domains. For example, some countries may not have strong e-government policies and may not have published existing laws and policies applicable to this research. Other countries may have elected not to publish certain material that they deem sensitive, such as regulations and policies related to biosecurity, which would then lead to an underestimation of scores in those areas.

Additionally, relying solely on publicly available data has limitations on the types of questions that can be credibly researched. For example, the GHS Index cannot capture processes that are often not publicly documented or available, such as the level of activity of cross-ministerial working groups or the average response time between the identification of an emergency and the initiation of a response.

However, there is immense value in restricting the research scope to publicly available information for two principal reasons: (a) although these limitations could be addressed through an interview process, this approach would create an extra reporting burden for country officials, which can divert attention away from implementation, and (b) there is value in making this information available, both to the international community and to the health workforce within each country. As such, Economist Impact, in consultation with NTI and the Johns Hopkins Center for Health Security, decided to pursue this approach.

Methodology

General

The 2021 Global Health Security Index comprises categories that are related to the health security conditions of each country. To score the indicators for the Index, the research team gathered data from the following sources:

- Primary legal texts and legal reports
- Government publications and reports
- Academic publications and reports
- Websites of government authorities, international organizations, and non-governmental organizations
- Economist Intelligence proprietary country data and reports (specifically Risk Briefing and the Democracy Index)
- Local and international news media reports

See the Selected Bibliography on page 63 for more information about central sources.

The 2021 Global Health Security Index assessed the capacity of 195 countries (listed in alphabetical order) in Table A2.

TABLE A2: COUNTRIES ASSESSED FOR 2021 GLOBAL HEALTH SECURITY INDEX

Afghanistan
Albania
Algeria
Andorra
Angola
Antigua and Barbuda
Argentina
Armenia
Australia
Austria
Azerbaijan
Bahamas
Bahrain
Bangladesh
Barbados
Belarus
Belgium
Belize
Benin
Bhutan
Bolivia
Bosnia and Herzegovina
Botswana
Brazil
Brunei
Bulgaria
Burkina Faso
Burundi
Cabo Verde
Cambodia
Cameroon
Canada
Central African Republic
Chad
Chile
China
Colombia
Comoros
Congo (Brazzaville)
Congo (Democratic Republic)
Cook Islands
Costa Rica
Côte d'Ivoire
Croatia
Cuba
Cyprus
Czech Republic
Denmark
Djibouti
Dominica
Dominican Republic
Ecuador
Egypt
El Salvador
Equatorial Guinea
Eritrea
Estonia
eSwatini
Ethiopia
Fiji
Finland
France
Gabon
Gambia
Georgia
Germany
Ghana
Greece
Grenada
Guatemala
Guinea
Guinea-Bissau
Guyana
Haiti
Honduras
Hungary
Iceland
India
Indonesia
Iran
Iraq
Ireland
Israel
Italy
Jamaica
Japan
Jordan
Kazakhstan
Kenya
Kiribati
Kuwait
Kyrgyz Republic
Laos
Latvia
Lebanon
Lesotho
Liberia
Libya
Liechtenstein
Lithuania
Luxembourg
Madagascar
Malawi
Malaysia
Maldives
Mali
Malta
Marshall Islands
Mauritania
Mauritius
Mexico
Micronesia, Federated States of
Moldova
Monaco
Mongolia
Montenegro
Morocco
Mozambique
Myanmar
Namibia
Nauru
Nepal
Netherlands
New Zealand
Nicaragua
Niger
Nigeria
Niue
North Korea
North Macedonia
Norway
Oman
Pakistan
Palau
Panama
Papua New Guinea
Paraguay
Peru
Philippines
Poland
Portugal
Qatar
Romania
Russia
Rwanda
Samoa
San Marino
São Tomé and Príncipe
Saudi Arabia
Senegal
Serbia
Seychelles
Sierra Leone
Singapore
Slovakia
Slovenia
Solomon Islands
Somalia
South Africa
South Korea
South Sudan
Spain

Sri Lanka
St. Kitts and Nevis
St. Lucia
St. Vincent and the Grenadines
Sudan
Suriname
Sweden
Switzerland
Syria
Tajikistan
Tanzania
Thailand
Timor-Leste
Togo
Tonga
Trinidad and Tobago
Tunisia
Turkey
Turkmenistan
Tuvalu
Uganda
Ukraine
United Arab Emirates
United Kingdom
United States of America
Uruguay
Uzbekistan
Vanuatu
Venezuela
Vietnam
Yemen
Zambia
Zimbabwe

Country research was conducted from August 2020 through June 2021.

International Panel of Experts

The framework for the 2021 Global Health Security Index was initially updated from April to June 2020 and later revised in April to June 2021 on the basis of additional lessons from the COVID-19 pandemic. This updated framework is based on the 2019 Global Health Security Index framework, which was developed over an 18-month period from 2017 to 2019. The initial 2019 framework was based on project team analysis, literature review, and standard accepted measurements for global health security as captured in the International Health Regulations Joint External Evaluation tool and elsewhere.

Both the published 2019 GHS Index framework and the updated 2021 GHS Index framework were further revised drawing from insights and commentary from an international panel of experts. For the 2019 GHS Index, expert panel meetings were held in April 2017 and April 2019 in London. For the 2021 GHS Index, the expert panel was reconvened for virtual meetings in May and June 2020 and in April 2021. During these meetings, experts offered insights and recommendations on the proposed structure, questions, and data sources for the Global Health Security Index. The panel insights were augmented by additional discussions with experts in the field, such as experts on One Health and epidemiology. For the 2021 GHS Index, experts provided real-world policy and research insights on identifying the factors that most affected the ability of countries to respond to the COVID-19 pandemic. These discussions informed the development of the categories, indicators, and individual questions that comprise the GHS Index framework.

Data Review and Validation Process

After completing the research, Economist Impact provided the 195 countries included in the Index with an opportunity to review and comment on Economist Impact's preliminary results. For consistency, countries were contacted through their official diplomatic channels (embassies and United Nations missions) and requested to share this information with the relevant national health and security experts. The purpose of this data review and validation process was to ensure the accuracy of the 2021 Global Health Security Index data. Score changes were considered only if there was publicly available evidence that had not been previously uncovered by the research team. Unpublished documents were not considered sufficient evidence, keeping in line with the Global Health Security Index's tenet of the value of publicly available information.

Economist Impact developed country-specific documents that presented all qualitative data for the 2021 Global Health Security Index indicators. The Index research team prioritized qualitative questions over quantitative questions, because these had not been drawn from country-specific sources (e.g., drawn from centralized databases or proprietary Economist Group databases assessing political stability, effective governance, and corruption). Instead, the questions shared for validation focused on verifying the publication of overarching plans and legislation (such as plans guiding response to public health emergencies or antimicrobial resistance).

The data review and validation form listed the range of possible answers for each subindicator and identified the answer Economist Impact assigned for the country. The forms allowed the reviewer to either agree or disagree with the answer and to provide an alternative answer with supporting evidence. Economist Impact used the submitted responses to reevaluate its scores. In some cases, respondents provided information that resulted in Economist Impact's raising a country's score, whereas in other cases, scores were lowered or kept the same. When the responses were unclear, Economist Impact contacted individuals for clarification. Country representatives had two months—July through September 2021—to respond to the data review and validation request.

Of the 195 countries, 19 responded to the data review and validation request: Australia, Austria, Bhutan, Canada, Croatia, Dominican Republic, Guatemala, Latvia, Liechtenstein, Lithuania, Luxembourg, Moldova, Norway, Portugal, Romania, Rwanda, Sierra Leone, Sweden, and Switzerland.

Data Modeling

Data were collected across 171 questions and metrics. The majority of the qualitative questions are binary (yes or no) questions, although a select few are tiered to have two to four possible scoring options to capture more nuanced observations. Each question is constructed so that a higher value is associated with more favorable health security conditions.

For example, for the question on personnel vetting to regulate access to locations with sensitive biological materials (1.3.3a), a country that requires drug testing, background checks, and psychological or mental fitness tests is assigned a value of 3, whereas a country that requires only one of the three checks is assigned a value of 1.

Calculation of the 2021 Global Health Security Index

Modeling the subindicators, indicators, and categories in the Global Health Security Index results in overall scores of 0–100 for each country, in which 100 represents the most favorable health security conditions possible and 0 the least favorable. A score of 100 in the Index does not indicate that a country has perfect health security conditions, and a score of 0 does not mean that a country has no health security capacity. Instead, scores of 100 and 0 represent the highest or lowest possible scores, respectively, as measured by the Index criteria. The individual questions and metrics listed are classified into subindicators, which, in turn, are grouped into indicators, followed by categories and then the final scores.

Each individual question (or metric) has been normalized on the basis of the following equation:

$$\text{Normalized score} = (x - \text{Min}(x))/(\text{Max}(x) - \text{Min}(x))$$

where Min(x) and Max(x) are the lowest and highest values, respectively, in the Global Health Security Index (of the 195 countries) for any given question or metric. The normalized value (i.e., a score of 0–100) makes it directly comparable with other normalized scores.

As an example, question 6.1.3a assesses risk of social unrest on a 0–4 scale, with 4 being best (lowest risk). If a country receives a score of 3, its normalized score would be 75 (x = 3, min(x) = 0, max (x) = 4).

Normalized score = (3 – 0) / (4 – 0) = 75

Their values are summed to determine the value of the subindicators and indicators. Each subindicator and indicator receives a weighted value, so that the total score would add up to be on a 0–100 scale:

subindicator score =
∑ weighted individual questions and metrics

indicator score =
∑ weighted individual subindicators

As an example, subindicator 4.4.1 (Access to healthcare) consists of three individual questions/metrics. Each of those metrics is weighted equally (33.3% each). If a country receives a normalized score of 75 on 4.4.1a, 100 on 4.4.1b, and 50 on 4.4.1c, the subindicator score would be 75 on a 0–100 scale.

subindicator score = (75 x 33.3%) + (100 x 33.3%) + (50 x 33.3%) = 75

Indicators are classified into six categories. Each category score is the weighted total of its included indicators:

category score =
∑ weighted individual indicators

Table A3 shows the calculation of a category score for Prevention of the Emergence or Release of Pathogens.

TABLE A3. SAMPLE CATEGORY SCORE CALCULATION FOR A COUNTRY

#	INDICATOR	INDICATOR SCORE (0–100)	WEIGHT	WEIGHTED SCORE	SCORE
1	Category score: Prevention of the emergence or release of pathogens				64.4
1.1	Antimicrobial resistance (AMR)	83.3	16.7%	16.7% of 83.3	13.9
1.2	Zoonotic disease	30.0	16.7%	16.7% of 30.0	5.0
1.3	Biosecurity	89.3	16.7%	16.7% of 89.3	14.9
1.4	Biosafety	75.0	16.7%	16.7% of 75.0	12.5
1.5	Dual-use research and culture of responsible science	33.3	16.7%	16.7% of 33.3	5.6
1.6	Immunization	75.0	16.7%	16.7% of 75.0	12.5

The overall GHS Index score for each country is the weighted sum of the category scores, as determined by the weighting profile:

Overall score = ∑ weighted category scores

Table A4 shows the calculation of an overall score.

TABLE A4. SAMPLE OVERALL SCORE CALCULATION FOR A COUNTRY

#	CATEGORY	CATEGORY SCORE (0–100)	WEIGHT	WEIGHTED SCORE	SCORE
	OVERALL SCORE: GHS INDEX				75.5
1	PREVENTION OF THE EMERGENCE OR RELEASE OF PATHOGENS	68.9	16.7%	16.7% of 68.9	11.5
2	EARLY DETECTION AND REPORTING FOR EPIDEMICS OF POTENTIAL INTERNATIONAL CONCERN	97.3	16.7%	16.7% of 97.3	16.2
3	RAPID RESPONSE TO AND MITIGATION OF THE SPREAD OF AN EPIDEMIC	65.9	16.7%	16.7% of 65.9	11.0
4	SUFFICIENT AND ROBUST HEALTH SYSTEM TO TREAT THE SICK AND PROTECT HEALTH WORKERS	63.5	16.7%	16.7% of 63.5	10.6
5	COMMITMENTS TO IMPROVING NATIONAL CAPACITY, FINANCING PLANS TO ADDRESS GAPS, AND ADHERING TO GLOBAL NORMS	77.0	16.7%	16.7% of 77.0	12.9
6	OVERALL RISK ENVIRONMENT AND COUNTRY VULNERABILITY TO BIOLOGICAL THREATS	79.8	16.7%	16.7% of 79.8	13.3

Model Weights

The weights assigned to each category and indicator can be changed in the Global Health Security Index data model to reflect different assumptions about their relative importance.

Four sets of weights are provided in the model as follows:

- **Neutral weights (default):** The first—and default—weighting option, neutral weights, assumes equal importance of all *categories* and evenly distributes weights on that basis. This approach has the advantage of simplicity and does not involve subjective judgment. A disadvantage of this option is that it assumes that all categories are equally significant.

- **Equal weights:** The second option, equal weights, assigns an identical weight to each *indicator*, rather than to each category. As with neutral weights, the advantage of using equal weights is removing subjective judgment. A disadvantage of this option is that it assumes that all indicators are equally significant.

- **Expert-informed panel weights:** The third option uses expert judgment to inform the weights assigned to categories and indicators to bring a real-world perspective to an index, which is important if an index is to guide policy actions. The weights were based on input from and discussions among the international panel of experts during both the April 2019 and April 2021 meetings on the relative value of each category and indicator; adjustments were based on reviews of existing qualitative and quantitative evidence.

- **Principal Components Analysis:** A fourth weighting option is principal components analysis (PCA). PCA weights are derived through a mathematical process that accounts for the covariance between indicators and the importance of a particular element in maximizing the variation in the Index scores. This process does not take into consideration expert viewpoints on individual indicators' perceived importance, but rather aims to minimize redundancy between variables and to maximize the importance of variance between indicators within the Index. (See page 24 for additional information on the PCA methodology.)

Table A5 shows the Global Health Security Index default weights by category.

TABLE A5. WEIGHT PROFILE BY CATEGORY (NEUTRAL)

	CATEGORY	WEIGHT
1	PREVENTION OF THE EMERGENCE OR RELEASE OF PATHOGENS	16.7%
2	EARLY DETECTION AND REPORTING FOR EPIDEMICS OF POTENTIAL INTERNATIONAL CONCERN	16.7%
3	RAPID RESPONSE TO AND MITIGATION OF THE SPREAD OF AN EPIDEMIC	16.7%
4	SUFFICIENT AND ROBUST HEALTH SYSTEM TO TREAT THE SICK AND PROTECT HEALTH WORKERS	16.7%
5	COMMITMENTS TO IMPROVING NATIONAL CAPACITY, FINANCING PLANS TO ADDRESS GAPS, AND ADHERING TO GLOBAL NORMS	16.7%
6	OVERALL RISK ENVIRONMENT AND COUNTRY VULNERABILITY TO BIOLOGICAL THREATS	16.7%

Table A6 shows the Global Health Security Index default weights by indicator.

TABLE A6. WEIGHT PROFILE BY INDICATOR (NEUTRAL)

	CATEGORY	WEIGHT
1	**PREVENTING THE EMERGENCE OR RELEASE OF PATHOGENS**	
1.1	Antimicrobial resistance (AMR)	16.7%
1.2	Zoonotic disease	16.7%
1.3	Biosecurity	16.7%
1.4	Biosafety	16.7%
1.5	Dual-use research and culture of responsible science	16.7%
1.6	Immunization	16.7%
2	**EARLY DETECTION AND REPORTING FOR EPIDEMICS OF POTENTIAL INTERNATIONAL CONCERN**	
2.1	Laboratory systems strength and quality	16.7%
2.2	Laboratory supply chains	16.7%
2.3	Real-time surveillance and reporting	16.7%
2.4	Surveillance data accessibility and transparency	16.7%
2.5	Case-based investigation	16.7%
2.6	Epidemiology workforce	16.7%
3	**RAPID RESPONSE TO AND MITIGATION OF THE SPREAD OF AN EPIDEMIC**	
3.1	Emergency preparedness and response planning	14.3%
3.2	Exercising response plans	14.3%
3.3	Emergency response operation	14.3%
3.4	Linking public health and security authorities	14.3%
3.5	Risk communication	14.3%
3.6	Access to communications infrastructure	14.3%
3.7	Trade and travel restrictions	14.3%

	CATEGORY	WEIGHT
4	**SUFFICIENT AND ROBUST HEALTH SYSTEM TO TREAT THE SICK AND PROTECT HEALTH WORKERS**	
4.1	Health capacity in clinics, hospitals, and community care centers	14.3%
4.2	Supply chain for health system and healthcare workers	14.3%
4.3	Medical countermeasures and personnel deployment	14.3%
4.4	Healthcare access	14.3%
4.5	Communications with healthcare workers during a public health emergency	14.3%
4.6	Infection control practices	14.3%
4.7	Capacity to test and approve new medical countermeasures	14.3%
5	**COMMITMENTS TO IMPROVING NATIONAL CAPACITY, FINANCING PLANS TO ADDRESS GAPS, AND ADHERING TO GLOBAL NORMS**	
5.1	International Health Regulations (IHR) reporting compliance and disaster risk reduction	16.7%
5.2	Cross-border agreements on public and health emergency response	16.7%
5.3	International commitments	16.7%
5.4	Joint External Evaluation (JEE) and Performance of Veterinary Services (PVS) Pathway	16.7%
5.5	Financing	16.7%
5.6	Commitment to sharing genetic and biological data and specimens	16.7%
6	**OVERALL RISK ENVIRONMENT AND COUNTRY VULNERABILITY TO BIOLOGICAL THREATS**	
6.1	Political and security risk	20.0%
6.2	Socio-economic resilience	20.0%
6.3	Infrastructure adequacy	20.0%
6.4	Environmental risks	20.0%
6.5	Public health vulnerabilities	20.0%

Principal Components Analysis

The goal of principal components analysis (PCA) is to define quantitatively a weighting scheme for the indicators that are used to create a composite index or ranking. PCA is a method for removing redundant information shared across indicators by specifying a weighting that explains the most variance in the data.

The PCA weights featured within the 2021 Global Health Security Index model have been provided for those experts who may wish to explore the behavior of the model in more depth. However, because the weights do not consider the intrinsic significance of an indicator in the context of the 2021 Global Health Security Index, they should not be considered (a) as an alternative to the default weights or (b) as a means of understanding country rankings and scores.

The PCA approach assigns each element in an index a weight that takes into account the covariance between indicators and the importance of a particular element in maximizing the variation in outcome. For the Global Health Security Index, the PCA looks to maximize the variance between indicators against the overall GHS Index scores (health security conditions). It aims to minimize redundancy between variables and to maximize the variance with respect to the outcome. The weight is calculated by taking the principal component (eigenvector) associated with the highest explained variance (eigenvalue).

This approach is a way of decomposing the data into independent components ordered by informational content and, according to Ram (1982),[5] is a natural choice for an index weighting. Important assumptions for valid PCA are (a) that variance is meaningful and not the result of data with large measurement error and (b) that the dynamics of interest (health security conditions) are along the direction with the largest variance.

A one-stage PCA solves for the weights that maximize the variance across all the indicators, irrespective of category membership:

1. Perform PCA on all the indicators at once, ignoring category membership.

2. Use the principal component associated with the highest eigenvalue.

3. Set negative components to zero (if positive weights are required).

4. Normalize within indicator weights so that the sum of the weights is 1.

5. Normalize the category weights so that the sum across categories is 1.

    - Use the sum of the non-normalized sub-indicator weights and assign this as the indicator weight for that category.

    - Then renormalize top-level indicator weights across indicators so that those also sum to 1.

Variation within indicator weights is a sign that redundancy is occurring in the elements or that some elements are not as relevant in explaining the variation in the overall Index once all the other variables are considered. Finding equal weights across indicators is a sign of very little redundancy across subgroups and similar relevance in explaining variation in the Global Health Security Index, which suggests that the Index was appropriately divided into subgroups.

[5] Rati Ram, "Composite Indices of Physical Quality of Life, Basic Needs Fulfilment, and Income: A 'Principal Component' Representation," *Journal of Development Economics* 11, no. 2 (October 1982): 227–47.

Research behind Selected Indicators

This section focuses on the research behind selected indicators, and it includes an explanation for the scoring framework behind select new and revised variables included in the 2021 Global Health Security Index. Scoring criteria for all of the indicators are included in the section titled "Sources and Definitions of Indicators."

Approach

Economist Impact employed country experts and regional specialists with a wide variety of necessary linguistic skills to undertake the research from its global network of more than 900 analysts and researchers. Researchers were asked to gather data from primary legal texts; government and academic publications; and websites of government authorities, international organizations, and non-governmental organizations. Researchers also reviewed local and international news and media reports. The research process proved challenging, both because of the difficulty in sourcing data and official information related to health security and, in some cases, because of a lack of publicly available information.

Select New and Revised Indicators

1.2.1b

Is there national legislation, plans, or equivalent strategy document(s) that includes measures for risk identification and reduction for zoonotic disease spillover events from animals to humans?

Indicator 1.2 examines the legal frameworks, systems, and capacities related to zoonotic disease monitoring and the prevention of diseases from spilling over from animals to humans. However, both existing policies and the individual measures in the 2019 Global Health Security Index focused primarily on specific diseases. This indicator looks to assess if countries are proactively identifying pathways for zoonotic disease spillover more generally—geographies, activities, and specific animal populations—and planning for how they can reduce the risk of animal to human disease transmission.

2.1.1b

Is there a national plan, strategy, or similar document for conducting testing during a public health emergency, which includes considerations for testing for novel pathogens, scaling capacity, and defining goals for testing?

As the COVID-19 pandemic has made clear, it is in countries' best interest to be able to rapidly scale up their capacities to conduct surveillance for an emerging global disease threat. In 2020, countries that were quickly able to make testing accessible to their populations were better able to identify emerging clusters and rapidly respond, reducing the potential for community transmission. This question assesses if countries have made plans to address this issue. Countries receive full credit for comprehensive plans that are disease-agnostic and that address considerations for testing for novel pathogens, identify how countries plan to scale capacity, and define goals for testing. Countries receive half credit for plans that address only specific pathogens (such as COVID-19 or influenza) and/or that do not include the three considerations listed in the question.

2.2.2a

Is there a plan in place to rapidly authorize or license laboratories to supplement the capacity of the national public health laboratory system to scale up testing during an outbreak?

A critical component of planning on how to scale testing is planning the logistics for how to increase laboratory testing capacity. Similar to the previous question, countries receive half credit for plans that address only specific pathogens or that have other limitations and full credit for plans that would apply to any pathogen type.

2.5 Case-based investigation

2.5.1a: Is there a national system in place to provide support at the sub-national level (e.g., training, metrics standardization, and/or financial resources) to conduct contact tracing in the event of a public health emergency?

2.5.1b: Does the country provide wraparound services to enable infected people and their contacts to self-isolate or quarantine as recommended, particularly economic support (paycheck, job security) and medical attention?

2.5.2a: Is there a joint plan or cooperative agreement between the public health system and border control authorities to identify suspected and potential cases in international travelers and to trace and quarantine their contacts in the event of a public health emergency?

Case-based investigation and contact tracing have played a critical role in control of the spread of the COVID-19 pandemic. As the pandemic has made clear, many countries that have not experienced widespread disease outbreaks in the past have public health systems that were unprepared to conduct contact tracing at a mass scale. This series of questions examines not only the ability of the public health system to conduct contact tracing, but also the factors related to the success of contract tracing, such as the ability for individuals to self-isolate when ordered to do so and the capacity of the public health system to cooperate with other government agencies.

3.1.3a

Does the country have a policy, plan, and/or guidelines in place to implement non-pharmaceutical interventions (NPIs) during an epidemic or pandemic?

Although the 2019 Global Health Security Index includes measures looking at medical countermeasures, non-pharmaceutical interventions had not previously been included. Given global experience with the COVID-19 pandemic, it is clear how important planning for non-medical interventions is in the early stages of a novel or emerging pathogen. This measure looks to see if countries have developed plans on how to implement such interventions. As with other measures, this question assigns half credit for countries that have developed a single disease-specific plan (such as for COVID-19 or influenza) and full credit for those that have plans that can be implemented in the face of any disease type.

3.2.2a

Is there evidence that the country in the past year has undergone a national-level biological threat–focused exercise that has included private sector representatives?

As a complement to existing questions assessing if countries have exercised their response mechanisms and plans, this question also looks at whether non-government actors—namely, the private sector—have been included in national-level response planning. As COVID-19 has evidenced, the effectiveness of national-level response is dependent not just on government actors, but also on multiple industries within the private sector, from transportation and logistics to agriculture and manufacturing.

3.5.1c

Does the risk communication plan (or other legislation, regulation, or strategy document used to guide national public health response) designate a specific position within the government to serve as the primary spokesperson to the public during a public health emergency?

Effective and trustworthy communication by the government with the public is a vital part of emergency response management. Not only must messages be delivered clearly, but they also must be delivered by a credible communicator. Credibility is built through trust, and designating a single person to act as that trusted voice can help ensure important messages are being heard. Furthermore, by designating a single spokesperson, a government can more easily avoid sending mixed messages or confusing communications.

3.5.2b

Is there evidence that senior leaders (president or ministers) have shared misinformation or disinformation on infectious diseases in the past two years?

In the past several years, misinformation and disinformation have become an increasing concern not only in response to public health emergencies but also in navigating daily life. Over the past year, as scientists and governments were learning more about the characteristics of the coronavirus-driven pandemic, people in high-level positions either accidentally or deliberately shared false information, which then influenced public decision making. Government officials are responsible for sharing information that is as accurate as possible, particularly in the midst of managing the response to a deadly disease outbreak.

4.2.2c

Is there evidence that the country conducts or requires an annual review of the national stockpile to ensure the supply is sufficient for a public health emergency?

In the 2019 Global Health Security Index, the framework included questions on whether countries maintained a stockpile of supplies to respond to a disease outbreak. This question has been so critical to the COVID-19 response that this year questions on stockpiling, manufacturing, and supplier agreements have been expanded and made more nuanced. As part of this expansion, the framework now includes a question assessing not only whether the stockpile exists, but also whether countries are required to regularly examine if the stockpile is sufficient for their needs in the case of an emergency scenario. Ideally, this question would assess whether the stockpile itself was sufficient for needs. However, there are two challenges: one, there is no global norm on what defines a stockpile as "sufficient," and two, information about stockpile contents is limited at best, and it would be impossible to conduct a cross-country assessment comparing the relative sufficiency of each country's stockpile to face an emergency scenario.

Sources and Definitions of Indicators

Table A7 provides the sources and definitions of indicators in the 2021 Global Health Security Index.

TABLE A7. SOURCES AND DEFINITIONS OF INDICATORS

QUESTION NUMBER	SOURCES	QUESTION AND SCORING
CATEGORY 1: PREVENTION OF THE EMERGENCE OR RELEASE OF PATHOGENS		
1.1 Antimicrobial resistance (AMR)		
1.1.1 AMR surveillance, detection, and reporting		
1.1.1a	World Health Organization (WHO) Library of national action plans on AMR; completed Joint External Evaluation (JEE) assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Is there a national AMR plan for the surveillance, detection, and reporting of priority AMR pathogens? Yes, there is evidence of an AMR plan, and it covers surveillance, detection, and reporting = 2 Yes, there is evidence of an AMR plan, but there is insufficient evidence that it covers surveillance, detection, and reporting = 1 No evidence of an AMR plan = 0
1.1.1b	WHO Library of national action plans on AMR; completed JEE assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Is there a national laboratory/laboratory system which tests for priority AMR pathogens? All 7 + 1 priority pathogens = 2 Yes, but not all 7 + 1 pathogens = 1 No = 0
1.1.1c	WHO Library of national action plans on AMR; completed JEE assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Does the government conduct environmental detection or surveillance activities (e.g., in soil, waterways) for antimicrobial residues or AMR organisms? Yes = 1 No = 0
1.1.2 Antimicrobial control		
1.1.2a	WHO Library of national action plans on AMR; completed JEE assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Is there national legislation or regulation in place requiring prescriptions for antibiotic use for humans? Yes = 1 No = 0
1.1.2b	WHO Library of national action plans on AMR; completed JEE assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Is there national legislation or regulation in place requiring prescriptions for antibiotic use for animals? Yes = 1 No = 0

QUESTION NUMBER	SOURCES	QUESTION AND SCORING
1.2 Zoonotic disease		
1.2.1 National planning for zoonotic diseases/pathogens		
1.2.1a	Completed JEE assessments; completed Performance of Veterinary Services (PVS) assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Is there national legislation, plans, or equivalent strategy documents on zoonotic disease? Yes = 1 No = 0
1.2.1b	Completed JEE assessments; completed PVS assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Is there national legislation, plans, or equivalent strategy document(s) that includes measures for risk identification and reduction for zoonotic disease spillover events from animals to humans? Yes = 1 No = 0
1.2.1c	Completed JEE assessments; completed PVS assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Is there national legislation, plans, or guidelines that account for the surveillance and control of multiple zoonotic pathogens of public health concern? Yes = 1 No = 0
1.2.1d	Completed JEE assessments; completed PVS assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Is there a department, agency, or similar unit dedicated to zoonotic disease that functions across ministries? Yes = 1 No = 0
1.2.2 Surveillance systems for zoonotic diseases/pathogens		
1.2.2a	Completed JEE assessments; completed PVS assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Does the country have a national mechanism (either voluntary or mandatory) for owners of livestock to conduct and report on disease surveillance to a central government agency? Yes = 1 No = 0
1.2.2b	Completed JEE assessments; completed PVS assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Is there legislation and/or regulations that safeguard the confidentiality of information generated through surveillance activities for animals (for owners)? Yes = 1 No = 0
1.2.2c	Completed JEE assessments; completed PVS assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Does the country conduct surveillance of zoonotic disease in wildlife (e.g., wild animals, insects, other disease vectors)? Yes = 1 No = 0

TABLE A7. SOURCES AND DEFINITIONS OF INDICATORS continued

QUESTION NUMBER	SOURCES	QUESTION AND SCORING
1.2.3 International reporting of animal disease outbreaks		
1.2.3a	World Organisation for Animal Health (OIE) World Animal Health Information System (WAHIS)	Has the country submitted a report to OIE on the incidence of human cases of zoonotic disease for the past calendar year? Yes = 1 No = 0
1.2.4 Animal health workforce		
1.2.4a	OIE WAHIS	Number of veterinarians per 100,000 people
1.2.4b	OIE WAHIS	Number of veterinary para-professionals per 100,000 people
1.2.5 Private sector and zoonotic disease		
1.2.5a	Completed JEE assessments; completed PVS assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Does the national plan on zoonotic disease or other legislation, regulations, or plans include mechanisms for working with the private sector in controlling or responding to zoonoses? Yes = 1 No = 0
1.3 Biosecurity		
1.3.1 Whole-of-government biosecurity systems		
1.3.1a	Completed JEE assessments; Verification Research, Training and Information Centre (VERTIC) database; Biological Weapons Convention (BWC) Confidence Building Measures; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Does the country have in place a record, updated within the past five years, of the facilities in which especially dangerous pathogens and toxins are stored or processed, including details on inventories and inventory management systems of those facilities? Yes = 1 No = 0
1.3.1b	Completed JEE assessments; VERTIC database; BWC Confidence Building Measures; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Does the country have in place legislation and/or regulations related to biosecurity which address requirements such as physical containment, operation practices, failure reporting systems, and/or cybersecurity of facilities in which especially dangerous pathogens and toxins are stored or processed? Yes = 1 No = 0

QUESTION NUMBER	SOURCES	QUESTION AND SCORING
1.3.1c	Completed JEE assessments; VERTIC database; BWC Confidence Building Measures; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Is there an established agency (or agencies) responsible for the enforcement of bio-security legislation and regulations? Yes = 1 No = 0
1.3.1d	Completed JEE assessments; VERTIC database; BWC Confidence Building Measures; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Is there public evidence that shows that the country has taken action to consolidate its inventories of especially dangerous pathogens and toxins into a minimum number of facilities? Yes = 1 No = 0
1.3.1e	Completed JEE assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Is there public evidence of in-country capacity to conduct Polymerase Chain Reaction (PCR)-based diagnostic testing for anthrax and/or Ebola, which would preclude culturing a live pathogen? Yes = 1 No = 0
1.3.2 Biosecurity training and practices		
1.3.2a	Completed JEE assessments; VERTIC database; BWC Confidence Building Measures; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Does the country require biosecurity training, using a standardized, required approach, such as through a common curriculum or a train-the-trainer program, for personnel working in facilities housing or working with especially dangerous pathogens, toxins, or biological materials with pandemic potential? Yes = 1 No = 0
1.3.3 Personnel vetting: Regulating access to sensitive locations		
1.3.3a	Completed JEE assessments; VERTIC database; BWC Confidence Building Measures; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Do regulations or licensing conditions specify that security and other personnel with access to especially dangerous pathogens, toxins, or biological materials with pandemic potential are subject to the following checks: drug testing, background checks, and psychological or mental fitness checks? Personnel are subject to all three of these checks = 3 Personnel are subject to two of these checks = 2 Personnel are subject to one of these checks = 1 Personnel are not subject to any of these checks = 0

TABLE A7. SOURCES AND DEFINITIONS OF INDICATORS continued

QUESTION NUMBER	SOURCES	QUESTION AND SCORING
1.3.4 Transportation security		
1.3.4a	Completed JEE assessments; VERTIC database; BWC Confidence Building Measures; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Does the country have publicly available information on national regulations on the safe and secure transport of infectious substances (specifically including Categories A and B[6])? Yes = 1 No = 0
1.3.5 Cross-border transfer and end-user screening		
1.3.5a	Completed JEE assessments; VERTIC database; BWC Confidence Building Measures; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Is there legislation and/or regulations in place to oversee the cross-border transfer and end-user screening of especially dangerous pathogens, toxins, and pathogens with pandemic potential? Yes = 1 No = 0
1.4 Biosafety		
1.4.1 Whole-of-government biosafety systems		
1.4.1a	Completed JEE assessments; VERTIC database; BWC Confidence Building Measures; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Does the country have in place national biosafety legislation and/or regulations? Yes = 1 No = 0
1.4.1b	Completed JEE assessments; VERTIC database; BWC Confidence Building Measures; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Is there an established agency responsible for the enforcement of biosafety legislation and regulations? Yes = 1 No = 0
1.4.2 Biosafety training and practices		
1.4.2a	Completed JEE assessments; VERTIC database; BWC Confidence Building Measures; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Does the country require biosafety training, using a standardized, required approach, such as through a common curriculum or a train-the-trainer program, for personnel working in facilities housing or working with especially dangerous pathogens, toxins, or biological materials with pandemic potential? Yes = 1 No = 0

[6] The World Health Organization defines a Category A substance as "an infectious substance which is transported in a form that, when exposure to it occurs, is capable of causing permanent disability, life-threatening or fatal disease in otherwise healthy humans or animals." Category B substances are all other infectious substances which do not meet the criteria of Category A.

QUESTION NUMBER	SOURCES	QUESTION AND SCORING
1.5 Dual-use research and culture of responsible science		
1.5.1 Oversight of research with especially dangerous pathogens, toxins, pathogens with pandemic potential, and/or other dual-use research		
1.5.1a	Completed JEE assessments; VERTIC database; BWC Confidence Building Measures; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Is there publicly available evidence that the country has conducted an assessment to determine whether ongoing research is occurring on especially dangerous pathogens, toxins, pathogens with pandemic potential, and/or other dual-use research? Yes = 1 No = 0
1.5.1b	Completed JEE assessments; VERTIC database; BWC Confidence Building Measures; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Is there legislation and/or regulation requiring oversight of research with especially dangerous pathogens, toxins, pathogens with pandemic potential, and/or other dual-use research? Yes = 1 No = 0
1.5.1c	Completed JEE assessments; VERTIC database; BWC Confidence Building Measures; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Is there an agency responsible for oversight of research with especially dangerous pathogens, toxins, pathogens with pandemic potential, and/or other dual-use research? Yes = 1 No = 0
1.5.2 Screening requirements for providers of genetic material		
1.5.2a	Completed JEE assessments; VERTIC database; BWC Confidence Building Measures; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Is there legislation and/or regulation requiring the screening of synthesized DNA against lists of known pathogens and toxins before it is sold? Yes = 1 No = 0
1.6 Immunization		
1.6.1 Vaccination rates		
1.6.1a	WHO	Immunization rate (measles/MCV2) 95% or greater = 2 80%–94.9% = 1 Less than 80%, or no data = 0
1.6.1b	OIE WAHIS	Are official foot-and-mouth disease (FMD) vaccination figures for livestock publicly available through the OIE database? Yes = 1 No = 0

TABLE A7. SOURCES AND DEFINITIONS OF INDICATORS continued

QUESTION NUMBER	SOURCES	QUESTION AND SCORING
CATEGORY 2: EARLY DETECTION AND REPORTING FOR EPIDEMICS OF POTENTIAL INTERNATIONAL CONCERN		
2.1 Laboratory systems strength and quality		
2.1.1 Laboratory capacity for detecting priority diseases		
2.1.1a	Completed JEE assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Does the national laboratory system have the capacity to conduct diagnostic tests for at least 5 of the 10 WHO-defined core tests? Evidence they can conduct 5 of the 10 core tests and these tests are named = 2 Evidence they can conduct 5 of the 10 core tests and the tests are not named = 1 No evidence they can conduct 5 of the 10 core tests = 0
2.1.1b	Completed JEE assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Is there a national plan, strategy, or similar document for conducting testing during a public health emergency, which includes considerations for testing for novel pathogens, scaling capacity, and defining goals for testing? Yes, there is evidence of a plan, and it includes considerations for testing for novel pathogens, scaling capacity, and defining goals for testing = 2 Yes, there is evidence of a plan, but there is insufficient evidence that it includes considerations for testing for novel pathogens, scaling capacity, and defining goals for testing = 1 No evidence of a plan = 0
2.1.2 Laboratory quality systems		
2.1.2a	Completed JEE assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Is there a national laboratory that serves as a reference facility which is accredited (e.g., International Organization for Standardization [ISO] 15189:2003, U.S. Clinical Laboratory Improvement Amendments [CLIA])?[7] Yes = 1 No = 0
2.1.2b	Completed JEE assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Is there a national laboratory that serves as a reference facility which is subject to external quality assurance review? Yes = 1 No = 0

[7] "Nationwide" is defined as evidence of at least 80% of districts covered by specimen transport systems.

QUESTION NUMBER	SOURCES	QUESTION AND SCORING
2.2 Laboratory supply chains		
2.2.1 Specimen referral and transport system		
2.2.1a	Completed JEE assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Is there a nationwide specimen transport system? Yes = 1 No = 0
2.2.2 Laboratory cooperation and coordination		
2.2.2a	Completed JEE assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Is there a plan in place to rapidly authorize or license laboratories to supplement the capacity of the national public health laboratory system to scale up testing during an outbreak? Yes = 2 Yes, but there is evidence of gaps in implementation = 1 No = 0
2.3 Real-time surveillance and reporting		
2.3.1 Indicator and event-based surveillance and reporting systems		
2.3.1a	Completed JEE assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Is there evidence that the country is conducting ongoing event-based surveillance and analysis for infectious disease? Yes, there is evidence of ongoing event-based surveillance and evidence that the data is being analyzed on a daily basis = 2 Yes, there is evidence of ongoing event-based surveillance, but no evidence that the data is being analyzed on a daily basis = 1 No = 0
2.3.1b	WHO Disease Outbreak News; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Is there publicly available evidence that the country reported a potential public health emergency of international concern (PHEIC) to the WHO within the past two years? Yes = 1 No = 0

TABLE A7. SOURCES AND DEFINITIONS OF INDICATORS continued

QUESTION NUMBER	SOURCES	QUESTION AND SCORING
2.3.2 Interoperable, interconnected, electronic real-time reporting systems		
2.3.2a	Completed JEE assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Does the government operate an electronic reporting surveillance system at both the national and sub-national level? Yes = 1 No = 0
2.3.2b	Completed JEE assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Does the electronic reporting surveillance system collect ongoing or real-time laboratory data? Yes = 1 No = 0
2.4 Surveillance data accessibility and transparency		
2.4.1 Coverage and use of electronic health records		
2.4.1a	WHO eHealth Atlas; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Are electronic health records commonly in use?[8] Electronic health records are commonly in use = 2 Electronic health records are not commonly in use, but there is evidence they are used = 1 No evidence electronic health records are in use = 0
2.4.1b	Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Does the national public health system have access to electronic health records of individuals in their country? Yes = 1 No = 0
2.4.1c	Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Are there data standards to ensure data is comparable (e.g., ISO standards)? Yes = 1 No = 0

[8] "Commonly in use" is defined as being used in 75% or more of the country's health facilities.

QUESTION NUMBER	SOURCES	QUESTION AND SCORING
2.4.2 Data integration between human, animal, and environmental health sectors		
2.4.2a	Completed JEE assessments; OIE PVS assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Is there evidence of established mechanisms at the relevant ministries responsible for animal, human, and wildlife surveillance to share data (e.g., through mosquito surveillance, brucellosis surveillance)? Yes = 1 No = 0
2.4.3 Transparency of surveillance data		
2.4.3a	Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Does the country make de-identified health surveillance data on infectious diseases publicly available via reports (or other format) on government websites (such as the Ministry of Health, Ministry of Agriculture, or similar)? Yes = 1 No = 0
2.4.4 Ethical considerations during surveillance		
2.4.4a	Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Is there legislation and/or regulations that safeguard the confidentiality of identifiable health information for individuals, such as that generated through health surveillance activities? Yes = 1 No = 0
2.4.4b	Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Is there legislation and/or regulations safeguarding the confidentiality of identifiable health information for individuals, such as that generated through health surveillance activities, including mention of protections from cyberattacks (e.g., ransomware)? Yes = 1 No = 0

TABLE A7. SOURCES AND DEFINITIONS OF INDICATORS continued

QUESTION NUMBER	SOURCES	QUESTION AND SCORING
2.4.5 International data sharing		
2.4.5a	Completed JEE assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Has the government made a commitment via public statements, legislation, and/or a cooperative agreement to share surveillance data during a public health emergency with other countries in the region? Yes, commitments have been made to share data for more than one disease = 2 Yes, commitments have been made to share data only for one disease = 1 No = 0
2.5 Case-based investigation		
2.5.1 Case investigation and contact tracing		
2.5.1a	Completed JEE assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Is there a national system in place to provide support at the sub-national level (e.g., training, metrics standardization, and/or financial resources) to conduct contact tracing in the event of a public health emergency? Yes, there is evidence that the national government supports sub-national systems to prepare for future public health emergencies = 2 Yes, there is evidence that the national government supports sub-national systems, but only in response to active public health emergencies = 1 No = 0
2.5.1b	Completed JEE assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Does the country provide wraparound services to enable infected people and their contacts to self-isolate or quarantine as recommended, particularly economic support (paycheck, job security) and medical attention? Yes, both economic support and medical attention are provided = 2 Yes, but only economic support or medical attention is provided = 1 No = 0

QUESTION NUMBER	SOURCES	QUESTION AND SCORING
2.5.2 Point of entry management		
2.5.2a	Completed JEE assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Is there a joint plan or cooperative agreement between the public health system and border control authorities to identify suspected and potential cases in international travelers and to trace and quarantine their contacts in the event of a public health emergency? Yes, plan(s)/agreement(s) are in place to prepare for future public health emergencies = 2 Yes, but plan(s)/agreement(s) are in place only in response to active public health emergencies = 1 No = 0
2.6 Epidemiology workforce		
2.6.1 Applied epidemiology training program, such as the field epidemiology training program, for public health professionals and veterinarians (e.g., FETP and FETPV)		
2.6.1a	Completed JEE assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Does the country meet one of the following criteria: • Applied epidemiology training program (such as FETP) is available in country. • Resources are provided by the government to send citizens to another country to participate in applied epidemiology training programs (such as FETP). Needs to meet at least one of the criteria to be scored a 1 on this measure. Yes for both = 1 Yes for one = 1 No for both = 0
2.6.1b	Completed JEE assessments; OIE PVS assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Are the available field epidemiology training programs explicitly inclusive of animal health professionals or is there a specific animal health field epidemiology training program offered (such as FETPV)? Yes = 1 No = 0
2.6.2 Epidemiology workforce capacity		
2.6.2a	Completed JEE assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Is there public evidence that the country has at least one trained field epidemiologist per 200,000 people? Yes = 1 No = 0

TABLE A7. SOURCES AND DEFINITIONS OF INDICATORS continued

QUESTION NUMBER	SOURCES	QUESTION AND SCORING
CATEGORY 3: RAPID RESPONSE TO AND MITIGATION OF THE SPREAD OF AN EPIDEMIC		
3.1 Emergency preparedness and response planning		
3.1.1 National public health emergency preparedness and response plan		
3.1.1a	Completed JEE assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Does the country have an overarching national public health emergency response plan in place which addresses planning for multiple communicable diseases with epidemic or pandemic potential? Evidence that there is a plan in place, and the plan is publicly available = 2 Evidence that the plan is in place, but the plan is not publicly available OR Disease-specific plans are in place, but there is no evidence of an overarching plan = 1 No evidence that such a plan or plans are in place = 0
3.1.1b	Completed JEE assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	If an overarching plan is in place, has it been updated in the past three years? Yes = 1 No/no plan in place = 0
3.1.1c	Completed JEE assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	If an overarching plan is in place, does it include considerations for pediatric and/or other vulnerable populations? Yes = 1 No/no plan in place = 0
3.1.1d	WHO Strategic Partnership for IHR and Health Security (SPH)	Does the country have a publicly available plan in place specifically for pandemic influenza preparedness that has been updated since 2009? Yes = 1 No = 0
3.1.2 Private sector involvement in response planning		
3.1.2a	Completed JEE assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Does the country have a specific mechanism(s) for engaging with the private sector to assist with outbreak emergency preparedness and response? Yes = 1 No = 0

QUESTION NUMBER	SOURCES	QUESTION AND SCORING
3.1.3 Non-pharmaceutical interventions planning		
3.1.3a	Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Does the country have a policy, plan, and/or guidelines in place to implement non-pharmaceutical interventions (NPIs) during an epidemic or pandemic? Yes, a policy, plan, and/or guidelines are in place for more than one disease = 2 Yes, but the policy, plan, and/or guidelines exist only for one disease = 1 No = 0
3.2 Exercising response plans		
3.2.1 Activating response plans		
3.2.1a	WHO SPH	Does the country meet one of the following criteria? • Is there evidence that the country has activated its national emergency response plan for an infectious disease outbreak in the past year? • Is there evidence that the country has completed a national-level biological threat-focused exercise (either with WHO or separately) in the past year? Needs to meet at least one of the criteria to be scored a 1 on this measure. Yes for both = 1 Yes for one = 1 No for both = 0
3.2.1b	WHO SPH; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Is there evidence that the country in the past year has identified a list of gaps and best practices in response (either through an infectious disease response or a biological threat-focused exercise) and developed a plan to improve response capabilities? Yes, the country has developed and published a plan to improve response capacity = 2 Yes, the country has developed a plan to improve response capacity, but has not published the plan = 1 No = 0
3.2.2 Private sector engagement in exercises		
3.2.2a	Completed JEE assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Is there evidence that the country in the past year has undergone a national-level biological threat-focused exercise that has included private sector representatives? Yes = 1 No = 0

TABLE A7. SOURCES AND DEFINITIONS OF INDICATORS continued

QUESTION NUMBER	SOURCES	QUESTION AND SCORING
3.3 Emergency response operation		
3.3.1 Emergency response operation		
3.3.1a	Completed JEE assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Does the country have in place an Emergency Operations Center (EOC)? Yes = 1 No = 0
3.3.1b	Completed JEE assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Is the Emergency Operations Center (EOC) required to conduct a drill for a public health emergency scenario at least once per year or is there evidence that it conducts a drill at least once per year? Yes = 1 No = 0
3.3.1c	Completed JEE assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Is there public evidence to show that the Emergency Operations Center (EOC) has conducted within the past year a coordinated emergency response or emergency response exercise activated within 120 minutes of the identification of the public health emergency/scenario? Yes = 1 No = 0
3.4 Linking public health and security authorities		
3.4.1 Public health and security authorities are linked for rapid response during a biological event		
3.4.1a	Completed JEE assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Does the country meet one of the following criteria? • Is there public evidence that public health and national security authorities have carried out an exercise to respond to a potential deliberate biological event (i.e., bioterrorism attack)? • Are there publicly available standard operating procedures, guidelines, memorandums of understanding (MOUs), or other agreements between the public health and security authorities to respond to a potential deliberate biological event (i.e., bioterrorism attack)? Needs to meet at least one of the criteria to be scored a 1 on this measure. Yes for both = 1 Yes for one = 1 No for both = 0

QUESTION NUMBER	SOURCES	QUESTION AND SCORING
3.5 Risk communication		
3.5.1 Risk communication planning		
3.5.1a	Completed JEE assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Does the country have in place, either in the national public health emergency response plan or in other legislation, regulation, or strategy documents, a section detailing a risk communication plan that is specifically intended for use during a public health emergency? Yes = 1 No = 0
3.5.1b	Completed JEE assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Does the risk communication plan (or other legislation, regulation, or strategy document used to guide national public health response) outline how messages will reach populations and sectors with different communications needs (e.g., different languages, within the country, media reach)? Yes = 1 No = 0
3.5.1c	Completed JEE assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Does the risk communication plan (or other legislation, regulation, or strategy document used to guide national public health response) designate a specific position within the government to serve as the primary spokesperson to the public during a public health emergency? Yes = 1 No = 0
3.5.2 Public health systems communication		
3.5.2a	Economist Impact analyst qualitative assessment based on official national sources, which vary by country	In the past year, is there evidence that the public health system has actively shared messages via online media platforms (e.g., social media, website) to inform the public about ongoing public health concerns and/or to dispel rumors, misinformation, or disinformation? Public health system regularly shares information on health concerns = 2 Public health system shares information only during active emergencies, but does not regularly use online media platforms = 1 Public health system does not regularly use online media platforms, either during emergencies or otherwise = 0

TABLE A7. SOURCES AND DEFINITIONS OF INDICATORS continued

QUESTION NUMBER	SOURCES	QUESTION AND SCORING
3.5.2b	Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Is there evidence that senior leaders (president or ministers) have shared misinformation or disinformation on infectious diseases in the past two years? Yes = 0 No = 1
3.6 Access to communications infrastructure		
3.6.1 Internet users		
3.6.1a	International Telecommunication Union (ITU)	Percentage of households with Internet
3.6.2 Mobile subscribers		
3.6.2a	ITU	Mobile-cellular telephone subscriptions per 100 inhabitants
3.6.3 Female access to a mobile phone		
3.6.3a	Gallup	Percentage point gap between males and females whose home has access to a mobile phone
3.6.4 Female access to the Internet		
3.6.4a	Gallup	Percentage point gap between males and females whose home has access to the Internet
3.7 Trade and travel restrictions		
3.7.1 Trade restrictions		
3.7.1a	Economist Impact analyst qualitative assessment based on official national sources, which vary by country	In the past year, has the country issued a restriction, without international/bilateral support, on the export/import of medical goods (e.g., medicines, oxygen, medical supplies, personal protective equipment [PPE]) due to an infectious disease outbreak? Yes = 0 No = 1
3.7.1b	Economist Impact analyst qualitative assessment based on official national sources, which vary by country	In the past year, has the country issued a restriction, without international/bilateral support, on the export/import of non-medical goods (e.g., food, textiles, and so on) due to an infectious disease outbreak? Yes = 0 No = 1
3.7.1 Trade restrictions		
3.7.2a	Economist Impact analyst qualitative assessment based on official national sources, which vary by country	In the past year, has the country implemented a ban, without international/bilateral support, on travelers arriving from a specific country or countries due to an infectious disease outbreak? Yes = 0 No = 1

QUESTION NUMBER	SOURCES	QUESTION AND SCORING
CATEGORY 4: SUFFICIENT AND ROBUST HEALTH SYSTEM TO TREAT THE SICK AND PROTECT HEALTH WORKERS		
4.1 Health capacity in clinics, hospitals, and community care centers		
4.1.1 Available human resources for the broader healthcare system		
4.1.1a	WHO; national sources	Doctors per 100,000 people
4.1.1b	WHO; national sources	Nurses and midwives per 100,000 people
4.1.1c	Completed JEE assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Does the country have a health workforce strategy in place (which has been updated in the past five years) to identify fields where there is an insufficient workforce and strategies to address these shortcomings? Yes = 1 No = 0
4.1.2 Facilities capacity		
4.1.2a	WHO/World Bank; national sources	Hospital beds per 100,000 people
4.1.2b	Completed JEE assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Does the country have the capacity to isolate patients with highly communicable diseases in a biocontainment patient care unit and/or patient isolation room/unit located within the country? Yes = 1 No = 0
4.1.2c	Completed JEE assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Does the country meet one of the following criteria? • Is there evidence that the country has demonstrated capacity to expand isolation capacity in response to an infectious disease outbreak in the past two years? • Is there evidence that the country has developed, updated, or tested a plan to expand isolation capacity in response to an infectious disease outbreak in the past two years? Yes = 1 No = 0

TABLE A7. SOURCES AND DEFINITIONS OF INDICATORS continued

QUESTION NUMBER	SOURCES	QUESTION AND SCORING
4.2 Supply chain for health system and healthcare workers		
4.2.1 Routine healthcare and laboratory system supply		
4.2.1a	Completed JEE assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Is there a national procurement protocol in place which can be used by the Ministries of Health and Agriculture for the acquisition of laboratory supplies (e.g., equipment, reagents, and media) and medical supplies (e.g., equipment, PPE) for routine needs? Yes for both laboratory and medical supply needs = 2 Yes, but only for one = 1 No = 0
4.2.2 Stockpiling for emergencies		
4.2.2a	Completed JEE assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Does the country have a stockpile of medical supplies (e.g., medical countermeasures [MCMs], medicines, vaccines, medical equipment, PPE) for national use during a public health emergency? Yes = 2 Yes, but there is limited evidence about what the stockpile contains = 1 No = 0
4.2.2b	Completed JEE assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Does the country have a stockpile of laboratory supplies (e.g., reagents, media) for national use during a public health emergency? Yes = 2 Yes, but there is limited evidence about what the stockpile contains = 1 No = 0
4.2.2c	Completed JEE assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Is there evidence that the country conducts or requires an annual review of the national stockpile to ensure that the supply is sufficient for a public health emergency? Yes = 1 No = 0

QUESTION NUMBER	SOURCES	QUESTION AND SCORING
4.2.3 Manufacturing and procurement for emergencies		
4.2.3a	Completed JEE assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Does the country meet one of the following criteria? • Is there evidence of a plan/agreement to leverage domestic manufacturing capacity to produce medical supplies (e.g., MCMs, medicines, vaccines, equipment, PPE) for national use during a public health emergency? • Is there evidence of a plan/mechanism to procure medical supplies (e.g., MCMs, medicines, vaccines, equipment, PPE) for national use during a public health emergency? Needs to meet at least one of the criteria to be scored a 1 on this measure. Yes for both = 1 Yes for one = 1 No for both = 0
4.2.3b	Completed JEE assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Does the country meet one of the following criteria? • Is there evidence of a plan/agreement to leverage domestic manufacturing capacity to produce laboratory supplies (e.g., reagents, media) for national use during a public health emergency? • Is there evidence of a plan/mechanism to procure laboratory supplies (e.g., reagents, media) for national use during a public health emergency? Needs to meet at least one of the criteria to be scored a 1 on this measure. Yes for both = 1 Yes for one = 1 No for both = 0

TABLE A7. SOURCES AND DEFINITIONS OF INDICATORS continued

QUESTION NUMBER	SOURCES	QUESTION AND SCORING
4.3 Medical countermeasures and personnel deployment		
4.3.1 System for dispensing medical countermeasures (MCM) during a public health emergency		
4.3.1a	Completed JEE assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Does the country have a plan, program, or guidelines in place for dispensing MCM for national use during a public health emergency (i.e., antibiotics, vaccines, therapeutics, and diagnostics)? Yes = 1 No = 0
4.3.2 System for receiving foreign health personnel during a public health emergency		
4.3.2a	Completed JEE assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Is there a public plan in place to receive health personnel from other countries to respond to a public health emergency? Yes = 1 No = 0
4.4 Healthcare access		
4.4.1 Access to healthcare		
4.4.1a	World Policy Analysis Center	Does the constitution explicitly guarantee citizens' right to medical care? Guaranteed free = 4 Guaranteed right = 3 Aspirational or subject to progressive realization = 2 Guaranteed for some groups, not universally = 1 No specific provision = 0
4.4.1b	WHO/World Bank/United Nations Children's Fund (UNICEF)	Access to skilled birth attendants (% of population)
4.4.1c	WHO Global Health Expenditure database	Out-of-pocket health expenditures per capita, purchasing power parity (PPP; current international $)
4.4.2 Paid medical leave		
4.4.2a	World Policy Analysis Center	Is there guaranteed paid sick leave? Paid sick leave = 2 Unpaid sick leave = 1 No = 0

QUESTION NUMBER	SOURCES	QUESTION AND SCORING
4.4.3 Healthcare worker access to healthcare		
4.4.3a	Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Has the government issued legislation, a policy, or a public statement committing to provide prioritized healthcare services to healthcare workers who become sick as a result of responding to a public health emergency? Yes = 1 No = 0
4.5 Communications with healthcare workers during a public health emergency		
4.5.1 Communication with healthcare workers		
4.5.1a	Completed JEE assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Is there a system in place for public health officials and healthcare workers to communicate during a public health emergency? Yes = 1 No = 0
4.5.1b	Completed JEE assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Does the system for public health officials and healthcare workers to communicate during an emergency encompass healthcare workers in both the public and private sector? Yes = 1 No = 0
4.6 Infection control practices		
4.6.1 Healthcare-associated infection (HCAI) monitoring		
4.6.1a	WHO Library of national action plans on AMR; completed JEE assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Is there evidence that the national public health system is monitoring for and tracking the number of healthcare-associated infections (HCAI) that take place in healthcare facilities? Yes = 1 No = 0

TABLE A7. SOURCES AND DEFINITIONS OF INDICATORS continued

QUESTION NUMBER	SOURCES	QUESTION AND SCORING
4.7 Capacity to test and approve new medical countermeasures		
4.7.1 Regulatory process for conducting clinical trials of unregistered interventions		
4.7.1a	Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Is there a national requirement for ethical review (e.g., from an ethics committee or via Institutional Review Board approval) before beginning a clinical trial? Yes = 1 No = 0
4.7.1b	Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Is there an expedited process for approving clinical trials for unregistered MCM to treat ongoing epidemics? Yes = 1 No = 0
4.7.2 Regulatory process for approving medical countermeasures		
4.7.2a	Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Is there a government agency responsible for approving new MCMs for humans? Yes = 1 No = 0
4.7.2b	Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Is there an expedited process for approving MCMs for human use during public health emergencies? Yes = 1 No = 0

QUESTION NUMBER	SOURCES	QUESTION AND SCORING
CATEGORY 5: COMMITMENTS TO IMPROVING NATIONAL CAPACITY, FINANCING PLANS TO ADDRESS GAPS, AND ADHERING TO GLOBAL NORMS		
5.1 International Health Regulations (IHR) reporting compliance and disaster risk reduction		
5.1.1 Official IHR reporting		
5.1.1a	WHO	Has the country submitted IHR reports to the WHO for the previous calendar year? Yes = 1 No = 0
5.1.2 Integration of health into disaster risk reduction		
5.1.2a	Completed JEE assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Are epidemics and pandemics integrated into the national risk reduction strategy or is there a standalone national disaster risk reduction strategy for epidemics and pandemics? Yes = 1 No = 0
5.2 Cross-border agreements on public and health emergency response		
5.2.1 Cross-border agreements		
5.2.1a	Completed JEE assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Does the country have cross-border agreements, protocols, or MOUs with neighboring countries, or as part of a regional group, with regard to public health emergencies? Yes = 1 No = 0
5.2.1b	Completed JEE assessments; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Does the country have cross-border agreements, protocols, or MOUs with neighboring countries, or as part of a regional group, with regard to animal health emergencies? Yes = 1 No = 0

TABLE A7. SOURCES AND DEFINITIONS OF INDICATORS continued

QUESTION NUMBER	SOURCES	QUESTION AND SCORING
5.3 International commitments		
5.3.1 Participation in international agreements		
5.3.1a	Biological Weapons Convention (BWC)	Does the county have signatory and ratification (or same legal effect) status to the Biological and Toxin Weapons Convention? Signed and ratified (or action having the same legal effect) = 2 Signed = 1 Noncompliant or not a member = 0
5.3.1b	Biological Weapons Convention	Has the country submitted confidence building measures for the Biological and Toxin Weapons Convention in the past three years? Yes = 1 No = 0
5.3.1c	Biological Weapons Convention	Has the state provided the required United Nations Security Council Resolution (UNSCR) 1540 report to the Security Council Committee established pursuant to resolution 1540 (1540 Committee)? Yes = 1 No = 0
5.3.1d	Biological Weapons Convention	Extent of UNSCR 1540 implementation: Scoring for 2021 Index: Very good (60+ points) = 4 Good (45–59 points) = 3 Moderate (30–44 points) = 2 Weak (15–29 points) = 1 Very weak (0–14 points) or matrix exists but is not publicly available = 0 Scoring for 2019 Index: Very good (100+ points) = 4 Good (75–99 points) = 3 Moderate (50–74 points) = 2 Weak (25–49 points) = 1 Very weak (0–24 points) or no matrix exists/ country is not party to the BWC = 0 Note: the information provided in the 1540 reports changed between 2019 and 2021. To ensure consistency in the scoring, Economist Impact revised the scoring for the 2021 Index to accommodate the same relative distribution with an overall lower number of points available in the most recent 1540 reports.

QUESTION NUMBER	SOURCES	QUESTION AND SCORING
5.3.2 Voluntary memberships		
5.3.2a	Global Health Security Agenda; JEE Alliance; Global Partnership Against the Spread of Weapons and Materials of Mass Destruction; Australia Group; Proliferation Security Initiative (PSI)	Does the country meet at least two of the following criteria? • Membership in Global Health Security Agenda (GHSA) • Membership in the Alliance for Country Assessments for Global Health Security and IHR Implementation (JEE Alliance) • Membership in the Global Partnership Against the Spread of Weapons and Materials of Mass Destruction (GP) • Membership in the Australia Group (AG) • Membership in the Proliferation Security Initiative (PSI) Needs to meet at least two of the criteria to be scored a 1 on this measure. Yes for five = 1 Yes for four = 1 Yes for three = 1 Yes for two = 1 Yes for one = 0 No for all = 0
5.4 Joint External Evaluation (JEE) and Performance of Veterinary Services (PVS) Pathway		
5.4.1 Completion and publication of a JEE assessment and gap analysis		
5.4.1a	WHO Strategic Partnership for IHR and Health Security (SPH); Global Health Security Agenda	Has the country completed a JEE or precursor external evaluation (e.g., GHSA pilot external assessment) and published a full public report in the past five years? Yes = 1 No = 0
5.4.1b	WHO Strategic Partnership for IHR and Health Security (SPH); Global Health Security Agenda	Has the country completed and published, within the past five years, either a National Action Plan for Health Security (NAPHS) to address gaps identified through the JEE assessment or a national GHSA roadmap that sets milestones for achieving each of the GHSA targets? Yes = 1 No = 0

TABLE A7. SOURCES AND DEFINITIONS OF INDICATORS continued

QUESTION NUMBER	SOURCES	QUESTION AND SCORING
5.4.2 Completion and publication of a Performance of Veterinary Services (PVS) assessment and gap analysis		
5.4.2a	World Organisation for Animal Health (OIE) PVS assessments	Has the country completed and published a PVS assessment in the past five years? Yes = 1 No = 0
5.4.2b	OIE PVS assessments	Has the country completed and published a PVS gap analysis in the past five years? Yes = 1 No = 0
5.5 Financing		
5.5.1 National financing for epidemic preparedness		
5.5.1a	Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Is there evidence that the country has allocated national funds to improve capacity to address epidemic threats within the past three years? Yes = 1 No = 0
5.5.2 Financing under Joint External Evaluation (JEE) and Performance of Veterinary Services (PVS) reports and gap analyses		
5.5.2a	WHO Strategic Partnership for IHR and Health Security (SPH); Global Health Security Agenda	Does the JEE report, National Action Plan for Health Security (NAPHS), and/or national Global Health Security Agenda (GHSA) road-map allocate or describe specific funding from the national budget (covering a time period either in the future or within the past five years) to address the identified gaps? Yes = 1 No/country has not conducted a JEE = 0
5.5.2b	OIE PVS assessments	Does the PVS gap analysis and/or PVS assessment allocate or describe specific funding from the national budget (covering a time period either in the future or within the past five years) to address the identified gaps? Yes = 1 No/country has not conducted a PVS = 0

QUESTION NUMBER	SOURCES	QUESTION AND SCORING
5.5.3 Financing for emergency response		
5.5.3a	Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Is there a publicly identified special emergency public financing mechanism and funds that the country can access in the face of a public health emergency (such as through a dedicated national reserve fund, an established agreement with the World Bank pandemic financing facility/other multilateral emergency funding mechanism, or other pathway identified through a public health or state of emergency act)? Yes = 1 No = 0
5.5.4 Accountability for commitments made at the international stage for addressing epidemic threats		
5.5.4a	Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Is there evidence that senior leaders (president or ministers), in the past three years, have made a public commitment either to • Support other countries to improve capacity to address epidemic threats by providing financing or support? • Improve the country's domestic capacity to address epidemic threats by expanding financing or requesting support to improve capacity? Needs to meet at least one of the criteria to be scored a 1 on this measure. Yes for both = 1 Yes for one = 1 No for both = 0

TABLE A7. SOURCES AND DEFINITIONS OF INDICATORS continued

QUESTION NUMBER	SOURCES	QUESTION AND SCORING
5.5.4b	Global Health Security Funding Tracker; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Is there evidence that the country has, in the past three years, either • Provided other countries with financing or technical support to improve capacity to address epidemic threats? • Requested financing or technical support from donors to improve the country's domestic capacity to address epidemic threats? Needs to meet at least one of the criteria to be scored a 1 on this measure. Yes for both = 1 Yes for one = 1 No for both = 0
5.5.4c	Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Is there evidence that the country has fulfilled its full contribution to the WHO within the past two years? Yes = 1 No = 0
5.6 Commitment to sharing of genetic and biological data and specimens		
5.6.1 Commitment to sharing genetic data, clinical specimens, and/or isolated specimens (biological materials) in both emergency and nonemergency research		
5.6.1a	Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Is there a publicly available plan or policy for sharing genetic data, clinical specimens, and/or isolated specimens (biological materials) along with the associated epidemiological data with international organizations and/or other countries that goes beyond influenza? Yes = 1 No = 0
5.6.1b	WHO; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Is there public evidence that the country has not shared samples in accordance with the Pandemic Influenza Preparedness (PIP) framework in the past two years? Yes = 0 No = 1
5.6.1c	WHO; Economist Impact analyst qualitative assessment based on official national sources, which vary by country	Is there public evidence that the country has not shared pandemic pathogen samples during an outbreak in the past two years? Yes = 0 No = 1

QUESTION NUMBER	SOURCES	QUESTION AND SCORING
CATEGORY 6: OVERALL RISK ENVIRONMENT AND COUNTRY VULNERABILITY TO BIOLOGICAL THREATS		
6.1 Political and security risk		
6.1.1 Government effectiveness		
6.1.1a	Economist Intelligence	Policy formation (Scored 0–4, where 4 = best)
6.1.1b	Economist Intelligence	Quality of bureaucracy (Scored 0–4, where 4 = best)
6.1.1c	Economist Intelligence	Excessive bureaucracy/red tape (Scored 0–4, where 4 = best)
6.1.1d	Economist Intelligence	Vested interests/cronyism (Scored 0–4, where 4 = best)
6.1.1e	Transparency International	Country score on Corruption Perception Index (Scored 0-100, where 100=best)
6.1.1f	Economist Intelligence	Accountability of public officials (Scored 0–4, where 4 = best)
6.1.1g	Economist Intelligence	Human rights risk (Scored 0–4, where 4 = best)
6.1.2 Orderly transfers of power		
6.1.2a	Economist Intelligence	How clear, established, and accepted are constitutional mechanisms for the orderly transfer of power from one government to another? Very clear, established, and accepted = 4 Clear, established, and accepted = 3 One of the three criteria (clear, established, accepted) is missing = 2 Two of the three criteria (clear, established, accepted) are missing = 1 Not clear, not established, not accepted = 0
6.1.3 Risk of social unrest		
6.1.3a	Economist Intelligence	What is the risk of disruptive social unrest? Very low: Social unrest is very unlikely = 4 Low: There is some prospect of social unrest, but disruption would be very limited = 3 Moderate: There is a considerable chance of social unrest, but disruption would be limited = 2 High: Major social unrest is likely and would cause considerable disruption = 1 Very high: Large-scale social unrest on such a level as to seriously challenge government control of the country is very likely = 0

TABLE A7. SOURCES AND DEFINITIONS OF INDICATORS continued

QUESTION NUMBER	SOURCES	QUESTION AND SCORING
6.1.4 Illicit activities by non-state actors		
6.1.4a	Economist Intelligence	How likely is it that domestic or foreign terrorists will attack with a frequency or severity that causes substantial disruption? No threat = 4 Low threat = 3 Moderate threat = 2 High threat = 1 Very high threat = 0
6.1.4b	UN Office of Drugs and Crime (UNODC)	What is the level of illicit arms flows within the country? Scoring banded into quintiles from 0–4
6.1.4c	Economist Intelligence	How high is the risk of organized criminal activity to the government or businesses in the country? Very low = 4 Low = 3 Moderate = 2 High = 1 Very high = 0
6.1.5 Armed conflict		
6.1.5a	Economist Intelligence	Is this country presently subject to an armed conflict, or is there at least a moderate risk of such conflict in the future? No armed conflict exists = 4 Yes; sporadic conflict = 3 Yes; incursional conflict = 2 Yes; low-level insurgency = 1 Yes; territorial conflict = 0
6.1.6 Government territorial control		
6.1.6a	Economist Intelligence Democracy Index	Does the government's authority extend over the full territory of the country? Yes = 1 No = 0

QUESTION NUMBER	SOURCES	QUESTION AND SCORING
6.1.7 International tensions		
6.1.7a	Economist Intelligence	Is there a threat that international disputes/ tensions could have a negative effect? No threat = 4 Low threat = 3 Moderate threat = 2 High threat = 1 Very high threat = 0
6.2 Socio-economic resilience		
6.2.1 Literacy		
6.2.1a	United Nations Development Programme (UNDP); United Nations Educational, Scientific and Cultural Organization (UNESCO); Economist Impact	Adult literacy rate, population 15+ years, both sexes (%)
6.2.2 Gender equality		
6.2.2a	United Nations Development Programme (UNDP); Economist Impact	UNDP Gender Inequality Index score
6.2.3 Social inclusion		
6.2.3a	World Bank; Economist Impact	Poverty headcount ratio at US$1.90 a day (2011 PPP) (% of population)
6.2.3b	World Bank; International Labour Organization; Economist Impact calculations	Share of employment in the informal sector Greater than 50% = 2 Between 25% and 50% = 1 Less than 25% = 0
6.2.3c	World Bank; Economist Impact calculations	Coverage of social insurance programs (% of population) Scored in quartiles (0–3, where 3 = best)
6.2.4 Public confidence in government		
6.2.4a	Economist Intelligence Democracy Index	Level of public confidence in government: High (more than 40%) = 2 Moderate (25–40%), or no data available = 1 Low (less than 25%) = 0
6.2.5 Local media and reporting		
6.2.5a	Economist Intelligence Democracy Index	Is media coverage robust? Is there open and free discussion of public issues, with a reasonable diversity of opinions? Scored 0–2, where 2 = best
6.2.6 Inequality		
6.2.6a	World Bank; Economist Impact calculations	Gini coefficient Scored 0–1, where 0 = best

TABLE A7. SOURCES AND DEFINITIONS OF INDICATORS continued

QUESTION NUMBER	SOURCES	QUESTION AND SCORING
6.3 Infrastructure adequacy		
6.3.1 Adequacy of road network		
6.3.1a	Economist Intelligence	What is the risk that the road network will prove inadequate to meet needs? Very low = 4 Low = 3 Moderate = 2 High = 1 Very high = 0
6.3.2 Adequacy of airports		
6.3.2a	Economist Intelligence	What is the risk that air transport will prove inadequate to meet needs? Very low = 4 Low = 3 Moderate = 2 High = 1 Very high = 0
6.3.3 Adequacy of power network		
6.3.3a	Economist Intelligence	What is the risk that power shortages could be disruptive? Very low = 4 Low = 3 Moderate = 2 High = 1 Very high = 0
6.4 Environmental risks		
6.4.1 Urbanization		
6.4.1a	World Bank	Urban population (% of total population)
6.4.2 Land use		
6.4.2a	World Bank; Economist Impact	Percentage point change in forest area between 2008 and 2018
6.4.3 Natural disaster risk		
6.4.3a	Economist Intelligence	What is the risk that the economy will suffer a major disruption owing to a natural disaster? Very low = 4 Low = 3 Moderate = 2 High = 1 Very high = 0

QUESTION NUMBER	SOURCES	QUESTION AND SCORING
6.5 Public health vulnerabilities		
6.5.1 Access to quality healthcare		
6.5.1a	United Nations; World Bank, UNICEF; Institute for Health Metrics and Evaluation (IHME); Central Intelligence Agency (CIA) World Factbook	Total life expectancy (years)
6.5.1b	WHO	Age-standardized noncommunicable disease (NCD) mortality rate (per 100,000 population)
6.5.1c	World Bank	Population aged 65+ (% of total population)
6.5.1d	World Bank	Prevalence of current tobacco use (% of adults)
6.5.1e	WHO	Prevalence of obesity among adults, BMI≥ 30 (age-standardized estimate) (% of adults)
6.5.2 Access to potable water and sanitation		
6.5.2a	UNICEF; Economist Impact	Percentage of homes with access to at least basic water infrastructure
6.5.2b	UNICEF; Economist Impact	Percentage of homes with access to at least basic sanitation facilities
6.5.3 Public healthcare spending levels per capita		
6.5.3a	WHO Global Health Expenditure database	Domestic general government health expenditure per capita, PPP (current international $)
6.5.4 Trust in medical and health advice		
6.5.4a	Wellcome Trust Global Monitor 2018	Share of population that trusts medical and health advice from the government More than 80% = 2 Between 60% and 80%, or no data available = 1 Less than 60% = 0
6.5.4b	Wellcome Trust Global Monitor 2018	Share of population that trusts medical and health advice from health professionals More than 80% = 2 Between 60% and 80%, or no data available = 1 Less than 60% = 0

Table A8 provides the sources and definitions of the background indicators of the 2021 Global Health Security Index. These indicators are not included in the index scores, but are provided as contextual information.

TABLE A8. SOURCES AND DEFINITIONS OF BACKGROUND INDICATORS

BACKGROUND INDICATORS FOR ANALYSIS
Overall GDP (US$) *Sources: Economist Intelligence; World Bank; Central Intelligence Agency (CIA) World Factbook*
GDP per capita (US$) *Sources: Economist Intelligence; World Bank; CIA World Factbook*
Population *Sources: Economist Intelligence; World Bank; CIA World Factbook*
Human Development Index score *Source: United Nations Development Programme (UNDP)*
Democracy Index score *Source: Economist Intelligence*
UN E-Government Survey, Online Services Index score *Source: United Nations*
Global Peace Index score *Source: Vision of Humanity*
Healthcare Access and Quality Index score *Source: Institute for Health Metrics and Evaluation (IHME)*
Human Capital Index score *Source: World Bank*
Sustainable Development Goals (SDG) Index score *Source: United Nations*
COVID-19-Specific Questions from 2021 Research
Does the country make de-identified COVID-19 surveillance data (including details such as daily case count, mortality rate, etc.) available via daily reports (or other formats) on government websites (such as the Ministry of Health, or similar)? Yes = 1 No = 0
Does the country make de-identified data on contact tracing efforts for COVID-19 (including percentage of new cases from identified contacts) available via daily reports (or other format) on government websites (such as the Ministry of Health, or similar)? Yes = 1 No = 0

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Note: Economist Impact qualitative assessments are based on official national sources, which vary by country.

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