COVID-19 Regional Safety Assessment Analytical Framework and Methodology

COVID-19 Regional Safety Assessment: Report Scope and Aim

The global challenge of this particular moment in history, which keeps the world's population in constant vigilance and hopeful for an immediate solution, is not only a medical and scientific challenge; it is also a political and governmental challenge, an economic and trade challenge, a reconfiguration of what national and international security means in practice, and a technological opportunity. And above all these things, it can be considered as a data science and an analytical challenge. Deep Knowledge Group recognizes that we are faced with the obligation, not only for ourselves but for society as a whole, to analytically disentangle the different facets of the crisis caused by the global pandemic of COVID-19, in order to establish optimal risk reduction and conflict resolution strategies to accelerate regional recoveries and the transition to a positive post-pandemic era.

Deep Knowledge Group seeks to utilize equally complex analytical frameworks to derive actionable insights and answers into how different aspects of the COVID-19 pandemic should be addressed: attending to all available data resources, using them to achieve a systemic approach to the different variables or dimensions that pre-determine it, in such a way that allows decision makers to influence these variables in practice and achieve the most positive outcomes in terms of reducing collateral damage and maximizing the likelihood of optimal post-pandemic national healthcare systems and economies.

These assessments present particular opportunities that the regions included in the present analysis may employ to improve their performance and outputs in the short and medium term in the fight against the pandemic, and to establish themselves as solid economies in the post-pandemic era. In the same way, the study has also allowed us to identify and characterize essential risks and threats that must be addressed early to avoid further outbreaks, deepening of economic damage and the collapse of healthcare systems. **The ultimate aim of the framework is to analyze and score different regions according to their overall level of stability**, both in terms of optimizing current health and wellness outcomes of their population amid the COVID-19 pandemic, as well as their prospects and likelihood of enabling geopolitical stabilization and economic recovery in the post-pandemic era.

COVID-19 Regional Safety Assessment: Brief Methodology Description

Deep Knowledge Group's COVID-19 Regional Safety Assessment is a hybrid index compiled from specific parameters and indicators originally formulated as part of the group's Global COVID-19 Safety and Risk Ranking Frameworks, in order to create a new framework designed to take into account safety and vulnerability factors simultaneously. The analysis uses reputable public sources of data, but applies specific weight factors and parameters in order to structure that data in a manner that is relevant and realistic to their proportional importance and impact on various nation's success at neutralizing the current COVID-19 pandemic.

Certain metrics used for advanced and qualitative assessment were formulated by Deep Knowledge Group analysts in coordination with specific experts and consultants using proprietary sources and techniques. Therefore, such rankings may be adjusted over time depending on the underlying information and in coordination with ongoing enhancements to our underlying analytical methodologies.

The current global COVID-19 pandemic is a complex system involving more than typical disease tracking and management techniques, affected not just by biology but by the behaviour of individual humans, and the larger-scale actions of companies, institutions and governments. It is heavily influenced by the current healthcare, medical, economic, governance and geopolitical actions, behaviours and situations of entire nations. Our consortium's various analytical subsidiaries have extensive experience in conducting Big Data Analytics for highly complex topics, industries and domains. *Now, Deep Knowledge Group has adapted its existing analytical frameworks, previously applied to the Longevity Industry, AI for Drug Discovery, GovTech and NeuroTech, to conduct analytics, ranking and forecasting on the global COVID-19 pandemic.* From the multiparameter analysis of 200 selected regions and countries, encompassing up to **130 variables**, this study has been able to identify, and qualitatively and quantitatively characterize the overall degree of COVID-19 safety, stability and resilience of 200 territories around the globe.

COVID-19 Regional Safety Assessment: Detailed Methodology Description

The analysis performed in the present report first groups all 200 regions and countries into 4 distinct Tiers. Tier 1 consists of the 20 regions that were ranked highest in terms of regional safety and stability according to the analytical framework and methodology utilized in Deep Knowledge group's first COVID-19 Regional Safety Assessment, according to all 130 parameters featured in that report's analysis.

Following this, a preliminary analysis utilizing a subset of 20 parameters (taken from a subset of the full set of 130 parameters, and spread across all 6 of the index's constituent categories) was performed, in combination with a preliminary analysis of data availability and reputability for each region, in order to select the subset of parameters that can be reasonably and relevantly applied given the scope of available data to each distinct Tier. In addition to this, the regions located in Tier 3 and Tier 4 were also grouped qualitatively according to several key characteristics. Thus, each set of regions was first allocated to a specific Tier based on this preliminary analysis, and then a second-stage analysis using distinct sets of parameters was performed on each tier in order to rank them amongst each other.
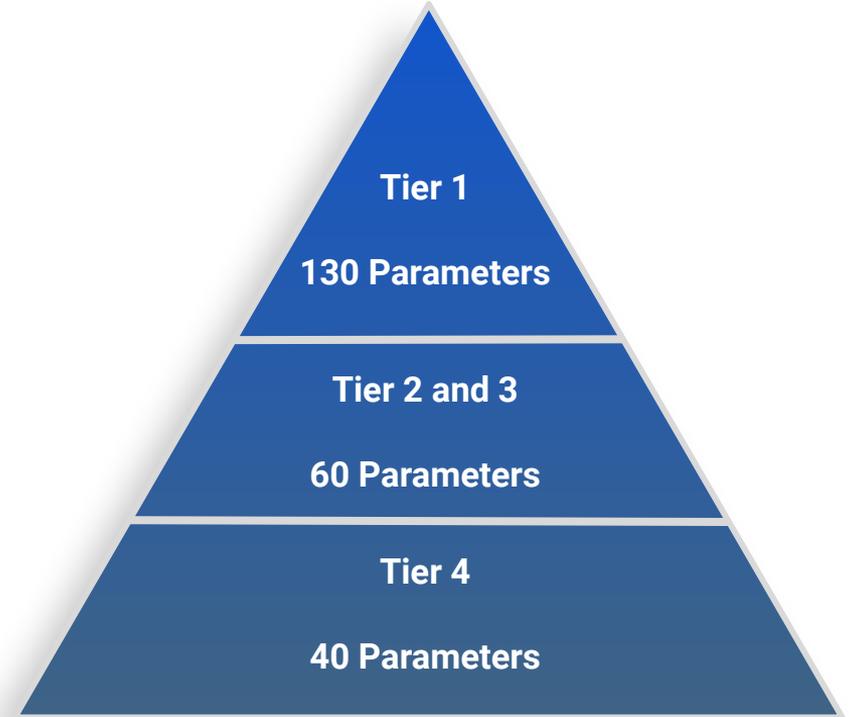
COVID-19 Regional Safety Index: Analytical Framework

The framework comprises 6 top-level categories (Quarantine Efficiency, Government Efficiency of Risk Management, Monitoring and Detection, Health Readiness, Regional Resilience and Emergency Preparedness).

Each category consists of a matrix of sub-parameters (referred to here as Indicators), which relate to specific factors of importance impacting the stability of current regional circumstances, of the effectiveness of various regions' emergency response efforts, and these variables will also address post-pandemic planning measures in future studies.

Finally, each indicator itself consists of a matrix of 2-10 quantitative or qualitative sub-parameters, relating to the specific topic, analytical focus and end-point of their parent indicator. Quantitative parameters are numeric, and are obtained from a variety of reputable, publicly available sources of data. Qualitative parameters are binary, and regions are assigned either a 1 or a 0, which represent an answer to a specific yes/no question.

6
Categories

30
Indicators

130
Parameters
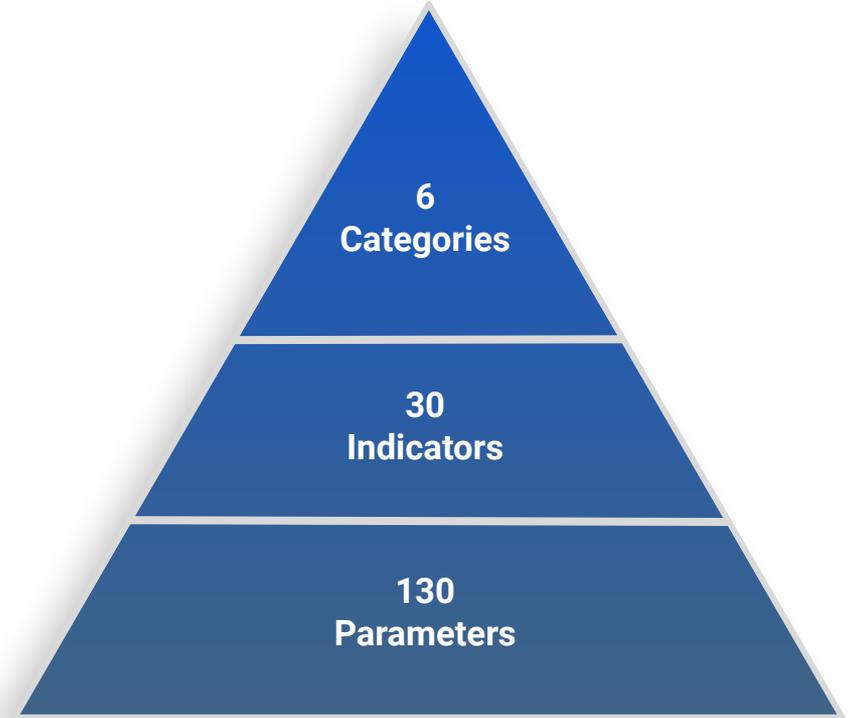
COVID-19 Regional Safety Index: Analytical Approach Behind the 4-Tiered Ranking System

Tier 1 consists of 20 regions with exceptionally high level sof regional safety, as determined by the full application of all 130 parameters across all 6 Regional Safety Index Categories.

Tier 2 consists of 20 regions that scored comparatively well in terms of regional safety according to the phase-1 analysis using 20 parameters, but not as well as those in Tier 1. After being located in Tier 2, they were ranked amongst each other using a subset of 60 parameters.

Tier 3 consists of 60 regions that scored much less favourably during the first-phase analysis that would be expected considering their general pre-pandemic levels of Quarantine Efficiency, Government Efficiency of Risk Management, Monitoring and Detection Efficiency, Health Readiness, Regional Resilience and Emergency Preparedness).

Tier 4 consists of 100 regions that scored least favourably during the first-phase analysis, and which suffer from high levels of data unavailability or unreliability. After being placed in Tier 4, they were ranked amongst each other using a subset of 40 parameters (due to data availability issues which prevented a more comprehensive analysis).

The aim of this approach is to conduct as comprehensive analysis an analysis as possible considering each region's unique levels of data availability and reliability.

Tier 1
130 Parameters

Tier 2
60 Parameters

Tier 3
60 Parameters

Tier 4
40 Parameters
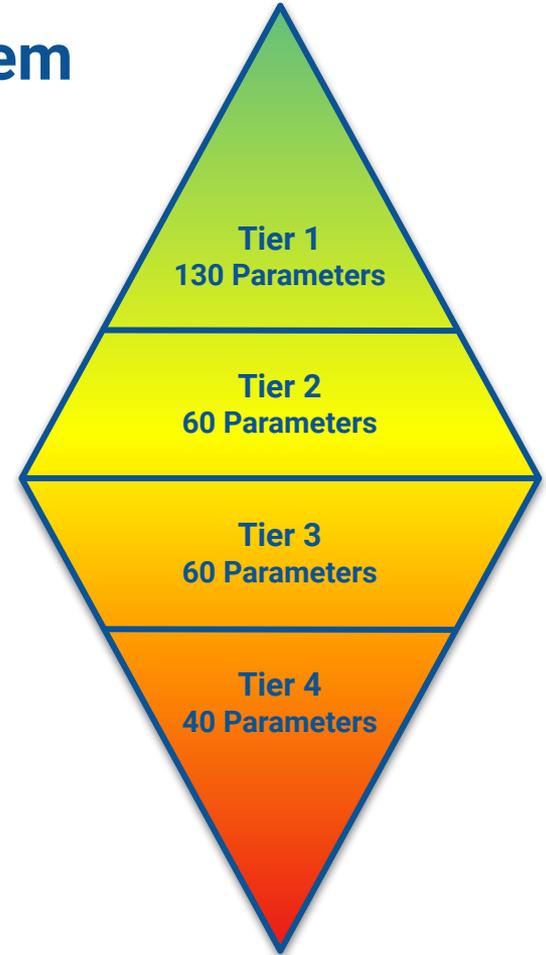
COVID-19 Regional Safety Index: Data Sources

Data collection is an essential stage of the research. Accurate data collection is essential to maintaining the integrity of research. To answer relevant questions of the working paper and evaluate outcomes, data used for this analysis was collected from credible sources.

World Health Organization	OECD Data
World Bank Open Data	Government Reports
Peer-Reviewed Scientific Publications	Worldometers
E-Government Development Index	Human Development Index
UNdata	Corruption Perceptions Index
IndexMundi	Our World in Data
World Population Review	TheGlobalEconomy.com
EuropePMC	The Lancet
GHS Index	WORLD LIFE EXPECTANCY
WCRF International	ProCon.org

COVID-19 Regional Safety Index: Data Accuracy Review

The index utilizes a combination of publicly available databases (including but not limited to indexes and region statistics), as well as manually-curated and researched quantitative and qualitative data obtained by manual searches using search engines, media and governmental reports, and the use of expert opinions and consultations in cases where data was not available.

In utilizing three qualitatively distinct sources of data, Deep Knowledge Group analysts have attempted to overcome barriers in conducting a robust and comprehensive, yet reliable and methodologically-rigorous analysis by utilizing the largest and most reputable databases (usually constructed by an unbiased international group or foundation) where possible, by consulting region-specific resources in cases when open-source international databases are not possible, and finally by utilizing expert opinion in all cases where publicly-accessible regional and/or international sources of data are unavailable.

By utilizing this approach, the present analysis attempts to find an optimal balance between using maximally transparent and reliable sources of data, and including data which are only obtainable from expert consultation.
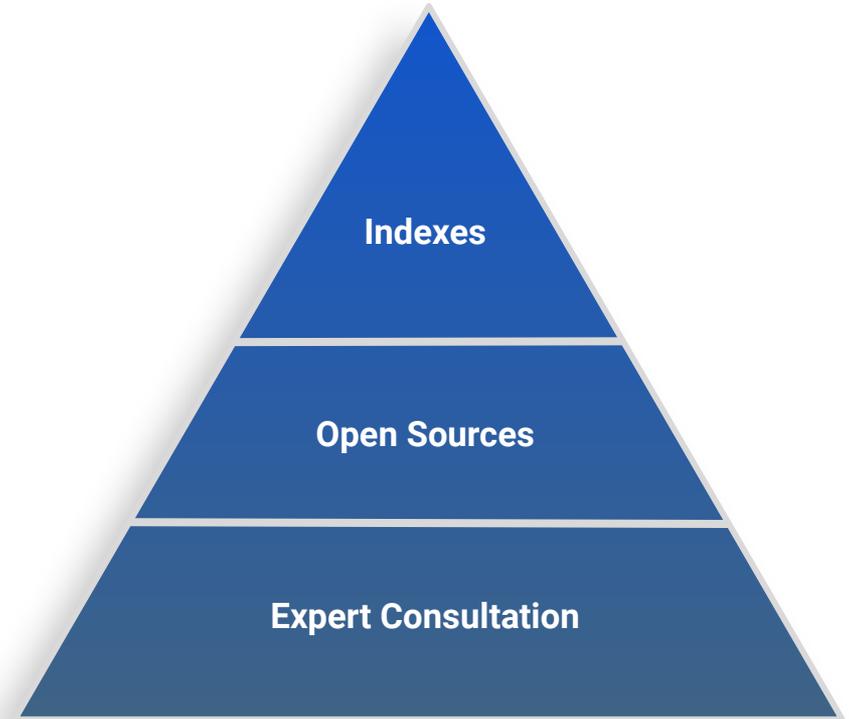
COVID-19 Regional Safety Index:
Data Modeling and Calculations

Each parameter in all three layers of the framework (categories, indicators and parameters) is assigned a specific weight, or importance factor, designed to approximate the relative importance of each parameter or parameter-matrix on the effectiveness of a region's current situation, emergency response efforts or post-pandemic preventive measures as it relates to the specific analytical focus and endpoint of its parent group (indicator or category).

While the index takes into account both positive and negative factors impacting a given region's current or future (post-pandemic) stability, each binary question is constructed in such a way that a higher value is associated with more favorable conditions.

Thus, for example, a higher score in an indicator or parameter within top-level categories focused on risk (such as region vulnerability) indicates less vulnerability, rather than higher vulnerability, than a lower score within the same category, indicator or parameter.

Deep Knowledge Group analysts first worked to formulate the specific list of parameters (categories, indicators and parameters), and to assign relevant parameter weights (importance factors) and then gathered data from government and academic publications; and websites of government authorities, international organizations, non-governmental organizations, and local and international news and media reports in order to compute the score for each parameter.

The research process proved challenging, both because of the difficulty in sourcing data and official information related each quantitative and qualitative parameter and, in some cases, because of a lack of publicly available information.

COVID-19 Regional Safety Index:
Data Modeling and Calculations

Modeling the parameters, indicators, and categories in the COVID-19 Regional Safety Index results in overall scores of 0–100 for each region, in which 100 represents the most favorable conditions possible and 0 the least favorable (with respect to the topical focus of each parameter).

A score of 100 in the Index does not indicate that a region has perfect regional stability conditions, and a score of 0 does not mean that a region has no regional stability at all. Instead, scores of 100 and 0 represent the highest or lowest possible scores, respectively, as measured by the Index criteria.

1. The values of each parameter are averaged to determine the value of their parent indicator: ***indicator score = average of weighted individual parameters***
2. Then, the indicator score is multiplied by the weight of the indicator, and is normalized (multiplied by 100) in order to allow for a final category value to be made by summing the individual values of all normalized indicators in each category.
3. Finally, the aggregate value of each category (consisting of the sum of indicators) is multiplied by the weight of the category. The final cumulative index score for each region is the obtained by summing the individual category weights. Thus, the category values consist of a weighted total of the indicator values within each category: ***category score = ∑ weighted individual indicators***

The category values have been normalized on the basis of the following equation: $x = (x − Min(x))/(Max(x) − Min(x))$, where Min(x) and Max(x) are the lowest and highest values, respectively, in the COVID-19 Regional Safety Index (of the 20 regions) for any given indicator. The normalized value (i.e., a score of 0–100) makes it directly comparable with other normalized indicator scores.

COVID-19 Regional Safety Index: Principal Component Analysis

Principal components analysis (PCA) is a data science technique used to quantitatively define the way that indicator weights are assigned in order to create a "composite index" (a ranking based on a weighted sum of specific indicators).

PCA allows us to remove redundant information that are shared among two or more indicators by creating a weighting that accounts for the greatest amount of variance in the data.

The PCA weights that have been used to create Deep Knowledge Group's COVID-19 Regional Stability Ranking are provided in order to provide further depth into the model's construction.

However, they should be considered as complementary tools, and not as supplemental weights to override the default weights assigned to indicators, parameters and categories, or as a direct means of understanding the regional index scores themselves, because they do not consider the "impact factor" or significance-based weights used in the model.

PCA gives a weight to each component in an the index which takes into account covariance between indicators, and the degree with which a particular component (parameter, indicator or category) maximizes the variation among scores in the index.

In essence, it is a method used to minimize redundancy between variables and maximize variation as it pertains to the actual final index scores.

In simplified terms, it minimizes the importance or impact of redundant factors shared among variables and maximizes the importance of impact of non-redundant factors that contribute significantly to the final output of the index (the regional scores).

Principal Component Analysis

Each PCA weight is calculated by taking the principal component (known as the eigenvector) associated with the highest explained variance (known as the eigenvalue), which constitutes a method of decomposing data into independent components ordered by informational content. Valid PCA makes several important assumptions.

These include (1) the assumption that variance is meaningful and not the result of significant measurement errors in the data itself, and (2) that the assumption that that the dynamic in question are along the direction with the largest variance.

Single-stage PCA analysis solves for the weights maximize variance across all variables, irrespective of which top-level category they belong to. The following steps are followed:

- Perform PCA analysis on all indicators, ignoring the category they belong to.
- Use the principal component associated with the highest eigenvalue.
- Set negative components to zero.
- Normalize indicator weights (such that the sum of weights is equal to 1).
- Normalize the category weights (such that the sum of categories is equal to 1).
- Use the sum of the non-normalized parameter weights and assign this as the indicator weight for that category.
- 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 COVID-19 Regional Safety Index, which suggests that the Index has been divided into subgroups appropriately.

COVID-19 Regional Safety Assessment Analytical Framework

DEEP KNOWLEDGE GROUP

Quarantine Efficiency

- Scale of Quarantine
- Quarantine Timeline
- Criminal Penalties for Violating Quarantine
- Economic Support for Quarantined Citizens
- Economic Supply Chain Freezing
- Travel Restrictions

Government Efficiency of Risk Management

- Level of Security and Defense Advancement
- Rapid Emergency Mobilization
- Efficiency of Government Structure
- Economic Sustainability
- Pandemic Readiness
- Legislative Efficiency

Monitoring and Detection

- Monitoring Systems & Disaster Management
- Scope of Diagnostic Methods
- Testing Efficiency
- AI for Diagnostics and Prognostics
- Government Surveillance Technology for Monitoring
- Reliability and Transparency of Data

Healthcare Readiness

- COVID-19 Equipment Availability
- Mobilization of New Healthcare Resources
- Quantity and Quality of Medical Staff
- Level of Healthcare Progressiveness
- Level of Technological Advancement
- Epidemiology System Level of Development

Regional Resiliency

- Infection Spread Risk
- Culture Specifics and Societal Discipline
- Level of Modern Sanitization Methods
- Demography
- Chronic Diseases
- Geopolitical Vulnerability

Emergency Preparedness

- Societal Emergency Resilience
- Emergency Military Mobilization Experience
- Surveillance Capabilities
- Previous National Emergency Experience

COVID-19 Quarantine Efficiency

Scale of Quarantine

This indicator quantifies the current scale of a region's quarantine measures, including both the total size and the geographical distribution of quarantine efforts. Different weightings are given for full-scale quarantine vs. mandatory social distancing measures.

Quarantine Timeline

This indicator qualifies how early (with respect to the overall timeline of infection spread) that a region implements quarantine and social distancing measures, with respect to the total number of cases present and the geographical distribution of infection at the time of implementing quarantine and social distancing measures.

Criminal Penalties for Violating Quarantine

This indicator quantifies and qualifies the presence and severity of a region's criminal penalties for violating imposed quarantine and social distancing measures. regions that police such violations are generally better equipped to limit infection spread.

Economic Support for Quarantined Citizens

This indicator qualifies and quantifies the level of economic support provided by governments to citizens under stay-at-home or lockdown orders. Economic support provides citizens with the capacity to stay at home in practice.

Economic Supply Chain Freezing

This indicator quantifies the extent of governments' efforts to "freeze" economic and supply-chain activity, which allows for nationwide lockdowns to occur in practice, and in a way that is believed to minimize eventual negative economic repercussions of the pandemic.

Travel Restrictions

This indicator quantifies the scale of regions' travel restrictions on both citizens and tourists in order to minimize infection spread. Different weightings are given for domestic and international travel restrictions.

COVID-19 Government Efficiency of Risk Management

Level of Security and Defense Advancement

This indicator quantifies the current scale of a region's military security and defense capabilities (taking into account both national security and reserve capacities for neutralizing potential external geopolitical threats).

Rapid Emergency Mobilization

This indicator serves qualifies the robustness of a region's capacity to mobilize emergency response measures in the face of national emergencies, including pandemics.

Efficiency of Government Structure

This indicator measures various nations' capacity for rapid and effective governance to provide insight on which regions have the greatest risk of dealing with the COVID-19 pandemic (and its potential economic, societal and geopolitical consequences) in a non-optimal manner.

Economic Sustainability

This indicator qualifies and quantifies the overall level of the region's economic stability and sustainability (taking into account not just the current state of economy, but also the growth rate of its debt and its capacity to remain economically sustainable in a post-pandemic era).

Pandemic Readiness

This indicator quantifies a region's level of preparedness in rapidly mobilizing nation-wide emergency response measures in response to pandemics across legal, economic and social efforts to minimize a pandemic's negative effects on their citizens health and their economy.

Legislative Efficiency

This indicator quantifies the flexibility and comprehensiveness of the region's legislative infrastructure and resources for rapidly deploying emergency response legislation on a nation-wide scale.

COVID-19 Monitoring and Detection

Monitoring Systems and Disaster Management

This indicator quantifies how advanced and sophisticated a region's surveillance and monitoring technologies are, including both the depth and breadth of technologies (the diversity of surveillance and monitoring technologies, and their general level of sophistication).

Scope of Diagnostic Methods

This indicator qualifies the scope, breadth and diversity of the specific diagnostic techniques in standard use in a region, assuming a relationship between the diversity and effectiveness of diagnostic techniques.

Testing Efficiency

The indicator quantifies regions' average testing efficiency, considering both the average time to get results from an administered test, and the average test backlog based on available lab analysis personnel.

AI for Diagnostics and Prognostics

The indicator qualifies whether the use of AI and data-driven techniques for diagnostic analysis are in widespread use in a region. Such techniques lower the burden on resources and personnel dedicated to analyzing the results of COVID tests and patient prognosis.

Government Surveillance Technology for Monitoring

This indicator quantifies how advanced and widespread a region's surveillance and monitoring activities are. Widespread monitoring gives governments greater capacity to track infection rates and compliance with quarantine and social distancing measures.

Reliability and Transparency of Data

This indicator qualifies the reliability and transparency of a region's reported infection, hospitalization and mortality statistics. Many regions appear to be manipulating their data to obscure the true level of infection, hospitalization and mortality.

COVID-19 Healthcare Readiness

COVID-19 Equipment Availability

This indicator quantifies the size (total and per capita) of emergency equipment stockpiles (i.e., medical supplies and emergency treatment supplies used to treat COVID-19 patients in hospital.

Mobilization of New Healthcare Resources

This indicator takes into account a region's preparedness for mobilizing additional healthcare resources (supplies, equipment, treatments and personnel) beyond their current capacity, taking into account existing guidelines and policies for emergency healthcare mobilization.

Quantity and Quality of Medical Staff

This indicator takes into account the quantity of medical staff and healthcare workers (doctors, nurses, administrative staff, etc.) in the region and the average level of medical doctors' education and expertise.

Level of Healthcare Progressiveness

This indicator provides a measure of the general level of a technological advancement and progressiveness of a region's medical science and healthcare infrastructure, and serves as an approximation of the overall quality of medical treatment in that region.

Level of Technological Advancement

This indicator ranks regions according to their healthcare system's level of technological sophistication, modernization and effectiveness in comparison to other regions.

Epidemiology System Level of Development

This indicator ranks the epidemiology system of a region (including both epidemiologists and epidemiological resources, companies, etc), in terms both of quantity and regional distribution, as well as in terms of technological sophistication.

COVID-19 Regional Resiliency

Infection Spread Risk

This indicator quantifies nations' overall spread infection risk, and is used in order to provide information on which citizens of which regions have the highest and lowest overall risk of getting infected with COVID-19.

Culture Specifics and Societal Discipline

This indicator qualifies regions according to their culture-specific practices and traditions, as it relates to health, wellness and sanitization, as well as general societal discipline. Populations which give less care and attention to health and sanitization are at greater risk of infection.

Level of Modern Sanitation Methods

This indicator ranks regions according to the presence (or absence) and degree of modernization of their sanitization systems. regions with poor sanitation systems, or those who lack them entirely, are at a much higher risk of infection spread.

Demography

This indicator quantifies the population size and demographics (age, sex, and proportion of populations with specific diseases) of a given region with respect to demographics most vulnerable to infection and negative patient outcomes.

Chronic Diseases

This indicator quantifies regions' level of geographic risk in terms of several variables including proximity to regions with a high level of infection, number of border crossings with neighboring regions, number of infection hot-spots, and number and distribution of population-dense areas.

Geopolitical Vulnerability

This indicator qualifies the current state of the region's geopolitical stability, taking into account the economic and military strength of the region's allies and rivals, assuming an association between high geopolitical stability and lower risk of attack by military rivals and resulting socioeconomic instability.

COVID-19 Emergency Preparedness

Societal Emergency Resilience

This indicator approximates the overall level of societal resilience, preparedness and experience with national emergencies, incorporating practical historical experience, psychological, cultural and religious practices and attitudes, etc.

Emergency Military Mobilization Experience

This indicator approximates the region's practical historical experience with mobilizing their military in order to help deal with national emergencies (both geopolitical and non-geopolitical emergencies), as well as the overall domestic military resources available.

Surveillance Capabilities (Scale, Scope and Technological Sophistication)

This indicator approximates the scale, scope and technological sophistication of the region's government surveillance capabilities.

Previous National Emergency Experience

This indicator approximates the region's practical historical experience with national emergencies, accounting for both geopolitical and non-geopolitical emergencies, with a focus on preparation policies and government-led emergency relief efforts.

COVID-19 Regional Safety Index: Tier-1 Methodology Framework

Tier 1 consists of the 20 regions that were ranked highest in terms of regional safety and stability according to the analytical framework and methodology utilized in Deep Knowledge group's first COVID-19 Regional Safety Assessment, according to all 130 parameters featured in that report's analysis. The 130 parameters developed for use in that report make up Deep Knowledge Group's COVID-19 Regional Safety Index, which itself is a hybrid index developed by expanding specific parameters and indicators originally formulated as part of the group's Global COVID-19 Safety and Risk Ranking Frameworks, in order to create a new framework designed to take into account safety and vulnerability factors simultaneously.

The pool of the 20 selected regions included in Tier 1 is made up of Switzerland, Germany, Israel, Singapore, China, Japan, Austria, Australia, New Zealand, Canada, South Korea, United Arab Emirates, Norway, Hong Kong, Denmark, Saudi Arabia, Hungary, Netherlands, Taiwan and Vietnam, and more than 130 qualitative and quantitative parametric variables have been developed, tuned, and grouped into 6 broad and top-level categories in order to determine the regional safety rankings of Tier 1 regions..

Nearly half of the regions positioned in Tier 1 are within Asia Pacific (and the overwhelming majority of those within Asia), with 35% being located in Europe, 15% in Middle East and Africa, and just one region (Canada) within North America. The predominance of Asian regions in Tier 1 can be partially explained by the fact that Asia is much later in the overall pandemic timeline, having faced COVID-19 earlier than others, and the factors which sets apart Asian regions in Tier 1 rather than Tiers 2 or 3, for example, can provide tangible insights into what strategies seem to have worked, and which ones have not. In addition to this, we also find a greater emphasis on government efficiency and a strong degree of coordination and integration of government-led action across many departments, more stringent and longer-lasting lock-down measures, a greater emphasis on monitoring and detection and generally more widespread testing than other parts of the world.

COVID-19 Regional Safety Index: Tier 1 Parameters

1	COVID-19 Quarantine Efficiency	
1.1	Scale of Quarantine	
1.1.1	Population Density	People per km^2
1.1.2	Does the region have dedicated military chemical and biological warfare divisions and forces?	yes=1, no=0
1.1.3	Does the region have "hotspots" (high density of cases in one specific area)?	yes=0, no=1
1.1.4	Number of cases.	per million individuals
1.1.5	Scale and scope of region-wide lockdown	full = 1, partial = 0.5 non-existing = 0
1.1.6	Does the region's federal government have legislative authority over the entire territory?	yes=0, no=1
1.1.7	Does the region possess culture and religion-specific behaviours that preclude enforcement of mandatory quarantine measures?	yes=0, no=1
1.2	Quarantine Timeline	
1.2.1	What is the length of quarantine?	14 days = 0.5, more than 14 = 1, no quarantine length = 0
1.2.2	Did the region impose quarantine measures early in the timeline of viral spread?	yes=1, no=0
1.2.3	Was quarantine easing officially declared?	yes=0, no=1
1.2.4	Did the population exert public pressure to ease quarantine measures?	yes=0, no=1
1.3	Criminal Penalties for Violating Quarantine	
1.3.1	Quantity of law enforcement officers.	number per capita

COVID-19 Regional Safety Index: Tier 1 Parameters

1.3.2	Did the region use volunteers to monitor quarantine compliance?	yes=1, no=0
1.3.3	Criminal penalties for violating quarantine.	Number of months in incarceration.
1.3.4	Fines	In USD
1.3.5	Did the region use military personnel to assist law-enforcement officers?	yes=1, no=0
1.4	Economic Support for Quarantined Citizens	
1.4.1	Economic support to citizens	in USD
1.4.2	Economic support to SMEs	in USD
1.4.3	Tax reliefs	in USD
1.4.4	Economic rescue package	% of GDP
1.5	Economic and Supply Chain Freezing	
1.5.1	Export-oriented region?	yes=0, no=1
1.5.2	Does the region have an absence of large supply shortages?	yes=0, no=1
1.5.3	Are the region's border-crossing routes open?	yes=0, no=1
1.5.4	Does the region have a high availability of food?	yes=1, no=0
1.5.5	Are there any shortages in protective equipment?	yes=0, no=1
1.6	Travel Restrictions	
1.6.1	Quantity of automotive vehicles.	number per 1000 people
1.6.2	Did the region allow for direct flights to Italy or China in February - March 2020?	yes=0, no=1
1.6.3	Average level of touristic flow.	number of tourists per year

COVID-19 Regional Safety Index: Tier 1 Parameters

2	COVID-19 Government Efficiency of Risk Management	
2.1	Level of Security and Defense Advancement	
2.1.1	Does the region's military have dedicated laboratories for protection against chemical and biological warfare?	yes=1, no=0
2.1.2	Does the region's military have pre-existing plans and policies in place in the event of a biological or chemical attack?	yes=1, no=0
2.2	Level of GovTech Development	
2.2.1	Does the region have COVID-specific training courses for doctors and nurses?	yes=1, no=0
2.2.2	Rural population	% of total population
2.2.3	Local vaccine development (attempts).	yes=1, no=0
2.3	The Efficiency of Government Structure	
2.3.1	Did the region's government develop a specific emergency response mechanism for engagement with the private sector?	yes=1, no=0
2.3.2	Are there government-startups cooperation?	yes=1, no=0
2.3.3	Government effectiveness (EIU score).	EIU Score
2.3.4	E-Government Development Index	EGDI score
2.3.5	Number of internet users per 1000 individuals.	number per 1000 people
2.3.6	Smartphone penetration.	% of population
2.3.7	Does the region utilize Electronic Health Records?	yes=1, no=0

COVID-19 Regional Safety Index: Tier 1 Parameters

2.3.8	Regional Corruption Index Score.	Index
2.4	Economic Sustainability	
2.4.1	Regional economic debt.	% of GDP
2.4.3	GDP index.	GDP index score
2.4.4	GNI index.	GNI index score
2.4.5	Minimum wages.	in USD
2.4.6	Unemployment rate due to COVID19.	% of population
2.4.7	Exit strategy plan.	yes=1, no=0
2.5	Legislative Efficiency	
2.5.1	Does the region's government have a pre-existing Action Plan for rapid resource mobilization in the event of a national emergency?	yes=1, no=0
2.5.2	Legislations and regulations for the cross-border screening of pathogens, toxic, pandemic potential pathogens.	yes=1, no=0
2.5.3	Legislative availability for disaster mobilization.	yes=1, no=0
2.5.4	State capability to adopt new surveillance laws.	yes=1, no=0
2.6	Political Stability	
2.6.1	State of emergency readiness	yes=1, no=0
2.6.2	Functioning of Government (Index)	HDI Index
2.6.3	Civil Liberties (Index)	HDI Index

COVID-19 Regional Safety Index: Tier 1 Parameters

3	COVID-19 Monitoring and Detection	
3.1	Monitoring Systems & Disaster Management	
3.1.1	Does the region's government use event-based surveillance for infection disease?	yes=1, no=0
3.1.2	Does the region's government share its surveillance data with the neighboring regions?	yes=1, no=0
3.1.3	Does the region's government have an existing Action Plan in place for the surveillance and detection of viral outbreaks and disease?	yes=1, no=0
3.2	Scope of Diagnostic Methods	
3.2.1	Does the region have validated laboratory testing methods available?	yes=1, no=0
3.2.2	Does the region have laboratories with molecular diagnostic capacity available?	yes=1, no=0
3.2.3	Does the region use online diagnostic tools?	yes=1, no=0
3.3	Testing Efficiency	
3.3.1	Number of COVID-19 tests conducted per day.	Numeric
3.3.2	Are mobile diagnostic stations available for use in the region?	yes=1, no=0
3.3.3	Does the region have a significant shortage of COVID-19 tests?	yes=0, no=1
3.3.4	Does the region use local production of COVID-19 tests?	yes=1, no=0
3.3.5	Does the region have national laboratories available for COVID-19 testing?	yes=1, no=0
3.4	AI for Diagnostics and Prognostics	
3.4.1	Are there AI/ML healthcare initiatives related to COVID-19?	yes=1, no=0

COVID-19 Regional Safety Index: Tier 1 Parameters

3.4.2	Are there AI startups that create solutions to fight Covid-19?	yes=1, no=0
3.4.3	Does the region employ AI technologies and techniques in hospitals?	yes=1, no=0
3.5	Government Surveillance Technology for Monitoring	
3.5.1	Per capita quantity of surveillance cameras.	per 1000 people / approximate
3.5.2	Does the region's government routinely use face-recognition technology for surveillance?	yes=1, no=0
3.5.3	Does the region's government use mobile tracking (tracking of population's mobile phones) in its surveillance practices?	yes=1, no=0
3.5.4	Does the region's government utilize other AI-based surveillance methods?	yes=1, no=0
3.6	Reliability and Transparency of Data	
3.6.1	Does the region have a publically-available National Plan for COVID-19?	yes=1, no=0
3.6.2	Does the region's governments conduct daily briefings on the current status of the pandemic?	yes=1, no=0
3.6.3	Does the region have an established agency or Action Group responsible for COVID-19 prevention and treatment?	yes=1, no=0
3.6.4	Does the region conduct centralized collection of COVID-19 data?	yes=1, no=0
3.6.5	Does the Ministry of Health provide data on confirmed COVID-19 cases among healthcare workers?	yes=1, no=0
3.6.6	Does the Ministry of Health provide data on confirmed COVID-19 cases, critical cases and deaths on a daily basis?	yes=1, no=0

COVID-19 Regional Safety Index: Tier 1 Parameters

4	COVID-19 Healthcare Readiness	
4.1	COVID 19 Equipment Availability	
4.1.1	Quantity of Ventilator Stockpile.	Numeric
4.1.2	Number of hospital beds	per 1000 people
4.1.3	Does the region have sufficient availability of PPE (masks and gloves)?	yes=1, no=0
4.1.4	Does the region have sufficient availability of face shields?	yes=1, no=0
4.2	Mobilization of New Healthcare Resources	
4.2.1	Did the government request that medical students assist in COVID-19 patient treatment?	yes=1, no=0
4.2.2	Does the region have the necessity and ability to build additional hospitals for COVID-19 treatment?	yes=0, no=1
4.2.3	Did the region use military mobile stations for chemical and bacteriological cleaning?	yes=1, no=0
4.2.4	Does the region have the necessary infrastructure for surplus ventilator production?	yes=1, no=0
4.2.5	Does the region have the necessary infrastructure for surplus mask production?	yes=1, no=0
4.2.6	Does the region have the necessary infrastructure for the production of other surplus PPE?	yes=1, no=0
4.3	Quantity and Quality of Medical Staff	
4.3.1	Number of doctors.	per 1000 people

COVID-19 Regional Safety Index: Parameters

4.3.2	Number of nurses.	per 1000 people
4.3.3	Does the region have epidemiology faculty at the majority of their medical universities?	yes=1, no=0
4.3.4	Are epidemiology classes available for medical students not specializing in epidemiology?	yes=1, no=0
4.4	Level of Healthcare Progressiveness	
4.4.1	Does the region have evidence of recent healthcare advancements?	yes=1, no=0
4.4.2	Healthcare Development Index score.	Index
4.4.3	Current health expenditure per capita.	in USD
4.4.4	Current health expenditure.	as % of GDP
4.4.5	HAQ (The Healthcare Access and Quality Index) - 2016.	Index
4.4.6	Pharmaceuticals spending per capita.	in USD
4.5	Level of Technological Advancement	
4.5.1	MRI number.	per million people
4.5.2	Quantity of ICU-CCB beds.	per 100,000 people
4.6	Epidemiology System Level of Development	
4.6.1	Global Health Security Index	GHS index score

COVID-19 Regional Safety Index: Tier 1 Parameters

5	COVID-19 Region Vulnerability	
5.1	Infection Spread Risk	
5.1.1	Container port traffic.	TEU: 20 foot equivalent units
5.1.2	Average number of international arrivals (incoming tourists) per year.	Number per year
5.1.3	Total transportation network size.	km
5.1.4	Does the region have a significant risk of power shortages?	yes=0, no=1
5.1.5	Does the region have a significant risk of medication shortages?	yes=0, no=1
5.2	Culture Specifics and Societal Discipline	
5.2.1	Literacy rate.	%
5.2.2	Proportion of population with tertiary education.	number per capita
5.2.3	Poverty rate.	Population living below national poverty line (%)
5.2.4	Does the region have religious or cultural practices that increase chances of infection risk or quarantine non-compliance?	yes=0, no=1
5.2.5	Human Development Index 2016.	Index
5.3	Level of Modern Sanitization Methods	
5.3.1	Does the region have access to basic sanitation facilities?	yes=1, no=0
5.4	Diseases	
5.4.1	Prevalence of diabetes.	% of population ages 20 to 79

COVID-19 Regional Safety Index: Tier 1 Parameters

5.4.2	Death rate due to endocrine disorder.	per 100,000 people
5.4.3	Prevalence of mental health and substance use disorders as a share of total disease burden, 2017.	Percent of total disease burden, 2017.
5.4.4	Incidence of tuberculosis.	per 100,000 people
5.4.5	Incidence of cancer.	per 100,000 people
5.4.6	Obesity	% of total population
5.5	Demography	
5.5.1	Size of Elderly Population.	% of total population
5.6	Societal Risks	
5.6.1	Is the region currently experiencing a political or election-based crisis?	yes=0, no=1
5.6.2	Is there a majoritively positive public sentiment regarding government COVID-19 strategy?	yes=1, no=0
5.6.3	Does the majority of the region's population support the current government?	yes=1, no=0
5.6.4	Does the region's government take into account diaspora as a factor in formulating its COVID-19 strategy?	yes=1, no=0
5.6.5	Does the region's government experience significant foreign pressure affecting its COVID-19 strategic decision making?	yes=0, no=1

COVID-19 Regional Safety Index: Tier 1 Proprietary Parameters

6	COVID-19 Emergency Preparedness	
6.1	Societal Emergency Resilience	
6.1.1	Proprietary metric #1	Not publicly disclosed.
6.1.2	Proprietary metric #2	Not publicly disclosed.
6.1.3	Proprietary metric #3	Not publicly disclosed.
6.1.4	Proprietary metric #4	Not publicly disclosed.
6.2	Emergency Military Mobilization Experience	
6.2.1	Proprietary metric #1	Not publicly disclosed.
6.2.2	Proprietary metric #2	Not publicly disclosed.
6.2.3	Proprietary metric #3	Not publicly disclosed.
6.3	Surveillance Capabilities (Scale, Scope and Technological Sophistication)	
6.3.1	Proprietary metric #1	Not publicly disclosed.
6.3.2	Proprietary metric #2	Not publicly disclosed.
6.3.3	Proprietary metric #3	Not publicly disclosed.
6.4	Previous National Emergency Experience	
6.4.1	Proprietary metric #1	Not publicly disclosed.
6.4.1	Proprietary metric #2	Not publicly disclosed.
6.4.1	Proprietary metric #3	Not publicly disclosed.

COVID-19 Regional Safety Index: Indicator Weighting Rationale

Each index category is assigned a weighting, representative of an "importance factor", which is applied to each aggregate category score when the final, cumulative regional score is computed. Generally speaking, greater weights are given to indicators that have a greater effect on overall regional safety and stability as it is defined in the present assessment. Similarly, the composite indicators within each index categories are also given individual weights, in accordance with their perceived importance and effect on the specific topic being measured by the indicator' parent category. While indicator weights are represented as a percentage, category weights are represented by integers for the purpose of obtaining round numbers that are more easily understandable.

The index's first two categories (COVID-19 Quarantine Efficiency and COVID-19 Government Efficiency of Risk Management) are given the highest weightings, of 2.2, respectively, because they measure the effectiveness of government responses made early in the overall timeline of COVID spread, which has a much greater (and, indeed, multiplative) effect on COVID-19 risk and safety than reactionary responses and management later on on the course of the pandemic. Meanwhile, COVID-19 Monitoring and Detection and COVID-19 Emergency Preparedness are given a weighting of 1.5, respectively, because they most closely measure the efficiency of ongoing responses, emergency relief efforts and real-time pandemic neutralization tactics, as well as the innate preventive infrastructure in place for rapid mobilization and coordination of crisis management efforts. Finally, COVID-19 Healthcare Readiness and COVID-19 Regional Resilience are given a weighting of 1.3, respectively, because while they are important to consider in the assessment of regional safety, they have comparatively less impact than the other categories. The high death rates in the USA and UK, for example, indicate that the tangible risk of infection and mortality in regions with a high degree of healthcare-related technological sophistication can still be high, despite the high level of medical modernization.

In future iterations of Deep Knowledge Group's COVID-19 Regional Safety Assessment, the relative weightings of categories that reflect the efficiency of early crisis neutralization and mitigation efforts will be decreased in accordance with the growing timeline of the pandemic, and the weighting assigned to categories that reflect the efficiency of ongoing crisis management efforts will be increased proportionately.

COVID-19 Index Indicator Weight

1.	COVID-19 Quarantine Efficiency	Weighting of Index Indicator
1.1	Scale of Quarantine	18%
1.2	Quarantine Timeline	17%
1.3	Criminal Penalties for Violating Quarantine	14%
1.4	Economic Support for Quarantined Citizens	18%
1.5	Economic and Supply Chain Freezing	15.50%
1.6	Travel Restrictions	17.50%

2.	COVID-19 Government Efficiency of Risk Management	Weighting of Index Indicator
2.1	Level of Security and Defense Advancement	17%
2.2	Rapid Emergency Mobilization	16%
2.3	Efficiency of Government Structure	18%
2.4	Economic Sustainability	17%
2.5	Legislative Efficiency	16%
2.6	Political Stability	16%

COVID-19 Index Indicator Weight

3.	COVID-19 Monitoring and Detection	Weighting of Index Indicator
3.1	Monitoring Systems and Disaster Management	18%
3.2	Scope of Diagnostic Methods	15%
3.3	Testing Efficiency	18%
3.4	AI for Diagnostics and Prognostics	15%
3.5	Government Surveillance Technology for Monitoring	17%
3.6	Reliability and Transparency of Data	17%

4.	COVID-19 Healthcare Readiness	Weighting of Index Indicator
4.1	COVID-19 Equipment Availability	18%
4.2	Mobilization of New Healthcare Resources	17.50%
4.3	Quantity and Quality of Medical Staff	16%
4.4	Level of Healthcare Progressiveness	15%
4.5	Level of Technological Advancement	17%
4.6	Epidemiology System Level of Development	16.50%

COVID-19 Index Indicator Weight

5.	COVID-19 Regional Resiliency	Weighting of Index Indicator
5.1	Infection Spread Risk	16.50%
5.2	Culture Specifics and Societal Discipline	18%
5.3	Level of Modern Sanitization Methods	15%
5.4	Demography	15.50%
5.5	Chronic Diseases	18%
5.6	Societal Risks	17%

6.	COVID-19 Emergency Preparedness	Weighting of Index Indicator
6.1	Societal Emergency Resilience	27%
6.2	Emergency Military Mobilization Experience	23%
6.3	Surveillance Capabilities (Scale, Scope and Technological Sophistication)	27%
6.4	Previous National Emergency Experience	23%

Index Category Weight

COVID-19 Quarantine Efficiency

	Weighting factor
❏ Scale of Quarantine	18%
❏ Quarantine Timeline	17%
❏ Criminal Penalties for Violating Quarantine	14%
❏ Economic Support for Quarantined Citizens	18%
❏ Economic and Supply Chain Freezing	15.50%
❏ Travel Restrictions	17.50%

2.2 WEIGHT

COVID-19 Government Efficiency of Risk Management

	Weighting factor
❏ Level of Security and Defense Advancement	17%
❏ Rapid Emergency Mobilization	16%
❏ Efficiency of Government Structure	18%
❏ Economic Sustainability	17%
❏ Legislative Efficiency	16%
❏ Political Stability	16%

2.2 WEIGHT

COVID-19 Monitoring and Detection

	Weighting factor
❏ Monitoring Systems and Disaster Management	18%
❏ Scope of Diagnostic Methods	15%
❏ Testing Efficiency	18%
❏ AI for Diagnostics and Prognostics	15%
❏ Government Surveillance Technology for Monitoring	17%
❏ Reliability and Transparency of Data	17%

1.5 WEIGHT

COVID-19 Emergency Preparedness

	Weighting factor
❏ Societal Emergency Resilience	27%
❏ Emergency Military Mobilization Experience	23%
❏ Surveillance Capabilities (Scale, Scope and Technological Sophistication)	27%
❏ Previous National Emergency Experience	23%

1.5 WEIGHT

COVID-19 Healthcare Readiness

	Weighting factor
❏ COVID-19 Equipment Availability	18%
❏ Mobilization of New Healthcare Resources	17.50%
❏ Quantity and Quality of Medical Staff	16%
❏ Level of Healthcare Progressiveness	15%
❏ Level of Technological Advancement	17%
❏ Epidemiology System Level of Development	16.50%

1.3 WEIGHT

COVID-19 Regional Resiliency

	Weighting factor
❏ Infection Spread Risk	6.50%
❏ Culture Specifics and Societal Discipline	18%
❏ Level of Modern Sanitization Methods	15%
❏ Demography	15.50%
❏ Chronic Diseases	18%
❏ Societal Risks	17%

1.3 WEIGHT

COVID-19 Regional Safety Index: Proprietary Data Overview

Five of the six top-level categories that comprise the index have been made publicly available in an open-source manner, all the way from the top level categories, down through their component indicators and parameters. However, Deep Knowledge group has only disclosed the component indicators of the sixth top-level index category (Emergency Preparedness), and not it's bottom-level parameters, because they employ proprietary techniques that are the group's intellectual property and are intended only for internal use.

The Emergency Preparedness index category consists of four component indicators: Societal Emergency Resilience (whose parameters measure the regions' overall level of societal resilience, preparedness and experience with national emergencies), Emergency Military Mobilization Experience (whose parameters measure region's practical historical experience with mobilizing their military in order to help deal with national emergencies), Surveillance Capabilities (which measure regions' the scale, scope and technological sophistication of the region's government surveillance capabilities), and Previous National Emergency Experience (which measures region's practical historical experience with national emergencies).

It has always been Deep Knowledge Group's long-term mission to pursue its strategic agenda in a dual non-profit and for-profit manner, aiming to achieve positive impact in the support of progressive technologies for the benefit of humanity. It is for this reason that the decision was made to conduct the majority of the group's COVID-19 analytics in an open-source manner, free of charge, to provide the public in general and authorized organizations in particular with fact-based and unbiased information. However, the group also remains open to disclosing its proprietary metrics and analytical techniques to relevant organizations, and to conducting region-specific and topic-specific analytics and forecasting for responsible governmental bodies and departments.

COVID-19 Regional Safety Index: Tier-2 and 3 Methodology Framework

Tier 2 consists of 20 regions which scored exceptionally well in terms of regional safety and stability according to the first-stage analysis utilizing 20 parameters, but not as high as those located in Tier 1. After being positioned in Tier 2, all 20 territories were then assigned cumulative and category-specific rankings using a subset of 60 parameters aggregated from each of the index's 6 categories.

Meanwhile, the 60 regions located in Tier 3 were selected based on having achieved cumulative regional safety scores (according to the stage 1 analysis described above) that were significantly lower than what one would have expected according to their pre-pandemic level of healthcare readiness, emergency preparedness and governmental management efficiency. In other words, Tier 3 consists of territories that should have ranked higher in terms of regional COVID-19 safety and stability, but which for one or another reason did not. Both cumulative and category-specific rankings were performed for Tier 3 using a subset of 60 parameters aggregated from each of the index's 6 categories.

The regions included in Tier 3 are, therefore, outliers, and to some extent anomalies, and demonstrate that one of the most critical factors impacting regional safety and stability is not the general level of healthcare sophistication in non-pandemic times, but the specific governmental strategies used to combat pandemics. The Unites States and United Kingdom, for example, have high degrees of healthcare sophistication, and yet have some of the most severe COVID-19 growth rates and mortality rates internationally, which represents a surprising result that can only be explained by specific inefficiencies relating to governmental policy, emergency preparedness and crisis management. The regions included in Tier 3 are prime targets for follow-up special analytical case studies that apply a deeper and more comprehensive, targeted, and case-by-case analytical methodologies and frameworks for identifying the specific factors behind these regions' surprisingly low comparative scores, and which utilize the results of tis analysis to provide key recommendations across all six categories of Deep Knowledge group's Regional Safety Index.

COVID-19 Regional Safety Index: Tier 2 and 3 Parameters

№	Parameter Name	
1	Population Density	People per km^2
2	Does the region have "hotspots" (high density of cases in one specific area)?	yes=1, no=0
3	Number of cases	per million individuals
4	Scale and scope of region-wide lockdown	full = 1, partial = 0.5 non-existing = 0
5	What is the length of quarantine?	14 days = 0.5, more than 14 = 1, no quarantine length = 0
6	Did the region impose quarantine measures early in the timeline of viral spread?	yes=1, no=0
7	Quantity of law enforcement officers.	number per capita
8	Criminal penalties for violating quarantine.	Number of months in incarceration.
9	Fines.	In USD
10	Economic support to citizens.	In USD

COVID-19 Regional Safety Index: Tier 2 and 3 Parameters

№	Parameter Name	
11	Economic support to SMEs.	In USD
12	Does the region have an absence of large supply shortages?	number of tourists per year
13	Quantity of automotive vehicles.	number per 1000 people
14	Average level of touristic flow.	yes=1, no=0
15	Does the region have dedicated military chemical and biological warfare divisions and forces?	EIU Score
16	Are there government-startups cooperation?	yes=1, no=0
17	Government effectiveness (EIU score).	yes=1, no=0
18	E-Government Development Index	EGDI score
19	Number of internet users per 1000 individuals.	number per 1000 people
20	State of emergency readiness	yes=1, no=0

COVID-19 Regional Safety Index: Tier 2 and 3 Parameters

№	Parameter Name	
21	Does the region have national laboratories available for COVID-19 testing?	Numeric
22	Number of COVID-19 tests conducted per day.	yes=0, no=1
23	Does the region have a significant shortage of COVID-19 tests?	yes=0, no=1
24	Quantity of Ventilator Stockpile	Numeric
25	Number of hospital beds	per 1000 people
26	Number of doctors.	per 1000 people
27	Healthcare Development Index score.	Index
28	HAQ (The Healthcare Access and Quality Index) - 2016.	Index
29	Does the region have access to basic sanitation facilities?	yes=1, no=0
30	Size of Elderly Population	% of total population

COVID-19 Regional Safety Index: Tier 2 and 3 Parameters

№	Parameter Name	
31	Is the region currently experiencing a political or election-based crisis?	yes=0, no=1
32	Does the region's military have pre-existing plans and policies in place in the event of a biological or chemical attack?	yes=1, no=0
33	Number of deaths per mln	Numeric
34	Economic support to citizens	in USD
35	Tax reliefs	in USD
36	Are there any shortages in protective equipment?	yes=0, no=1
37	EGDI.	EGDI score
38	Does the region utilize Electronic Health Records?	yes=1, no=0
39	Regional economic debt (number).	% of GDP
40	Functioning of Government (Index)	HDI Index

COVID-19 Regional Safety Index: Tier 2 and 3 Parameters

№	Parameter Name	
41	Does the region have the necessary infrastructure for surplus ventilator production?	yes=1, no=0
42	Global Health Security Index	GHS index score
43	Total transportation network size.	km
44	Literacy rate.	%
45	Proportion of population with tertiary education.	number per capita
46	Poverty rate.	Population living below national poverty line (%)
47	Does the region have religious or cultural practices that increase chances of infection risk or quarantine non-compliance?	yes=0, no=1
48	Human Development Index 2016.	Index
49	Prevalence of diabetes.	% of population ages 20 to 79
50	Death rate due to endocrine disorder.	per 100,000 people

COVID-19 Regional Safety Index: Tier 2 and 3 Parameters

№	Parameter Name	
51	Prevalence of mental health and substance use disorders as a share of total disease burden, 2017.	Percent of total disease burden, 2017.
52	Incidence of tuberculosis.	per 100,000 people
53	Incidence of cancer.	per 100,000 people
54	Obesity	% of total population
55	Is there a majoritively positive public sentiment regarding government COVID-19 strategy?	yes=1, no=0
56	Proprietary metric #1	Not publicly disclosed.
57	Proprietary metric #2	Not publicly disclosed.
58	Proprietary metric #3	Not publicly disclosed.
59	Proprietary metric #4	Not publicly disclosed.
60	Proprietary metric #5	Not publicly disclosed.

COVID-19 Regional Safety Index: Tier-4 Methodology Framework

The 100 territories located in Tier 4 were chosen based on the quantitative results of the first-stage regional safety analysis utilizing 20 parameters, as well as on the qualitative basis whether they suffered from severe levels of data unavailability and unreliability, preventing a fully comprehensive analysis. Due to such data availability issues, only 40 parameters (from the initial set of 130 parameters) was used was used to determine the cumulative scores for each of its 100 constituent regions.

Furthermore, due to the comparatively lower number of parameters utilized, and the fact that a single composite category (consisting of parameters taken from each of the index's 6 component categories) was created, only cumulative scoring was performed for each constituent region of Tier 4, rather than individual category-specific scoring. Additionally, the rankings provided for Tier 4 regions are approximate, and are given as score ranges rather than discrete, individual values, to better account for the fundamental issue of data unavailability for these regions.

Thus, region-specific rankings for Tier 4 should be considered as more preliminary than the rankings presented for Tiers 1 - 3. While quantitative and qualitative parameters were utilized in order to arrive at the presented territory-specific scoring, severe data unavailability and unreliability prevented a fully comprehensive analysis, and it is our hope that these regions will consider releasing a greater volume of data necessary to conduct a more thorough analysis.

Future iterations of Deep Knowledge Group's Regional Safety and Risk Assessment analytical case study will expand the scope of its Tiering system to include a fifth Tier, consisting of those territories from among Tier 4 which still score comparatively negatively after having provided a sufficient volume of available and reliable data necessary to conduct a more thorough analysis with a greater number of parameters.

COVID-19 Regional Safety Index: Tier 1 Parameters

№	Parameter Name	
1	Does the region have "hotspots" (high density of cases in one specific area)?	yes=1, no=0
2	Number of cases	per million individuals
3	Does the region have an absence of large supply shortages?	yes=0, no=1
4	Average level of touristic flow.	number of tourists per year
5	Does the region have dedicated military chemical and biological warfare divisions and forces?	yes=1, no=0
6	Government effectiveness (EIU score).	EIU Score
7	State of emergency readiness	yes=1, no=0
8	Does the region have national laboratories available for COVID-19 testing?	yes=1, no=0
9	Number of COVID-19 tests conducted per day.	Numeric
10	Does the region have a significant shortage of COVID-19 tests?	yes=0, no=1

COVID-19 Regional Safety Index: Tier 1 Parameters

№	Parameter Name	
11	Quantity of Ventilator Stockpile	Numeric
12	Number of hospital beds	per 1000 people
13	Number of doctors.	per 1000 people
14	Healthcare Development Index score.	Index
15	HAQ (The Healthcare Access and Quality Index) - 2016.	Index
16	Does the region have access to basic sanitation facilities?	yes=1, no=0
17	Size of Elderly Population	% of total population
18	Is the region currently experiencing a political or election-based crisis?	yes=0, no=1
19	Does the region's military have pre-existing plans and policies in place in the event of a biological or chemical attack?	yes=1, no=0
20	Number of deaths per mln	Numeric

COVID-19 Regional Safety Index: Tier 1 Parameters

№	Parameter Name	
21	Economic support to citizens	in USD
22	Tax reliefs	in USD
23	Are there any shortages in protective equipment?	yes=0, no=1
24	EGDI.	EGDI score
25	Does the region utilize Electronic Health Records?	yes=1, no=0
26	Regional economic debt (number).	% of GDP
27	Functioning of Government (Index)	HDI Index
28	Does the region have the necessary infrastructure for surplus ventilator production?	yes=1, no=0
29	Global Health Security Index	GHS index score
30	Total transportation network size.	km

COVID-19 Regional Safety Index: Tier 1 Parameters

№	Parameter Name	
31	Prevalence of diabetes.	% of population ages 20 to 79
32	Death rate due to endocrine disorder.	per 100,000 people
33	Prevalence of mental health and substance use disorders as a share of total disease burden, 2017.	Percent of total disease burden, 2017.
34	Incidence of tuberculosis.	per 100,000 people
35	Incidence of cancer.	per 100,000 people
36	Obesity	% of total population
37	Is there a majoritively positive public sentiment regarding government COVID-19 strategy?	yes=1, no=0
38	Proprietary metric #1	Not publicly disclosed.
39	Proprietary metric #2	Not publicly disclosed.
40	Proprietary metric #3	Not publicly disclosed.

COVID-19 Regional Safety Index: Conclusion and Future Methodology Development

Deep Knowledge Group's COVID-19 analytics generally, as well as the methodological underpinning of the present special case study, are in a continuous state of refinement, expansion and enhancement, and future COVID-19 rankings and special case studies will strive to incorporate a larger number of regions in its analysis, a broader scope of specific parameters, a wider array of topics and categories of analysis, and a greater scope of data-science techniques.

Continuously-Updated Sources of Data	New Analytical Frameworks
Deep Knowledge Group is constantly incorporating the latest findings from existing and new, reputable sources of public data as they become available, and regularly consulting with specific experts on the matter of advanced and qualitative aspects of the current COVID-19 pandemic, to remain on the forefront of shifting trends.	Deep Knowledge Group is developing and releasing entirely new ranking frameworks on additional topics relating to COVID-19 on a continual basis. In the coming weeks the group will reveal frameworks relating to such topics as regions' prospects for economic vulnerability and geopolitical instability as a result of the pandemic.
Enhancing of Analytical Techniques	**Customized Consultancy**
Deep Knowledge Group is continually refining and expanding both the breadth and depth the analytical techniques applied to its ranking frameworks, and periodically enhancing their capacity to handle and quantitatively assess highly complex and multidimensional data, as the complexity of the pandemic increases.	Deep Knowledge Group is open to disclosing its proprietary metrics and analytical techniques to select counterparties, and to conducting customized region-specific and topic-specific analytics and forecasting for interested governmental bodies and departments in order to derive as much humanitarian benefit from its activities as possible.

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CONTACT US

www.dkv.global/covid
info@dkv.global