

Making Healthcare Systems Resilient

An action plan for
the next decade

Ideation Center Insight

**WORLD
GOVERNMENT
SUMMIT 2021**

in collaboration with

strategy&

Part of the PwC network



Answering Tomorrow's Questions, Today

The World Government Summit is a global platform dedicated to shaping the future of governments worldwide. Each year, the Summit sets the agenda for the next generation of governments, with a focus on how they can harness innovation and technology to solve universal challenges facing humanity.

The World Government Summit is a knowledge exchange center at the intersection of government, futurism, technology, and innovation. It functions as a thought leadership platform and networking hub for policymakers, experts and pioneers in human development.

The Summit is a gateway to the future as it functions as the stage for analysis of future trends, concerns, and opportunities facing humanity. It is also an arena to showcase innovations, best practice, and smart solutions to inspire creativity to tackle future challenges.

VERNMENT SUMMIT

مؤتمة للحكومات



القمة العالمية للحكومات
WORLD GOVERNMENT SUMMIT





Table of Contents

Executive Summary	01
Understanding Healthcare Resilience	03
The Imperative of Healthcare Resilience	05
A Framework for Assessing Healthcare Resilience	09
Exposure to Hazards	11
Healthcare System Vulnerabilities	13
Response Capacities	15
A Plan for Action	19
Case Study: Reshoring Pharmaceutical Production in France	23
Case Study: Regional Disaster Health Response in the United States	27
Case Study: National University Cancer Institute, Singapore	31
Conclusion	33
Appendix: Indicators in the Composite Healthcare Resilience Framework	34
Endnotes	43
Contacts	46

Executive Summary





It has become all too apparent that healthcare systems around the world are poorly prepared to meet the demands of the populations they serve. The COVID-19 pandemic has underscored this harsh truth: In everything from public health capacity to the simple availability of personal protective equipment, governments and healthcare providers everywhere have struggled to cope with the spread and impact of this virus.

The failures highlighted by the COVID-19 pandemic have not been the only sign that current healthcare systems are struggling to protect local populations. Major public health threats — arising from both natural and human causes — have been exposing the weaknesses of healthcare systems that, in most cases, were designed for more stable and predictable circumstances.

Today, just as the business sector has recognized the need to adapt to a world of volatility, uncertainty, and complexity, the healthcare sector must take urgent steps to build its resilience. Governments, regulators, and healthcare providers must work to make systems more robust over the next decade.

Under- standing Healthcare Resilience



Healthcare resilience can be defined in different ways. It has been described as “a health care system’s ability to adjust its functioning prior to, during, or following changes and disturbances, so that it can sustain required performance under both expected and unexpected conditions”¹; or as “the capacity to adapt to challenges and changes at different system levels, to maintain high quality care.”² Strategy& defines healthcare resilience as the capacity of countries to prevent, surveil, respond to, and recover from shocks, stresses, and adversity (see Exhibit 1).

Building healthcare resilience requires coordinated action among three sets of core stakeholders: central

governments (acting both internally and in cross-government efforts), health system regulators, and healthcare providers.

Each of these core stakeholders needs to act across three areas: exposure to hazards, vulnerabilities, and response capacities. This paper presents a framework for assessing where a country stands in each of these three areas, and blueprints for action for each set of stakeholders with respect to prevention, surveillance, response, and recovery. Case studies illustrate how particular healthcare system stakeholders are demonstrating what can be done to address the imperative of healthcare resilience.

EXHIBIT 1: HEALTHCARE RESILIENCE

Countries need to have the capacity to:



...PREVENT...

Prevention is a healthcare system’s ability to anticipate potential shocks, prepare institutions & human resources for emergency, while ensuring availability of enough critical medical supplies & equipment for times of crisis



...SURVEIL...

Surveillance is a healthcare system’s ability to detect, early on, the emergence of a crisis, monitor it, & control its spread across an area, small or large



...RESPOND...

Response is a healthcare system’s ability to deal with any emerging health crisis or shock, then quickly mitigate & adjust to changing conditions in a way that is agile and flexible



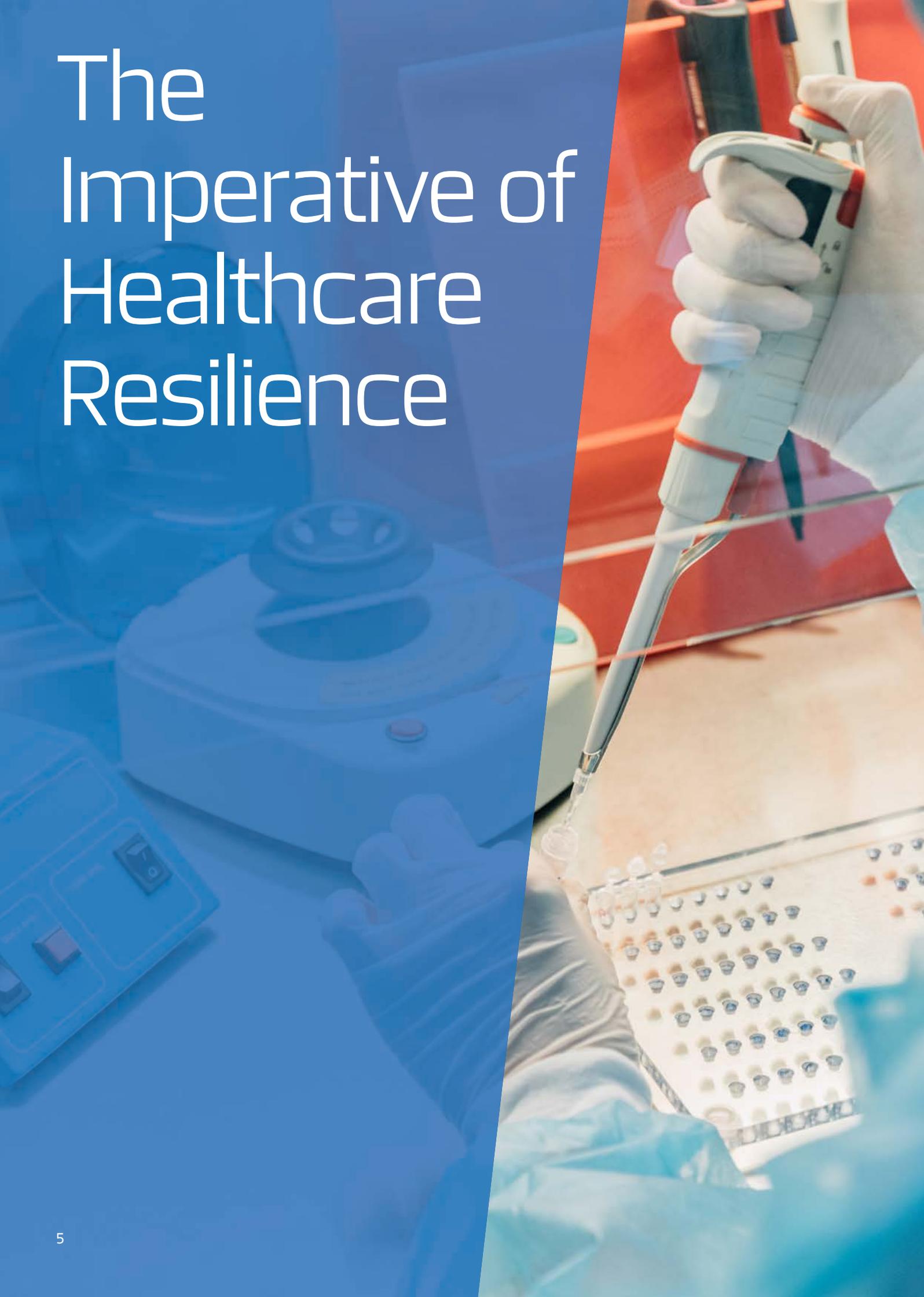
...& RECOVER...

Recovery is a healthcare system’s ability to regain its pre-crisis operating capacity & improve by enhancing resilience against potential future shocks

... in the face of shocks, stresses, & adversity

Source: Strategy&

The Imperative of Healthcare Resilience





The consequences of unprepared healthcare systems during the COVID-19 pandemic have been severe. As of May 7, 2021, more than 156 million COVID-19 cases have been confirmed worldwide, with more than 3.2 million deaths.³ It is estimated that as many as 150 million people will fall into extreme poverty⁴ and 265 million will experience acute hunger.⁵ Meanwhile, the global economy is estimated to have contracted 4.3 percent in 2020, and global GDP in 2021 is forecast to be 5.3 percent lower than pre-pandemic projections, a drop of about US\$4.7 trillion.⁶ In 2020, 8.8 percent of global working hours were lost compared with the last quarter of 2019, equivalent to 255 million full-time jobs.⁷

The pandemic has not been the first global warning in recent years that there is a need to make healthcare systems resilient. In 2005, Hurricane Katrina caused more than 1,800 deaths and displaced more than 770,000 in New Orleans, Louisiana, but also “destroyed much of the New Orleans health care system.”⁸ Access to healthcare facilities that were not actually destroyed was seriously hampered, and facilities that were not evacuated found it impossible to maintain standards of care as the floodwaters rose. The number of evacuees from New Orleans requiring healthcare — many of whose medical records were destroyed — caused public health emergencies to be declared in nine states that were not primarily affected by the storm.⁹

A subsequent report by a select bipartisan committee of the US House of Representatives came to conclusions that still apply to many healthcare systems around the world. The report argued that “medical care and evacuations suffered from a lack of advance preparations, inadequate communications, and difficulties coordinating efforts.” Among its findings were that:

- Deployment of medical personnel was reactive, not proactive
- Poor planning and inadequate pre-positioning of medical supplies and equipment led to delays and shortages
- New Orleans hospitals, the Veterans Affairs Medical Center, and medical first responders were not adequately prepared for a full evacuation of medical facilities
- Hospital and Veterans Affairs Medical Center emergency plans did not adequately address communication needs
- Medical responders did not have adequate communications equipment or operability
- Lack of electronic patient medical records contributed to difficulties and delays in medical treatment of evacuees
- Deployment confusion, uncertainty about mission assignments, and government red tape delayed medical care¹⁰

Another example is the tsunami set off by the 2011 Tōhoku earthquake in Japan. It claimed more than 16,000 lives, filled more than 1,300 shelters in Miyagi Prefecture with more than 320,000 evacuees, and devastated the region's healthcare infrastructure. In the coastal areas of Iwate Prefecture, three hospitals were destroyed and approximately half of all clinics and other health facilities were damaged.¹¹ On the coast of Miyagi, five hospitals and 186 other healthcare institutions were damaged.¹² These two prefectures, along with the neighboring Fukushima Prefecture, already suffered from shortages of doctors and healthcare facilities.¹³ The **Japanese Medical Association Journal** subsequently described a number of problems “during the emergency relief phase,” issues that are valid elsewhere:

1. Delay in the rescue and evacuation of patients and workers who were isolated in coastal hospitals
2. Delay in reaching evacuees at shelters and at home
3. The leadership and coordination system for disaster health management were undefined
4. The input of logistic supports and non-clinical public health interventions (such as food sanitation, environmental hygiene, infection control, nutritional assessment, and support for people requiring special care) were delayed and sometimes insufficient
5. Disaster control centers at towns and prefectures could not promptly respond to the requests from frontline operations
6. Disparities in levels of hygiene, nutrition, and living environment among shelters were recognized even three weeks after the disaster event¹⁴

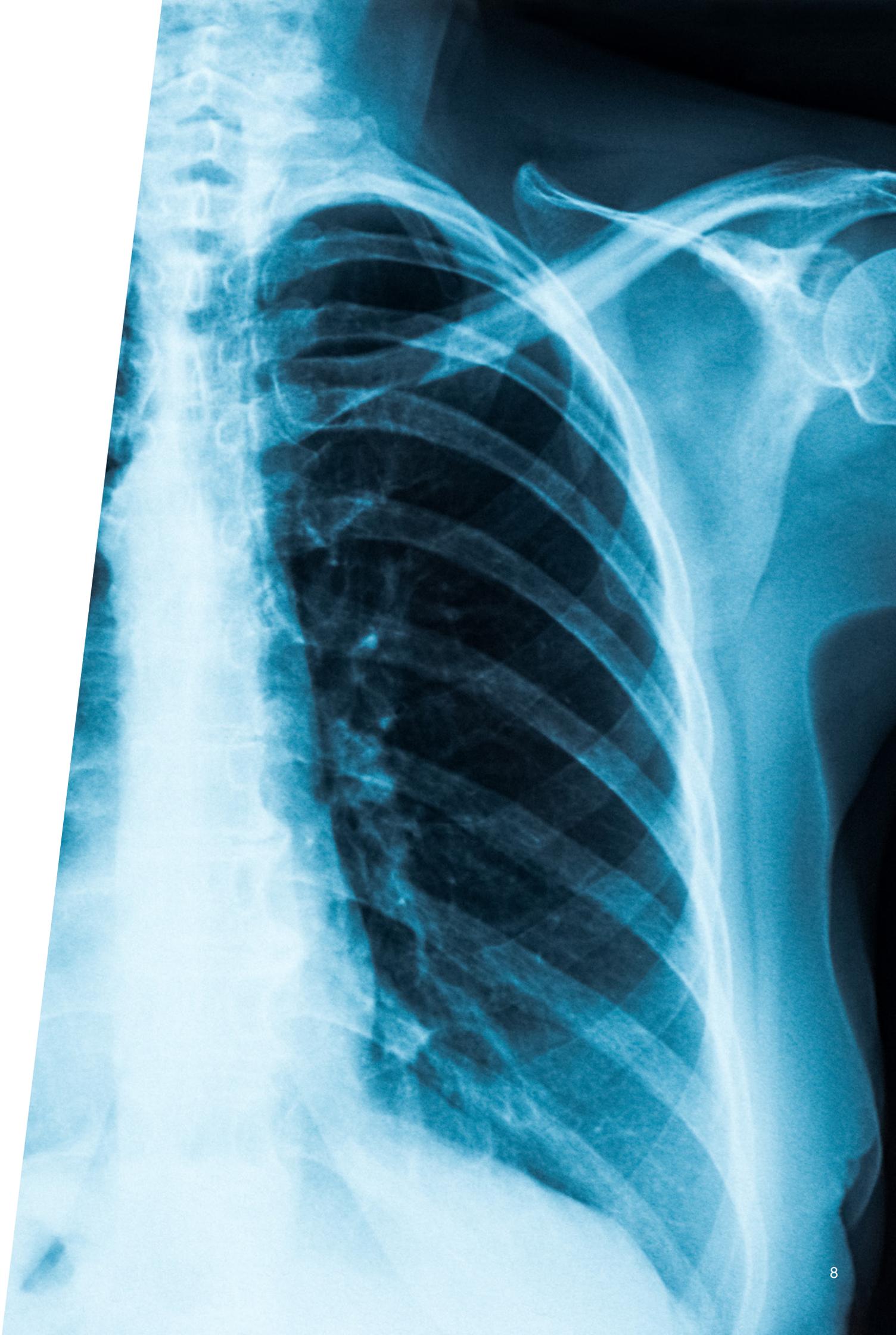
A warning that relates directly to the impact of the COVID-19 pandemic was the Ebola epidemic of 2014–16 in West Africa, which resulted in a reported 11,310 deaths in Guinea, Liberia, and Sierra Leone. The issues in those healthcare systems are directly relevant. The Centers for Disease Control and Prevention in the U.S. concluded that “[w]eak surveillance systems and poor

public health infrastructure contributed to the difficulty surrounding the containment” of Ebola when the first outbreak of the virus occurred in Guinea.¹⁵ A study published in 2015 in **The Pan African Medical Journal** reported:

“In most of the affected areas interventions like case contact tracing and follow-up, referrals to a health centre when a case is suspected, safe burial practices and disease surveillance at community level were not routinely carried out. There was an insufficient number of case management centres despite the daily increasing demand. The already fragile National Health System in Guinea was rapidly overwhelmed leading to the inevitable accelerated spread of Ebola.”¹⁶

Countries’ realization that their healthcare systems lack resilience has certainly been reinforced by the COVID-19 pandemic. A 2020 report from the European Commission observed, “Health systems were largely unprepared for an outbreak of this magnitude.”¹⁷ Such perceptions were amplified in the October 2019 Global Health Security (GHS) Index compiled by the Nuclear Threat Initiative, the Johns Hopkins Center for Health Security, and the Economist Intelligence Unit. The GHS Index’s compilers examined data from 195 countries across six categories: prevention, detection and reporting, rapid response, health system, compliance with international norms, and risk environment. The overall finding: “National health security is fundamentally weak around the world. No country is fully prepared for epidemics or pandemics, and every country has important gaps to address.”¹⁸

Healthcare resilience is about more than fending off these dangers. Developing resilient healthcare systems provides a country with numerous advantages. It makes a country able to cope with unforeseen needs and outright emergencies, whether natural disasters or human-made problems — saving lives and enhancing personal security and that of society at large. It protects economic activity from the effects of these hazards, whether the problem is widespread crime or the impact of cyberattacks on healthcare entities, thereby strengthening the national economy.



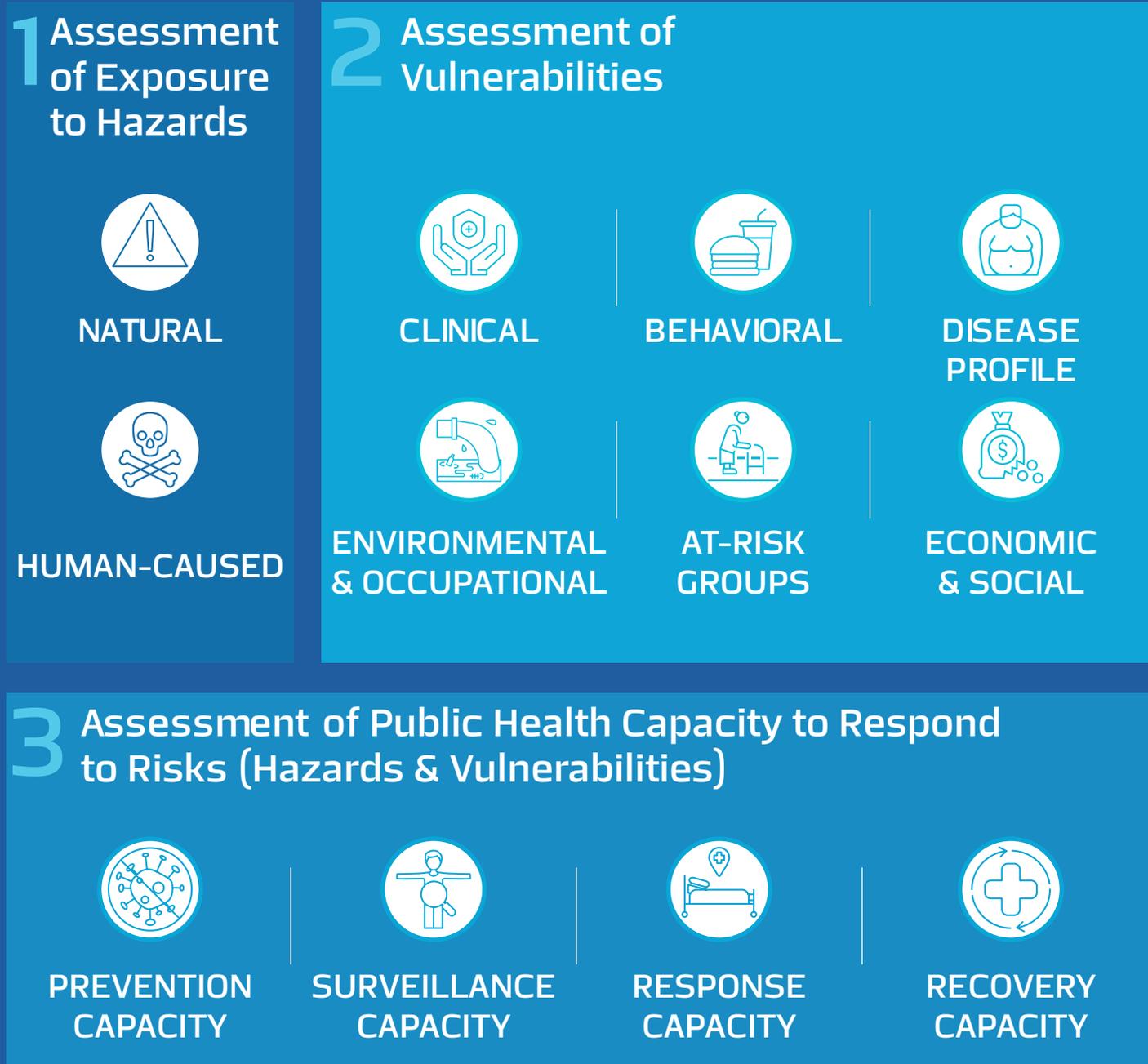
A Framework for Assessing Healthcare Resilience



To build healthcare resilience, governments need to begin by identifying their country's strengths and weaknesses in three areas: exposure to hazards,

vulnerabilities, and response capacities. Assessment in each of these areas should cover various specific factors (see Exhibit 2).¹⁹

EXHIBIT 2: STRATEGY& HEALTHCARE SYSTEM RESILIENCE ASSESSMENT FRAMEWORK



Source: Strategy&

Exposure to Hazards



Building health preparedness is a global imperative due to the increasing prevalence of hazards, both natural and human-made, including extreme weather, pandemics, environmental pollution, crime, terrorism, and political unrest.

Natural Hazards

Natural hazards include instances of extreme weather such as droughts and hurricanes, the frequency of which is increasing due to climate change. Over the last two decades, according to a U.N. report, 7,348 natural disasters around the world claimed 1.23 million lives and affected over 4 billion people — a dramatic increase over the previous 20 years.²⁰

Infectious diseases and dangerous pathogens such as the Ebola virus, SARS, MERS, and SARS-CoV-2 have become major considerations in national risk assessments, such as the Worldwide Threat Assessment of the U.S. Intelligence Community (2019), the National Risk Assessment in the U.K., and the National Risk Assessment by the Federal Office of Civil Protection and Disaster Assistance in Germany (2011).

Human-Caused Hazards

Human-caused health hazards come in many forms, including environmental threats, crimes, and political unrest. Human-caused hazards can deliver a shock to the healthcare system in many ways. For example, on the environmental front, air pollution is the fifth-leading risk factor for mortality globally, and more people die each year from air pollution than road traffic injuries or malaria.²¹ Water contamination and pollution cause diseases such as cholera, diarrhea, and dysentery. It is estimated that 829,000 people die from diarrhea each year due to unsafe drinking water, inadequate sanitation, and poor hand hygiene.²²

Roughly 400,000 people die from intentional homicide each year. In some countries, such as Brazil and India, intentional homicides account for over 60,000 and

40,000 deaths per year, respectively.²³ More than 190,000 terrorist incidents have occurred worldwide since 1970, according to one estimate.²⁴ In a finding that suggests a particular human-caused hazard not just for countries generally but for healthcare systems in particular, the International Institute for Counter-Terrorism reported in 2013 that “[a]pproximately 100 terrorist attacks have been perpetrated at hospitals worldwide, in 43 countries on every continent, killing approximately 775 people and wounding 1,217 others.”²⁵

Moreover, it is not just the exposure of people to human-caused hazards that requires resilience from healthcare systems. Cyberattacks targeting healthcare infrastructure now pose a significant threat to public health. The chief information security officer of a major American healthcare provider observed in late 2020, a year when malevolent actors took advantage of the COVID-19 pandemic to develop new cyberthreats, that “[H]ealthcare is and has been the No. 1 target for cybercrime, and the number of attacks on healthcare organizations has been increasing exponentially over the past few years, primarily because of the value of data they can obtain from a successful attack, and the fact that cybercriminals know that if they lock up systems and data, that has a significant impact on operations.”²⁶

Political unrest in the developing world also frequently has adverse consequences for the provision of healthcare services. A study of rural hospitals in Uganda notes that political unrest, along with the lack of a healthcare workforce and the insufficient availability of essential medicines and equipment, is a main factor “affecting the international community in addressing the hefty disease burden in World Health Organization African regions.”²⁷ Research on utilization of antenatal care in Nepal has found that “[a]rmed conflicts, which primarily occur in low- and middle-income countries, have profound consequences for the health of affected populations, among them a decrease in the utilization of maternal health care services.”²⁸

Healthcare System Vulnerabilities

In the face of the many hazards just described, healthcare systems must deal with major vulnerabilities at the country level that will intensify the impact of natural and human-caused hazards. These vulnerabilities can be summarized into six types that will put increasing pressure on health systems: clinical, behavioral, disease profile, environmental and occupational, demographic/at risk-groups, and economic and social.

1. Clinical

Inadequate or unequal access to quality healthcare, where such lack of access exists, is a critical vulnerability. A healthcare system is more vulnerable if, even in good times, access to care is insufficient. The Healthcare Access and Quality (HAQ) Index is a standardized measure that sheds light on the access and quality of healthcare globally. There is obviously significant variation in access and quality between developed and developing economies, and there are even notable differences in HAQ scores among developed countries with established healthcare systems. HAQ scores ranged between the 10th and seventh deciles in 2016 for both England and the U.S.²⁹

2. Behavioral

Individual behaviors such as poor diet (which can be caused by factors beyond individuals' control — see “Economic and social”), lack of exercise, alcohol and tobacco use, etc., create vulnerabilities for healthcare systems. They make individuals more vulnerable to chronic diseases and to crises.

3. Disease Profile

The high prevalence within a given population of chronic conditions such as cardiovascular and kidney disease or diabetes, which make people more vulnerable in acute situations, is an obvious source of vulnerability for healthcare systems. The fact that the prevalence of diabetes, for example, has been rising more rapidly in low- and middle-income countries than in high-income countries³⁰ indicates rising vulnerability. (A country or region's disease profile, in turn, will in various ways depend on the vulnerabilities listed below.)

4. Environmental and Occupational

Population health vulnerabilities are also dependent on environmental conditions such as water and air quality. A 2018 UNICEF report, **Mongolia's air pollution crisis: A call to action to protect children's health,**

observed that “[a]ir pollution is linked to reduced foetal growth, preterm birth, low birth weight, impaired cognitive intra-uterine development, impaired cognitive development, and even spontaneous abortion. It is also linked to diseases that can be highly debilitating for children, such as bronchitis and asthma, causing children to miss school and other important learning and development opportunities.”³⁴ A country's occupational profile may also be a significant factor in creating health vulnerabilities: For example, countries with mining industries and without proper health and safety protocols can have an elevated incidence of respiratory ailments.

5. Demographic/At-Risk Groups

The healthcare systems of different countries will also have differing levels of vulnerability depending on the country's demographic profile and its implications for population health. Countries with large elderly populations, for example, will have a relatively high prevalence of people with non-communicable diseases such as cardiovascular disease, hypertension, arthritis, and diabetes — so that developing countries with relatively young populations have fewer health vulnerabilities of certain types than do developed countries. High fertility rates in developing countries, on the other hand, create their own vulnerabilities for healthcare systems, forcing them to increase capacity and access.

6. Economic and Social

Populations and segments of populations — and therefore the healthcare systems that serve them — are more or less vulnerable to various health risks depending on variables such as poverty rates, population density, housing quality, household size, quality of public sanitation, etc. In the U.S., where asthma occurs disproportionately among minority communities, “[s]ocial determinants and structural inequities largely drive disparities” in this area of health.³²

Sometimes economic and social conditions can explain factors that may appear to stem from individual choices, such as poor diet. In the Marshall Islands, which currently has the highest prevalence of diabetes of any country in the world, with the highest ratio of people diagnosed with type 2 diabetes, “[i]nhabitants have become increasingly dependent on imported, processed foods that are high in sugar, since local foods and imported fruits and vegetables tend to be the most expensive.”³³

Response Capacities



Response capacities describe a healthcare system's abilities and available resources to respond to public health crises.



PREVENTION CAPACITY



SURVEILLANCE CAPACITY



EMERGENCY RESPONSE CAPACITY



RECOVERY CAPACITY

1. Prevention Capacity

Healthcare systems must be able to prevent the emergence of new shocks via preparedness plans, immunization strategies, national medical stockpiles, and emergency procurement protocols. The WHO's **Toolkit for assessing health-system capacity for crisis management: Help countries minimize the impact of future health crises** suggests structuring prevention capacity around the following six key functions of healthcare systems:³⁴

- Leadership and Governance
- Health Workforce
- Medical Products, Vaccines, and Technology
- Health Information
- Health Financing
- Service Delivery

2. Surveillance Capacity

Surveillance is a healthcare system's ability to detect the emergence of a crisis early on, and then monitor and control its spread across the country. Means of health surveillance include disease testing, veterinary supervision, predictive analytics, data monitoring, and international cooperation. The authors of a paper for the Disease Control Priorities Project defined public health surveillance as "a tool to estimate the health status and behavior of the populations served by ministries of health, ministries of finance, and donors." They propose a list of "surveillance strategies" including "sentinel surveillance" (in which "a prearranged sample of reporting sources agrees to report all cases of defined conditions, which might indicate trends in the entire target population"), periodic population-based surveys, laboratory-based surveillance, and integrated disease surveillance and response.³⁵

3. Emergency Response Capacity

Response is a healthcare system's ability to deal with any emerging health crisis or shock, quickly mitigate it, and adjust to changing conditions in a way that is agile and flexible.

4. Recovery Capacity

Recovery is a healthcare system's ability to regain its pre-crisis operating capacity and potentially bounce forward by enhancing resilience to potential future shocks. Key elements are disaster recovery plans, stimulus funding, investment in the localization of supply chains for critical goods, and investment in technology-enabled systems.

Scoring Methodology

Strategy& has developed a methodology to score a country's healthcare resilience based on all the factors described above. We have identified 202 indicators across all the factors. These indicators are normalized to score the resilience of a country's healthcare system. The key performance indicators have been summarized in **Exhibit 3** and detailed in the **Appendix**.

EXHIBIT 3: STRATEGY & RESILIENCE ASSESSMENT METHODOLOGY

1 Assessment of Exposure to Hazards



NATURAL

7 indicators spanning 7 key dimensions; sources include World Resources Institute, Food and Agriculture Organization of the United Nations



HUMAN-CAUSED

12 indicators spanning 6 key dimensions, sources include World Economic Forum, European Union, Vision of Humanity

2 Assessment of Vulnerabilities

 CLINICAL 5 indicators spanning 2 key dimensions	 BEHAVIORAL 39 indicators spanning 10 key dimensions	 DISEASE PROFILE 36 indicators spanning 23 key dimensions
 ENVIRONMENTAL & OCCUPATIONAL 20 indicators spanning 5 key dimensions	 AT-RISK GROUPS 10 indicators regrouped in a single dimension	 ECONOMICAL & SOCIAL 6 indicators regrouped in a single dimension

Source: World Health Organization, World Bank, UNESCO, Institute for Health Metrics and Evaluation, United Nations, World Prison Brief, Macrotrends, Strategy& analysis

3 Assessment of Public Health Capacity to Respond to Risks (Hazards & Vulnerabilities)

 PREVENTION CAPACITY	 SURVEILLANCE CAPACITY	 RESPONSE CAPACITY	 RECOVERY CAPACITY
-------------------------------------------------------------------------------------------------------------------	---------------------------------------------------------------------------------------------------------------------	-----------------------------------------------------------------------------------------------------------------	------------------------------------------------------------------------------------------------------------------

Assessment of strategies, policies, & regulations; governance & partnerships; financing; information management resources; infrastructure; & medicine vaccines, & technology. Source: GHS index, World Bank, World Health Organization, Strategy& analysis

Scoring

Assessment of 202 KPIs, Normalizing & Averaging Scores

Note: KPIs = key performance indicators
 Source: Strategy& analysis

A Plan for Action



Countries need integrated and evidence-based health resilience blueprints that enable them to:

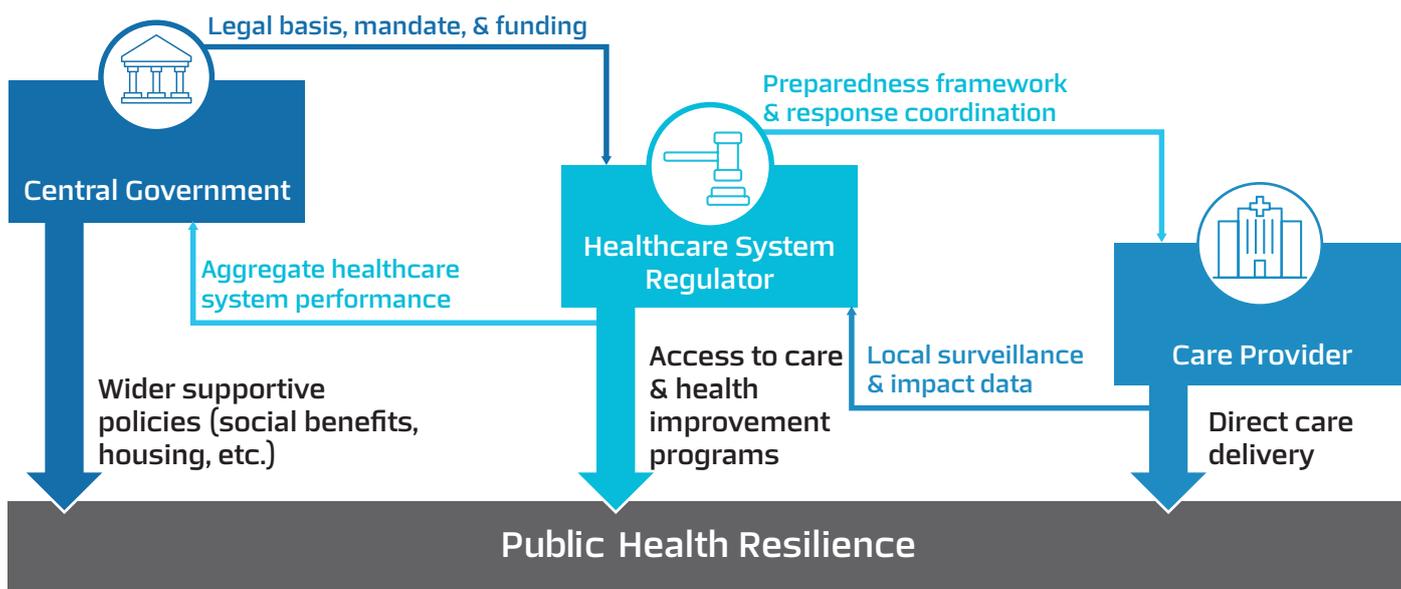
1. Assess their exposure to natural and human-caused hazards in order to establish a baseline of factors that may cause a strain on their healthcare system
2. Reduce their key vulnerabilities (clinical, behavioral, disease profiles, environmental and occupational, at-risk groups, economic and social) through a targeted long-term resilience strategy
3. Build their prevention capacity through instituting the right enablers for leadership and governance; health workforce; medical products, vaccines, and technology; health information; health financing; and service delivery
4. Build their surveillance capacity through real-time and comprehensive disease testing, risk-based veterinary supervision, predictive analytics, data monitoring, and international cooperation

5. Build their emergency response capacity through adaptation strategies, anticipatory and flexible laws, agile governance structures and decision making, public-private partnerships and risk sharing models, contingency funding, and available financial resources

6. Build their recovery capacity through disaster recovery strategies, investments in technology-enabled systems, and localization of supply chains

Governments can deliver on their health resilience only through coordinated action. Health resilience, even in the most developed countries, requires such action throughout the entire government and healthcare systems by the three core stakeholders. These are the central government (acting internally and in cross-government efforts), healthcare regulators, and healthcare providers (see Exhibit 4).

EXHIBIT 4: KEY STAKEHOLDERS FOR IMPROVING RESILIENCE



Source: Strategy&

These three core stakeholders will each take action in multiple areas, including strategies, plans, and regulations; governance and partnerships; financing; information management; resources; infrastructure; and medicines, vaccines, and technology. Each core stakeholder will need to identify priorities so that efforts to build healthcare resilience are effective and protect the system when an unanticipated event occurs.

Central Government/Cross-Government

The central government must provide the legal basis and budget for preparedness activities, drafting the master emergency communications plan (including coordination with international actors) and leading regular operational readiness testing exercises (see Exhibit 5).

The Roles of the Three Stakeholders

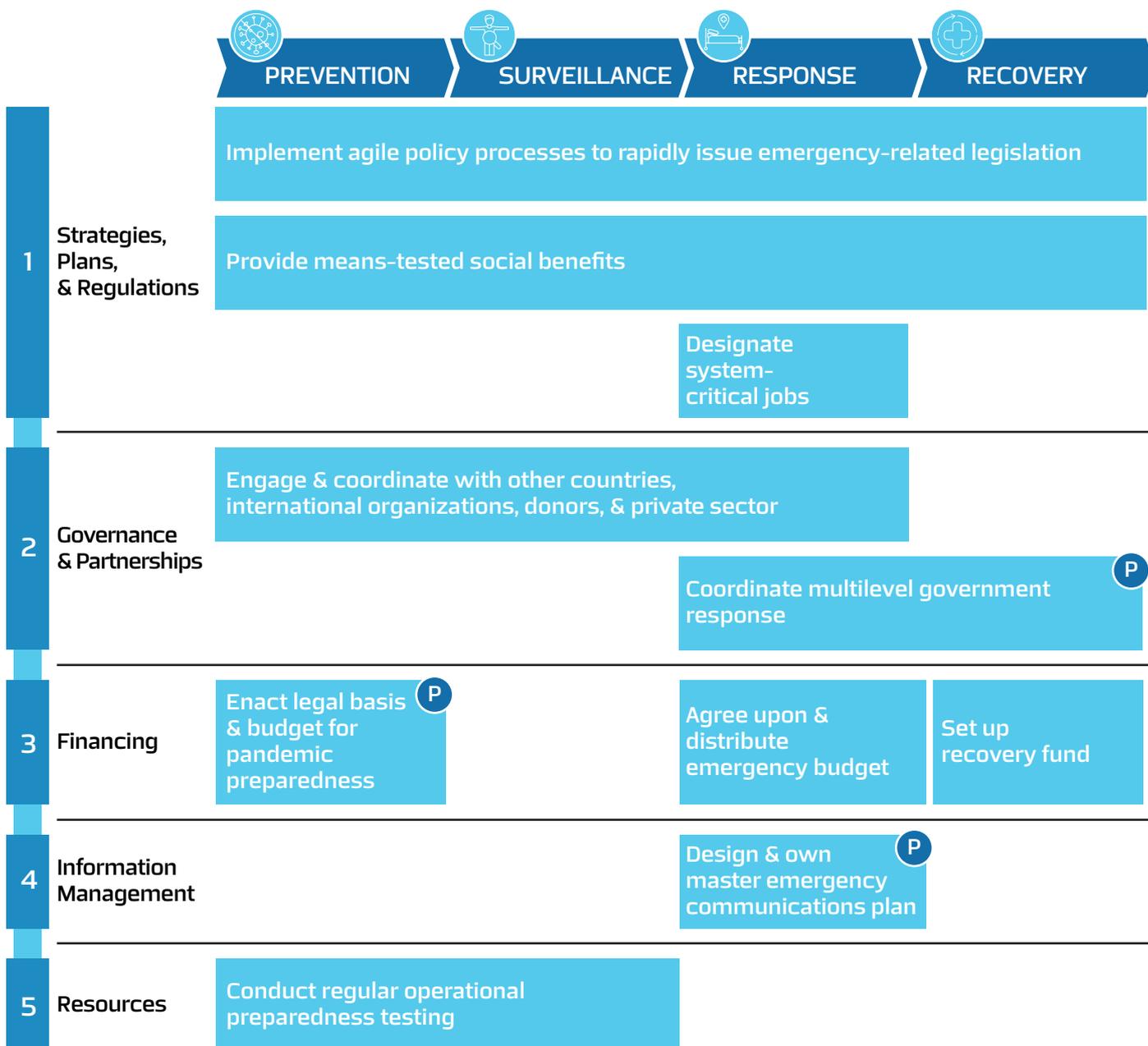
Each of the three stakeholders plays a different role, and the roles are complementary.

The central government and cross-government efforts are required to allocate funding as well as to coordinate national and international actions. The government should undertake many initiatives in order to build a resilient healthcare system spanning five categories. However, there are three high-priority actions:

1. Coordinating a multilevel government response platform or policy to enable different levels of government to work together in an effective manner during a crisis

2. Preparing the budget for pandemic preparedness and the legal basis for disbursement of funds when required
3. Designing and owning the master emergency communications plan

EXHIBIT 5: ACTION PLANS FOR CENTRAL & CROSS-GOVERNMENT



P High-priority actions (must-have initiatives if governments are to build a resilient healthcare system to face a potential shock &/or adversity)

Source: Strategy&



CASE STUDY: Reshoring Pharmaceutical Production in France



In June 2020, the French government unveiled a new initiative to start bringing production of critical pharmaceuticals back to France. The aim of this effort was to make the healthcare system more resilient by creating pharmaceutical supply chains for generic drugs less vulnerable to disruption than current ones have proven to be during the COVID-19 pandemic.

Even before the pandemic, France had encountered shortages of medicines attributed, in part, to vulnerable global supply chains. The French initiative is meant as a hedge against France's (and all of Europe's) reliance on medicines sourced from China and India. It resembles Project Defend in the U.K., where an estimated 70 percent of active pharmaceutical ingredients in medicines on the domestic market are made in China, and 80 to 90 percent of all generic medicines are imported.³⁶

As the first part of its initiative, the French government plans to re-shore production of the painkiller paracetamol within three years. Critics of the plan point out that producing the drug in France will result in higher prices for healthcare systems and consumers, and/or government subsidies for companies that currently manufacture it at much lower cost by sourcing active pharmaceutical ingredients (APIs) from India and China. Europe-based manufacturers of branded drugs, meanwhile, fear the repercussions of a "strategic autonomy" approach to pharmaceutical production that could disrupt free trade and cut into their profits from overseas markets including China. Re-shoring of production of APIs for generic drugs, which is chemical-intensive and polluting, could also run counter to E.U. environmental initiatives.

Notwithstanding these criticisms, the European Commission, responding to a request in June 2020 from six E.U. leaders for incentives from Brussels for Europe-based production of critical pharmaceuticals and pharmaceutical components, has moved to accelerate existing efforts on drug supply security for E.U. countries.³⁷

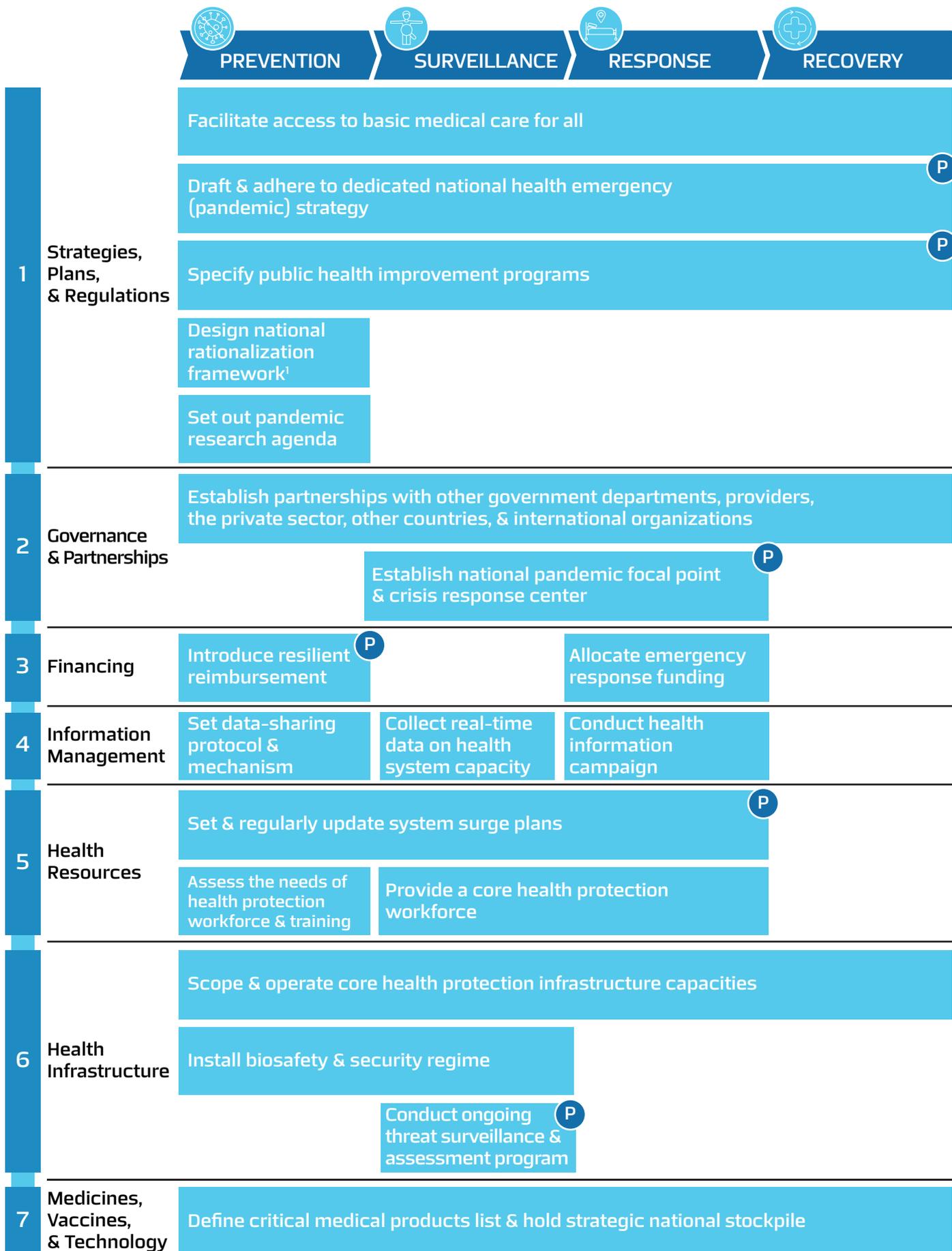
Healthcare Regulators

Healthcare regulators must establish a dedicated national health emergency strategy. Regulators should undertake multifaceted prevention and preparation activities, including system surge plans and public health programs designed to strengthen the population's health resilience. They should survey and assess threats on an ongoing basis. They need to act fast to create national response centers that synthesize real-time data and coordinate the healthcare system's response (**see Exhibit 6**).

Healthcare regulators should undertake many initiatives to build a resilient healthcare system spanning seven categories. However, there are six high-priority actions:

1. Drafting and ensuring adherence to a dedicated national health emergency strategy
2. Specifying and designing public health improvement programs in preparation for, during, and after a crisis
3. Establishing a national pandemic focal point and crisis response center
4. Introducing resilient reimbursement offerings
5. Creating healthcare system surge plans and regularly updating them
6. Designing the threat surveillance and assessment program and conducting ongoing threat surveillance during a crisis

EXHIBIT 6: ACTION PLANS FOR HEALTHCARE REGULATORS



P High-priority actions (must-have initiatives if healthcare regulators are to build a resilient healthcare system to face a potential shock &/or adversity)

¹ To manage resource shortages
Source: Strategy&

CASE STUDY: Regional Disaster Health Response in the United States



The Statue of Liberty is partially visible on the left side of the page, showing her head with the crown and her right arm raised holding the torch. The background is a solid blue color.

In the U.S., the Office of the Assistant Secretary for Preparedness and Response (ASPR) within the federal government’s Department of Health and Human Services is creating a Regional Disaster Health Response System (RDHRS) “to train, equip, and organize our health care systems in ways that make our local communities more resilient.”³⁸

The RDHRS is building on existing healthcare coalitions that already work with funding and guidance from ASPR’s Hospital Preparedness Program (HPP). These coalitions consist of healthcare providers and businesses, emergency medical services providers, and state and local public health departments across the country. The RDHRS’s approach is to combine the coalition with tiers of treatment, which resembles how the U.S. dealt with the Ebola outbreak in 2014–16. The tiered system involves frontline hospitals, assessment hospitals, regional treatment centers, and national treatment centers.

The RDHRS will also expand the HPP to encompass trauma centers, burn centers, pediatric hospitals, public health laboratories, outpatient facilities, and federal facilities such as the Veterans Affairs healthcare clinics. The combination of the coalition approach and the tiered model will serve to expand ASPR’s definition of disasters beyond disease outbreaks to include readiness for chemical, biological, and radiological attacks.³⁹ The RDHRS “is intended to define [and] enhance the delivery of clinical care when the existing referral patterns and healthcare delivery capacity and capabilities are exceeded by catastrophic events.”⁴⁰

To stimulate innovation, ASPR has created an initiative (the Partnership for Disaster Health Response Cooperative Agreement) inviting applicants “to develop demonstration projects that address healthcare preparedness challenges, establish best practices for improving disaster readiness across the healthcare system, and show the potential effectiveness and viability of a RDHRS.”⁴¹ Two pilot projects launched in September 2019 were initially focused on healthcare preparedness, then rapidly pivoted to a response posture when the COVID-19 pandemic struck. They are supporting COVID-19 preparedness and response efforts by bringing together critical stakeholders, sharing relevant information, providing needed expertise, and preparing for more COVID-19 cases.⁴²

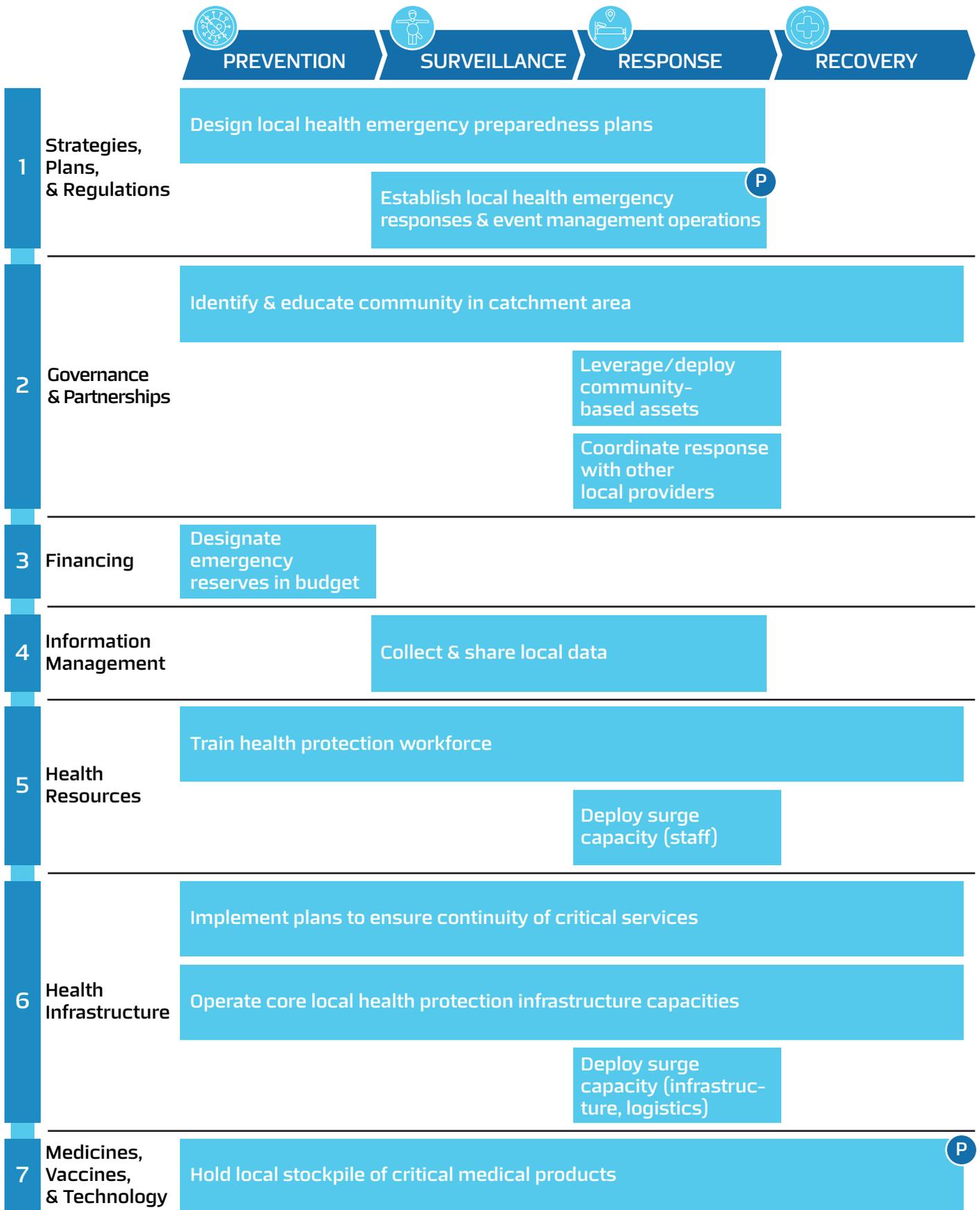
Healthcare Providers

Healthcare providers must implement plans to ensure continuity of critical services and establish local health emergency response operations that are synchronized with national response mechanisms (**see Exhibit 7**).

The healthcare providers need to build strong relationships with communities and other providers to coordinate effective local responses. Healthcare providers should undertake many initiatives and actions to build a resilient healthcare system spanning seven categories. However, there are two priority actions:

1. Establishing the local health emergency response and event management operation during the onset of a crisis
2. Implementing plans before, during, and after the crisis to ensure continuity of critical healthcare services

EXHIBIT 7: ACTION PLANS FOR HEALTHCARE PROVIDERS



P High-priority actions (must-have initiatives if healthcare providers are to build a resilient healthcare system to face a potential shock &/or adversity)

CASE STUDY: National University Cancer Institute, Singapore





At the National University Cancer Institute in Singapore, as a July 2020 paper in the **Annals of Oncology** reported, “[t]he higher risk of COVID-19 complications in cancer patients required a coordinated effort to ensure business continuity while maintaining patient and staff safety.”⁴³

The National University Cancer Institute built resilience by protecting its core clinical care activities and its research and educational missions. The organization relied on four main principles: a focus on staff welfare and protecting employees against burnout; multifaceted infection control measures; redesignation and prioritization of essential hospital resources; and adaptable workflows that related to Singapore’s Disease Outbreak Response System Condition (DORSCON) risk levels and the hospital’s policies.⁴⁴

The institute’s strategy incorporated lessons from the 2003 SARS epidemic, after which Singapore’s DORSCON was established. The two main pillars for clinical care were a segregated-team workflow and measures to allocate and conserve resources:

Segregated-team Workflow. To minimize the loss of workforce from potential COVID-19 infection, all institute staff, clinical and non-clinical, were segregated into two teams. This ensured that entire departments would not have to be quarantined in the event of an infection. Other measures included the cancellation of physicians’ leave, and confining physician sub-teams to specific ward, outpatient, and office areas to minimize exposure and cross-contamination. Each outpatient sector had its own registration counter, rooms, and lavatories to facilitate contact tracing. Face-to-face meetings were canceled, and all department meetings were conducted on a secure videoconferencing platform.

Resource Allocation and Conservation. Reducing patient volume was necessary to make the segregated-team model sustainable. This was accomplished by various means, including curtailing outpatient referrals and appointments (e.g. appointments for cancer surveillance were deferred); encouraging telemedicine consults, home delivery of medications, and online payment; postponing all non-cancer surgeries for three months; conserving blood stocks for cancer patients for emergency surgeries, active bleeding, and semi-elective cancer surgeries; and limiting per-patient red cell and platelet transfusion and accepting lower hemoglobin levels for asymptomatic patients.⁴⁵

Conclusion

Whereas previous health emergencies have highlighted hazards and vulnerabilities, and healthcare systems' limited response capacities at smaller, national or regional scales, the current COVID-19 pandemic has fully exposed the catastrophic reality of a large-scale global healthcare crisis. The pandemic's implications reach far beyond healthcare systems, drastically affecting the global economy and livelihoods.

Governments therefore have an opportunity to draw appropriate lessons on how to make healthcare systems more resilient and responsive. This paper has laid out a framework with which to assess and strengthen health system resilience holistically. It stresses the importance of all stakeholders coordinating their respective actions. Government actors at all levels need to define the overall national and multinational strategies, which healthcare regulators need to then refine into more detailed action plans and initiatives. The initiatives themselves concern all actors in a healthcare system, including pharmaceutical and life sciences, healthcare payors (those entities that pay for care), providers, and others.

In the past, the focus may have been too much on making healthcare systems more efficient, often in cost terms, and on tackling widely prevalent non-communicable diseases. This focus came at the expense of reserve capacity and the ability to respond quickly to other hazards and shocks to systems. Taking actions now to strengthen resilience will thus require redirecting funding or increasing it for better preparedness related to pandemic situations or natural catastrophes. Making appropriate choices in balancing these different priorities will be key to achieving greater resilience, an enhanced capacity to respond, and sustainability for the future.

Appendix: Indicators in the Composite Healthcare Resilience Framework

Table 1: Indicators for Hazards

SECTION	CATEGORY	KEY DIMENSION	INDICATOR
1. Hazards	Natural	Droughts	Drought intensity
		Earthquakes	Global seismic hazard
		Extreme Weather Incidence	Change in temperature compared with the average in the last 30 years or the moving average of the last 30 years (1990-2020) compared with the average of the 30 year span a decade earlier (1980-2010) - Celsius
		Floods	Global flood map
		Insect Infestation	Desert locust risk maps
		Pandemics & Epidemics	Exposure to pandemics and epidemics over the past 30 years
		Wildfires	Change in fire risk
	Human-Caused	Air Pollution	NOX emissions per capita
			SO2 emissions per capita
		Cyberattacks	Cyber vulnerability
		Geopolitical Tensions	Global Peace Index
		Homicide	Homicide rate
			Prison population
		Technological Hazards	Airplane crashes
			Fires death rate
			Road traffic death rate
		Terrorist Attacks	Global terrorism index
			Index of terrorism incidence
			Political stability and absence of violence/terrorism

Table 2: Indicators for Vulnerabilities

SECTION	CATEGORY	KEY DIMENSION	INDICATOR
2. Vulnerabilities	Clinical	Access to Care	Risk of impoverishing expenditure for surgical care (proxy for coverage)
			Universal health coverage index data availability
		Quality of Care	Adult mortality rates
			Healthy life years
			Life expectancy at birth
		Behavioral	Alcohol Use
	Neoplasms		
	Neurological disorders		
	Respiratory infections and tuberculosis		
	Self-harm and interpersonal violence		
	Substance use disorders		
	Transport injuries		
	Unintentional injuries		
	Childhood Maltreatment		Substance use disorders
	Dietary Risks		Cardiovascular diseases
			Diabetes and kidney diseases
			Neoplasms
	Drug Use		Digestive diseases
			HIV/AIDS and sexually transmitted infections
			Neoplasms
			Other infectious diseases
			Self-harm and interpersonal violence
			Substance use disorders
	Intimate Partner Violence		HIV/AIDS and sexually transmitted infection
			Maternal and neonatal disorders
			Self-harm and interpersonal violence
	Low Physical Activity	Cardiovascular diseases	
Diabetes and kidney diseases			
Neoplasms			
Self-Harm & Interpersonal Violence	Self-harm and interpersonal violence		

Table 2: Indicators for Vulnerabilities (continued)

SECTION	CATEGORY	KEY DIMENSION	INDICATOR
2. Vulnerabilities	Behavioral	Tobacco	Cardiovascular diseases
			Chronic respiratory diseases
			Diabetes and kidney diseases
			Digestive diseases
			Musculoskeletal disorders
			Neoplasms
			Neurological disorders
			Respiratory infections and tuberculosis
			Self-harm and interpersonal violence
			Transport injuries
			Unintentional injuries
		Unintentional Injuries	Unintentional injuries
	Unsafe Sex	HIV/AIDS and sexually transmitted infections	
		Neoplasms	
	Disease Profile	Cardiovascular Diseases	Cardiovascular diseases
			Chronic Respiratory Diseases
		Diabetes & Kidney Diseases	Diabetes and kidney diseases
		Digestive Diseases	Digestive diseases
		Enteric Infections	Enteric infections
		High Body-Mass Index	Cardiovascular diseases
			Chronic respiratory diseases
			Diabetes and kidney diseases
			Digestive diseases
Neoplasms			
High Fasting Plasma Glucose		Cardiovascular diseases	
		Diabetes and kidney diseases	
		Neoplasms	
		Neurological disorders	
		Respiratory infections and tuberculosis	
High LDL Cholesterol		Cardiovascular diseases	
High Systolic Blood Pressure	Cardiovascular diseases		
	Diabetes and kidney diseases		

Table 2: Indicators for Vulnerabilities (continued)

SECTION	CATEGORY	KEY DIMENSION	INDICATOR
2. Vulnerabilities	Disease Profile	HIV/AIDS & Sexually Transmitted Infections	HIV/AIDS and sexually transmitted infections
		Impaired Kidney Function	Cardiovascular diseases
			Diabetes and kidney diseases
		Low Bone Mineral Density	Self-harm and interpersonal violence
			Transport injuries
			Unintentional injuries
		Maternal & Neonatal Disorders	Maternal and neonatal disorders
		Mental Disorders	Mental disorders
		Musculoskeletal Disorders	Musculoskeletal disorders
		Neglected Tropical Diseases & Malaria	Neglected tropical diseases and malaria
		Neoplasms	Neoplasms
		Neurological Disorders	Neurological disorders
		Nutritional Deficiencies	Nutritional deficiencies
		Other Infectious Diseases	Other infectious diseases
		Other Non-Communicable Diseases	Other non-communicable diseases
	Respiratory Infections & Tuberculosis	Respiratory infections and tuberculosis	
	Skin & Subcutaneous Diseases	Skin and subcutaneous diseases	
	Environmental & Occupational	Air Pollution	Cardiovascular diseases
			Chronic respiratory diseases
			Diabetes and kidney diseases
			Neoplasms
			Respiratory infections and tuberculosis
		Child & Maternal Malnutrition	Enteric infections
Maternal and neonatal disorders			
Nutritional deficiencies			

Table 2: Indicators for Vulnerabilities (continued)

SECTION	CATEGORY	KEY DIMENSION	INDICATOR
2. Vulnerabilities	Environmental & Occupational	Child & Maternal Malnutrition	Other infectious diseases
			Other non-communicable diseases
			Respiratory infections and tuberculosis
		Occupational Risks	Chronic respiratory diseases
			Neoplasms
			Transport injuries
			Unintentional injuries
		Other Environmental Risks	Cardiovascular diseases
			Diabetes and kidney diseases
			Neoplasms
		Unsafe Water, Sanitation, & Handwashing	Enteric infections
			Respiratory infections and tuberculosis
		At-Risk Groups	At-Risk Groups
	Incarceration numbers and rate (total values and per 100,000 people)		
	Incidence of tuberculosis (per 100,000 people)		
	Population ages 0-14 (% of total population)		
	Population age 65 and older (% of total population)		
	Prevalence of hepatitis C		
	Prevalence of HIV, total (% of population ages 15-49)		
	Proportion of migrants (migrants/total population – proxy for migrant workers)		
	Proportion of time spent on unpaid domestic and care work, female (% of 24 hour day)		
	Refugee population by country or territory of asylum		
	Economic & Social		
		Educational attainment, at least bachelor's degree or equivalent, population age 25 and older, total (%) (cumulative)	
		Population density	
		Poverty rate	
		Literacy rate	
Unemployment rate			

Table 3: Indicators for Capacity for Response

SECTION	CATEGORY	KEY DIMENSION	INDICATOR
3. Capacity for Response	Prevention	Strategies, Plans, & Regulations	Are pandemics and epidemics integrated into the national risk reduction strategy or is there a standalone national disaster risk reduction strategy for pandemics and epidemics?
			Antimicrobial control for humans and animals
			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?
			Does the country have in place national biosafety legislation and/or regulations?
			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?
			Are legislation and financing in place to allow implementation of international health regulations (IHR) capacities?
			Does the country have individual cross-border agreements, protocols, or Memorandums of Understanding with neighboring countries, or does it have such arrangements as part of a regional group, with regard to public health emergencies?
		Health Governance & Partnerships	Is there an agency responsible for oversight of research with especially dangerous pathogens, toxins, pathogens with pandemic potential, and/or other dual-use research?
			Has a national health emergency framework been established?
		Health Financing	Government expenditure on healthcare, total (% of government expenditure)
		Health Resources	Number of veterinarians per 1,000,000 people
		Health Infrastructure	Is there a national laboratory/laboratory system that serves as a reference?
			Is there a national laboratory that serves as a reference facility which is subject to external quality assurance review?
			Is national industrial infrastructure able to be repurposed to manufacture basic/essential items if required?
		Medicine, Vaccines, & Technology	Tuberculosis immunization coverage

Table 3: Indicators for Capacity for Response (continued)

SECTION	CATEGORY	KEY DIMENSION	INDICATOR
3. Capacity for Response	Surveillance	Health Financing	Does the government cover the cost of testing potentially infected people? What portion of the costs does the government cover? (% of current government healthcare expenditure)
		Health Governance & Partnerships	Is there a department, agency, or similar unit dedicated to diseases/epidemics surveillance and detection?
		Health Resources	Is there public evidence that the country has at least 1 trained field epidemiologist per 200,000 people?
			Applied epidemiology training programs such as a field epidemiology training program, for public health professionals and veterinarians (e.g. Field Epidemiology Training Program and the Field Epidemiology Training Program for Veterinarians)
		Health Information Management	Are electronic health records available?
			Are there data standards to ensure data is comparable (e.g. ISO standards)?
			Availability of anonymized surveillance data
			Does the electronic reporting surveillance system collect ongoing or real-time laboratory data?
			Does the government conduct environmental detection or surveillance activities (e.g. in soil, waterways) for antimicrobial residues or antimicrobial resistant organisms?
			Is there evidence that the country is conducting ongoing event-based surveillance and analysis for infectious disease?
			Does the government operate an electronic reporting surveillance system at both the national and sub-national levels?
			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)?
			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?
		Health Infrastructure	Is there a national laboratory/laboratory system which tests for priority antimicrobial resistant pathogens?
Does the national laboratory system have the capacity to conduct diagnostic tests for at least 5 of the 10 WHO-defined core tests?			

Table 3: Indicators for Capacity for Response (continued)

SECTION	CATEGORY	KEY DIMENSION	INDICATOR
3. Capacity for Response	Surveillance	Medicine, Vaccines, & Technology	Is there a national procurement protocol in place that can be utilized by the Ministries of Health and Agriculture for the acquisition of laboratory needs (such as equipment, reagents, and media)?
		Strategies, Plans, & Regulations	Is there a national Antimicrobial Resistance (AMR) plan for the surveillance, detection and reporting of priority antimicrobial resistant pathogens?
			Are there resources for the detection and alert of chemical events?
			Are there resources for the detection and alert of radiation emergencies?
			Are there mechanisms and documented procedures among all relevant sectors, particularly those responsible for human health and animal health, in place to ensure operational preparedness?
			Are plans and mechanisms in place for event-based and indicator-based surveillance?
			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?
			What are the ethical considerations during surveillance?
			Is there a commitment to sharing genetic data, clinical specimens and/or isolated specimens (biological materials) in both emergency and non-emergency research?
			Response
	Is the Emergency Operations Center (EOC) required to conduct a drill at least once per year, or is there evidence that it conducts a drill at least once per year?		
	Does the country have a specific mechanism(s) for engaging with the private sector to assist with outbreak emergency preparedness and response?		
	Health Resources	Physician density	
		Are the appropriate human resources available to implement IHR Core Capacity requirements?	
		Specialist surgical workforce (per 100,000 people)	
		Nurses and midwives (per 1,000 people)	
		Researchers engaged in research and development (per 1,000,000 people)	
	Health Information Management	Does the country have in place an Emergency Operations Center (EOC)?	
		Have the appropriate IHR policy and procedures for risk communications been implemented?	

Table 3: Indicators for Capacity for Response (continued)

SECTION	CATEGORY	KEY DIMENSION	INDICATOR
3. Capacity for Response	Response	Health Information Management	Are there appropriate IHR coordination and National IHR Focal Point functions in place?
			Is there evidence that the government utilizes media platforms (e.g. social media, website updates) to inform the public about public health emergencies?
		Health Infrastructure	Hospital beds (per 1,000 people)
			Is there sufficient capacity at points of entry?
			Are laboratory services available to test for priority health threats?
		Medicine, Vaccines, & Technology	Infection control equipment availability
			Does the country maintain a stockpile of medical countermeasures for national use during a public health emergency (i.e. vaccines, therapeutics, and diagnostics)?
			Research and development expenditure (% GDP)
		Strategies, Plans, & Regulations	Is there emergency preparedness and response planning that addresses planning for multiple communicable diseases that could become a pandemic or an epidemic?
			If this plan is in place, has it been updated in the last 3 years?
			If this plan is in place, does it include considerations for pediatric and/or other vulnerable populations?
			Is there capacity to detect, investigate and respond in a timely manner to food safety events involving foodborne diseases and/or food contamination?
			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 are there strategies to address these shortcomings?
			Are there health service provisions to continue to manage essential services, infection prevention and control, and case management capacity?
	Has the country completed a biological threat-focused IHR exercises with the WHO in the past year (excluding chemical and radiological exercises)?		
	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. a bioterrorism attack)?		
	Recovery	Health Governance & Partnerships	Is there a dedicated disaster recovery entity/unit?
		Health Information Management	Are there programs to address the psychosocial needs of affected populations after the emergency?

Endnotes

1. The Safety II approach and Hollnagel et al., quoted in Siri Wiig et al., "Defining the boundaries and operational concepts of resilience in the resilience in healthcare research program," *BMC Health Services Research* 20, Article No. 330, 2020 (<https://doi.org/10.1186/s12913-020-05224-3>).
2. Ibid.
3. "COVID-19 Coronavirus Pandemic," Worldometer, accessed May 7, 2021 (<https://www.worldometers.info/coronavirus/>).
4. "COVID-19 to Add as Many as 150 Million Extreme Poor by 2021," World Bank, October 7, 2020 (<https://www.worldbank.org/en/news/press-release/2020/10/07/covid-19-to-add-as-many-as-150-million-extreme-poor-by-2021>).
5. "WFP Chief warns of hunger pandemic as COVID-19 spreads (Statement to UN Security Council)," United Nations World Food Programme, April 21, 2020 (<https://www.wfp.org/news/wfp-chief-warns-hunger-pandemic-covid-19-spreads-statement-un-security-council>).
6. World Bank, "Global Economic Prospects," January 2021 (<https://www.worldbank.org/en/publication/global-economic-prospects>).
7. "ILO Monitor: COVID-19 and the world of work. Seventh edition," International Labour Organization, January 25, 2021 (https://www.ilo.org/wcmsp5/groups/public/@dgreports/@dcomm/documents/briefingnote/wcms_767028.pdf).
8. Stephen Zuckerman and Teresa Coughlin, "Initial Health Policy Responses to Hurricane Katrina and Possible Next Steps," The Urban Institute, February 2006 (<https://www.urban.org/sites/default/files/publication/51061/900929-initial-health-policy-responses-to-hurricane-katrina-and-possible-next-steps.pdf>).
9. Sarah A. Lister, "Hurricane Katrina: The Public Health and Medical Response," CRS Report for Congress, September 21, 2005 (https://digital.library.unt.edu/ark:/67531/metacrs7639/m1/1/high_res_d/RL33096_2005Sep21.pdf).
10. "A Failure of Initiative. Final report of the Select Bipartisan Committee to Investigate the Preparation for and Response to Hurricane Katrina," U.S. House of Representatives, February 15, 2006 (<https://www.nrc.gov/docs/ML1209/ML12093A081.pdf>).
11. Masaru Nohara, "Impact of the Great East Japan Earthquake and tsunami on health, medical care and public health systems in Iwate Prefecture, Japan," *Western Pacific Surveillance and Response Journal*, 2011; Vol. 2, No. 4, pp. 24-30 (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3729067/>).
12. Shunichi Koshimura and Nobuo Shuto, "Response to the 2011 Great East Japan Earthquake and Tsunami Disaster," *Philosophical Transactions of the Royal Society A*, 2015; Vol. 373, No. 2053 (<https://royalsocietypublishing.org/doi/10.1098/rsta.2014.0373>).
13. John Sparrow, "Japan: Red Cross intervenes as healthcare breakdown threatens tsunami survivors," International Federation of Red Cross, May 11, 2011 (<https://www.ifrc.org/en/news-and-media/news-stories/asia-pacific/japan/japan-red-cross-intervenes-as-healthcare-breakdown-threatens-tsunami-survivors/>).
14. Ibid.
15. "2014-2016 Ebola Outbreak in West Africa," Centers for Disease Control and Prevention, last reviewed March 8, 2019 (<https://www.cdc.gov/vhf/ebola/history/2014-2016-outbreak/index.html>).
16. Sylla Thiam et al., "Challenges in controlling the Ebola outbreak in two prefectures in Guinea: Why did communities continue to resist?" *Pan African Medical Journal*, 2015 (<https://pubmed.ncbi.nlm.nih.gov/26740850/>).
17. "The Organisation of Resilient Health and Social Care Following the COVID-19 Pandemic," Publications Office of the European Union, April 2020 (https://ec.europa.eu/health/sites/health/files/expert_panel/docs/026_health_socialcare_covid19_en.pdf); Sriram Shamasunder et al., "COVID-19 reveals weak health systems by design: Why we must re-make global health in this historic moment," *Global Public Health*, July 2020; Vol. 15, No. 7, pp. 1083-1089 (<https://www.tandfonline.com/doi/pdf/10.1080/17441692.2020.1760915>).
18. "Global Health Security Index: Building Collective Action and Accountability," Johns Hopkins Bloomberg School of Public Health, October 2019 (<https://www.ghsindex.org/wp-content/uploads/2019/10/2019-Global-Health-Security-Index.pdf>).
19. Strategy& has created an index with 202 key performance indicators (KPIs) for assessing exposure to hazards,

vulnerabilities, and response capacity. For a summary of this index, see the Appendix.

20. "Human cost of disasters – An overview of the last 20 years 2000–2019," U.N. Office for Disaster Risk Reduction, accessed January 28, 2021 (<https://reliefweb.int/sites/reliefweb.int/files/resources/Human%20Cost%20of%20Disasters%202000-2019%20Report%20-%20UN%20Office%20for%20Disaster%20Risk%20Reduction.pdf>). As the report also notes (on page 6), "While better recording and reporting may partly explain some of the increase in events, much of it is due to a significant rise in the number of climate-related disasters."
21. "State of Global Air 2019," Health Effects Institute and Institute for Health Metrics and Evaluation, 2019 (https://www.stateofglobalair.org/sites/default/files/soga_2019_report.pdf).
22. "Drinking-water," World Health Organization fact sheet, June 14, 2019 (<https://www.who.int/news-room/fact-sheets/detail/drinking-water>).
23. "Intentional Homicide Victims," United Nations Office of Drugs and Crime (UNODC), accessed January 31, 2021 (<https://dataunodc.un.org/crime/intentional-homicide-victims>).
24. "Global Terrorism Overview: Terrorism in 2019," National Consortium for the Study of Terrorism and Responses to Terrorism, July 2020 (https://www.start.umd.edu/pubs/START_GTD_GlobalTerrorismOverview2019_July2020.pdf).
25. Boaz Ganor and Miri Halperin Wernli, "Terrorist Attacks against Hospitals: Case Studies," International Institute for Counter-Terrorism (ICT), 2013 (<http://www.jstor.org/stable/resrep09457>).
26. Laura Dyrda, "It's not a good week for healthcare': Health system IT execs react to recent ransomware attacks," Becker's Health IT, October 3, 2020 (<https://www.beckershospitalreview.com/cybersecurity/it-s-not-a-good-week-for-healthcare-health-system-it-execs-react-to-recent-ransomware-attacks.html>); Laura Dyrda, "The 5 most significant cyberattacks in healthcare for 2020," Becker's Health IT, December 14, 2020 (<https://www.beckershospitalreview.com/cybersecurity/the-5-most-significant-cyberattacks-in-healthcare-for-2020.html>); Jessica Davis, "UPDATE: The 10 Biggest Healthcare Data Breaches of 2020," Health IT Security, accessed January 27, 2021 (<https://healthitsecurity.com/news/the-10-biggest-healthcare-data-breaches-of-2020>).
27. T.A. Kakyoo and L.D. Xiao, "Challenges faced in rural hospitals: The experiences of nurse managers in Uganda," *International Nursing Review*, April 19, 2018 (<https://onlinelibrary.wiley.com/doi/abs/10.1111/inr.12459>).
28. James I. Price and Alok K. Bohara, "Maternal health care amid political unrest: The effect of armed conflict on antenatal care utilization in Nepal," *Health Policy and Planning*, Vol. 28, No. 3, pp. 309–319, May 2013 (<https://doi.org/10.1093/heapol/czs062>).
29. "Measuring performance on the Healthcare Access and Quality Index for 195 countries and territories and selected subnational locations: A systematic analysis from the Global Burden of Disease Study 2016," *The Lancet*, Vol. 391, 2018 (<https://www.thelancet.com/action/showPdf?pii=S0140-6736%2818%2930994-2>).
30. "Diabetes," World Health Organization fact sheet, accessed January 27, 2021 (<https://www.who.int/news-room/fact-sheets/detail/diabetes>).
31. "Mongolia's Air Pollution Crisis: A call to action to protect children's health," UNICEF, February 2018, page 15 (https://reliefweb.int/sites/reliefweb.int/files/resources/Mongolia_air_pollution_crisis_ENG.pdf).
32. "Asthma Disparities in America," Asthma and Allergy Foundation of America, accessed January 27, 2021 (<https://www.aafa.org/asthma-disparities-burden-on-minorities.aspx>).
33. "Diabetes Rates by Country 2021," World Population Review, accessed June 9, 2021 (<https://worldpopulationreview.com/country-rankings/diabetes-rates-by-country>).
34. "Strengthening health-system emergency preparedness: Toolkit for assessing health-system capacity for crisis management," World Health Organization Europe, 2012, Part 1 (https://reliefweb.int/sites/reliefweb.int/files/resources/Full%20Report_683.pdf); Part 2 (https://www.euro.who.int/_data/assets/pdf_file/0010/157888/e96188.pdf).
35. P. Nsubuga, M.E. White, S.B. Thacker, et al., "Public Health Surveillance: A Tool for Targeting and Monitoring Interventions," in D.T. Jamison, J.G. Breman, A.R. Measham, et al., editors, *Disease Control Priorities in Developing Countries*, 2nd Ed., The International Bank for Reconstruction and Development/The World Bank, Oxford University Press, Chapter 53, 2006 (<https://www.ncbi.nlm.nih.gov/books/NBK11770/>).
36. "Project Defend: New approach to national security aims to diversify supply and 'reshore' manufacture," Institute of Export & International Trade, May 22, 2020 (<https://www.export.org.uk/news/509100/Project-Defend-New-approach-to-national-security-aims-to-diversify-supply-and-reshore-manufacture.htm>); House of Commons, Business, Energy and Industrial Strategy Committee, "The impact of Brexit on the pharmaceutical sector: Ninth Report of Session 2017–19," 2018 (<https://publications.parliament.uk/pa/cm201719/cmselect/cmbeis/382/382.pdf>).
37. Leila Abboud and Michael Peel, "Covid-19 hastens French push to bring home medicines manufacture,"

- Financial Times, July 29, 2020 (<https://www.ft.com/content/80a4836b-ca25-48e0-996d-458186e968dc>); Carlo Martuscelli and Giorgio Leali, "Can the coronavirus bring back Europe's pharmaceutical factories?" Politico, October 12, 2020 (<https://www.politico.eu/article/can-the-coronavirus-bring-back-europe-pharmaceutical-factories/>).
38. "The U.S. Needs a Disaster Health Response System to Save Lives After an Emergency," American Hospital Association, May 10, 2018 (<https://www.aha.org/news/insights-and-analysis/2018-05-10-us-needs-disaster-health-response-system-save-lives-after>).
39. Ibid.
40. "Regional Disaster Health Response System: An Overview," U.S. Department of Health & Human Services, page last reviewed February 3, 2021 (<https://www.phe.gov/Preparedness/planning/RDHRS/Pages/rdhrs-overview.aspx>).
41. Ibid.
42. "RDHRS Pilot Projects Demonstrate Value during the COVID-19 Response," U.S. Department of Health and Human Services, page last reviewed February 3, 2021 (<https://www.phe.gov/Preparedness/planning/RDHRS/Pages/rdrhs-response-during-COVID19.aspx>).
43. National University Cancer Institute of Singapore (NCIS) Workflow Team, "A segregated-team model to maintain cancer care during the COVID-19 outbreak at an academic center in Singapore," *Annals of Oncology*, Vol. 31, No. 7, pp. 840-843, 2020 (<https://pubmed.ncbi.nlm.nih.gov/32243893/>).
44. Ibid.
45. Ibid.

Contacts

Dima Sayess

Partner
+971-4-436-3000
dima.sayess
@strategyand.ae.pwc.com

Dr. Walid Tohme

Partner
+971-4-436-3000
walid.tohme
@strategyand.ae.pwc.com

Ana Garcia

Senior Associate
+971-4-436-3000
ana.ag.garcia
@strategyand.ae.pwc.com

Jan Schmitz-Hubsch

Partner
+971-4-436-3000
jan.schmitz-hubsch
@strategyand.ae.pwc.com

Robert Wang

Manager
+971-4-436-3000
robert.x.wang
@strategyand.ae.pwc.com

The Ideation Center

The Ideation Center is the leading think tank for Strategy& Middle East, part of the PwC network. We aim to promote sustainable growth in the region by helping leaders across sectors translate socioeconomic trends into actions and better business decisions. Combining innovative research, analysis, and dialogue with hands-on expertise from the professional community in the private and public sectors, the Ideation Center delivers impactful ideas through our publications, website, and forums. The end result is one that inspires, enriches, and rewards. The Ideation Center upholds Strategy&'s mission to develop practical strategies and turn ideas into action. At the Ideation Center, we enjoy the full support of all practices in the Middle East. Together we bring unsurpassed commitment to the goal of advancing the interests of the Middle East region. Find out more by visiting www.ideationcenter.com.

About the Authors

Dima Sayess is a partner with Strategy& Middle East, part of the PwC network, and the director of the Ideation Center, the leading think tank for Strategy& Middle East. Based in Dubai, she has more than 15 years of experience in public-sector consulting in the region, including working for Strategy&, focusing on socioeconomic and government reforms. She has also worked as a strategic development advisor at Dubai's Executive Council.

Jan Schmitz-Hubsch is a partner with Strategy& Middle East. Based in Dubai, he is a member of the health practice in the Middle East. He has led diverse strategy assignments for governments, healthcare payors, providers, investors, and life science companies across a multitude of areas including healthcare strategy development and implementation support, public-sector strategies, and growth and investment strategies. He also has experience with operating model and market development in the Middle East and Europe.

Dr. Walid Tohme is a partner with Strategy& Middle East. Based in Dubai, he is the leader of the health practice in the Middle East. He works with major healthcare providers, healthcare payors, and ministries of health across the GCC. He specializes in strategic and operational transformations, healthcare investment strategies, postmerger integrations, and joint ventures. Additionally, he is one of Strategy&'s experts on digitization and big data and leads its efforts in this area in the Middle East.



**WORLD
GOVERNMENT
SUMMIT**



@WorldGovSummit

#WorldGovSummit

Join the conversation
worldgovernmentsummit.org