

How Can We Be Better Prepared for the Next Public Health Crisis?

Lessons Learned from
the COVID-19 Pandemic

An ISGlobal Policy Paper

Elizabeth Diago-Navarro, Oriana Ramírez, Marta Rodó,
Gonzalo Fanjul, Elisabeth Cardis

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CONTENTS

EXECUTIVE SUMMARY	3
SECTION 1. Preparedness and Global Response before COVID-19.....	5
SECTION 2. Nine Lessons Learned on Preparedness During COVID-19 Response	7
SECTION 3. Governing Global Preparedness in the Aftermath of COVID-19: Challenges and Responses	12
SECTION 4. ISGlobal's Proposal for a Comprehensive Preparedness Model for Health Crises.....	15
SECTION 5. Conclusions and Recommendations	18
TO LEARN MORE	20
REFERENCES	21

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EXECUTIVE SUMMARY

Though many institutions had been calling for **investments in preparedness** for decades, warning about the threat of novel infectious diseases, the COVID-19 pandemic struck an ill-prepared world, highlighting **major challenges and gaps** in global response. The effects of the pandemic have gone much further than health, affecting societies and the economy globally.

It is important that we learn from this pandemic. This entails improving plans for preparedness, **response, recovery and resilience (PR³)** for possible future public health and environmental crises. Also, strengthening global, regional and local capabilities to effectively respond to them.

This paper identifies **nine lessons** that must be drawn from this tragic experience in order to avoid or mitigate future systemic health risks. Not all are negative. Successes include **rapid mobilization of the scientific community** leading to novel scientific research and development innovations that have worked well or have the potential to be used in the future. An important example is wastewater surveillance –to monitor and anticipate environmental health hazards including pathogens, chemicals and antibiotic resistance– and enormous advances in diagnostics, treatments and vaccines. The importance of **epidemiological intelligence** –relying on real-time exploitation of routinely collected data on health, protection measures, environmental exposure and policies– has been clearly demonstrated. It allows anticipating threats, monitoring the impact of crises and preventive measures and providing evidence for the development of policy and the evaluation of their efficacy.

Other gaps identified include the **lack of early warning systems** and real-time surveillance that could have prompted a quicker response to contain the pathogen. The widespread availability of unvetted information and the questionable use of social media has created an additional challenge. This, together with conflicting guidelines and recommendations, have created mistrust in large segments of the populations and diffculted the implementation of prevention measures. There is a clear need to incorporate **risk communication and social behavior experts** and to fully engage all relevant stakeholders, in developing communication strategies and messages for the public. From the mental health and socio-economic perspectives, moreover, the COVID-19 response has had a major impact, which, unfortunately, was particularly pronounced in vulnerable sections of the populations and in poorer countries. **Fighting inequities and addressing the well-being** of populations should be a priority in preparedness and response plans.

In terms of **governance**, various roadblocks prevented appropriate coordination of the response, with fragmentation and inequities at the global, regional and local levels. As a consequence, a number of actions have been taken –or are in the process

of being implemented or developed—, such as the new **WHO Hub for Pandemic and Epidemic Intelligence**, the new European Health Emergency Preparedness and Response Authority (**HERA**) and ongoing discussions for a **Pandemic Treaty**. Although this institutional development exercise is welcomed, its results are still unclear.

The pandemic has taught us that **coordination** is essential, from the local to the global level. With this paper's analysis and recommendations, ISGlobal wants to help in developing a comprehensive approach for preparedness, calling for a scientific coordination and investments in peace-times that allow the development of novel strategies and applying best-evidence approaches to respond efficiently to crises.

SECTION 1:

Preparedness and Global Response before COVID-19

The global crisis posed by the COVID-19 pandemic has had **major impacts in all areas** of our lives, ranging from the direct impact of the SARS-CoV-2 infection on COVID morbidity and mortality to indirect effects of the pandemic on the health and well-being of populations across the globe, the economy, societies and education. The pandemic has also highlighted **challenges and gaps** in our strategies for preparedness and response in general to health hazards with the potential of causing a public health crisis.

COVID-19 was **not the first pandemic** that our world has endured. Indeed, pandemics and epidemics have shaped our societies since human living in communities made possible the effective transmission of infectious diseases. Examples of important infectious diseases causing epidemics and pandemics include **plague, smallpox, cholera, HIV/AIDS, Ebola, SARS and pandemic flu**.

For years, a wide range of scientists, public health officials, citizens and academic, private and public institutions have warned of the imminent threats of emerging and re-emerging infectious diseases with pandemic potential and called for investments in preparedness to respond efficiently to this type of crisis ^{1,2,3,4,5,6}. **The SARS epidemic** in 2002-2004, which infected over 8,000 people in 29 countries, was a **real worldwide warning**⁷.

In 2005, in an attempt to respond to deadly epidemics, the **WHO** developed the **International Health Regulations (IHR)**⁸ to provide an overarching legal framework for responding to public health events and emergencies with cross-border potential, defining countries' obligations and rights. These regulations, which entered into force and were adopted by all WHO Member States in 2007, require States to maintain **core capabilities for surveillance and response**, with the WHO providing tools, guidelines and training. All States Parties (196) have reported indicators of their capabilities to respond to a health crisis, at least once in the past 9 years, with varying levels of success in their performance and gaps identified⁹. The indicators refer to **13 IHR capacities**, including Legislation and Financing, Laboratory, Surveillance, National Health Emergency Framework and Risk Communication¹⁰.

The International Health Regulations, though binding, turned out **not** to be **effective** preparedness measures when SARS-CoV-2 struck the world, as important challenges were met in implementing plans and putting capabilities into action during the COVID-19 crisis response, in particular in relation to surveillance and early warning systems, and risk communication with the population. Furthermore, **some countries with worse preparedness** performance indicators **responded more efficiently** to the **COVID-19 crisis** than others with better indicators^{11,12}. For example, according to the [COVID-19 Global Response Index](#), Senegal and Ethiopia responded quite well to the COVID-19 pandemic in terms of public health directives for virus containment, as well as financial

“The SARS epidemic in 2002-2004, which infected over 8,000 people in 29 countries, was a real worldwide warning.”

response and fact-based communication, despite their poor preparedness scores ([Prevent Epidemics' ReadyScore](#)). In contrast, response was judged to be **deficient in some countries with good self-reported preparedness** performance scores like the USA and South Korea¹³.

Once COVID-19 was found to be rapidly (and silently) spreading around the world, countries had to enter into a **response phase**, generally adopting mitigation strategies aimed at limiting transmission and diminishing the impact of COVID-19 in their community. COVID-19 response strategies varied across the world depending on the intensity of containment, mitigation and recovery strategies, with varying degrees of success. While many difficulties were encountered across the world, **successful and innovative strategies** were identified, and these, together with identified gaps in response strategies, need to be taken into account to improve preparedness now and in the future, for pandemics specifically and, more generally for a holistic all-hazards (including natural or climate change-driven, biological, chemical, radiological hazards) preparedness system.

BOX 1. Preparedness concepts [adapted from [City of St. Louis, MO, Fairfax County, WHO emergency preparedness documents](#)].

- **Preparedness** refers to all the activities designed to increase the ability of a community/organization/administration to respond if/when a health emergency or a disaster occurs. Normally, these activities are carried out in “peace times”, before a crisis occurs. They include developing **core protocols** for responding to crises; **surveillance mechanisms** and **communication strategies**; **capacity building**, by training both response personnel and concerned citizens or conducting exercises to reinforce training and testing capabilities; and developing **educational campaigns** related to all possible types of hazards (natural, biological, chemical, radiological).
- **Response** refers to all actions carried out during, and immediately after a crisis, which are aimed at saving lives, alleviating suffering, maintaining healthy populations, and reducing economic losses. Response actions include **risk identification** including surveillance of exposures/infection distribution and evolution, early alert systems; **containment** of a health threat, depending on the type of crisis, for example, by evacuating threatened populations, opening shelters and providing mass care, emergency rescue operations and providing medical care, fire fighters, urban search and rescue, contact tracing and quarantine; **mitigation**, i.e. measures that reduce the damaging effects of unavoidable emergencies, including development and testing medical countermeasures; **suppression**, i.e. maintaining low levels of disease transmission or exposure to the environmental agent; and **communication**, throughout the entire response phase.
- **Recovery** refers to all actions taken to return a community to **normal or near-normal conditions**, including the restoration of basic services and the recovery of physical, psychological, social and economic damages.
- **Resilience**: The capacity of actors, institutions and society to prepare for and respond effectively to crises; to maintain core functions when a crisis occurs; and, based on lessons learnt during the crisis, to reorganise if conditions warrant it. Resilience allows them to **recover quickly** and to **be less susceptible**.

SECTION 2:

Nine Lessons Learned on Preparedness During COVID-19 Response

During the COVID-19 crisis the **collaboration between research and public health authorities** has been unprecedented and has led to the advancement of tools to respond efficiently to COVID-19. Existing and *de novo* generated knowledge in different research areas in academic institutions was incorporated into the actual plans to control the spread of COVID-19 and mitigate its effects. Unfortunately, scientific advancements and evidenced-based strategies were not implemented thoroughly and globally, and political debates may have often polarized the response.

Nevertheless, research results highlight several important examples of **science/evidence-based strategies** to be incorporated in preparedness planning for future health crises. This includes: wastewater surveillance, investigation of new diagnostics tools, antiviral treatments and new high-tech vaccines, and epidemiologic intelligence, including modelling of the dynamics of the epidemic.

“Research results highlight several important examples of science/evidence-based strategies to be incorporated in preparedness planning for future health crises.”

01. **Waste-water surveillance, a not so novel strategy.** Surveillance of the spread of SARS-CoV-2 virus infections has been key to the adoption of mitigation strategies to control the spread within a community or region. One innovative approach, though not new, is wastewater surveillance. This approach has been **used in the past** to monitor trends in circulation of various infectious diseases, including poliovirus¹⁴, antibiotic resistance or drug use in different populations. With SARS-CoV-2, changes in the levels of virus detected in sewage water allows public health authorities to anticipate possible outbreaks in a community and monitor the dynamics of virus circulation¹⁵. This has led different authorities to adopt, or recommend the adoption, of wastewater analysis as one approach for surveillance of the spread of the virus and its variants, for example in the USA with the creation of the [National Wastewater Surveillance System \(NWSS\)](#) and in Europe with the [EU adopting guidelines](#) to monitor the spread of the virus and its variants. Unfortunately, the implementation of such a system has not yet been fully successful due to technical and investment problems and has left communities less prepared to anticipate epidemic changes than they could have been. But wastewater surveillance can be a key approach to **monitor and anticipate many environmental public health hazards**, including chemicals, pathogens and antibiotic resistance and thus be an important surveillance tool in the framework of an all-hazards preparedness strategy^{16, 17}.
02. **Diagnostics, treatments and vaccines: the rapid expansion of medical countermeasures.** The near immediate **public sharing of the genetic sequence** of the SARS-CoV-2 virus, only 12 days after the notification (on December 31st 2019) of pneumonia of unknown aetiology to the WHO China country office, made it possible to develop diagnostics tests very quickly¹⁸, with the first RT-PCR diagnostic test shared by the WHO

only one day after the sequence was released by the Chinese government¹⁹. Unfortunately, the **availability of tests** was not immediate, due to shortages of supplies and laboratory workforce, and countries lacked adequate diagnostic capacity for months.

During the first few months of the pandemic, healthcare workers lacked efficient drugs or best practices to manage patients with severe COVID-19, but intensive **scientific research** allowed testing the efficacy of drugs with potential antiviral activity, in most cases repurposing already approved drugs²⁰. The establishment of large, **randomized clinical trials** with adaptive design where several drugs could be tested and added and dropped during the trial time, allowed the quick and efficient evaluation of possible treatments²¹. **Regulatory agencies** also worked on emergency frameworks that would allow the prioritized efficacy and safety evaluation of drugs and vaccines²². Additionally, **sharing best practices openly** among the medical and research community allowed the adoption of better strategies to treat patients.

As a result, for the first time, **highly effective and safe vaccines** were developed in less than a year after the first isolation of the virus²³. Many countries around the world have been able to achieve high levels of vaccination among their population, allowing the reduction/lifting of restrictions and non-pharmaceutical interventions. Despite these successes, access to the vaccines is still limited in some LMICs, and additional efforts are needed to ensure global protection.

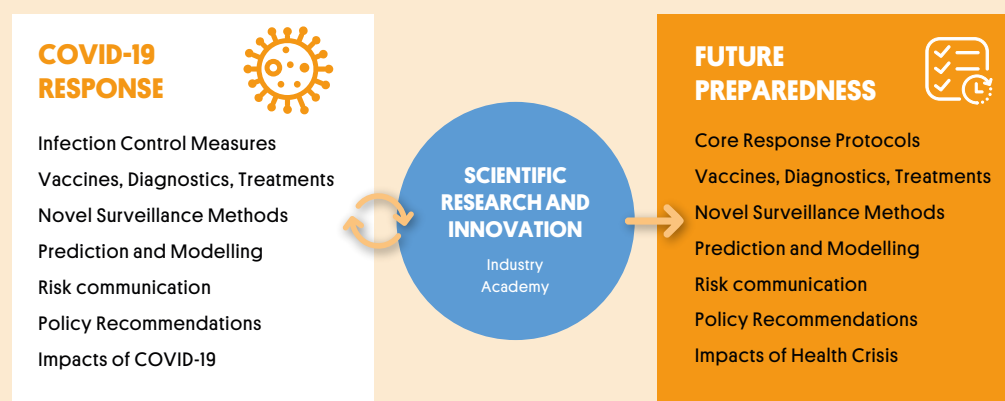
03. Epidemiologic intelligence or how to integrate real-time data into decision-making processes. This is another example of best practice arising from the COVID pandemic. **Anticipating changes** in the evolution of the COVID-19 epidemic (or of the responsible agent in any other environmental public health crisis, including other pandemic infectious diseases), in a particular country, region or locality is key to adapt containment and mitigation strategies^{24, 25, 26, 27}. Numerous research institutions around the world have participated in the development of **monitoring and prediction systems** for use by public health authorities^{28, 29} and have applied these both for prediction of the pandemic and for the evaluation of the public health and other impacts of the crisis^{30, 31, 32, 33}. Many governments requested technical assistance from investigators working on modelling and forecasting to respond efficiently to COVID-19 pandemic. This has been the case, for example, in **Catalonia** with researchers from different academic centers advising the EU³⁴ and the Catalonian authorities, as well as in the USA, for example, with research institutions advising the CDC or State and Local health departments. Moreover, in an attempt to add epidemic intelligence to global health security capabilities, the WHO has created a new **Hub for Pandemic and Epidemic Intelligence in Berlin** for forecasting and predicting disease outbreaks³⁵. Unfortunately, epidemic/epidemiologic intelligence is not yet globally available and most countries lack the capacity to use real-time epidemic data to inform their response strategies, mainly because of **logistic and legal difficulties** in accessing and linking all appropriate **population databases**.

These (and other) rapid developments have only been possible because of the unprecedented scientific collaboration between academia, industry and public agencies and the near real-time public availability of data and research results. This has enhanced the scientific advancement in technologies and therapies to control the spread of COVID-19. These **successful collaborations and partnerships**

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should be a model for preparedness and response for future environment/public health crises, with further **investments** in surveillance and early alert systems, vaccines for multiple viruses, quick diagnostic testing and repurposing of drugs, and continued sharing data, resources and best practices while maintaining data integrity and effective communication with the public. **Figure 1** shows the interplay between the scientific research and innovation driven by academia and industry that is being applied to COVID-19 response. The lessons learned including successes and knowledge gaps need to be addressed by industry and academic R&D to be better prepared for future health crises.

FIGURE 1. The role of science in the development of effective responses to COVID-19 pandemic and adopting best practices for the future.



Source: Adapted from OECDiLibrary. [COVID-19: A pivot point for science, technology and innovation?](#)

While the global COVID-19 response is, in retrospect, a success story in many ways, many **obstacles** were found that limited the efficiency and speed of the response.

04. If you do not have the right tools, you cannot find the problem. Early warning systems and planned control measures were not comprehensive and did not include all relevant stakeholders. Real-time surveillance and epidemic intelligence data was absent or deficient in most countries hence mitigation policies were often based, particularly in the early months of the pandemic, on incomplete or inadequate information, and did not take into account the indirect health (including mental health), social and economic consequences of the COVID-19 response and mitigation measures. For a **holistic all-hazards preparedness system**, real-time access to data from all appropriate population and environmental monitoring databases is essential. This includes primary health data, disease registries, social and economic indicators and linkage between all **databases** is needed to provide epidemiological intelligence and inform response activities at all levels, from community, city, region, to the national and global levels. **Epidemiological intelligence**, moreover, should rely not only on data on humans but also, and particularly for infectious diseases on **animal data**, recognising the links between human, animal and environmental health. Hence a **One Health approach** should be considered in the development of preparedness plans ^{36, 37}.

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“The rapid spread of misinformation, in particular, but not exclusively, in social media, increases mistrust in health authorities and hinders mitigation strategies.”

05. A pandemic in the era of infodemics. The COVID-19 pandemic showed clearly that risk communication with different stakeholders, including the general population, failed and continues to be less than adequate, leading to important **misunderstandings** and **conflicting guidelines** (over time, between areas and countries) that created –and continue to create– confusion and mistrust in the authorities and may have reduced population compliance with response strategies. The problem is amplified by the universal access to information through the Information and Communication Technologies –including the **overabundance of information** that makes it difficult to identify that of real quality–, as well as the proliferation of **false or misleading information**. All of this is captured by the term *infodemics*³⁸. The rapid spread of misinformation, in particular, but not exclusively, in social media, increases mistrust in health authorities and hinders mitigation strategies. Most recently, this is apparent with vaccination campaigns being challenged by false claims about the safety and efficacy of vaccines.

06. When too much unvetted information becomes a risk. While the rapid open access publication of research results and public availability of data has greatly enhanced our scientific knowledge and the rapid development and evaluation of vaccines, treatments and other mitigation strategies, it has also led to misinformation which, in some cases, was detrimental. Indeed, the availability of research studies through **preprint repositories**, such as MedRxiv or BioRxiv, without an appropriate peer-reviewed publication process, has led to conflicting results being posted, shared by the media and given validity only to be later disproven during the **peer-review process** or flagged for retraction due to flawed methodology³⁹. This phenomenon has contributed to the infodemics threat and mistrust and continues to stir controversy in some sectors of the population. This was the case, for example, of some papers investigating treatments for COVID-19 such as ivermectin or hydroxychloroquine which have since been shown to be ineffective but have been widely accepted and recommended in some countries to prevent and treat COVID-19^{40, 41, 42, 43}.

07. Lack of coordination is not optimal. While the COVID-19 pandemic has spurred an enormous research effort in all related disciplines globally, the efforts were often uncoordinated, with many scientists **working independently**, leading to duplication and sometimes **competition**, research results that were **not translated into policy or innovation**, and overall a less efficient (and cost-efficient) response than could have arisen from a coordinated research response.

08. Mental health and socioeconomic impacts need to be addressed. The pandemic, the measures implemented to mitigate it, the uncertainties and mistrust all have negatively impacted the mental health and social and economic wellbeing of the general population (increasing the prevalence of psychiatric disorders, including anxiety and depression, or worsening the condition of some already suffering such disorders), of healthcare and other essential workers, and of many other categories of workers indirectly affected by the pandemic, through restrictions and lay-offs resulting from loss of economic viability of businesses due to lockdowns⁴⁴. Some groups have, moreover, been more impacted than others by the psychosocial effects of the pandemic and remediation measures, including those at increased risk for severe COVID-19

(the elderly, the chronically ill), those with pre-existing medical, psychiatric or substance use disorders, and those whose economic and social situation was most impacted by the public health mitigation strategies, including **the poorest** in society and **the most isolated** (including migrants and refugees) ^{45, 46}.

09. Inequity amplified the impacts of COVID-19 crisis. COVID-19 response has varied enormously depending on the economic power of the country and sectors in the society. **Low and middle income countries** still struggle to have access to first doses of COVID-19 vaccines, while other countries are providing boosters to large segments of their populations. In places where universal health coverage is not implemented, poor and marginalized communities have suffered poor access to medical care, job losses and income insecurities and children's education lapses and supply chain shortages.

SECTION 3:

Governing Global Preparedness in the Aftermath of COVID-19: Challenges and Responses

Besides the gaps identified with the International Health Regulations and preparedness regulations, several other challenges have been identified at the international level in regard to coordination and collaboration between countries. In an attempt to strengthen global security at the international level, 194 **WHO** Member States have agreed to discuss **a new international treaty on pandemics** at a special session to be held in November 2021⁴⁷. This Pandemic Treaty will give WHO greater authority to respond more quickly and in a coordinated manner to cross-border threats, applying lessons learned from the COVID-19 response. In addition, as forecasting and predicting disease outbreaks has been proven to be extremely important for quickly detecting and responding to pandemic and epidemic risks, the WHO has created a **new Hub for Pandemic and Epidemic Intelligence**⁴⁸.

“As highlighted by the COVID-19 response, actors at the international, national and local levels all play a key role in the emergency response.”

At the European level, several agencies have taken part in the response to the COVID-19 pandemic, notably the **European Centre of Disease Control (ECDC)** and the **European Medicines Agency (EMA)**, which regulates the approval of medical countermeasures. The mandate of the ECDC is to perform risk assessments and surveillance and provide European Union Member States with guidelines and recommendations; it does not, however, have the authority to regulate preparedness and response activities of Member States. During the pandemic, there was fragmentation of response efforts between different Member States and the market and supply chain for medical countermeasures, personal protective equipment or medical devices was shown not to be effective at the EU level^{49, 50}. Even if the vaccination coverage progress has improved over time, and it is now one of the regions with highest vaccination rates per capita, the financing and deployment lagged in comparison with the USA, Israel and the United Kingdom. These problems have led to the recent approval for the development of the **European Health Emergency Preparedness and Response Authority (HERA)**⁵¹. The main objectives of this new entity are to assess health threats, promote research and development, address market challenges and EU autonomy, and quickly purchase medical countermeasures and improve knowledge on health preparedness. The authority will mainly focus on risk identification and medical countermeasures development and deployment and will work closely with the ECDC and EMA.

In **Latin America**, the creation of the **Ibero-American Epidemiological Observatory** was agreed during the XXVII Ibero-American Summit of Heads of State and Government in April 2021, to strengthen response capabilities to crises and health emergencies in Iberoamerican countries. This observatory aims to tackle the fragmentation and lack of coordination between governments in their response to cross-border threats, and will be based on epidemiological and health data from the region⁵².

The **lack of coordination** and collaboration was seen not only at the international level, but also at the **national and local levels**. In **Spain** for example, problems were experienced due to the lack of a unified response to COVID-19, and legal frameworks not allowing an efficient and unified response. Spain focused its mitigation efforts on strict lockdowns and mobility restrictions, initially at the state level but later the strategies differed between different autonomous regions in terms of implementing general recommendations and guidelines, leading to uneven responses. Additionally, as in most countries, communication of risk to the general population could have been better, with mixed messages depending on the source or region, thus undermining population confidence and trust in authorities. The magnitude of the COVID-19 epidemic in Spain, though the country ranks well in the Global Health Security Index and has a strong healthcare system, has led to a **call for an independent evaluation of the response** that could shed light to areas needing further strengthening^{53,54}. Such action reviews/reports during and after crisis response are key to increase its effectiveness and optimise future capabilities for crisis preparedness^{55,56}. WHO and ECDC have provided guidance for conducting these types of evaluations both for real responses or for simulation exercises^{57,58,59,60}.









As highlighted by the COVID-19 response, **actors at the international, national and local levels** all play a key role in the emergency response. COVID-19 has highlighted the importance of health crisis and emergency preparedness and several new and existing organizations have strengthened their commitment to advance in global health security by acting on preparedness and response objectives.

Table 1 shows some of the key international actors in the COVID-19 response, as well as institutions created in response to the COVID-19 crisis. In **Europe**, as described above, the three main agencies/authorities involved in preparedness, prevention and response –the ECDC, EMA and the new HERA authority– have complementary missions and engage with research and innovation institutions. In the **USA**, FEMA and BARDA agencies play a key role, the former preparing local and state departments to respond to emergencies and the later promoting the development of novel medical countermeasures. At the **global level**, CEPI promotes innovation in vaccines against emerging infectious diseases and the new WHO Hub on Pandemic and Epidemic Intelligence will be focused on forecasting infectious diseases dynamics. In the **African region**, the African CDC has an important role in the prevention, control and response to infectious diseases.

“The COVID-19 crisis has highlighted the need for urban preparedness and response frameworks.”

Finally, the COVID-19 crisis has highlighted the need for **urban preparedness and response frameworks**. Cities have been crucial in the response to COVID-19 due to their unique characteristics such as having higher population densities, serving as travel hubs or having large public transportation systems. In addition, there are a diverse range of populations living in them and some of them may be facing vulnerable situations, like living in crowded settings with poor hygiene or having difficulties accessing health care. The COVID-19 pandemic and other health crises affecting urban settings, such as floodings, chemical accidents, fires, and others, have emphasized gaps and challenges when **implementing health crisis responses in urban settings**. Lessons learned from these crises and disasters should be applied when preparing frameworks for urban preparedness⁶¹.

TABLE 1. International organizations involved in COVID-19 response and/or prevention and preparedness strategies for the future.

	HERA	ECDC	EMA	BARDA	PHEP	AfCDC	WHO HUB	CEPI
MISSION, VISION AND OBJECTIVES	Prevent, detect and rapidly respond, ensuring the availability, access and distribution of medical countermeasures	Identify, assess and communicate current and emerging threats to human health posed by infectious diseases	Foster scientific excellence in the evaluation and supervision of medicines, for the benefit of public and animal health	Develop and procure medical countermeasures that address the public health and medical emergencies	Help health departments build and strengthen their abilities to effectively respond to a range of public health threats	Strengthen the capacity of MS public health institutions to detect, prevent, control and respond quickly and effectively to disease threats	Build a system of collaborative intelligence enabling better decisions to avert and manage pandemic and epidemic risks	Accelerate the development of vaccines against EID and enable equitable access to vaccines during outbreaks.
GEOGRAPHICAL SCOPE								
TYPE OF HEALTH CRISIS	Cross-border health threats	Infectious diseases	Not specific for health threats but mechanisms for rapid MCM development in case of a crisis	CBRN accidents, incidents and attacks, Pl, and EID.	Public health threats	Infectious diseases	Cross-border health threats	Infectious diseases
AREAS OF ACTION	Preparedness and response	Prevention and control	Preparedness and response	Preparedness and response	Preparedness and response	Preparedness and response	Preparedness and response	Preparedness and response
RESEARCH AND INNOVATION AREAS	Medical countermeasures from preclinical development to clinical trials.	Provides calls for tenders and calls for proposals. It has a disease and laboratory network.	Develops innovative methodologies by fostering collaboration across regulatory network and with academia.	Medical countermeasures from preclinical development to clinical trials.	Partners with local research and scientific institutions.	Partners with local research and scientific institutions. Provides calls for proposals.	Innovations in data science for public health surveillance and response, creating systems to share/expand expertise globally.	Key role to create a global R&D ecosystem.

HERA: European Health Emergency Preparedness and Response Authority; ECDC: European Centre for Disease Prevention and Control; EMA: European Medicines Agency; BARDA: Biomedical Advanced Research and Development Authority; PHEP: Public Health Emergency Preparedness; WHO Hub: New WHO Hub for Pandemic and Epidemic Intelligence; AfCDC: Africa Centre for Disease Control and Prevention; CEPI: Coalition for Epidemic Preparedness Innovations; MS: Member States; EID: emerging infectious disease CBRN: chemical, radiological, biological and nuclear; Pl: pandemic influenza; EU: European Union; USA: United States of America; MCM: medical countermeasures; R&D: research and development

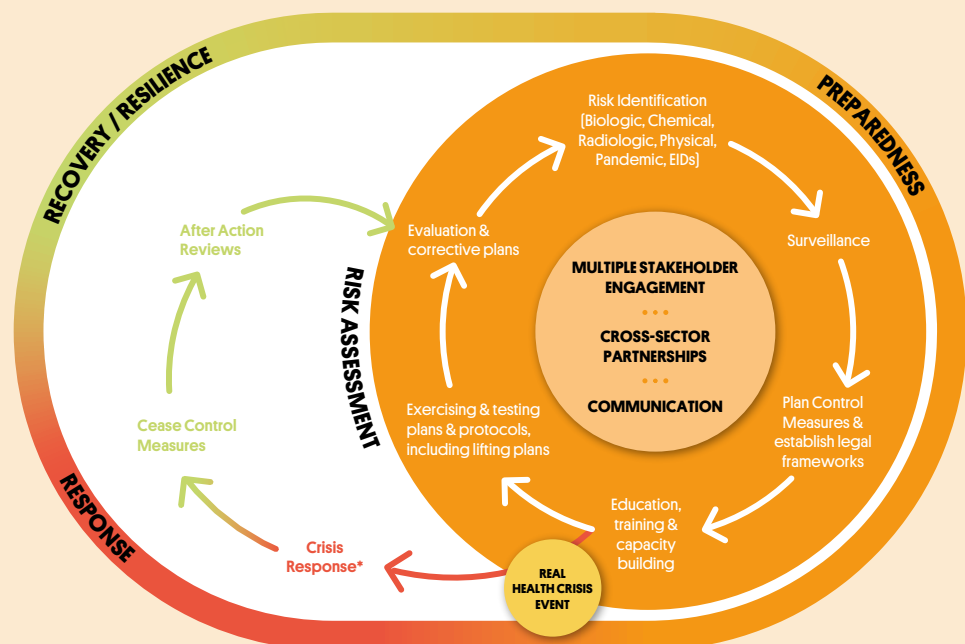
SECTION 4:

ISGlobal's Proposal for a Comprehensive Preparedness Model for Health Crises

The world has been affected by an emergent new infectious disease but history has shown us that our health and well-being may be affected in the future by a variety of hazards including natural disasters and biological, chemical, radiological and physical hazards, epidemics and pandemics, and emerging infectious diseases (EIDs). The **key lesson from COVID-19**, and this is a lesson we learned previously from nuclear accidents, is the need to be much better prepared. COVID-19 has exposed the **fragmentation of the global governance** for health emergency preparedness and response and the **key role that science, research and innovation can play** in having a world better prepared for future health crises. For that purpose, ISGlobal has coined the **term PR³** as the concept that combines different phases of preparing for and responding to crises: Preparedness, Response, Recovery and Resilience.

This model takes into account the wide variety of hazards that could end up in a public health crisis and includes several steps in the continuous spectrum of preparedness, response and recovery/resilience phases, of note is that the phases could overlap in responses to certain health crises. They are based on the successes and challenges observed during COVID-19 health crisis in which ISGlobal **researchers and policy advocates** actively participated (**Figure 2**).

FIGURE 2. Diagram of PR³ Concept.



Source: ECDC country preparedness activities. 2013–2017.

“ISGlobal has coined the term PR³ as the concept that combines different phases of preparing for and responding to crises: Preparedness, Response, Recovery and Resilience.”

Several **key elements** should be present at all stages of PR³, including early engagement of multiple stakeholders, establishment of cross-sectoral partnerships and constant communication within responders and with the affected population through a planned risk communication strategy.

Regarding **preparedness**, in the absence of any imminent hazard, there should be a process to **identify potential risks** affecting a community or population and establishment of appropriate surveillance mechanisms for each of the hazards. The process of risk identification and assessment will be carried on in the first quarter of 2022 by the new EU HERA. Surveillance mechanisms could include wastewater surveillance for chemicals and infectious diseases agents. The process will include establishing alliances with different local, national and international groups/ organizations that could provide an early warning mechanism. Once potential risks are identified, **control strategies** should be planned to respond efficiently to the different hazards and establish legal and collaborative frameworks that will allow real-time, concerted and evidence-based implementation of control measures. These steps align with the possible creation of the Pandemic Treaty or the new WHO Hub for Pandemic and Epidemic Intelligence.

All control measures plans should be the subject of exercises and drills by all relevant stakeholders to **identify gaps and challenges** that need to be worked out and implemented in their revised versions. This will allow the partners involved to build capacity to ensure an efficient planned response. ISGlobal has played an important role in advising authorities and contributing with novel research during the COVID-19 pandemic. It also has the **know-how and expertise** to continue contributing as a subject matter expert to the design of PR³ plans, including preparedness and response for crises related to new infections, radiological and chemical accidents and climate change, training and education, and communication.

In particular, as explained above, it is extremely important to establish capacity to predict and model the level of risk in a population in order to provide an early warning system in specific populations. Several groups in ISGlobal have worked on **modelling and prediction mechanisms** for COVID-19 and the lessons learned will inform their research on prediction and modelling for other future health crises.

Communication with the citizens and the public health authorities is key to maintain communities well-informed and provide strategic guidance to authorities. ISGlobal has contributed to this area during the COVID-19 response. For a comprehensive health crisis response, it will be important to develop capacities to ensure risk communication and behavioural change research is incorporated. These areas are of special interest if we want to engage with the communities and increase population compliance with crisis management strategies. In particular, urban preparedness is of key importance.

Many of these steps feed into current scientific knowledge and private and public academic and research institutions could play a significant role by providing **up-to-date knowledge and infrastructures**, contributing to the training and capacity building in our societies, engaging with public health agencies and contributing to risk communication and fighting disinformation –one of the big problems we have faced during this crisis–.

ISGlobal proposes to be a **centre of reference for research and translation in the area of PR³**. It proposes to take a proactive role, building upon collaborative efforts and bringing together experts in Europe and other regions (including LMICs) with complementary expertise into a PR³ Network and making strategic alliances with the following **goals**:

- **Reflect and prepare in “peace time”**, e.g. develop frameworks and core protocols for surveillance/research in case of crisis that can be rapidly adapted to crisis at hand; encourage establishment of appropriate infrastructures and a collaborative framework for near real-time data collection, sharing, analysis, alerts, investigation, and response (both at the local and global levels).
- **Respond rapidly in case of crisis**, identifying and mobilizing appropriate expertise inside ISGlobal and in the network to provide knowledge and information to public health authorities and to civil society from the local (city) and regional to the national and global levels and link with appropriate initiatives (including the European Health Emergency Response Authority, the Iberoamerican Epidemiological Observatory, and others).
- **Conduct relevant research** in the areas of our competence in case of a crisis, and liaising with appropriate partners and entities, including risk identification, risk assessment, risk-benefit evaluation to feed into policy decisions.
- **Advise policy makers and media** on the basis of the best scientific expertise and the access to a network of professionals.

“ISGlobal proposes to be a centre of reference for research and translation in the area of PR³.”

SECTION 5:

Conclusions and Recommendations

“ISGlobal wants to be an active part of this effort through our contribution to collective knowledge and the translation of science into public and private policies and practices.”

It seems commonplace to state that tragedies are a learning opportunity, but the best way to honor the memory of the millions of victims of this pandemic is **not to repeat the mistakes** that brought us this far. The future is a landscape of systemic health risks, stemming from a myriad of factors that must be studied, prevented and mitigated.

This paper has made a cursory review of the experience of the scientific and policy community in the area of PR3. The collective mood generated by the coronavirus crisis now allows decisions to be made that would otherwise be the result of much longer processes. On the basis of the best scientific knowledge, as well as the cooperative will of governments and institutions, we must build the theoretical, legal, institutional and personal infrastructure that will allow us to prevent the next tragedy. **ISGlobal** wants to be an **active part** of this effort, as we explained in the previous pages, through our **contribution to collective knowledge** and the **translation of science into public and private policies and practices**.

These are, in our opinion, the **priorities** that should guide the actions of Spain and the rest of the international community in the coming months:

- 01. Strengthen global governance in health emergencies.** Greater level of coordination, and collaboration among the different levels, establishing legal frameworks for coordination of response is imperative.
- 02. Promote investments in preparedness in “peace” times.** This includes innovation in novel surveillance and early alert systems as well as core protocols and frameworks for response that can rapidly be adapted to a particular crisis.
- 03. Address mental health in preparedness and response plans** for COVID-19 and further future health crises is imperative. Planning and designing of future response strategies should include mental health and psychosocial considerations in risk reduction strategies, including measures to reduce psychosocial impacts (e.g. isolation, income insecurity...), to improve risk communication, to increase mental health services and universal care coverage. For this to be effective, community-based organizations and citizen representatives need to be involved in the design and implementation of new policies⁶².
- 04. Address social and economic inequities** when planning health emergency preparedness and response strategies. A lesson learned from this pandemic is that we should really work together as this health crisis will not end until all countries are able to recover from it, and that will not be possible without global solidarity. Regions with inequities in their communities are less prepared to respond comprehensively to health crises.

05. Risk communication and behavioural sciences expertise should be incorporated in the design and implementation of strategies for communicating protective and mitigation measures with the population, and should address, in particular, infodemics as a threat to population compliance. For future health crises, clear, transparent and timely communication is needed (and should be prepared in advance and tailored to the particular crisis), including and adequately covering the inherent uncertainties in the crisis, to increase trust and compliance. An essential aspect of this is the engagement of relevant stakeholders (including citizens) in the preparation of the communication strategies and the development of the messages.

TO LEARN MORE

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