4. Transnational scientific co-operation in crises

While many OECD countries have the scientific capacity and management structures in place to deal with 'routine' domestic emergencies, as the scale and complexity of a crisis increases so the need for international cooperation is likely to increase. There are a number of international frameworks that have already been agreed, which govern the exchange of scientific data and information between countries during certain types of crisis. Some of these are 'owned' by international organisations. However, the implementation of these agreements is dependent on the existence of trusted international networks.

4.1. The need for transnational scientific co-operation in crises

Major crises such as the 2010 Icelandic Eyjafjallajökull volcano eruption, the 2011 Great Eastern Japan earthquake, floods in central Europe in 2013, the West Africa Ebola outbreak, and the Zika and microcephaly public health emergency, have highlighted the special challenges associated with responding to events that are transnational in nature: the need to understand the (scientific) basis of decisions made by different countries, and the need to improve the sharing of data and information.

As discussed above, crises vary in their degree of complexity, novelty, and scale. Crises range from domestic to transnational in their geographical scale. Their impact can be both direct, for example on the territory of the countries directly affected by a natural disaster, or indirect, for example when citizens, assets or interests abroad of a given country are being affected. It is important to recognise that the scientific capacity of any country is ultimately limited. The transnational exchange of scientific information and advice not only provides essential substantive material for better decision-making, but also powerfully extends finite resources by maximising shared capabilities. The extent to which complexity or novelty represents a challenge for a country depends largely on the country’s capabilities in terms of crisis response and science, with better prepared countries able to deal better and quicker with a broader range of crises.

During a crisis, decisions must be made balancing scientific information and evidence with political, diplomatic, economic and logistical considerations. At times, this can result in different decisions being made in different constituencies for the same crisis situation. For example, different national decisions on whether to evacuate citizens or cancel flights between two countries. Understanding the scientific advice that has fed into the decisions of countries can help explain why certain decisions were taken - albeit recognising that the influence of scientific advice in decisions is context dependent. Analysis of the scientific advice can reveal key differences in what information and data have been considered and provide reassurance, that decisions, albeit different, were made based on adequate scientific analysis.

4.2. Crisis situations requiring transnational scientific co-operation

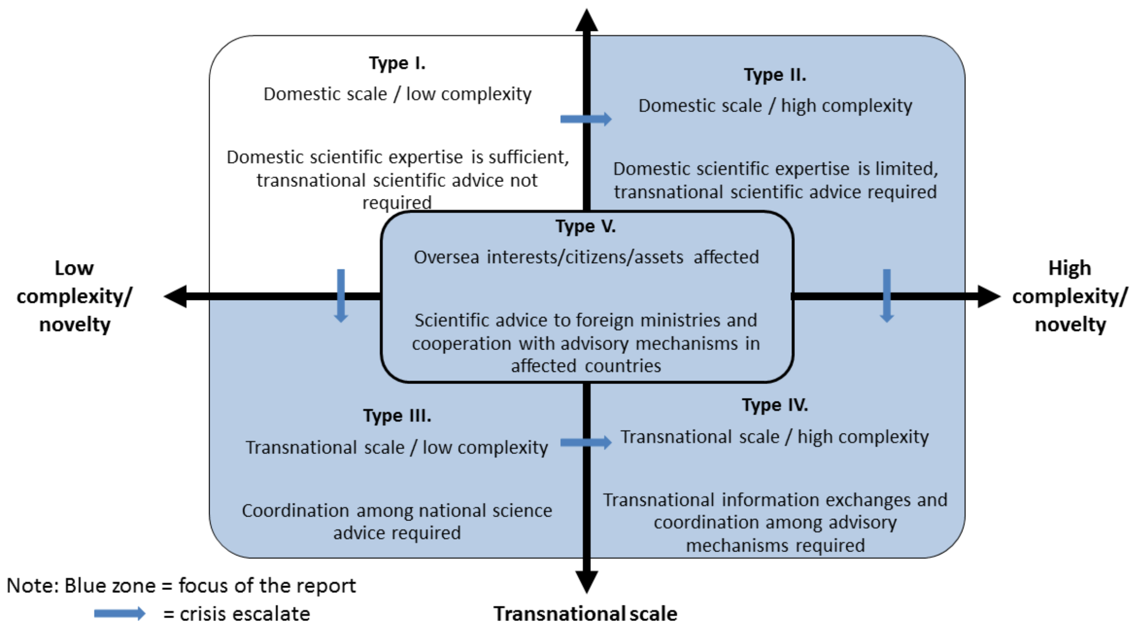
Different circumstances require different modes of scientific co-operation during crises, as illustrated in Figure 4.1.

In situations where the impact of a crisis is limited to a single country, and national scientific advice mechanisms are sufficient to cope with them (Type I), transnational co-operation is not required. Such situations are already discussed in existing documents, including the 2015 OECD report, and are not extensively addressed here.

Conversely, transnational co-operation will be needed if the impact of a crisis, albeit local, surpasses a country’s capabilities or catches it unprepared (Type II). This could be for example due to the small size and/or limited scientific development of a country, but also because the crisis is of a kind that the country had limited experience dealing with, as for example in the case of the UK flooding of 2014 where transnational co-operation with Netherlands was necessary to bring in expertise that was not nationally available.

Transnational co-operation is also needed in situations where, although the complexity and novelty of the crisis is within a country’s scientific capabilities, the transnational scale of the crisis requires co-operation to respond adequately (Type III). This is for example the case when a whole transnational region is affected by the outbreak of a common hazard and countries are obliged to work together to tackle it. This cooperation usually takes the form of data and information sharing, and coordination between national scientific advice systems, for example through bilateral and regional agreements around specific hazard types.

Figure 4.1. Crisis situations requiring transnational scientific co-operation



Source: Authors' Analysis

Finally, on occasions both the geographical scale, and the complexity and novelty of a crisis far exceed the capabilities of any given country (Type IV), such as in the case of a (novel) global pandemic. Such situations require scientific co-operation to make sense of the crisis and inform the response. In such situations, supranational organisations such as the WHO are often involved in both providing advice and facilitating information exchange. The importance attached to supranational organisations in providing expert advice tends to be a function of an individual country's own scientific capacity - less developed countries are generally more dependent of international organisations than larger developed economies.

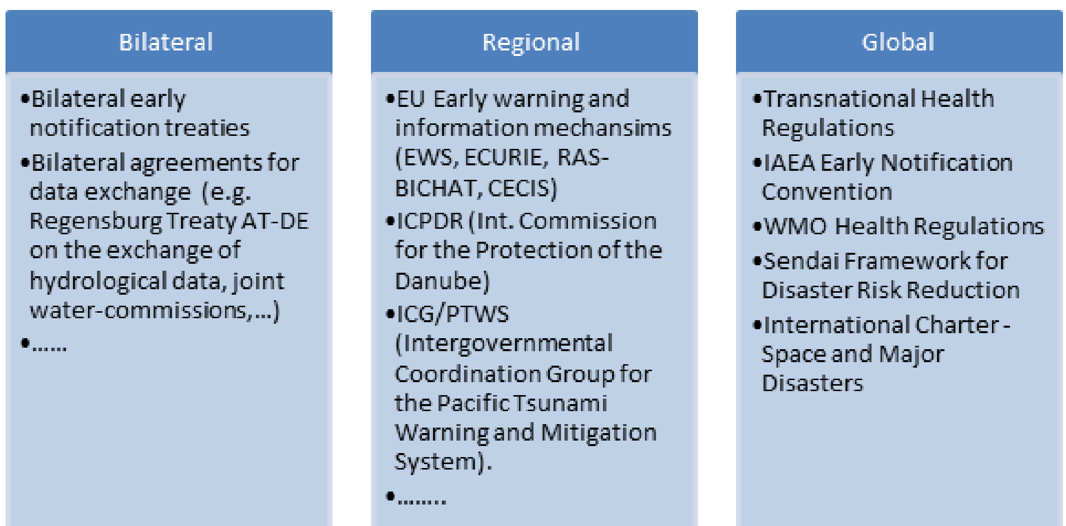
Another circumstance for transnational scientific co-operation is that when a country's interests, assets or citizens abroad are threatened by a crisis beyond the country's borders (Type V). Such situations require not only that scientific advice is effectively provided to the relevant Foreign Ministry, but also scientific co-operation with the affected countries, both to access information and to avoid conflicting messages.

As described earlier, crises are dynamic and can rapidly escalate with cascading effects that can shift the emphasis of sense making and response from one domain to another in a short period of time. A small scale local crisis requiring well defined and readily accessible scientific and technical advice can be transformed into a complex global shock that requires transnational exchange of information and expertise (Type 1 to Type 4).

4.3. Frameworks for transnational scientific co-operation in crises

Transnational co-operation in scientific advice during crises can take several forms at different geographical scales, involving both formal and informal agreements. Bilateral, regional and global frameworks for sharing scientific information and data during transnational crises play an important role in transnational scientific co-operation. These not only provide guidelines and protocols for access to information, expertise and advice in times of crisis, but also provide a focus for building networks of crisis managers and scientific advisors, and help building mutual understanding and trust. The complexity of the scientific data and information flows between different actors in different crisis situations are illustrated in the schematic diagrams in case studies 1, 2 and 3.

Figure 4.2. Transnational frameworks for collection and sharing of data and information



Source: Authors' analysis.

4.3.1. Bi-lateral agreements

Bilateral agreements are common between neighbouring countries that are exposed to common or similar risks. These can be general, hazard-specific, or related to vulnerability of a particular sector or region. In the specific context of scientific advice, these can cover for example early notification treaties, and data exchange agreements. Examples include the Regensburg Treaty that provides a framework for the exchange of hydrological data between Austria and Germany (Box 4.1) and the International Boundary and Water Commissions (Box 4.2) between Mexico and neighbouring countries.

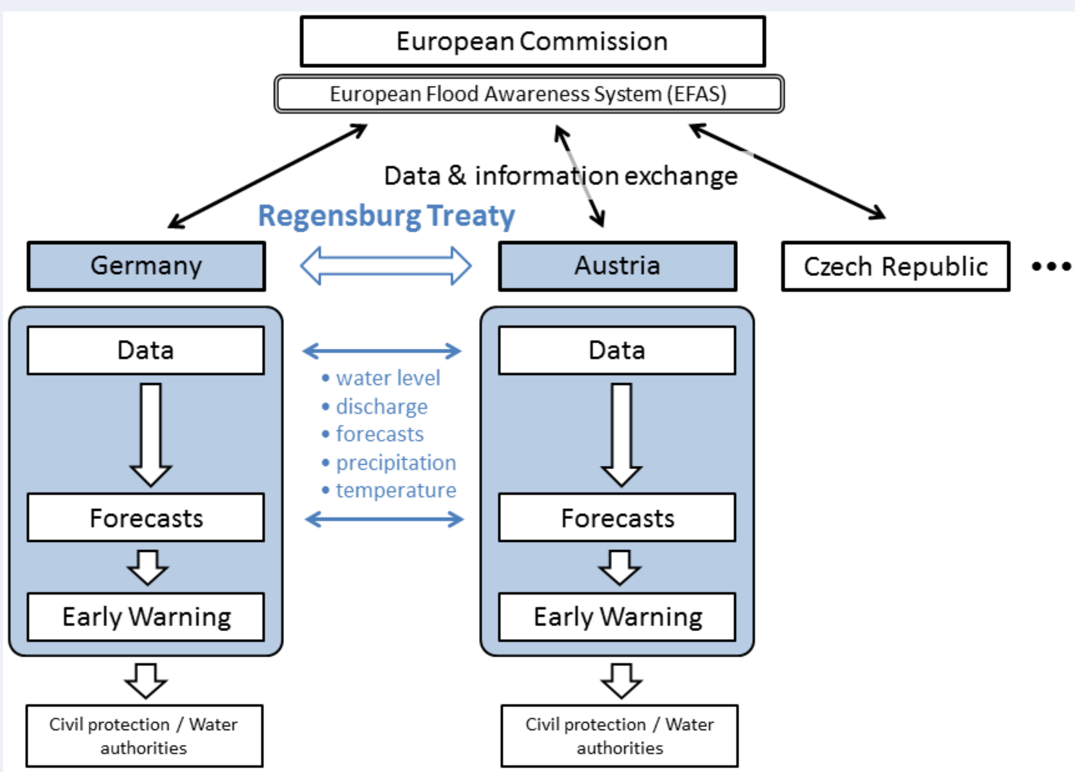
Box 4.1 Case study 2: Data and information exchange during 2013 Danube river flooding

From 26 April to 3 June 2013 up to threefold the mean annual precipitation amount was recorded in many catchment areas in Central Europe, where the ground was already saturated. Continuous heavy rain was widespread in the south and east of Germany, but Austria and the Czech Republic were also seriously affected. In Passau (German Bavaria, at the German-Austrian border) where the Danube, Inn and Ilz rivers meet, the water level reached 12.89 metres. Large parts of the Old City were under water. It is estimated that the flooding caused an overall economic loss of 11.7 billion euros, 10 billion euros of which was in Germany alone. 25 people lost their lives.

Under an agreement between Germany, Austria and the European Commission (EC) known as the Regensburg Treaty, the signatories exchange relevant information and data from each catchment area, including water levels, discharges, forecasts, precipitations and temperatures. These data are integrated and sent to German and Austrian early warning and forecasting systems. During the Danube River Flooding, this information enabled a prompt response to the flooding through preparation of action forces and arrangements for flood mobile protection and timely evacuation. The data analysis was carried out by relevant federal agencies using 'in house' scientific expertise.

The EC Joint Research Centre (JRC) operates the European Flood Awareness System (EFAS) to forecast the potential for floods in Europe in advance and communicate this information to EU member states. During the Danube River Flooding in 2013, EFAS flood warnings were sent to the principally affected authorities as well as to all downstream located authorities.

Figure 4.3. Data and information flow during Danube River Flooding in the Central Europe 2013



Source: EC (2018 and 1990), ICPDR (2014), Kickinger (2017), and Krahe, P. (2017).

Box 4.2. Case study 3: The International Boundary and Water Commissions (IBWCs) between Mexico, USA Belize and Guatemala

The historic and geographic importance of the Río Bravo led to the establishment of an International Boundary and Water Commission (IBWC, established in 1889), which is divided in two co-ordinated branches – one in each country, CILA in Mexico and IBWC in the United States. The IBWC was created with the United States to manage the Río Bravo, and the Colorado and Tijuana rivers' water resources, which spread across the two countries. In 1944, the Treaty for the Utilization of Waters of the Colorado and Tijuana Rivers and of the Río Grande expanded the commission's responsibilities and formally enacted the functioning of the Mexico-US IBWC.

The IBWC manages water demand for irrigation purposes through the operation of dams. It has also developed a flood protection programme and a civil contingency programme in case its infrastructures are affected. Joint activities include the regulation and conservation of the Río Bravo's water resources; construction, operation and maintenance of bi-national dams; and the protection of lands along the river from floods by levee and floodway projects. The IBWC also includes a mutual information-sharing process.

The high-profile issues associated with the northern border tend to overshadow the fact that Mexico‘s territory shares six river basins with Belize and Guatemala. Mexico created an IBWC with Guatemala in 1961 in order to manage water resources from the Suchiate, Usumacinta and Chixoy rivers, and in 1990, a treaty was signed to strengthen this co-operation. An IBWC with Belize was created in 1993 to monitor the Río Hondo and Arroyo Azul water levels and water quality. It also provides for the management of three bi-national hydro-climate stations that function to measure the water quantity flowing every day to monitor climate data. These commissions are intended to provide bi-national solutions and joint management for issues related to boundary demarcation, use and treatment of water, floods and hazard controls in the border areas and risk management. The Mexican sections of each IBWC are decentralised entities dependent on the Ministry of Foreign Affairs.

Source: OECD (2013).

4.3.2. Regional co-operation

Regional agreements are also in place to deal with common hazards at a regional level, such as for example among countries occupying the same river basin. Examples include the Transnational Commission for the Protection of the Rhine (IKSR/CIPR/ICBR, 2018) and the International Commission for the protection of the Elbe River (IKSE/MKOL, 2018). Within Europe, the Emergency response Coordination Centre has established a Common Emergency Communication and Information System that facilitates real time exchange of information (Box 4.3). For public health emergencies the regional structures of the WHO provide a structure for exchange of data and information (see Box 4.5 for the role of the Pan-American Health Organisation, PAHO, in relation to Zika)

Box 4.3. Regional co-operation: The European Union ERCC/Aristotle

The European Union established the Emergency Response Coordination Centre (ERCC), which is the 24/7 operational hub of it Civil Protection Mechanism. It coordinates the delivery of civil protection assistance to disaster stricken countries. Through a direct link with the national civil protection authorities of the Mechanism's participating states, the ERCC ensures rapid deployment of civil protection assets.

It provides emergency communications and monitoring tools through the Common Emergency Communication and Information System (CECIS), a web-based alert and notification application enabling real time exchange of information.

To further enhance the European preparedness for disasters, European countries created the European Emergency Response Capacity (EERC) in 2014, as part of the EU Civil Protection Mechanism. The EERC brings together a range of relief teams, experts and equipment, which participating states make available and keep on standby for EU civil protection missions all over the world. This voluntary pool allows for a faster and more effective EU response to disasters and it ensures better planning and coordination of EU operations.

The ARISTOTLE project, currently in its pilot phase, was designed to offer a flexible and scalable mechanism for providing new hazard-related services to the ERCC and to create a pool of experts in the field of Meteorology and Geophysics of Europe that can support the ERCC with regard to situation assessments during crises.

Source: European Commission.

4.3.3. Global frameworks and international organisations

There are a number of globally agreed frameworks for exchange of data and information in crises. Most notable among these in relation to the focus of the present report are the WHO International Health Regulations (Case study 4) and the UN Sendai Framework and International Charter for Space and Major Disasters (Box 4.4). Another example that relates to the Fukushima nuclear accident is the Convention on Early Notification of a Nuclear Accident.

Global frameworks are most effective when they are translated into regional and national jurisdictions and structures, with the appropriate actors and scientific experts being involved at the relevant scale. This can be seen in the mechanisms that operate under the auspices of the WMO and other regional and national bodies to deal with volcano eruptions and volcanic ash.

Box 4.4. Global Frameworks for exchange of scientific data and information during crises

Sendai Framework for Disaster Risk Reduction 2015-2030

The Sendai Framework is a non-binding agreement which recognises the State's primary role to reduce disaster risk but also that the responsibility should be shared with other stakeholders including local government and the private sector. It outlines targets and priorities for action and points out the necessity of scientific expertise for disaster risk management. To understand disaster risk, it recommends (1) enhancement of the development and dissemination of science-based methodologies and tools; (2) partnership with the scientific and technological community, to establish, disseminate and share good practices internationally; (3) enhancement of scientific and technical work on disaster risk reduction through coordination of existing networks; (4) promotion of scientific research; (5) provision of guidance on risk assessment and the use of data; and (6) application of science and technology to decision-making, in the global and regional levels. It also recommends states, in particular developing countries, enhance their access to science and technology, and knowledge and information-sharing through cooperation.

Source: UNISDR (2018, 2015).

The International Charter for Space and Major Disasters

The International Charter is a worldwide collaboration among space agencies to make satellite data available for the benefit of disaster management authorities during the response phase of an emergency. The Charter functions on a voluntary basis, and no funds are exchanged between the Charter members. 22 member agencies (as of 2018), including the European Space Agency (ESA), French Space Agency (CNES), US National Oceanic and Atmospheric Administration (NOAA) and the Japanese Aerospace Exploration Agency (JAXA), have committed resources to support the provisions of the Charter and thus help to mitigate the effects of disasters on human life and property. The Charter has identified the satellite sensors and their options for use to obtain the most useful data for each disaster type. Any national disaster management authority can submit requests to the Charter for emergency response. Since its inception in 2000, the Charter has been activated in response to over 400 major disasters in more than 110 countries, including the 2010 flooding in Pakistan, the 2011 earthquake and tsunami in Japan, the 2012 cyclone Bopha and the 2013 super Typhoon Haiyan in the Philippines.

Source: International Charter (2018a and 2018b).

International Framework for Nuclear or Radiological Emergencies

The Convention on Early Notification of a Nuclear Accident (Early Notification Convention) and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (Assistance Convention) are the primary legal instruments that establish an international framework to facilitate the exchange of information and prompt provision of assistance in the event of a nuclear or radiological emergency, with the aim of mitigating any consequences. A number of established IAEA mechanisms and practical arrangements supplement these frameworks. Together, these instruments establish the IAEA emergency preparedness and response framework for nuclear and radiological incidents and emergencies.

The IAEA's central role under this framework includes: (1) notification and official information exchange; (2) provision of public information; (3) assessment of potential emergency consequences and prognosis of possible emergency progression; (4) provision of assistance upon request; and (5) coordination of inter-agency response. These roles are implemented through the IAEA's Incident and Emergency Centre (IEC), which is operational 24 hours a day, 7 days a week.

However, as seen in response the Fukushima nuclear accident (Case study 1) the effectiveness of the IAEA system depends on the responsiveness of countries and their willingness to devolve responsibilities, in a domain that is often closely linked to national security considerations.

4.4. The role of networks in international exchange of data and information

Whilst formal frameworks agreed between countries can provide a mandate for exchange of scientific data and information in crises they do not necessarily provide an operational mechanism for achieving this. For such frameworks to be effective, international networks of trusted and committed institutions and individuals are required. This was clearly recognised by the ERCC when it established the ARISTOTLE network (Box 4.4). International networks of meteorological agencies and institutes, including EUMETNET, linked with a variety of volcano monitoring institutions are critical for implementing agreements relating to volcanic ash. The Northwest Pacific Tsunami Advisory Centre that gave warning of the Tsunamis that followed the Great East Japan Earthquake (Case study 1) is linked to a network of ocean observation facilities and there are international networks of seismic observatories and satellite data analysis centres (Box 4.4). The participants in these networks vary from one country to another but they normally have well established relationships with responsible governmental bodies and/or inter-governmental organisations.

However, even where agreed frameworks and established formal networks exist, there can be an important role to play for more flexible informal arrangements (that may even involve some of the same actors as the more formal structures). While agreements and standard procedures are important, the threshold for activating these may be too strict in the early stages of a crisis, particularly if different political and economic interests have to be taken into account (Case study 4). Informal networks, frequently associated with academic research but also involving other actors such as non-governmental agencies, can often operate effectively in contexts where more formal arrangements might struggle. Such informal networks can also contribute to the development and adoption of community standards for transnational data and information sharing, particularly where these networks are linked with technical conferences and international societies.

More broadly, the international response to the Zika and Ebola epidemics (Case study 4) illustrates how trusted relationships between individuals and institutions are critical not only for sense making in the early stages of crisis response but also as the basis for implementing existing frameworks for international exchange of data and information and for establishing new arrangements. Where governmental structures and public infrastructure are weak, informal networks that link local expertise and decision makers with international scientific experts can be particularly important. The result of an absence of international exchange during the early stages of health pandemics was illustrated when cases of Middle East Respiratory Syndrome (MERS) appeared in Korea in 2014-2015. There was a significant delay in diagnosing the infection, which was well characterised in its region of origin - the Middle East - but little known in Asia and the links in terms of scientific advice/sense-making between the two regions were weak.

Box 4.5. Case study 4: Transnational scientific co-operation in the Ebola and Zika epidemics

The first case in the West Africa Ebola virus epidemic was identified in Guinea in December 2013 but several investigations failed to reach any firm diagnosis, because the region had never experienced Ebola before. The Health Ministry shared the first information transnationally in March 2014 by which time a few scattered cases had already been imported into Liberia and Sierra Leone. The World Health Organization (WHO) eventually declared the outbreak a Public Health Emergency of Transnational Concern (PHEIC) in August 2014. During 2014-2015, more than 28,600 people were infected with Ebola virus and more than 11,300 lives were lost in Guinea, Liberia, and Sierra Leone.

The national structures and services of the countries most seriously affected by Ebola were unable to examine and diagnose patients immediately and did not have the necessary mechanisms to share information properly. They have generally poor medical facilities and a shortage of qualified health care staff. Their scientific capacity is also limited and communication infrastructure, particularly to rural areas, is poor. In addition, cultural habits that can promote the spread of Ebola are prevalent, and many people lack formal education. Since many communities were in post-conflict situations, there were high levels of distrust towards the authorities. Infected people were reluctant to share their contact information with the central governments.

The International Health Regulations (IHR) are a transnational legal instrument that is binding on 196 countries across the world, including all WHO member countries. IHR require WHO and party states to establish contact points for urgent communications. These regulations also require countries to notify WHO within 24 hours of all events which may constitute a PHEIC within its territory. During the Ebola outbreak, 25 national focal points were used to share scientific data and information with WHO and other countries. Local health care institutions were also important sources of data and information. The US Centers for Disease Control and Prevention (CDC) played a critical role and, for example worked via WHO, to advise healthcare workers, researchers and travellers how to prevent the spread of Ebola. Existing international research networks were extended with a major focus on characterisation of the virus, vaccine development and then testing, in collaboration with pharmaceutical companies.

Some countries carried out their own situation analyses, which incorporated scientific advice, and suspended their flights to the affected countries. At the same time the WHO recommended against any ban on transnational travel or trade, because this would constrain the supply of resources, including doctors, to address the epidemic, and the transfer of biological samples. WHO was subsequently criticised for not playing a proactive transnational leadership role during the Ebola outbreak. Its culture and experience of past events prevented it from declaring a PHEIC in the early stage of the outbreak. However, WHO has its own limitations in terms of budget and human resources, and it doesn't have the power to make countries comply with its advice.

After the Ebola outbreak came to an end, a Zika virus epidemic occurred in South America during 2015-2016. Unlike Ebola, many people infected with Zika do not have obvious symptoms. There was a great deal of uncertainty around Zika virus, including its modes of transmission and prevalence of immunity. Zika infection was first confirmed in Brazil in May 2015. The Pan American Health Organization (PAHO), a specialised health agency of the Inter-American system and also serving as a regional office of WHO for the Americas, began to send epidemiological alerts to its member countries from this point onwards. In the following months, Brazil reported an unusual increase in the number of cases of microcephaly (a condition where the infant is born with a small head and neurological compromise) among new-borns in the areas associated with Zika virus. The authorities of Brazil officially declared a National Public Health Emergency due to a detected increase in cases of microcephaly in November 2015, and WHO declared a PHEIC in February 2016. At the time of writing, the virus had been found in 60 countries, and there had been some 2,300 confirmed cases worldwide of babies born with microcephaly, most of them in Brazil.

There were several challenges to sharing information and data about Zika. In the early stage of the outbreak Brazil hesitated to share Zika samples and disease data, which were necessary for researchers to determine whether the Zika virus was linked to the increased number of cases of microcephaly. A major obstacle appeared to be Brazilian law. It is illegal for Brazilian researchers and institutes to share genetic material, including blood samples, with other countries. Another problem related to academic practice, whereby the results of trials and epidemiological surveys are not normally shared prior to publication in peer-reviewed journals. WHO and other major health institutions quickly recognised the need to co-operate with academia in tackling Zika. As well as sharing data and information through its website, WHO simultaneously put out a call for researchers to share more data to stem the spread of the virus. Leading global health research organisations including WHO, the US National Institute of Health, Wellcome Trust and Bill and Melinda Gates Foundation committed to sharing data and results relevant to the Zika emergency as openly as possible in February 2016. As was the case with Ebola, a number of countries carried out their own scientific analysis of the Zika epidemic in order to provide travel advice to their citizens. Zika coincided with the hosting of the Olympics in Rio de Janerio in 2016 and so advice on travel had major economic as well as public health implications.

In both Ebola and Zika, international scientific networks and open sharing of scientific data and information have been critical to the crisis response. Whilst international organisations, governments and academia were all shown to be less than optimally prepared for these crises, rigorous ex poste scientific analysis should help provide the basis for more effective responses to similar events in the future. For example, it appears that one area, which attracted only limited and belated attention in both cases, was understanding the social structures, conditions and behaviours that promote infection and are crucial to the design of effective prevention strategies.

Sources: BBC (2016), CDC (2018a. 2018b), Dye et al (2016), Grady and Frink (2014), Gurdian (2016), Lancet (2018), National (2016), Nebehay and Steenhuysen (2016), PAHO/WHO (2018), Saxena (2015), Wellcome Trust (2016), White House, USA Government (2014), and WHO (2018, 2016a, 2016b, 2015).

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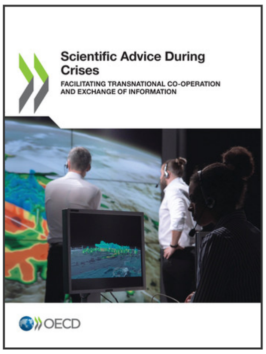

From:

Scientific Advice During Crises

Facilitating Transnational Co-operation and Exchange of Information

Access the complete publication at:

https://doi.org/10.1787/9789264304413-en

Please cite this chapter as:

OECD (2018), "Transnational scientific co-operation in crises", in *Scientific Advice During Crises: Facilitating Transnational Co-operation and Exchange of Information*, OECD Publishing, Paris.

DOI: https://doi.org/10.1787/9789264304413-7-en