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World Health Organization
REGIONAL OFFICE FOR THE Eastern Mediterranean

# Strategic framework

## for the prevention and control of emerging and epidemic-prone infectious diseases in the Eastern Mediterranean Region

2019–2023

**Prevent . Detect . Respond**

**Save lives**

WHO-EM/CSR/293/E

# Strategic framework for the prevention and control of emerging and epidemic-prone infectious diseases in the Eastern Mediterranean Region 2019–2023

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This strategic framework for the prevention and control of emerging and epidemic-prone infectious diseases in the Eastern Mediterranean Region 2019–2023 has been developed by WHO in full consultation with Member States of the Region. The framework sets out a road map for enhancing the capacity of countries in the Region to prevent, forecast, promptly detect and respond to epidemics and any other emerging infectious disease threat by promoting evidence-based interventions, guidance and best practices for infectious disease prevention and control. The framework is intended to be used by countries in the Region as a guide to setting priorities and formulating national strategic plans in this area.

The Infectious Hazard Management unit of the WHO Health Emergencies Programme has taken the lead in the development of this framework following both direct and indirect consultations with Member States and experts. The first draft of the framework was presented during an intercountry meeting held in Amman, Jordan on 14–19 December 2018 at which representatives from the health and animal sectors of all countries of the Region and other experts participated. An expert consultation was then held in Cairo, Egypt on 4–5 August 2019.

WHO wishes to acknowledge the contributions made by the representatives of all 22 Member States, and by WHO collaborating centres and other experts, who gave so generously of their time, shared their experience and provided technical input into the development and finalization of this strategic framework.

**ABBREVIATIONS**

| | |
|---|---|
| **EMARIS** | Eastern Mediterranean Acute Respiratory Infection Surveillance (network) |
| **EOC** | emergency operations centre |
| **EWARN** | Early Warning, Alert and Response Network |
| **FAO** | Food and Agriculture Organization of the United Nations |
| **GOARN** | Global Outbreak Alert and Response Network |
| **GPW 13** | Thirteenth General Programme of Work |
| **IHR (2005)** | International Health Regulations (2005) |
| **ILI** | influenza-like illness(es) |
| **ICAO** | International Civil Aviation Organization |
| **MERS** | Middle East respiratory syndrome |
| **MERS-CoV** | Middle East respiratory syndrome coronavirus |
| **NAPHS** | National Action Plan for Health Security |
| **OIE** | World Organisation for Animal Health |
| **PHEIC** | public health emergency of international concern |
| **PIP** | Pandemic Influenza Preparedness (Framework) |
| **PoE** | points of entry |
| **PPE** | personal protective equipment |
| **R&D Blueprint** | WHO Research and Development Blueprint |
| **SARI** | severe acute respiratory infection(s) |
| **SARS** | severe acute respiratory syndrome |
| **SDG** | Sustainable Development Goal |
| **TAG** | Technical Advisory Group |
| **VBD** | vector-borne disease |
| **WASH** | water, sanitation and hygiene |
| **WHO** | World Health Organization |
| **UNHCR** | United Nations High Commissioner for Refugees |

## EXECUTIVE SUMMARY

The Eastern Mediterranean Region of the World Health Organization (WHO) comprises 22 countries with a diverse range of cultures, socioeconomic conditions and demographic characteristics. The provision of health and other services in the Region is challenging due to protracted humanitarian emergencies, poverty, lack of political commitment and fragile health systems. This has resulted in a number of retrograde health indicators, an increase in the burden of infectious diseases and the emergence/re-emergence of high-risk pathogens. Over the last few decades, many outbreaks and epidemics have been reported in the Region with the potential for global spread, including avian influenza A(H5N1), Middle East respiratory syndrome coronavirus (MERS-CoV), yellow fever, Rift Valley fever, monkey pox, Crimean–Congo haemorrhagic fever, dengue, chikungunya and cholera. Most of these outbreaks were not detected early due to weak surveillance, lack of a functional laboratory network, inadequate human and other resources, and the lack of technical and managerial capacities. Avian influenza A(H5N1) and MERS-CoV currently pose two of the biggest threats to global health security and both viruses are circulating in the Region.

Through its Infectious Hazards Management unit within the WHO Health Emergencies Programme, the WHO Regional Office for the Eastern Mediterranean has developed this strategic framework. The main aim of the framework is to enhance the capacity of countries in the Region to prevent, detect and respond to emerging and epidemic-prone infectious diseases by improving preparedness, and by promoting evidence-based interventions, guidance and best practices for the control of infectious diseases. The framework forms part of the implementation strategy of Vision 2023 and has been aligned with numerous global strategies and initiatives, including the Sustainable Development Goals (SDGs), WHO's Thirteenth General Programme of Work (GPW 13), the International Health Regulations (IHR) (2005), the Global Influenza Strategy, the Global Health Security Agenda, the Global Vector Control Response and the WHO Research and Development (R&D) Blueprint. The framework was developed through a consultative process involving various stakeholders and experts from all countries of the Region, the WHO Regional Office for the Eastern Mediterranean and international organizations. The framework is intended to be used by national government authorities and other stakeholders in countries involved in preparedness and response to emerging and epidemic-prone infectious diseases in the Region.

The overall vision of the framework is to reduce the burden of emerging and epidemic-prone infectious diseases in the WHO Eastern Mediterranean Region by 2023. The primary goal is to increase the capacities, capabilities and preparedness of countries to better forecast, detect, prevent and control emerging and epidemic-prone infectious diseases. Four strategic priorities and 15 strategic components have been developed to support the vision of the strategic framework and attain its high-level outcomes and targets. The four strategic priories are:

- strengthen public health capacity to prepare for and prevent emerging and epidemic-prone infectious diseases;
- strengthen capacity for the early detection and investigation of outbreaks of emerging and epidemic-prone infectious diseases;

- build capacity to implement high-impact control strategies for rapid response to high-risk emerging and epidemic-prone infectious diseases;
- enhance knowledge management and innovation.

In addition to the core components of this strategic framework, health systems should also be strengthened in line with the SDGs, GPW 13, and the WHO Regional Office strategic priorities for "health for all, by all". Member States should also ensure that the required core capacities are put in place in order to fulfil their obligations under the IHR (2005) in relation to detecting, reporting and responding to a public health emergency of international concern (PHEIC).

The strategic framework is intended to act as a common resource for countries in the Region in formulating short- and long-term preparedness and response plans that reflect key national and regional priorities, while addressing specific national issues and challenges. Countries will mainly be responsible for implementing the strategy at national level. National governments should therefore take ownership of the strategy and adopt it to the local context, with emphasis placed on a health-systems approach, country-specific risk assessments, alignment with existing country processes, intersectoral coordination, and monitoring and evaluation. A national IHR focal point should be nominated for overall coordination and reporting, with a steering committee established to oversee the progress made in implementing the strategy. The Regional Office will provide guidance and technical support to countries in implementing and monitoring the strategy through the establishment of a Technical Advisory Group (TAG). The Regional Office will also facilitate partnership development at international and regional levels, and will organize high-level meetings with senior decision-makers from national governments to garner and sustain political commitment for the implementation of the strategy.

The progress made in implementing the strategy will be assessed through steering committee and TAG meetings, annual reporting, review of significant disease outbreaks and external evaluations. Countries will report each year to the Regional Office on the progress made, based on a self-assessment approach. The development of the progress report should be guided by the monitoring and evaluation framework provided in Annex 1 of the current document, which includes indicators for each strategic priority. In-depth reviews of significant disease outbreaks or simulation exercises will be undertaken to assess preparedness, prevention, detection, response and recovery activities under "real-life" situations and to identify best practices, gaps and challenges. Countries will also conduct external evaluations to assess mid-term and end-term progress, with technical assistance from the WHO Regional Office.

## 1. INTRODUCTION

The history of infectious diseases goes back a very long way, with outbreaks of smallpox, poliomyelitis, leprosy and tuberculosis reported in ancient Egypt and Greece *(1)*. Before the availability of better control measures in the twentieth century, smallpox, plague and cholera killed millions of people. Three influenza pandemics also occurred during the twentieth century, again killing millions of people *(2)*. Despite our improved understanding of the epidemiology and control of infectious diseases, many new infections are emerging and re-emerging which pose an ongoing threat to global health security. Examples of recently emerged pathogens include the severe acute respiratory syndrome (SARS) coronavirus, avian influenza A(H5N1) virus, influenza A(H1N1)pdm09 virus, Middle East respiratory syndrome coronavirus (MERS-CoV) and the avian influenza A(H7N9) virus (Table 1) *(3)*. Moreover, many existing epidemic-prone infectious diseases are re-emerging in new geographical areas or their incidence has recently increased. Ebola is an example of a re-emerging infection, and the large epidemic that occurred in West Africa from 2014–2016 resulted in more than 28 000 cases and 11 000 deaths *(4)*. Similarly, many vector-borne diseases (VBDs), such as dengue, West Nile virus, chikungunya and Zika, are emerging in new areas *(5)*. Prior to 1970, dengue epidemics were reported in only nine countries, but according to WHO, the disease is now endemic in more than 100 countries *(6)*. West Nile virus was first reported in the United States of America in 1999, when infected humans, mosquitoes or birds from the Middle East introduced the virus into the local mosquito or bird population.

Most of these emerging and epidemic-prone infectious diseases are of zoonotic origin, which highlights the importance of the human–animal interface *(7)*. Factors which contribute to the emergence and re-emergence of these diseases include: increased population movements due to travel, trade (economic development) and tourism; more frequent contact with animals; changes in food production and farming practices; changes in human habitat; and climate change. When people move they are capable of spreading diseases to new areas where conditions may be suitable for continuing the transmission chain *(8)*. In addition, changes in human habitat due to urbanization, agricultural practices, deforestation and reforestation, and the building of dams and irrigation systems *(9)*, may all lead to increased contact between humans and rodents, insects and other animals. For example, the construction of dams and irrigation systems has resulted in the spread of malaria and other VBDs in many new areas. Changes in food production practices have also increased the risk of emerging diseases; for example, through increased poultry density, more contact with animals and widespread use of antibiotics in farm animals *(3, 10)*. Climate change can also facilitate the emergence of new infections due to the spread of ticks, mosquitoes and other vectors to new areas *(3, 10)*. Other contributing factors for emerging and re-emerging diseases include the breakdown of public health measures due to humanitarian and other medical emergencies, changing human susceptibility due to the use of immunosuppressive therapies, aging populations, poverty and social inequality *(3, 10)*.

The potential consequences of emerging and epidemic-prone infectious diseases are enormous. Morbidity and mortality due to a newly emerged pathogen can be very high as humans may have little or no pre-existing immunity. For example, the 1918 influenza pandemic was due to a new strain of influenza virus, resulting in 20–50 million deaths worldwide *(3)*, while the SARS epidemic in 2002–2003 was due to a novel coronavirus of zoonotic origin, resulting in more

than 8000 cases and 800 deaths *(11)*. In contrast to mass trauma incidents and other medical emergencies, the scale of an epidemic due to an emerging pathogen is usually small at the start and grows with time. The peak of an epidemic is difficult to predict and therefore the scale of the response is difficult to predict. These epidemics generally disproportionally affect vulnerable groups, including those living in remote areas, those impacted by poor living conditions and overcrowding, and those lacking access to clean water, sanitation and health care.

Controlling an emerging infectious disease epidemic is difficult due to the unavailability of drugs, vaccines and other control measures. In the initial period of an outbreak, the characteristics of the pathogen will probably not be known and a vaccine against it might not be available for many months or even longer, and will likely not be available to everyone. When SARS emerged in 2002–2003, there was no vaccine or drugs available and the virus spread to more than 20 countries in a very short time span *(21)*. For an influenza pandemic, it could take up to six months for a vaccine to be developed and the first supplies of the vaccine may be further delayed in countries where vaccine manufacturing capability is not available *(22)*. Once a vaccine is developed, its licensing, storage, distribution and administration will present other challenges. Moreover, initial vaccine supplies may be limited, requiring prioritization to achieve the greatest benefit. During the 2009 influenza A(H1N1) pandemic, the vaccine development process was initiated in April 2009 with the first vaccines being available for deployment by late September 2009 *(16)*. However, vaccine distribution was slow and by the time vaccine supplies had increased sufficiently, the outbreak was over in many countries *(23)*.

**Table 1. Major epidemics and pandemics in history and during the twenty-first century**

| Epidemic/pandemic | Time period | Origin | Impact |
|---|---|---|---|
| Plague (Justinian Plague) *(1, 12)* | Sixth century | Unclear | ~25–50 million deaths |
| Plague (Black Death) *(1, 12)* | 14th century | Asia | ~40–75 million deaths |
| Modern plague *(1, 12)* | 19th century | China | ~10–15 million deaths |
| Smallpox *(1)* | 16th to 19th century | Unclear | ~500 million deaths |
| Six cholera pandemics *(13)* | 17th century | Unclear, but most likely India | Not known |
| Influenza H1N1 pandemic *(3)* | 1918 | Unclear | ~20–50 million deaths |
| Influenza H2N2 pandemic *(3)* | 1957 | Southern China | ~1–4 million deaths |
| Influenza H3N2 pandemic *(3)* | 1968 | Southern China | ~1–4 million deaths |
| Seventh cholera pandemic (ongoing) *(14)* | Started in 1961 | Indonesia | ~2.9 million cases and 95 000 deaths every year |
| SARS *(11)* | 2002 | China | 8437 cases and 813 deaths |
| Re-emergence of influenza A(H5N1) *(15)* | 2003 | China | 860 cases and 454 deaths from 17 countries* |
| Influenza H1N1 pandemic *(16)* | 2009 | Mexico | ~0.1–0.3 million deaths |
| MERS *(17)* | 2012 | Saudi Arabia | 2279 cases and 806 deaths from 27 countries |
| Influenza A (H7N9) *(18)* | 2013 | China | ~1500 cases, and 600 deaths* |
| Ebola *(19)* | 2014 | Guinea | 28 616 cases and 11 310 deaths |
| Zika *(20)* | 2015 | Brazil | More than 1.6 million suspected cases in Brazil alone |

** By end of 2018*

Large epidemics may also disrupt the delivery of routine health care and other government operations. Routine health services are strained during epidemics, which may in turn affect the control of other communicable and noncommunicable diseases. During Ebola epidemics, routine health services for malaria, tuberculosis, HIV/AIDS, noncommunicable diseases, and reproductive, maternal, neonatal and child health are compromised *(24)*. Large epidemics and pandemics can cause social disruption and existing laws or (individual) human rights may need to be overruled in order to implement control measures that are in the best interests of the community. The support of law enforcement agencies many therefore be required in such situations to provide essential health services and to maintain supplies and other operations *(2, 25)*.

Finally, despite reductions in the number of human cases and associated mortality as a result of better diagnostic and treatment services, the economic costs of emerging infectious diseases are increasing. Epidemics and pandemics of such diseases generally have a huge impact on travel, trade and tourism. Economic studies have estimated that the SARS outbreak cost US$ 40 billion *(26)* and the Ebola outbreak in West Africa cost US$ 53.19 billion globally *(27)*. According to the World Bank, the annual global cost of moderately severe to severe pandemics is expected to be around US$ 570 billion, or 0.7% of global income *(28)*.

The WHO Regional Office for the Eastern Mediterranean is one of WHO's six regional offices around the world and directs and coordinates public health activities in all 22 countries. The Region continues to be a hotspot for emerging and re-emerging diseases, including infectious disease outbreaks that have significant impacts on health and economic development *(29)*. This strategic framework for the prevention and control of emerging and epidemic-prone infectious diseases in the Eastern Mediterranean Region 2019–2023 was developed by the Infectious Hazards Management unit, within the WHO Health Emergencies Programme of the Regional Office. The aim of developing this strategic framework is to enhance the capacity of countries in the Region to prevent, promptly detect and respond to emerging and epidemic-prone infectious diseases by improving preparedness and promoting evidence-based interventions, guidance and best practices for disease prevention and control efforts.

## 2. SITUATION ANALYSIS: EMERGING AND EPIDEMIC-PRONE INFECTIOUS DISEASES IN THE EASTERN MEDITERRANEAN REGION

The Eastern Mediterranean Region is home to around 600 million people and comprises 22 countries[a] from the Middle East, North Africa, the Horn of Africa and Central Asia. Most of these countries are diverse in terms of their geography, culture, demography and socioeconomic and health status. The geopolitical situation is extremely challenging and more than 75 million people in the Region are living in countries experiencing natural or man-made humanitarian emergencies, and have limited access to basic health services, appropriate shelter, clean water, sanitation and other basic amenities *(29, 30, 31)*. Many health facilities have been destroyed and health care workers have been killed due to ongoing conflicts and wars. There is also a severe shortage of medicines, vaccines and other supplies in some areas. This has

[a] Afghanistan, Bahrain, Djibouti, Egypt, Iran (Islamic Republic of), Iraq, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Pakistan, Palestine, Qatar, Saudi Arabia, Somalia, Sudan, Syrian Arab Republic, Tunisia, United Arab Emirates and Yemen.

resulted in huge population displacement, disruption of routine health services, weak disease surveillance and detection, and a lack of disease control measures. According to a 2017 United Nations High Commissioner for Refugees (UNHCR) report, around 68.5 million individuals had been forcibly displaced worldwide as a result of persecution, conflict or generalized violence by the end of 2017, including 40 million internally displaced people, 25.4 million refugees and 3.1 million asylum seekers *(32)*. Around half of all displaced people (~30 million) live in the Eastern Mediterranean Region.

In addition to protracted humanitarian emergencies, a number of environmental factors also exist in the Region that promote the survival, reproduction and distribution of high-risk pathogens, as well as their vectors and hosts. These factors, coupled with climate change, human population movements and rapid urbanization, especially in poor urban slum areas, contribute to the increased frequency and severity of emerging infectious disease outbreaks in the Region. The Region also hosts annual mass gatherings for religious, sporting and other events that increase the risk of infectious disease spread, both within the Region and globally *(33, 34)*.

## 2.1 Disease burden

Infectious diseases are among the major causes of mortality and morbidity in many countries of the Region. According to WHO estimates, infectious diseases are responsible for around one third of all deaths and illnesses in the Eastern Mediterranean Region *(35)*. Most of these deaths are due to: diarrhoea; acute respiratory infections and pneumonia; measles and other vaccine-preventable diseases; malaria, dengue and other VBDs; HIV/AIDS; and tuberculosis *(35)*. According to a Global Burden of Disease study, lower respiratory infections remained the third leading cause of death and fourth leading cause of disability-adjusted life years in the Eastern Mediterranean Region in 2015 *(36)*. In addition to these common infections, the Region is exposed to significant health security threats associated with emerging and re-emerging infectious disease outbreaks. At least 11 of the 22 countries in the Region have reported major outbreaks and epidemics which have had the potential to spread globally, including avian influenza A(H5N1), MERS-CoV, yellow fever, Rift Valley fever, monkey pox, Crimean–Congo haemorrhagic fever, dengue, chikungunya and cholera *(29)* (Table 2).

**Table 2. Emerging and epidemic-prone infectious disease outbreaks in the Eastern Mediterranean Region since 2000**

| Outbreak/epidemic | Country (year) |
|---|---|
| MERS-CoV | Bahrain (2016); Egypt (2014); Islamic Republic of Iran (2014); Jordan (2012); Kuwait (2013); Lebanon (2014, 2017); Oman (2013–2019); Qatar (2012–2017); Saudi Arabia (2012–2019); Tunisia (2013), United Arab Emirates (2013–2018); Yemen (2014) |
| Influenza A(H5N1) | Iraq (2006); Djibouti (2006); Pakistan (2007); Egypt (2006–2017) |
| Influenza A(H9N2) | Egypt (2016) |
| Influenza A(H1N1)pdm09 | All countries (2009) |
| Ebola | Sudan (2004) |
| Monkey pox | Sudan (2005) |
| Rift Valley fever | Yemen (2000); Saudi Arabia (2000); Sudan (2007) |
| Sandfly fever | Lebanon (2007) |
| Ebola haemorrhagic fever | Sudan (2004) |
| Cholera | Afghanistan (2012, 2013, 2017); Iraq (2007, 2008, 2012, 2015, 2017); Somalia (2007, 2010, 2012, 2015–2019); Yemen (2016–2019) |
| Dengue fever | Djibouti (2012); Egypt (2015); Oman (2014, 2018); Pakistan (2012–2019); Yemen (2012, 2016–2019); Sudan (2012–2017) |
| Plague | Libya (2009) |
| Chikungunya | Yemen (2010, 2011); Pakistan (2016–2018); Somalia (2016); Sudan (2018) |
| Yellow fever | Sudan (2005, 2012, 2013) |
| Crimean–Congo haemorrhagic fever | Afghanistan (2007–2012, 2016–2019); Islamic Republic of Iran (2000–2012); Pakistan (2000–2014, 2016–2018); Sudan (2007–2011); Iraq (2018); Oman (2019) |
| Q fever | Afghanistan (2011) |
| West Nile fever | Tunisia (2012, 2018) |
| Extensively drug-resistant typhoid fever | Pakistan (2016–2019) |
| Travel-associated Legionnaires' disease | Jordan (2018); Kuwait (2018); Morocco (2018); United Arab Emirates (2018); Saudi Arabia (2018); Tunisia (2018) |
| Diphtheria | Yemen (2017, 2018, 2019) |

*Adapted from*: Buliva E et al. *(29),* Malik M et al. *(40)* and WHO *(41–44)*

Among recent emerging zoonotic infections, SARS was the only one that did not strike the Region (11). Although no human case of Zika has yet been reported from any country in the Region, the risk is high due to the presence of competent-vector Aedes mosquitoes in many countries including Djibouti, Egypt, Lebanon, Oman, Pakistan, Saudi Arabia, Somalia, Sudan and Yemen *(37)*. Dengue, chikungunya and yellow fever are transmitted by the same Aedes mosquitoes and are endemic in a number of countries *(29)*. Although Ebola was not reported from any country in the Region during the 2014–2016 epidemics, the risk was thought to be very high. Ebola outbreaks have previously been reported in Sudan in 1976, 1979 and 2004 *(38)*. Avian influenza A(H5N1) and MERS-CoV currently pose two of the biggest threats to global health security and both viruses are circulating in the Region. According to WHO, a total of 860 cases and 454 deaths have been reported worldwide due to avian influenza A(H5N1) with 366 of these cases (43%) and 123 deaths (27%) reported in the Eastern Mediterranean Region. Most of these cases and deaths were reported in Egypt, with others having been reported in Djibouti, Iraq and Pakistan *(15)*. Between 2012 and June 2019, 2428

laboratory-confirmed cases of MERS-CoV infection were reported to WHO, of which more than one third (838 cases) were fatal *(39)*. Most of these MERS cases have been reported from countries in the Region, with Saudi Arabia accounting for more than 83% of the global total (2037 laboratory-confirmed cases and 760 deaths) *(39)*. MERS cases have also been reported by many other countries in the Region, including Bahrain, Egypt, the Islamic Republic of Iran, Jordan, Kuwait, Lebanon, Oman, Qatar, Tunisia, United Arab Emirates and Yemen.

VBDs, zoonotic diseases, foodborne diseases and the re-emergence of vaccine-preventable diseases thus remain major public health concerns in the Region. In addition to VBDs such as dengue, chikungunya, yellow fever and West Nile fever, which cause ongoing disease and outbreaks across all countries of the Region, many new VBDs are also emerging and existing diseases are re-emerging from various other areas. In addition to MERS and avian influenza, other important zoonotic infections in the Region include rabies, and brucellosis and other foodborne zoonotic infections. Cholera is endemic in most countries of the Region with large epidemics recently reported from Iraq, Somalia and Yemen *(45)*. There is also an ongoing outbreak of extensively drug-resistant *Salmonella* Typhi in Pakistan due to the mixing of drinking-water and sewage in several districts *(46)*. The incidence of vaccine-preventable diseases is also increasing in the Region and outbreaks of poliomyelitis, measles, diphtheria and other diseases have been reported from many new areas *(30)*. Polio is now endemic in only two countries of the world (Afghanistan and Pakistan), both of which are situated in the Eastern Mediterranean Region *(47)*. Cases of vaccine-derived polio are also regularly reported by some countries in the Region, including Somalia and the Syrian Arab Republic *(47)*.

## 2.2 Progress towards achieving public health preparedness in the Region

Despite the many challenges faced in the Region (see next section), significant progress has been made in the prevention and control of emerging and epidemic-prone infectious diseases. Malaria, lymphatic filariasis, measles, schistosomiasis and dracunculiasis have been eliminated from many areas *(35, 48)*. Immunization coverage has improved in many countries and other disease control approaches are also being adopted. Many important achievements and advancements in the regional public health landscape have occurred since the emergence of MERS and avian influenza A(H5N1) and the threat of introduction of Ebola and Zika viruses into countries, as described below.

- **Implementation of the IHR (2005):** considerable progress has been made in developing and strengthening IHR (2005) core capacities in the Region. A total of 17 countries have completed the joint external evaluation for assessing IHR (2005) core capacities to prevent, protect against, control and respond to the international spread of disease while avoiding unnecessary interference with international traffic and trade *(49)*. Additionally, five countries have developed and finalized their National Action Plan for Health Security (NAPHS), which stipulates a planning process to address national gaps and accelerate implementation of IHR (2005) core capacities.

- **Capacity-building:** the WHO Regional Office works closely with countries to build capacities in the surveillance, early detection and prevention of health threats posed by emerging and re-emerging infectious diseases *(50)*. For example, the Emerging and Dangerous Pathogen Laboratory Network has been expanded and surveillance systems

strengthened in many countries for the detection of high-risk pathogens *(50)*. The Early Warning, Alert and Response Network (EWARN) has also been implemented in seven conflict-affected countries in the Region. In collaboration with the Global Outbreak Alert and Response Network (GOARN) *(51)*, training has been provided to public health experts in conducting field investigations and responding to public health emergencies.

- **Outbreak prevention:** numerous outbreak prevention activities have been initiated in the Region to address the threat of cholera, meningitis, yellow fever, MERS and VBDs. For example, mass vaccination campaigns have been conducted in Sudan for meningitis and yellow fever, and oral cholera vaccination has been introduced in Iraq, Somalia, Sudan and Yemen, resulting in the protection of millions of people against cholera infection. A strategic framework was also developed specifically for cholera preparedness and response, and technical support provided to various countries, including Jordan, Somalia, Sudan, Syrian Arab Republic and Yemen, to develop comprehensive cholera preparedness and response plans *(51)*. Steps have also been taken to improve preparedness for, and the response to, MERS and to address the knowledge gaps in understanding its transmission. Strategic frameworks and preparedness plans were also developed to improve preparedness, detection and response activities to prevent the spread of Zika virus infection in the Region *(37, 53, 53)*. As part of these plans, many activities have been conducted including risk assessments, strengthening of epidemiological and entomological surveillance in all high-risk countries, development of risk communication materials and training of health managers *(51)*.

- **Rapid response:** all countries of the Region have trained rapid response teams at the national level to investigate and rapidly respond to influenza and other emerging disease events. However, capacity at subnational level remains low and only 15 (68%) countries have rapid response teams at subnational levels for responding to local disease events *(54)*. A number of emerging infectious disease outbreaks have been successfully contained in the Region since 2000, including dengue fever in Pakistan, cholera in Yemen and Somalia, travel-associated Legionnaires' disease in the United Arab Emirates, acute watery diarrhoea in Sudan, chikungunya in Pakistan and Sudan, and a small number of hospital outbreaks of MERS in Saudi Arabia.

- **Progress on the Pandemic Influenza Preparedness (PIP) Framework:** under the PIP Framework, WHO has enhanced the capacity of Member States to detect, prepare for and respond to pandemic influenza *(54)*. Through the PIP Framework's benefit-sharing system, WHO has secured annual partnership contributions from manufacturers of influenza vaccines, pharmaceuticals and diagnostics to help fund country-level pandemic preparedness and response capacity-building activities. As a result, laboratory and surveillance capacities in the Region have improved considerably. Currently, seven countries in the Region (Afghanistan, Egypt, Jordan, Lebanon, Morocco, Sudan and Yemen) are benefitting from PIP Framework support in enhancing their surveillance and response capacities for seasonal and pandemic influenza. The WHO Regional Office promotes sentinel surveillance in order to collect and analyse data on influenza-like illnesses (ILI) and severe acute respiratory infections (SARI) as part of its work in pandemic influenza preparedness. Surveillance systems for ILI and SARI have been established in 19 of the 22 countries *(54)*, thus improving the monitoring not only of seasonal influenza but of other emerging diseases in the Region, such as avian influenza and MERS-CoV. In addition to the annual partnership contributions, WHO has entered into legally binding Standard Material Transfer Agreements with industry to ensure manufacturer commitment to providing pandemic-related vaccines, antiviral drugs and diagnostics in the event of a pandemic.

- **Improved One Health collaborations:** One Health is an important and relatively new concept in public health. It is based on the fact that humans, animals and the environment are linked and affect each other. It has been estimated that more than 75% of emerging infections are of zoonotic origin. One Health is a collaborative approach to promoting human and animal health, for example by vaccinating poultry and other animals to prevent the spread of infections to humans. One specific example of this has been the elimination of canine rabies in many countries due to the vaccinating of canine populations, resulting in huge cost savings and other benefits to humans. WHO collaborates with the Food and Agriculture Organization of the United Nations (FAO) and the World Organisation for Animal Health (OIE) to promote the One Health approach and facilitate cross-sectoral responses to public health threats at the human–animal–ecosystem interface. The 2010 Tripartite Agreement Concept Note set forth a collective strategic direction for the three organizations and underlined their commitment to work more closely together in support of member countries *(55)*. FAO, OIE and WHO reaffirmed their commitment in 2017, citing achievements in the prevention and control of zoonotic influenza and other emerging zoonotic pathogens, while undertaking to maintain this momentum *(56)*. The WHO Regional Office has also developed a framework in support of the One Health approach. However, despite these achievements, coordination mechanisms between the human and animal health sectors are generally weak in most countries of the Region *(57)*.

- **Reform of WHO's management of health emergencies:** as part of WHO reform efforts following the 2013–2016 Ebola crisis, the Sixty-ninth World Health Assembly adopted decision WHA69(9) on the reform of WHO's work in health emergency management. The WHO Health Emergencies Programme was officially launched in July 2016 to address the full risk-management cycle, including prevention, preparedness, response and recovery. Additionally, the Programme leads and coordinates international responses to contain disease outbreaks, and provides effective relief and recovery services to affected people. The Programme has a common structure across headquarters, regional offices and country offices, consisting of one workforce, one budget, one line of accountability, one set of processes and systems, and one set of benchmarks.

- **The Eastern Mediterranean Acute Respiratory Infection Surveillance (EMARIS) network:** the EMARIS network was established in the Region in 2007 after the emergence of the avian influenza virus A(H5N1) in Egypt. The network was established in the Region in collaboration with the US Centers for Disease Control and Prevention (CDC) and the US Naval Medical Research Unit No. 3 (NAMRU-3) *(58)*. The main aims of the EMARIS network are to increase laboratory diagnostic capacity to detect seasonal and novel influenza viruses and to strengthen sentinel-based surveillance systems for ILI and SARI in countries of the Region *(59)*. Through this collaboration, functional systems for ILI and SARI surveillance have been established in 19 of the 22 countries of the Region, with 20 reference laboratories working to detect influenza viruses *(60)*.

### 2.3 Challenges in prevention and control of emerging and epidemic-prone infectious diseases

Progress towards achieving public health preparedness in the Region faces a broad range of challenges related to the prevention and control of emerging and epidemic-prone infectious diseases, as listed below.

- Many countries in the Region are facing protracted humanitarian emergencies resulting in huge population movements, poor living conditions, inadequate food, unsafe water, interruption to health services and a lack of disease control measures.
- Many countries are still poorly prepared to detect and respond to outbreaks and epidemics.
- Infectious disease outbreaks have consistently been reported from various countries in the Region during the last few decades and most have been detected late, resulting in delays in outbreak response.
- The surveillance systems in most countries remain fragmented and paper-based, with variable and limited ability to detect impending health threats in real time.
- Many countries do not have adequate laboratory capacities for detecting or diagnosing emerging or new pathogens or for identifying novel influenza viruses.
- Influenza is not perceived as a high-priority health issue in the Region and there is a general lack of political commitment to invest in influenza and pandemic preparedness.
- Collaboration between animal and human health sectors is weak.
- Several countries in the Region have included additional vaccines in their routine immunization programmes; however, information on the population coverage of these vaccines is not available and therefore their effectiveness or impact on controlling the emerging pathogens have not been studied.
- Vaccine coverage is low in countries, particularly among vulnerable groups and other groups at high risk.
- There are huge knowledge gaps in predicting new epidemic threats in the Region, developing medicines and vaccines, and testing the effectiveness of various control measures; a lack of resources, infrastructure and technical expertise are the main challenges.
- Although WHO has published a series of emergency guidelines for the clinical management of infectious diseases, these have not been transformed into nationally adapted clinical management protocols for the clinical management of severe infectious disease-related illness with specific guidance for individuals at high risk of severe illness across all resource settings.

## 3. DEVELOPMENT OF THE STRATEGIC FRAMEWORK

### 3.1 Consultative process

The development of this strategic framework was informed by evidence gathered from various sources, including: (a) a review of existing strategic documents, policies and guidelines developed by WHO and other leading organizations; (b) published reports and data; and (c) journal papers. Prior to the development of the framework, the WHO Regional Office for the

Eastern Mediterranean conducted a systematic review of all prevailing health threats in countries, risk factors for disease transmission, and inhibiting factors for disease prevention and control. After collecting this initial evidence, the first draft of the framework was prepared in 2018 in consultation with the Member States of the Region and technical experts, and then circulated to various parties for technical revision. The draft was then presented to the intercountry meeting on the strategic framework for the prevention and control of emerging and epidemic-prone infectious diseases in the Eastern Mediterranean Region held in Amman, Jordan on 16–19 December 2018 *(41)*. Over 100 representatives from health authorities, United Nations organizations, partner institutions and other experts attended the meeting. The objectives of the meeting were to share the draft strategic framework with stakeholders and to obtain their feedback and support. The framework was further revised in the light of the comments received during the intercountry meeting and then finalized based on the recommendations of technical experts.

### 3.2 Guiding principles of the strategic framework

Due to recurring epidemic threats, the Infectious Hazards Management unit within the WHO Health Emergencies Programme in the Regional Office has taken steps to strengthen regional and national capacities to detect, verify and control emerging and epidemic-prone infectious diseases through this integrated five-year strategic framework based on the following guiding principles.

- **Alignment with other strategies:** the strategic framework builds upon and aligns with other global strategies and frameworks to ensure that objectives, priorities and activities are cohesive and coordinated (Box 1).
- **Country ownership and leadership:** improving epidemic preparedness and response at the national and subnational levels is the primary responsibility of governments, taking into account their national health, social, economic, health security and political contexts. Therefore, many of the activities that follow from this strategic framework are dependent on a country-level approach and country ownership. As WHO Member States further implement IHR (2005) and build their core capacities, governments are encouraged to properly budget for public health preparedness and readiness measures for prevention, detection and response to emerging and epidemic-prone infectious diseases. These preparedness efforts need to be synchronized with the IHR (2005) capacity-building efforts through joint external evaluation and NAPHS. Member States should also generate domestic funding to implement this strategic framework and to carry out the required preparedness, response, and monitoring and evaluation activities.
- **Health systems approach:** the strategic framework supports health systems strengthening in line with the SDGs, GPW 13 and the Regional Office strategic priorities for "health for all, by all" *(61)*. The ultimate aim is to improve overall health systems in Member States and incorporate epidemic control activities into the national public health strategy.
- **WHO leadership:** in line with the GPW 13, one of the core functions of WHO is "providing leadership on matters critical to health and engaging in partnerships where joint action is needed" *(62)*. The Regional Office will support Member States in adapting the strategic framework to the local context. The Regional Office will also support Member States in building, strengthening and maintaining the core capacities required under IHR (2005) as essential public health functions of their health system.

**Box 1. Global/regional strategies and initiatives aligned with the strategic framework**

- Vision 2023
- Sustainable Development Goals
- WHO's Thirteenth General Programme of Work, 2019–2023
- International Health Regulations (2005)
- Five-year global strategic plan to improve public health preparedness and response, 2018–2023
- Global Influenza Strategy 2019–2030
- Pandemic Influenza Preparedness Framework
- WHO Global Influenza Surveillance and Response System
- Global Health Security Agenda
- Global Strategy to Eliminate Yellow Fever Epidemics (EYE) 2017–2026
- Global Vector Control Response 2017–2020
- Ending Cholera – A Global Roadmap to 2030
- Zero by 30: the global strategic plan to end human deaths from dog-mediated rabies by 2030
- WHO Research and Development (R&D) Blueprint
- Regional Committee resolutions and information documents:
  - EM/RC63/R.1 (2016) on Emerging and re-emerging diseases including dengue and dengue haemorrhagic fever
  - EM/RC62/R.1 (2015) on Global health security, with special emphasis on MERS-CoV and A(H5N1)
  - EM/RC59/R.4 (2012) on National core capacities for the International Health Regulations (2005): meeting the 2014 deadline
  - EM/RC61/R.2 (2014) on Global health security – challenges and opportunities with special emphasis on the International Health Regulations (2005)
  - EM/RC58/INF.DOC.7 (2011) on the Report on pandemic H1N1 and progress on the response
  - EM/RC58/R.4 (2011) on Dengue: call for urgent interventions for a rapidly expanding emerging disease
  - EM/RC57/R.6 (2010) on Infection prevention and control in health care: time for collaborative action
  - EM/RC56/INF.DOC.10 (2009) on the Follow-up to the special session of the Regional Committee on pandemic (H1N1) 2009
  - EM/RC54/R.4 (2007) on Growing threat of viral haemorrhagic fevers in the Eastern Mediterranean Region: a call for action
  - EM/RC53/R.3 (2006) on Regional strategy on preparedness and response for human pandemic influenza

- **Strengthening and expanding partnerships:** this strategic framework supports strong coordination among all partners to strengthen preparedness programmes and avoid duplication of activities. Early detection, prevention and control of emerging infectious diseases, and particularly pandemic preparedness, all require effective partnerships at global, regional and national levels. Many global organizations provide support to countries in the field of epidemic preparedness and response. A multisectoral approach is required to address the social, environmental and economic determinants of infectious diseases, especially in the case of animal and human health partners and networks, such as the WHO Global Influenza Surveillance and Response System. Additionally, there are opportunities to engage with the private health sector, non-health sectors and law enforcement agencies to successfully implement the strategic priorities and components of this framework. Local governments, civil society organizations, political leaders and communities should all be involved in preparedness and response activities. Community engagement is particularly important in implementing effective public health interventions and achieving the desired outcomes.
- **Knowledge management:** among WHO's six critical functions *(62)* is the shaping of the research agenda and stimulating the generation, translation and dissemination of valuable

knowledge. The Regional Office will promote innovation to identify new or improved policies and systems, and to create new ways of thinking and working with a focus on the needs of vulnerable populations. This strategic framework supports the priorities outlined in the five streams of focus within the WHO Public Health Research Agenda for Influenza, accords with research into other priority diseases, and identifies opportunities to link with regional- and country-level research agendas to ensure a cohesive approach to promoting innovation, generating evidence and managing knowledge for the detection, prevention and control of emerging infectious diseases. Similarly, implementation of the framework will supplement the work accomplished by the WHO R&D Blueprint *(63)*.

- **Focus on countries with a high risk of epidemics:** the strategic framework particularly focuses on highly vulnerable low-resource countries where the risk of emergence of epidemics of infectious disease is high. This strategy covers all emerging and re-emerging diseases with epidemic potential that are prevalent in the Region or have been reported in the Region in the past.

### 3.3 Scope and priority diseases

The aim of this strategic framework is to strengthen the detection of and response to all emerging and epidemic-prone infectious diseases as required by IHR (2005). However, the main focus will be on the priority diseases shown in Box 2, which are:

- emerging infectious diseases prevalent in the Region which may have pandemic potential;
- caused by highly infectious pathogens routinely reported in the Region;
- emerging and re-emerging infections that have caused outbreaks/epidemics in the past;
- emerging and re-emerging infections in other parts of the world which have the potential to cause severe epidemics in the Region;
- diseases with international surveillance requirements (IHR/PHEIC).

**Box 2. Priority diseases**

**Vector-borne diseases**
Dengue fever/severe dengue
Chikungunya fever
Sandfly fever
West Nile fever
Zika virus disease
Malaria

**Viral haemorrhagic diseases**
Ebola virus disease
Crimean–Congo haemorrhagic fever
Rift Valley fever
Yellow fever

**Influenza**
Avian influenza A(H5N1)
Influenza caused by any novel and zoonotic viruses

**Meningococcal meningitis**

**Zoonotic diseases**
MERS
SARS
Other emerging respiratory diseases with epidemic potential

**Waterborne diseases**
Cholera
Acute hepatitis (hepatitis A and E viruses)
Typhoid fever
Epidemic diarrhoeal disease (*Escherichia coli* and Shigella)

**Endemic zoonoses**
Anthrax
Brucellosis
Leishmaniasis
Rabies

**Disease X**

**Any other unknown/emerging diseases**

### 3.4 Target audience

This strategic framework is primarily intended for use by national government authorities and other stakeholders in countries involved in preparedness and response activities against emerging and epidemic-prone infectious diseases in the Region. As a coordinated approach is required to control infectious diseases in the Region, the current document provides a common framework and collaborative platform for the Regional Office, Member States and partners to work together on strengthening preparedness and response efforts to threats associated with emerging and epidemic-prone infectious diseases. This framework should be used by all agencies and individuals working in the health, agriculture, poultry, animal, food and environment sectors of countries as a high-level guide to preparing for and responding to emerging and epidemic-prone infectious diseases at national and subnational levels. The framework may also be used as a guidance document for stakeholders in other sectors who are indirectly involved in preparedness and response activities, including trade, tourism, law enforcement and other relevant departments, representatives from academic and research institutes and other professional bodies, civil society, nongovernmental organizations working in the health sector and other private sector partners.

## 4. STRATEGIC FRAMEWORK FOR THE PREVENTION AND CONTROL OF EMERGING AND EPIDEMIC-PRONE INFECTIOUS DISEASES IN THE EASTERN MEDITERRANEAN REGION 2019–2023

### 4.1 Vision

Reduce the burden of emerging and epidemic-prone infectious diseases in the WHO Eastern Mediterranean Region by 2023.

### 4.2 Goals

To increase the capacities, capabilities and preparedness of countries to better forecast, detect, prevent and control emerging and epidemic-prone infectious diseases, so that:

- the national and international spread of infectious diseases is prevented;
- rapid responses can be made to contain any epidemic or pandemic effectively and efficiently;
- the impact of an epidemic or pandemic is minimized;
- the recovery from an epidemic or pandemic is quick;
- the risk of reoccurrence is mitigated.

### 4.3 High-level outcomes

- Member States are better prepared to prevent, detect and respond to the threat of emerging and epidemic-prone infectious diseases.
- People living in the WHO Eastern Mediterranean Region are better protected from the impacts of emerging and epidemic-prone infectious diseases.

## 5. STRATEGIC PRIORITIES AND COMPONENTS

Four strategic priorities and 15 strategic components support the vision of this framework and outline a way forward to attain the high-level outcomes and targets for 2023.

### Strategic priority 1: Strengthen public health capacity to prepare for and prevent emerging and epidemic-prone infectious diseases

Public health preparedness activities include actions taken before an incident to ensure effective response and recovery. Preparedness is the best strategy for avoiding morbidity and mortality associated with epidemics, and to reduce their socioeconomic impact. According to World Bank estimates, the cost of pandemic preparedness in low- and middle-income countries is less than US$ 1 per person per year *(28)*, which is much lower than the actual or estimated costs during a large epidemic or pandemic *(27, 28)*. This strategic priority focuses on maintaining and improving public health preparedness by ensuring that core capacities for the prevention of, detection and response to emerging infectious diseases are incorporated into national plans. Public health preparedness includes developing preparedness plans, improving surveillance and laboratory diagnosis, preparing the workforce to respond to epidemics, strengthening intersectoral coordination and devising effective communication strategies. However, health-system strengthening, readiness and resilience are also important in operationalizing these components effectively and efficiently. Preparedness will be more effective when activities are integrated into existing public health programmes to support wider national systems strengthening.

Member States should develop a preparedness plan to prepare for and respond to emerging and epidemic-prone infectious diseases. The preparedness plan should be developed in consultation with all relevant stakeholders including health and other relevant government departments (for example, agriculture, animal, food and law enforcement), public health organizations, hospitals, general practitioners and other partners. The plan must be flexible as the epidemiology of each emerging and epidemic-prone infectious disease may be different and it is difficult to define a set of actions before an epidemic occurs. The plan should be tested during outbreaks or simulation exercises and updated as needed. It is also important to review current legislation, regulations and policies for dealing with large outbreaks and epidemics, including the enforcement of quarantine, use of privately-owned buildings as health care facilities, the off-label use of drugs, compulsory vaccination and implementation of emergency shifts in essential services. For example, to prevent avian influenza, policies and regulations should be developed to engage the large number of unlicensed commercial and semi-commercial poultry farms in developing new means of implementing and assuring effective disease prevention and control measures. Legislation and guidelines should also be developed for implementing the national preparedness plan.

The implementation of public health measures requires coordination among various individuals and stakeholders who do not normally work within the same organization. Therefore, a coordination mechanism should be in put place to carry out various preparedness, prevention and response activities. Member States should particularly coordinate with organizations working in the animal sector to expand their capability for rapid and effective investigation of

zoonotic infections, based on joint risk assessment and the One Health approach *(64)*. The risk of zoonotic infections is increasing due to changes in human habitat, behaviour and food production practices, more frequent contact with animals and increased population movements *(3, 7)*. Collaboration between the human and animal health sectors is essential to understanding the risk of transmission of infections between animals and humans and to prevent the spill-over of zoonotic infections from animals to humans. To reduce the opportunity for human exposure, the spread of infection in animal populations can be limited through the use of vaccines and better management of infected animals. Antimicrobial resistance is now a serious global public health threat due to the irrational use of antibiotics in both humans and animals, and can lead to prolonged illness, disability and death *(65)*.

Finally, a skilled and competent workforce is essential for responding to emerging and epidemic-prone infectious diseases. Countries should build up the capacities of all those involved in preparedness, detection and response activities, including epidemiologists, biostatisticians, physicians, veterinarians, laboratory scientists and farming/livestock professionals. Countries should also develop at least one rapid response team at national level and two at subnational level. Further rapid response teams may be developed depending on the national context in terms of disease burden, geographical accessibility and available funds. As per IHR (2005) requirements, emergency operations centre (EOC) staff should be trained and put in place or be readily available for deployment (49).

*Strategic component 1.1: Develop, test and disseminate multisectoral disease-specific national preparedness plans*

- Develop or update multisectoral disease-specific national preparedness plans for high-risk emerging and epidemic-prone infectious diseases in conjunction with an all-hazards approach and NAPHS.
- Test and periodically revise disease-specific preparedness plans to improve multisectoral coordination, communication and information sharing.
- Ensure that public health measures and surveillance strategies for preventing the importation or international spread of infectious diseases are harmonized and operationally linked with national plans.
- Ensure the availability of domestic resources to implement the activities proposed in the disease-specific preparedness plans, including the deployment of human resources, training, infrastructure development, procurement of laboratory and other equipment, and the maintaining of national stockpiles of vaccines, medicines and personal protective equipment (PPE).

*Strategic component 1.2: Build capacity to develop policies, legislation and guidelines*

- Develop and disseminate public health policies, procedures and laws to support the disease-specific preparedness plans.
- Maintain the legislative aspects (including policies, procedures and laws) required to meet IHR (2005) requirements.
- Periodically review public health policies, legislation and guidelines.

*Strategic component 1.3: Improve multisectoral collaboration and coordination with the animal sector and other non-health sectors*

- Roll out the One Health approach to improve collaboration and coordination with the animal sector and other non-health sectors, including the agriculture, poultry, food and environment sectors, in line with the regional One Health framework for action.
- Ensure that a system is in place to govern, manage, coordinate and oversee all One Health activities.
- Improve surveillance and timely data-sharing on emerging zoonoses at the animal–human interface for joint rapid risk assessment and response.
- Increase intersectoral sharing of knowledge, technologies, protocols and laboratory resources.
- Improve coordination with private health sector and stakeholders from other sectors involved in preparedness and response activities, including law enforcement agencies, academic institutes, professional bodies and nongovernmental organizations.
- Develop memorandums of understanding or other agreements with various stakeholders involved in preparedness and response activities to clarify roles and responsibilities and to guide preparedness and response activities.
- Establish an early warning system through emergency disease-reporting mechanisms within the animal health sector, and strengthen system integration between the animal health and human health sectors.
- Ensure sufficient diagnostic capacity for testing high numbers of animal samples at the national level.
- Implement biosecurity measures in all animal holding facilities, including farms, animal markets, zoos and natural wildlife reserves.
- Improve coordination between public health and security authorities (for example, law enforcement, border control and customs).
- Ensure effective border control through effective animal quarantine systems to prevent imported risk.

*Strategic component 1.4: Conduct risk and vulnerability analyses to implement proven and effective control measures to reduce threats*

- Identify and periodically update information on disease hotspots and generate public health risk maps for high-priority pathogens and endemic diseases.
- Conduct disease and economic burden studies for endemic and high-risk emerging pathogens.
- Enhance national capacity to perform disease forecasting using modelling techniques.
- Develop an investment case for the introduction of proven and effective interventions to reduce the risk of emergence and re-emergence of infectious diseases.
- Introduce disease-specific interventions/control measures for endemic and high-risk pathogens, especially in disease hotspots.
- Build capacity to introduce and administer new vaccines, medicines and other new medical countermeasures in a systematic manner.

*Strategic component 1.5: Develop and maintain a multisectoral health workforce that is fit for purpose*

- Establish and maintain a skilled and competent health workforce to respond to emerging infectious diseases caused by high-risk emerging and epidemic-prone pathogens.
- Develop and introduce a training curriculum for a pyramid-model field epidemiology training programme for health workers, including veterinarians not only from the health ministry but also from the armed forces, department of agriculture, and so on.
- Establish, train and maintain multisectoral rapid response teams at national and subnational levels that can respond within 48 hours of notification of a potential health threat.
- Establish and maintain a deployable multisectoral roster of experts including those from partner institutions (international/national) and other in-country expert networks to support rapid outbreak responses.
- Maintain the capacity of a multisectoral health workforce through refresher training and simulation exercises.
- Support and further strengthen national IHR focal point and EOC functions.

**Strategic priority 2: Strengthen capacity for the early detection and investigation of outbreaks of emerging and epidemic-prone infectious diseases**

The focus of this strategic area is to strengthen and sustain the capacity of countries in the Region to promptly detect, report and confirm outbreaks of emerging and epidemic-prone infectious diseases. Due to protracted humanitarian emergencies, fragile health systems and the presence of other risk factors for the emergence and re-emergence of infectious diseases, outbreaks frequently occur in the Region and 15–20% of the population remain at high risk. High-quality risk assessment and timely and effective responses to acute public health risks are essential in order to minimize the negative health consequences for affected populations.

Laboratories play a vital role in the rapid detection, risk assessment and monitoring of an outbreak, and a functional and tiered laboratory network should therefore be established. Such a laboratory network is important as surveillance and outbreak management depend on the rapid detection and identification of the causative pathogen during an outbreak or epidemic. Laboratories should not only maintain routine diagnostic capabilities, but should also be prepared for surge testing demands during epidemics and pandemics. The detection of high-risk pathogens in particular requires specialized laboratories with appropriate biosafety levels and capacity for the accurate detection of emerging and re-emerging pathogens. Under the requirements of IHR (2005), Member States have to build laboratory diagnostic capacity for priority diseases and implement comprehensive biosafety and biosecurity legislation *(67)*. Therefore, safety and security standards in laboratories should be improved, including standards for the safe storage, use, transport and disposal of high-risk pathogens. Training programmes and simulation exercises should be ongoing to build the capacities of laboratory staff. A referral network of laboratories should be established to provide advanced diagnostic services through the development of linkages with other laboratories in the Region.

Public health surveillance is defined as "the systematic on-going collection, collation and analysis of data for public health purposes and the timely dissemination of public health information for assessment and public health response as necessary" *(66)*. National surveillance systems should be strengthened by including both indicator-based surveillance and event-based surveillance for timely detection of and response to existing infectious diseases and emerging public health threats. According to WHO, indicator-based surveillance (including comprehensive/routine, sentinel and syndromic surveillance) involves using data sources that are structured, regular and continuous, such as disease notifications and daily monitoring of emergency patient databases, to identify any increase in the number of patients presenting with certain symptoms or infections. These sources are usually health care data sources. Event-based surveillance is the semi-organized and rapid capture of information about events that are a potential risk to public health. For example, event-based surveillance is being conducted in the Region to detect MERS among pilgrims returning from hajj, umrah and other religious events. Event-based surveillance data can also be gathered from media reports, the community, social media, websites and other informal networks *(66)*. Strong surveillance will support timely recognition of the emergence of relatively rare or previously undescribed pathogens in specific countries.

During an outbreak or epidemic situation, routine surveillance systems will be the main focus, supplemented by information from WHO, international agencies and other event-based surveillance channels. Strengthening of surveillance may be required depending on the nature of the pathogen causing the epidemic. However, many countries in the Region are facing protracted humanitarian emergencies, during which national surveillance systems may be underperforming or non-functional. As routine disease surveillance systems may not be working in some areas experiencing ongoing war and other conflicts, WHO recommends using EWARN for early detection of and response to outbreaks *(68)*. EWARN has played a crucial role in countries – for example in Somalia and Yemen – by improving the early detection and effective monitoring of cholera and other infectious diseases outbreaks. In the case of Somalia, the disease surveillance system is managed by EWARN to detect outbreaks of cholera and other emerging infections due to weak surveillance and protracted humanitarian emergencies *(69)*. In all countries of the Region, efforts should be made to strengthen routine surveillance as soon as possible and EWARN should be integrated into the national surveillance system once an outbreak is over. Countries should also enhance their capacity for data analysis and reporting in accordance with WHO requirements.

*Strategic component 2.1: Ensure adequate capacity to detect, monitor and respond to emerging infectious diseases caused by high-risk pathogens*

- Ensure the capacities needed to conduct and update a landscape analysis of the national surveillance systems.
- Improve the use of innovative technologies and tools to detect and monitor health threats.
- Periodically analyse epidemiological data, especially in outbreak settings, to monitor the quality and effectiveness of ongoing outbreak response operations.
- Promote integration and analysis of epidemiological and laboratory data wherever possible to understand severity.

*Strategic component 2.2: Strengthen laboratory diagnostic capacity and networks to investigate, detect, monitor and report high-risk pathogens*

- Ensure that a functional nationwide laboratory system is in place with diagnostic and testing capabilities for emerging and epidemic-prone pathogens, surge capacity for outbreak response throughout the country, and linkages to regional and international reference laboratories.
- Map or inventory all human, veterinary and food diagnostic laboratories and existing laboratory networks at the country level to better identify the diagnostic laboratory resources available.
- Encourage public health laboratories working in the human health sector to participate in external quality assessment programmes for all emerging infectious diseases.
- Ensure the availability of policies, guidelines and standard operating procedures for specimen collection, storage, testing, transportation, data sharing and quality control.
- Establish and maintain capacity to rapidly deploy mobile laboratories and/or laboratory services for the detection and diagnosis of high-risk pathogens in emergency situations.
- Enhance collaboration, information-sharing and resource-sharing between public health laboratories in the human health sector, animal health sector, food sector and environment sector; this will include the sharing of samples.
- Develop and maintain laboratory quality management systems, including for biosafety and biosecurity, which meet international standards.

*Strategic component 2.3: Strengthen surveillance for the early detection and monitoring of emerging and epidemic-prone infectious disease outbreaks*

- Continuously update a priority list of emerging and epidemic-prone pathogens (including zoonotic infections), and map the pathogens by geographical area to ensure that surveillance systems cover these areas and that surveillance and response systems are in place for the priority high-risk pathogens.
- Strengthen national surveillance systems with a strong real-time early warning mechanism for the rapid detection of and timely response to unusual cases or clusters of high-risk emerging and epidemic-prone infectious diseases; specifically, ILI and SARI surveillance systems.
- Periodically assess and evaluate surveillance systems (including the types of systems available, the population coverage of each system, and any gaps in resources, data collection and reporting) along with any other systems that exist for specific disease control and intervention programmes with a view to identifying gaps and improving system performance and/or efficiency.
- Use electronic health records and other evolving health information technology tools to improve the timeliness of reporting, according to national guidelines.
- Improve compliance with IHR (2005) requirements and ensure implementation of IHR (2005) core capacities to ensure the prompt reporting of PHEICs.

**Strategic priority 3: Build capacity to implement high-impact control strategies for rapidly responding to high-risk emerging and epidemic-prone infectious diseases**

This strategic priority involves building capacity to implement high-impact control strategies for rapidly responding to high-risk emerging and epidemic-prone infectious diseases. Appropriate and evidence-informed prevention and control measures should be applied to contain outbreaks and prevent international spread. The control and prevention of infectious diseases generally depend on controlling the source/reservoir of infection, protecting the host and/or interrupting disease transmission *(70)*. The best strategy is to control or eliminate the agent at source – however, this is rarely possible. If humans are the only reservoir, a disease may be eradicated (for example, smallpox) or eliminated (for example, measles in some countries).

Vaccination is the most effective public health intervention for reducing morbidity and mortality due to infections and for preventing outbreaks and epidemics *(71)*. It has been estimated that vaccines prevent around 2–3 million deaths every year *(72)*. Due to the use of vaccines an 84% drop in measles deaths was observed between 2000 and 2016, corresponding to more than 20 million deaths averted. In addition, meningitis A epidemics have almost been eliminated in Africa through the use of vaccines, while maternal and neonatal tetanus have been eliminated in the WHO Region of the Americas and the WHO South-East Asia Region *(73)*. However, routine immunization coverage needs to be improved in the Eastern Mediterranean Region to prevent outbreaks of VBDs. Vaccines should also be used for other high-priority and endemic diseases not included in national immunization programmes, such as seasonal influenza, meningococcal meningitis, yellow fever, cholera and rabies. More than half of the countries in the Region are experiencing humanitarian emergencies, which require special vaccination campaigns. In these situations, the WHO decision-making framework can be used for risk assessment and vaccine selection *(73)*. Related considerations include vaccine storage, delivery and accessibility to vulnerable and marginalized populations.

Vaccines are, however, not available for many emerging and re-emerging pathogens and it is difficult to predict which pathogen will cause the next epidemic or pandemic. Therefore, various strategies are used concomitantly at individual and community levels to interrupt the disease transmission cycle. This strategic priority also includes other prevention and control interventions such as vector control and water, sanitation and hygiene (WASH) improvements to reduce the transmission rate of diseases (which is the factor that has the greatest impact on the scale of an epidemic). For example, VBDs can be controlled through vector surveillance, controlling mosquito populations and breeding sites, vaccination (if available), and increasing awareness and community engagement. A WASH strategy is appropriate for preventing the transmission of foodborne and waterborne diseases, and such improvements will help to prevent WASH-related diseases in the Region particularly cholera. Countries also need to enhance their capacity to assess and measure the effectiveness of these prevention and control interventions.

A rapid and coordinated response is needed to contain outbreaks at an early stage to prevent morbidity and mortality. An initial risk assessment should be conducted to inform risk management decisions, followed by continued risk assessment throughout the outbreak period. Ensuring the continuity of routine health services is vital during outbreaks and epidemics, particularly for vulnerable groups such as children, pregnant women, the elderly and people with

chronic conditions. Countries should develop plans and procedures to ensure that routine health services are not interrupted. Health-care workers are at the frontline of outbreaks and epidemics and are at increased risk of acquiring infections. During the Ebola epidemic in West Africa, 881 health care workers were infected and 513 died *(74)*. Studies have also shown that the risk of spread of MERS increases in health care settings, due to inappropriate infection prevention and control practices and the performing of aerosol-generating and other high-risk procedures *(75)*. Therefore, enhancing various pharmaceutical and non-pharmaceutical measures and increasing infection prevention and control awareness and implementation measures are critical in preventing the possible spread of emerging and epidemic-prone infectious diseases in health care facilities. Pharmaceutical measures refer to the use of vaccines, medicines and antibiotics. Non-pharmaceutical measures include hand hygiene, respiratory etiquette, triage, isolation, quarantine, social distancing, use of PPE, cleaning and disinfection, waste management and integrated vector control *(76, 77)*. Deciding which of these measures to use in health care and/or community settings will depend on many factors, such as the nature of the infectious agent, the phase of the epidemic, geographical spread and the availability of prevention and control measures. A multifaceted approach using a combination of various infection control strategies is generally recommended to reduce the transmission of infectious pathogens.

During outbreaks and epidemics, it is also important to control points of entry (PoE). According to the International Civil Aviation Organization (ICAO) Air Transport Yearly Monitor, international passenger traffic grew by 6.8% in the year 2015, and by 6.3% in 2016 *(78)*. The strongest growth in both international and domestic traffic was recorded in the Middle East and highlights the risk of spread of infectious diseases through the movement of people between countries. As provided by IHR (2005), countries should ensure that a public health emergency contingency plan is in place and appropriate medical services are available at PoE for responding to events that may constitute a PHEIC *(79)*. Countries should maintain a high level of vigilance during an outbreak, and monitor travellers coming from countries where an outbreak is ongoing. Countries should develop core capacities to detect cases rapidly to mitigate the risk of secondary infection due to imported cases. Capacity should also be developed to manage cases at PoE including initial assessment, provision of initial treatment and other support services, and quarantine or isolation away from the PoE *(79)*. Capacity should also be developed to detect and manage vectors and reservoirs at PoE. Strong community involvement is also crucial during large outbreaks, as was documented during the Ebola crisis.

Finally, effective communication is the key to dispersing information to all stakeholders before, during and after an outbreak. Communication needs to be strengthened between governments and partners, across governments, and between governments and the public. Effective communication helps in making informed decisions, reducing public anxiety, undertaking positive behaviour change and maintaining trust in health authorities. Communication mechanisms should be developed and tested to engage key national, intermediate, local and international stakeholders. Public communication should be conducted through various platforms such as television, radio, newspapers, social media, mobile text messages and websites. Community engagement is also important for case detection and the implementation of prevention and control measures. Under the IHR (2005), countries are required to develop and test multisectoral communication and community engagement mechanisms and to update them regularly, either through simulation exercises or during an actual event *(49)*.

*Strategic component 3.1: Build and implement evidence-based programmes and policies to prevent and control high-risk infectious diseases*

- Develop and implement policies and programmes for protection against high-risk pathogens, particularly for health care workers, vulnerable and marginalized populations and other groups at high risk.
- Improve protection through the achievement and maintenance of high levels of immunization coverage against epidemic-prone vaccine-preventable diseases.
- Strengthen routine national immunization coverage to control epidemic-prone infectious diseases and to prevent the re-emergence of existing pathogens in new areas.
- Improve vaccination coverage among health care workers and other groups at high risk.
- Promote the integration of priority/selected vaccines against high-risk pathogens into routine immunization schedules where these are shown to be cost effective (for example, for influenza, yellow fever, meningitis and cholera).
- Promote animal vaccination as a means of preventing human diseases (for example, rabies).
- Develop plans for the effective distribution of vaccines, with adequate cold chains and ongoing quality control, in preparation for responding to new disease threats.
- Generate evidence of the benefits of vaccination and identify ways to tackle vaccine misperceptions and hesitancy, particularly among groups at high risk.
- Strengthen national vector control programmes to prevent the emergence of new VBDs and the re-emergence of existing VBDs.
- Develop/update national vector control strategies in line with global and regional strategies for VBD control.
- Implement national VBD control programmes though intersectoral collaboration and community participation.
- Strengthen entomological surveillance and integrated vector management approaches to control various VBDs.
- Implement effective WASH strategies in coordination and collaboration with relevant sectors to reduce the burden of foodborne and waterborne diseases and prevent outbreaks, particularly during humanitarian emergencies.
- Adopt evidence-based policies and practices that minimize the transmission of zoonotic diseases through the detecting and controlling of zoonotic threats while they are still in animal populations.
- Enhance capacity to identify the causes of antimicrobial resistance and apply best practices to slow the spread of resistance.
- Build the capacity of countries to evaluate the impact of prevention and control measures.

*Strategic component 3.2: Strengthen rapid response capacities at national and subnational levels*

- Develop standard operating procedures, guidelines and best practice documents for rapid response, including field investigation, data management, continuity of health services, and infection prevention and control.
- Develop mechanisms for operationalizing EOCs and incident management systems at the country level to allow for integrated and coordinated responses.
- Establish/support rapid response team formation and operation at national and subnational level:
  - incorporate rapid response teams into the existing emergency structure in the country;
  - develop standard operating procedures that describe rapid response team operations in terms of activation, deployment, response and post-action review activities;
  - based on the country risk assessment, identify the competencies required within the national rapid response team and identify experts in each area (rapid response team candidates);
  - develop and update the rapid response team roster of experts;
  - build the capacity of national and subnational rapid response teams by providing modular training addressing general topics such as rapid response team operation and leadership, as well as topics specific to individual subject areas;
  - test rapid response team operation through the use of simulation exercises.
- Strengthen capacities to deploy national partner institutions and other in-country expert networks for rapid outbreak response (such as GOARN).
- Improve capacity to apply appropriate pharmaceutical and non-pharmaceutical infection prevention and control measures in health care and community settings, including vaccination (if available), triage, isolation, adoption of general and transmission-based precautions, quarantine, social isolation, use of PPE and vector control.
- Improve capacity for the clinical management and treatment of patients and their close contacts for high-risk pathogens, including diseases caused by novel pathogens.
- Maintain core capacities at international airports, ports and other PoE to detect infection among travellers.

*Strategic component 3.3: Maintain field operations capacity and access to life-saving interventions (vaccines, medicines and diagnostic kits) for timely outbreak response*

- Ensure accessibility and rapid mobilization of resources during outbreaks, including deployment of rapid response teams, vaccines (if available), medicines, diagnostic kits, PPE and other supplies.
- Strengthen capacity to deploy mobile laboratories and point-of-care testing.
- Enhance existing surveillance systems for high-risk pathogens during an outbreak, with the ability to detect and monitor health threats in real time.
- Maintain reporting capacities and coordination with the national IHR focal point to report the situation to WHO under the requirements of IHR (2005).

*Strategic component 3.4: Strengthen emergency communication and community engagement capacities*

- Develop multisectoral communication plans, as part of the NAPHS and national emerging diseases plans, to communicate the risk, threat and burden of emerging diseases to policy-makers, the general public, media and other partners and key stakeholders.
- Use effective strategies to communicate and engage with various groups, including government departments involved in outbreak response, partners, the general public, media and the international community.
- Promote active community involvement in prevention and control activities (including surveillance and public health interventions) through targeted awareness, education and partnership efforts.
- Encourage the development of supportive policies and programmes for community engagement and social interventions for reducing and mitigating the threat of emerging infectious diseases.
- Engage academic and professional bodies, media and other relevant stakeholders to extend the reach of public health messages.
- Enhance the use of new technologies and new media, including social media and social networks, for effective communication.

**Strategic priority 4: Enhance knowledge management and innovation**

This strategic priority focuses on global and regional partnerships to foster research and advance technology thorough effective knowledge management. Although emerging infectious diseases research in the Eastern Mediterranean Region is increasing, several important gaps remain *(80)*. More research is needed to better understand the origin and characteristics of pathogens, their genetic diversity and its impact on epidemiology and transmission mechanisms, sources of infection, the causes of under- and non-reporting, and the impact of interventions. Such research will help to identify which emerging pathogens pose the greatest risk and better ways to reduce risk and control emerging and epidemic-prone infectious diseases, particularly in vulnerable populations.

New strategies and tools should be developed to capture and utilize clinical, population-based and virological surveillance data for evidence-based decision-making. Countries should support the participation of their public health laboratories in research to develop, validate and test new diagnostic tools and technologies for detecting and characterizing emerging threats, including point-of-care testing. The efficacy and effectiveness of various pharmaceutical and non-pharmaceutical control measures should also be tested. There is an urgent need to develop new vaccines and medicines against nine emerging and high-risk pathogens, as proposed in the WHO R&D Blueprint, including several identified as priorities within this strategic framework. It is vital that the Region is actively engaged in this research *(81)*.

*Strategic component 4.1: Promote research to better understand the epidemiology and control of high-risk emerging and epidemic-prone pathogens*

- Promote and support multidisciplinary research to understand the factors contributing to the transmission of emerging and epidemic-prone pathogens, including human-to-human and animal-to-human transmission.
- Promote research to understand the cultural and behavioural risk factors associated with the spread of emerging and epidemic-prone pathogens.
- Improve the evidence base for estimating the disease and economic burden of emerging infectious diseases, including influenza and other diseases for which effective medical countermeasures exist, such as vaccines.
- Research new approaches to controlling zoonotic diseases, especially foodborne diseases, and conduct health systems research to strengthen intersectoral collaboration and coordination.
- Promote studies to estimate vaccine effectiveness in reducing severe disease and mortality in target populations by vaccine type, vaccination history and time of receipt of vaccine.
- Assess the effectiveness of other strategies for the prevention and control of infectious diseases, such as vector control and WASH strategies.
- Contribute to clinical trials or other similar studies measuring the efficacy of treatment options for priority and endemic infectious diseases.
- Review and document lessons learned from previous outbreaks and epidemics and share experiences with the international community.
- Develop capacities to store clinical samples for future research.

*Strategic component 4.2: Promote new and innovative technologies and approaches for the prevention, detection and control of high-risk pathogens*

- Develop new tools to capture and utilize public health data for evidence-based decision-making.
- Develop new surveillance strategies for the early identification of emerging pathogens.
- Contribute to the development of improved, innovative and cost-effective diagnostic tests for high-risk pathogens, such as next-generation sequencing and affordable point-of-care testing.
- Contribute to the development of new vaccines.
- Promote the adoption of innovative modelling and forecasting methods to anticipate outbreaks and optimize medical countermeasures.

*Strategic component 4.3: Promote research capacity and collaboration*

- Promote training and exchange of research expertise at national, regional and global levels.
- Advocate for financial resources to support research related to infectious diseases at national and regional levels.

- Share knowledge and research findings at both national and regional levels.
- Promote collaboration among national and regional academic and research institutions to address knowledge gaps and undertake studies on high-risk pathogens.
- Advocate for national streamlining procedures for ethical approval to remove barriers to research.

## 6. IMPLEMENTATION OF THE STRATEGIC FRAMEWORK

Countries in the Eastern Mediterranean Region should take ownership of this strategic framework and ensure its implementation in coordination with the WHO Regional Office, partners and other stakeholders involved in outbreak preparedness and response. Health departments or other organizations managing emerging and epidemic-prone infectious diseases in the country will mainly be responsible for implementing the strategy at national level, in coordination with the national IHR focal point. Although this is a common strategic framework for all 22 countries of the Region, the individual situation and context in each country will have to be considered when implementing this strategy at national level. The framework provides a flexible platform for countries and their partners to integrate its strategic priories into their own policies, programmes and systems. Each country will determine its own path and will develop activities for achieving the targets mentioned. All activities should be consistent with this strategic framework, relevant WHO regional and global initiatives, and the IHR (2005). Countries should also ensure the alignment of activities with existing country processes to develop a holistic approach and avoid duplication. A coordinated and multisectoral approach is required at country level to strengthen preparedness, prevention, response, and research and development activities that follow on from this strategic framework. The overall aim is to ensure that countries are in a constant state of preparedness, prevention and response to emerging and epidemic-prone infectious diseases.

The WHO Regional Office for the Eastern Mediterranean will provide technical support to countries in implementing this strategic framework in the local context, responding to outbreaks of emerging and epidemic-prone infectious diseases, and conducting monitoring and evaluation activities. Because of its history, relevance and mandate, WHO is in a unique position to mobilize countries and relevant stakeholders in collaboratively advancing health strategies. As a number of the proposed strategic actions in this document are in line with the WHO Health Emergencies Programme, the strategic framework will also contribute towards achieving the goals of the Programme[62]. The Regional Office will assist countries in the adoption of this strategic framework at country level and in its integration with global frameworks and initiatives such as IHR (2005), pandemic preparedness plans, GPW 13 and the SDGs. The Regional Office will also work closely with WHO headquarters, other United Nations organizations, WHO country offices, partners, donors, intergovernmental organizations, research institutes and all other technical partners whose work is fundamental to the successful implementation of the strategic framework.

The specific roles and responsibilities of Member States and WHO in relation to the implementation of this strategic framework are described below.

### 6.1 Role of Member States

1. Adapt the strategic framework to the local context (or integrate it into national plans such as the NAPHS), including through the adding of national-level activities and monitoring indicators, based on the results of a comprehensive country-specific assessment.
2. Cost and allocate adequate domestic resources to implement the framework (within the context of the broader health system), identify funding gaps and mobilize partner support to bridge such gaps; take ownership of the strategy; and nominate a national IHR focal point for emerging and epidemic-prone infectious diseases responsible for overall coordination and reporting.
3. Establish a multisectoral steering committee (or use an existing one) at the national level to oversee progress on strategy implementation. The committee should comprise senior executives from health and non-health departments, the national IHR focal point, and representatives from international organizations, nongovernmental organizations and civil society.
4. Establish and/or maintain capacity at the national level to ensure coordination, planning, implementation, monitoring and periodic review of the strategy. Where possible, existing structures in health departments or other units responsible for health emergencies should be involved.
5. Develop sustainable mechanisms to enhance multisectoral collaboration at country level in the implementation of the strategic framework.
6. Monitor progress in the implementation of the framework using both qualitative and quantitative data.
7. Provide mid-term and final reports to the Regional Office on the progress made in the implementation of the framework using self-assessment.
8. Conduct mid-term and end-term external evaluations using national and international experts.
9. Advocate for implementation of the strategy at the country level.

### 6.2 Role of WHO

10. Establish a Technical Advisory Group (TAG) to oversee the implementation of the strategy in the Region and improve compliance of Member States with regard to the core activities that follow on from this strategic framework.
11. Provide technical support to Member States in integrating the strategy into the local context, taking into account differences in terms of governance and health system capacities.
12. Disseminate relevant policies, guidelines and other information to support the implementation of this strategy.
13. Facilitate partnerships at the international and regional levels to improve the epidemic preparedness and response capacities of Member States; and support Member States in

promoting coordination with relevant sectors and partners in the country under the One Health approach.

14. Arrange high-level meetings of senior decision-makers from national health authorities in Member States to ensure political commitment for the implementation of the strategy.
15. Facilitate coordination among WHO country offices, national governments and other international agencies. The Regional Office will also continue to coordinate activities across related WHO programmes and initiatives, including the WHO Health Emergencies Programme and IHR (2005).
16. Advocate for the allocation of adequate domestic resources to ensure implementation of the activities proposed in the strategic framework.
17. Support Member States in training and monitoring and evaluation activities.
18. Provide technical support for the implementation of rapid response measures in the event of epidemics.
19. Continue to monitor regional emerging and epidemic-prone infectious disease trends and ensure the availability of data to Member States and global health partners.
20. Promote the research and knowledge generation required to control emerging infections in line with the WHO R&D Blueprint.

## 7. MONITORING AND EVALUATION

Monitoring and evaluation are important tools in tracking the progress of activities and facilitating decision-making for current and future interventions. This is a continuous process, which involves planning, reviewing, learning and improving. The monitoring and evaluation framework provided in this strategic framework (Annex 1) has not been developed to rank or compare the performances of Member States in the Region; instead, the aim is to support countries in monitoring their progress in implementing the strategy. At the country level, processes to monitor progress may be refined on a needs basis. Some monitoring activities can also be carried out through the implementation of existing monitoring frameworks and tools (for example, the IHR (2005) monitoring and evaluation framework) to avoid duplication and help to ensure that countries are not overburdened *(82)*.

### 7.1 Monitoring and evaluation at country level

Countries should improve their capacity to monitor the implementation of the strategy and to assess/measure the impact of preparedness, prevention, response, and research and development activities. The progress made in implementing the strategy will be assessed through national steering committee meetings, annual progress reporting, review of significant disease outbreaks and external evaluations.

- **Steering committee meetings:** steering committee meetings will be held regularly (at least quarterly or biannually) to oversee the implementation of the strategic framework, monitor activities and progress indicators, identify challenges and propose solutions.
- **Annual progress reporting:** Members States will report each year to the Regional Office on the progress made in implementing the strategic framework. A self-assessment approach will be used to align activities with the IHR (2005) monitoring and evaluation framework

*(82)*. To help achieve the goals and high-level outcomes set out in this strategic framework for the prevention, containment and control of emerging and epidemic-prone diseases in the Region, a set of key indicators have been identified (Annex 1). These indicators will monitor progress against the four strategic priorities set out in this document, namely: (1) strengthen public health preparedness and prevention capacities; (2) strengthen capacity for early detection and investigation of outbreaks; (3) build capacity for rapidly responding to high-risk infectious diseases; and (4) enhance knowledge management and innovation. A set of indicators has been developed for each strategic priority to monitor the progress of each country in implementing the strategic framework. Most of the indicators are aligned with existing programmes and initiatives, such as the IHR (2005) monitoring and evaluation framework, to reduce the burden of data collection. Member States should develop capacity at national and subnational levels to monitor these indicators. Initial assessments will be required at country level to establish the baseline for these indicators and set targets. Detailed qualitative reports on the various activities performed to meet the strategic objectives will be submitted separately.

- **Outbreak review:** in-depth reviews of significant disease outbreaks will be conducted to help assess the capacity of countries during a real event and to strengthen overall preparedness and response activities. The actions undertaken at each phase of the outbreak will be reviewed in detail to assess preparedness, prevention, detection, response and recovery activities under "real life" situations and to identify best practices, gaps and challenges. The aim will be to improve planning and operational preparedness though lessons learned from past outbreaks. Various qualitative strategies may be used to review outbreaks, including interviews and focus group discussions with people directly involved in the outbreak response. The review should be completed within three months of the end of the outbreak to avoid recall bias. The frequency of outbreak reviews will be determined by the number of outbreaks and by a country's capacity to manage these reviews. Ideally a country should conduct a review after each major outbreak and at least once a year. The recommendations of the review should then be incorporated into appropriate planning cycles. If there is no significant outbreak reported in a country, simulation exercises can be reviewed to test the functional capabilities of emergency systems and to assess preparedness and response capacities. According to WHO, "a simulation exercise is a form of practice, training, monitoring or evaluation of capabilities involving the description or simulation of an emergency, to which a described or simulated response is made" *(83)*.
- **External evaluations:** countries will conduct external evaluations using national and international experts to identify strengths and weaknesses within their national health systems in relation to the implementation of this strategic framework, and identify gaps and future needs. External evaluations will also help countries to engage with partners and donors to mobilize resources. Mid-term reviews will be conducted in 2022 to assess interim progress and final reviews will be conducted in 2024 before the development of the next strategy in 2024. However, depending on needs, an external evaluation can be arranged early for in-depth evaluation of specific strategic areas; for example, surveillance, laboratory services, health system preparedness, and so on. A modified version of the *Joint external evaluation tool: International Health Regulations (2005), second edition* developed for monitoring the progress of IHR (2005) may be used for monitoring and evaluation.

## 7.2 Monitoring and evaluation at the regional level

The Regional Office will regularly monitor the progress made in each of the strategic priority areas through annual reporting, progress review meetings and participation in external evaluations. All countries will be required to submit annual progress report to the Regional Office using the indicator sets provided in the monitoring and evaluation framework (Annex 1). Baselines have been set for some of these indicators using the most recent data available from countries. Initial assessments will be required at country level to establish the baselines for the remaining indicators and to set targets. Detailed qualitative reports on other activities will be submitted separately. The reports will then be reviewed by the regional TAG before being submitted to the Regional Director. The Regional Office will establish an electronic platform to monitor the implementation process and collect reports. Data will be analysed and presented in various formats. The Regional Office will also hold annual progress review meetings with focal points to review progress and identify the challenges faced during the implementation process. The TAG will also contribute to monitoring and evaluation activities to improve compliance with the core activities that follow on from this strategic framework. TAG meetings will be held annually to provide feedback to Member States, partners and other stakeholders on the progress made. The Regional Office will coordinate and facilitate evaluation by countries of the progress made in implementing the strategic framework at mid-term and end-term. A modified version of the *Joint external evaluation tool: International Health Regulations (2005), second edition (49)* may be used for evaluation purposes. The results, findings and progress reports will be shared with Member States through consultative meetings, reports and other channels to improve implementation performance.

## REFERENCES


1. Nelson KE, Williams CM. Early history of infectious disease: epidemiology and control of infectious diseases. In: Nelson KE, Williams CM, Graham NMH, editors. Infectious disease epidemiology: theory and practice. Gaithersberg (MD): Aspen Publishers; 2001.

2. Pandemic influenza preparedness and response: a WHO guidance document. Geneva: World Health Organization; 2009 (https://apps.who.int/iris/handle/10665/44123, accessed 26 July 2020).

3. Morens DM, Fauci AS. Emerging infectious diseases: threats to human health and global stability. PLoS pathog. 2013;9(7):e1003467.

4. Ebola operational readiness and preparedness: Ebola situation reports (cited from 5 October 2015). Geneva: World Health Organization (http://www.who.int/csr/disease/ebola/situation-reports/en/).

5. Huntington MK, Allison J, Nair D. Emerging vector-borne diseases. Am Fam Physician. 2016;94(7):551–7.

6. Dengue and severe dengue [website]. Geneva: World Health Organization; 2020 (https://www.who.int/news-room/fact-sheets/detail/dengue-and-severe-dengue, accessed 12 April 2019).

7. Morens DM, Folkers GK, Fauci AS. The challenge of emerging and re-emerging infectious diseases. Nature. 2004;430(6996):242–9.

8. Wilson ME. Travel and the emergence of infectious diseases. Emerg Infect Dis. 1995;1:39–46.

9. Patz JA, Graczyk TK, Geller N, Vittor AY. Effects of environmental change on emerging parasitic diseases. Int J Parasitol. 2000;30(12–13):1395–405.

10. van Doorn HR. Emerging infectious diseases. Medicine (Abingdon). 2014;42(1):60–3.

11. Emergencies preparedness, response: cumulative number of reported probable cases of SARS [website]. Geneva: World Health Organization (https://www.who.int/csr/sars/country/2003_07_11/en/, accessed 12 April 2019).

12. Tikhomirov E. Epidemiology and distribution of plague. In: Dennis DT, Gage KL, Gratz N, Poland JD, Tikhomirov E. Plague manual: epidemiology, distribution, surveillance and control. Geneva: World Health Organization; 2011 (https://www.who.int/csr/resources/publications/plague/whocdscsredc992a.pdf, accessed 26 July 2020).

13. Blake PA. Historical perspectives on pandemic cholera. In: Wachsmuth I, Blake P, Olsvik Ø, editors. Vibrio cholerae and cholera: molecular to global perspectives. Washington (DC): American Society of Microbiology Press; 1994:293–5.

14. Cholera: the forgotten pandemic [webiste]. Geneva: World Health Organization; 2018 (https://www.who.int/cholera/the-forgotten-pandemic/en/, accessed 24 April 2019).

15. Cumulative number of confirmed human cases of avian influenza A(H5N1) reported to WHO [website] (cited 15 October 2014). Geneva: World Health Organization (http://www.who.int/influenza/human_animal_interface/H5N1_cumulative_table_archives/en/).

16. Implementation of the International Health Regulations (2005): report of the Review Committee on the Functioning of the International Health Regulations (2005) in relation to pandemic (H1N1) 2009: report by the Director-General. Sixty-fourth World Health Assembly, 2011. Geneva: World Health Organization (https://apps.who.int/iris/handle/10665/3350).

17. Emergencies presparedness, response: MERS-CoV summary updates [website] (cited 25 October 2014). Geneva: World Health Organization (http://www.who.int/csr/disease/coronavirus_infections/archive_updates/en/, .

18. Influenza at the human-animal interface: summary and assessment, 13 February to 9 April 2019 [website]. Geneva: World Health Organization; 2019 (https://www.who.int/influenza/human_animal_interface/Influenza_Summary_IRA_HA_interface_09_04_2019.pdf, accessed 12 April 2019).

19. Situation report: Ebola virus disease, 10 June 2016. Geneva: World Health Organization; 2016 (https://apps.who.int/iris/bitstream/handle/10665/208883/ebolasitrep_10Jun2016_eng.pdf?sequence=1, accessed 12 April 2019).

20. de Oliveira WK, de França GVA, Carmo EH, Duncan BB, de Souza Kuchenbecker R, Schmidt MI. Infection-related microcephaly after the 2015 and 2016 Zika virus outbreaks in Brazil: a surveillance-based analysis. Lancet. 2017;390(10087):861–70.

21. Lipsitch M, Cohen T, Cooper B, Robins JM, Ma S, James L, et al. Transmission dynamics and control of severe acute respiratory syndrome. Science. 2003;300(5627):1966–70.

22. Pandemic Influenza Preparedness Framework for the sharing of influenza viruses and access to vaccines and other benefits. Geneva: World Health Organization; 2011 (https://www.who.int/influenza/resources/pip_framework/en/, accessed 25 July 2020).

23. Fineberg HV. Pandemic preparedness and response—lessons from the H1N1 influenza of 2009. New Eng J Med. 2014;370:1335–42.

24. Pandemic preparedness and response in fragile, conflict and violence (FCV) situations, HNP Knowledge Brief. Washington (DC): World Bank Group; 2019 (http://documents1.worldbank.org/curated/en/302471552972075221/pdf/Pandemic-Preparedness-and-Response-in-Fragile-Conflict-and-Violence-FCV-Situations.pdf, accessed 25 July 2020).

25. A checklist for pandemic influenza risk and impact management: building capacity for pandemic response. Geneva: World Health Organization; 2018 (http://www.who.int/influenza/preparedness/pandemic/influenza_risk_management_checklist_2018/en/, accessed 18 April 2019).

26. Lee J-W, McKibbin WJ, editors. Estimating the global economic costs of SARS. In: Knobler S, Mahmoud A, Lemon S, et al., editors. Learning from SARS: preparing for the next disease outbreak: workshop summary. Washington (DC): National Academies Press; 2004.

27. Huber C, Finelli L, Stevens W. The economic and social burden of the 2014 Ebola outbreak in West Africa. J Infect Dis. 2018;218:S698–S704.

28. From panic and neglect to investing in health security: financing pandemic preparedness at a national level (English). Washington (DC): World Bank Group; 2017 (http://documents.worldbank.org/curated/en/979591495652724770/From-panic-and-neglect-to-investing-in-health-security-financing-pandemic-preparedness-at-a-national-level, accessed 25 July 2020).

29. Buliva E, Elhakim M, Minh T, Elkholy A, Mala P, Abubakar A, et al. Emerging and reemerging diseases in the World Health Organization (WHO) Eastern Mediterranean Region—progress, challenges, and WHO initiatives. Front Public Health. 2017;5:276.

30. Raad II, Chaftari A-M, Dib RW, Graviss EA, Hachem R. Emerging outbreaks associated with conflict and failing healthcare systems in the Middle East. Infect Control Hosp Epidemiol. 2018;39:1230–6.

31. Haq Z, Mahjour J, Khan W. Communicable diseases in the Eastern Mediterranean Region: prevention and control 2010–2011. East Mediterr Health J. 2013;19(10):888–91.

32. Global trends: forced displacement in 2017. Geneva: United Nations High Commissioner for Refugees; 2018 (https://www.unhcr.org/statistics/unhcrstats/5b27be547/unhcr-global-trends-2017.html, accessed 25 July 2020).

33. Memish ZA, Al-Rabeeah AA. Public health management of mass gatherings: the Saudi Arabian experience with MERS-CoV. Bull World Health Organ. 2013;91(12):899–899A.

34. Communicable disease alert and response for mass gatherings: key considerations, June 2008. Geneva: World Health Organization; 2008 (https://www.who.int/csr/Mass_gatherings2.pdf, accessed 25 July 2020).

35. Communicable diseases in Eastern Mediterranean Region: prevention and control 2010–2011 report. Cairo: WHO Regional Office for the Eastern Mediterranean; 2012 (https://apps.who.int/iris/bitstream/handle/10665/116803/EMRPUB_2012_EN_766.pdf?sequence=1&isAllowed=y, accessed 25 July 2020).

36. GBD 2015 Eastern Mediterranean Region Lower Respiratory Infections Collaborators. Burden of lower respiratory infections in the Eastern Mediterranean Region between 1990 and 2015: findings from the Global Burden of Disease 2015 study. Int J Public Health. 2018;63:97–108.

37. Minh N, Huda Q, Asghar H, Samhouri D, Abubakar A, Barwa C, et al. Zika virus: no cases in the Eastern Mediterranean Region but concerns remain. East Mediterr Health J. 2016;22:350–5.

38. Ebola virus disease [website]. Geneva: World Health Organization; 2020 (https://www.who.int/news-room/fact-sheets/detail/ebola-virus-disease, accessed 2 April 2019).

39. Epidemic and pandemic-prone diseases: MERS situation update, April 2019 [website]. Cairo: WHO Regional Office for the Eastern Mediterranean.

(http://www.emro.who.int/pandemic-epidemic-diseases/mers-cov/mers-situation-update-april-2019.html, accessed 16 May 2019).

40. Malik M, Mafi A, Mahjour J, Opoka M, Elhakim M, Muntasir MO. Novel coronavirus infection in the Eastern Mediterranean Region: time to act. East Mediterr Health J. 2013;19(1):S31–8.

41. Summary report on the intercountry meeting on the strategic framework for prevention and control of emerging and epidemic-prone diseases in the Eastern Mediterranean Region. Amman, Jordan 16–19 December 2018. Cairo: WHO Regional Office for the Eastern Mediterranean; 2019 (https://apps.who.int/iris/handle/10665/325825, accessed 26 July 2020).

42. Epidemic and pandemic-prone diseases: emerging infectious disease outbreaks reported in the Eastern Mediterranean Region in 2017 [website]. Cairo: WHO Regional Office for the Eastern Mediterranean; 2018 (http://www.emro.who.int/pandemic-epidemic-diseases/news/emerging-infectious-disease-outbreaks-reported-in-the-eastern-mediterranean-region-in-2017.html, accessed 16 May 2019).

43. Epidemic and pandemic-prone diseases: current outbreaks in the WHO Eastern Mediterranean Region [website]. Cairo: WHO Regional Office for the Eastern Mediterranean (http://www.emro.who.int/pandemic-epidemic-diseases/outbreaks/index.html, accessed 16 May 2019).

44. Epidemic and pandemic-prone diseases: infectious disease outbreaks reported in the Eastern Mediterranean Region in 2018. Cairo: WHO Regional Office for the Eastern Mediterranean; 2019 (http://www.emro.who.int/pandemic-epidemic-diseases/news/infectious-disease-outbreaks-reported-in-the-eastern-mediterranean-region-in-2018.html, accessed 12 May 2019).

45. Epidemic and pandemic-prone diseases: outbreak update – cholera [website]. Cairo: WHO Regional Office for the Eastern Mediterranean (http://www.emro.who.int/ar/pandemic-epidemic-diseases/cholera/index.html, accessed 12 May 2019).

46. Qamar FN, Yousafzai MT, Khalid M, Kazi AM, Lohana H, Karim S, et al. Outbreak investigation of ceftriaxone-resistant Salmonella enterica serotype Typhi and its risk factors among the general population in Hyderabad, Pakistan: a matched case-control study. Lancet Infect Dis. 2018;18(12):1368–76.

47. Global Polio Eradication Initiative. Polio now [website]. Geneva: World Health Organization; (http://polioeradication.org/polio-today/polio-now/, acessed 22 May 2019).

48. Atta H, Barwa C, Zamani G, Snow RW. Malaria and complex emergencies in the Eastern Mediterranean Region. East Mediterr Health J. 2016;22(4):235–6.

49. Joint external evaluation tool: International Health Regulations (2005), second edition. Geneva: World Health Organization; 2018 (https://www.who.int/ihr/publications/WHO_HSE_GCR_2018_2/en/, accessed 25 July 2020).

50. Pandemic and epidemic diseases: 2018 in retrospect [website]. Cairo: WHO Regional Office for the Eastern Mediterranean (http://www.emro.who.int/pandemic-epidemic-diseases/information-resources/ped-2018-in-retrospect.html, accessed 16 May 2019).

51. The work of WHO in the Eastern Mediterranean Region: annual report of the Regional Director 2016. Cairo: WHO Regional Office for the Eastern Mediterranean; 2017 (https://apps.who.int/iris/handle/10665/259257, accessed 25 July 2010).

52. Obtel M, Malik MR, Nguyen TMN, Buliva E, Elkhobby A, Salim SA, et al. Enhancing surveillance for early detection of Zika virus infection: strategies for the countries of Eastern Mediterranean Region. East Mediterr Health J. 2019;25(1):58–65.

53. Summary report on the consultative workshop to define an appropriate surveillance strategy for detection of clusters of Zika virus infection and other arboviral diseases using both syndromic- and event-based surveillance systems. Islamabad, Pakistan 14–16 November 2016. Cairo: WHO Regional Office for the Eastern Mediterranean; 2017 (https://apps.who.int/iris/handle/10665/258595?locale-attribute=fr&mode=full, accessed 26 July 2010).

54. Abubakar A, Elkholy A, Barakat A, Shrestha B, Elhakim M, Malik MR, et al. Pandemic influenza preparedness (PIP) framework: progress challenges in improving influenza preparedness response capacities in the Eastern Mediterranean Region, 2014–2017. J Infect Public Health. 2019;13(3):446–50.

55. The FAO–OIE–WHO collaboration: sharing responsibilities and coordinating global activities to address health risks at the animal–human–ecosystems interfaces. A Tripartite concept note, April 2010. Geneva, Paris, Rome: World Health Organization, World Organisation for Animal Health, Food and Agriculture Organization of the United Nations; 2010 (http://www.who.int/foodsafety/zoonoses/final_concept_note_Hanoi.pdf, 23 April 2019).

56. The Tripartite's commitment: providing multi-sectoral, collaborative leadership in addressing health challenges, October 2017. Geneva, Paris, Rome: World Health Organization, World Organisation for Animal Health, Food and Agriculture Organization of the United Nations; 2017 (http://www.who.int/zoonoses/tripartite_oct2017.pdf, accessed 12 April 2019).

57. Implementation of the Pandemic Influenza Preparedness (PIP) framework in the Eastern Mediterranean Region, July 2014–August 2016. Cairo: WHO Regional Office for the Eastern Mediterranean; 2018 (https://apps.who.int/iris/handle/10665/260162, accessed 26 July 2020).

58. Horton KC, Dueger EL, Kandeel A, Abdallat M, El-Kholy M, Al-Awaidy A, et al. Viral etiology, seasonality and severity of hospitalized patients with severe acute respiratory infections in the Eastern Mediterranean Region, 2007–2014. PloS One. 2017;12(7):e0180954.

59. Malik M, Mahjour J, Khan W, Alwan A. Influenza in the Eastern Mediterranean Region: identifying the unknowns for detection and control of epidemic and pandemic threats. East Mediterr Health J. 2016;22(7):428–9.

60. Summary report on the fourth intercountry meeting of the Eastern Mediterranean Acute Respiratory Infection Surveillance (EMARIS) network and the first scientific conference on acute respiratory infections in the Eastern Mediterranean Region. Amman, Jordan 11–14 December 2017. Cairo: WHO Regional Office for the Eastern Mediterranean; 2018. (https://applications.emro.who.int/docs/IC_Meet_Rep_2018_EN_20484.pdf, accessed 26 Juy 2020).

61. Vision 2023: health for all by all: a call for solidarity and action. Cairo: WHO Regional Office for the Eastern Mediterranean; 2018 (http://applications.emro.who.int/docs/RD_Vision_2018_20675_en.pdf?ua=1, accessed 24 April 2019).

62. Thirteenth General Programme of Work, 2019–2023. Geneva: World Health Organization (https://apps.who.int/iris/bitstream/handle/10665/324775/WHO-PRP-18.1-eng.pdf, accessed 26 July 2020).

63. R&D Blueprint [website]. Geneva: World Health Organization (http://www.who.int/blueprint/en/, accessed 4 April 2019).

64. Mackenzie JS, Jeggo M, Daszak P, Richt JA, editors. One Health: the human-animal-environment interfaces in emerging infectious diseases: the concept and examples of a One Health approach. Cham: Springer; 2013.65. Antimicrobial resistance [website]. Geneva: World Health Organization; 2018 (https://www.who.int/en/news-room/fact-sheets/detail/antimicrobial-resistance, accessed 16 May 2020).

65. Antimicrobial resistance [website]. Geneva: World Health Organization; 2018 (https://www.who.int/en/news-room/fact-sheets/detail/antimicrobial-resistance, accessed 16 May 2020).

66. Early detection, assessment and response to acute public health events: implementation of early warning and response with a focus on event-based surveillance. Geneva: World Health Organization; 2014 (https://www.who.int/ihr/publications/WHO_HSE_GCR_LYO_2014.4/en/, accessed 26 July 2020).

67. International Health Regulations (2005): IHR core capacity monitoring framework: checklist and indicators for monitoring progress in the implementation of IHR core capacities in States Parties. Geneva: World Health Organization; 2013 (https://www.who.int/ihr/checklist/en/, accessed 26 July 2020).

68. Outbreak surveillance and response in humanitarian emergencies: WHO guidelines for EWARN implementation. Geneva: World Health Organization; 2012 (https://apps.who.int/iris/handle/10665/70812, accessed 26 July 2020).

69. Epidemic and pandemic-prone diseases: outbreak update – cholera in Somalia, 12 May 2019 [website]. Cairo: WHO Regional Office for the Eastern Mediterranean; 2019 (http://www.emro.who.int/pandemic-epidemic-diseases/cholera/outbreak-update-cholera-in-somalia-12-may-2019.html, accessed 26 July 2020).

70. Principles of epidemiology in public health practice, third edition. An introduction to applied epidemiology and biostatistics. Atlanta (GA): Centers for Disease Control and Prevention (CDC); 2012 (https://www.cdc.gov/csels/dsepd/ss1978/index.html, accessed 26 May 2019).

71. Doherty M, Buchy P, Standaert B, Giaquinto C, Prado-Cohrs D. Vaccine impact: benefits for human health. Vaccine. 2016;34(52):6707–14.

72. Immunization [website]. Geneva: World Health Organization; 2019 (https://www.who.int/features/factfiles/immunization/en/, accessed 26 July 2020).

73. Vaccination in acute humanitarian emergencies: a framework for decision making. Geneva: World Health Organization; 2017 (https://apps.who.int/iris/handle/10665/255575, accessed 26 July 2020).

74. Health worker Ebola infections in Guinea, Liberia and Sierra Leone. A preliminary report, 21 May 2015. Geneva World Health Organization; 2015 (https://www.who.int/hrh/documents/21may2015_web_final.pdf, accessed 26 July 2020)

75. FAO-OIE-WHO MERS Technical Working Group. MERS: progress on the global response, remaining challenges and the way forward. Antiviral Res. 2018;159:35–44.

76. Infection prevention and control of epidemic- and pandemic-prone acute respiratory infections in health care. Geneva: World Health Organization; 2014 (https://www.who.int/csr/bioriskreduction/infection_control/publication/en/, accessed 26 July 2020).

77. World Health Organization Writing Group. Non-pharmaceutical interventions for pandemic influenza, national and community measures. Emerging Infect Dis. 2006;12(1):88–94.

78. Air Transport Monitor [website]. Montreal: International Civil Aviation Organization (ICAO); 2020 (https://www.icao.int/sustainability/pages/air-traffic-monitor.aspx, accessed 12 May 2019).

79. International Health Regulations (2005), third edition. Geneva: World Health Organization 2016 (https://www.who.int/ihr/publications/9789241580496/en/, accessed 26 July 2020).

80. Kayali G, Webby RJ, Samhouri D, Mafi AR, Bassili A. Influenza research in the Eastern Mediterranean Region: the current state and the way forward. Influenza Other Resp Viruses. 2013;7(6):914–21.

81. Gouglas D, Le TT, Henderson K, Kaloudis A, Danielsen T, Hammersland NC, et al. Estimating the cost of vaccine development against epidemic infectious diseases: a cost minimisation study. Lancet Glob Health. 2018;6(12):e1386–e96.

82. International Health Regulations (2005) IHR monitoring and evaluation framework. Geneva: World Health Organization; 2018 (https://www.who.int/publications/i/item/international-health-regulations-(-2005)-ihr-monitoring-and-evaluation-framework, accessed 26 July 2020).

83. Strategic Partnership for International Health Regulations (2005) and Health Security (SPH): simulation exercise [website]. Geneva: World Health Organization (https://extranet.who.int/sph/simulation-exercise, accessed 15 April 2019).

# ANNEX.

## MONITORING AND EVALUATION FRAMEWORK – CORE AND OPTIONAL INDICATORS

| Key performance indicators | Country baseline (2019) | Country target (2023) | Regional baseline (2019) | Regional target (2023) | Information source/ means of verification |
|---|---|---|---|---|---|
| *Strategic priority 1: Strengthen public health capacity to prepare for and prevent emerging and epidemic-prone infectious diseases* | | | | | |
| Countries have developed or updated an integrated preparedness plan for country-specific priority high-risk diseases (including viral haemorrhagic fevers, VBDs, waterborne diseases, and emerging respiratory diseases) | Yes/No | Yes | 5/22 | 15/22 | National integrated preparedness plan that includes priority high-risk diseases based on country context |
| Countries have updated and tested national pandemic influenza preparedness plan | Yes/No | Yes | 4/22 | 15/22 | Pandemic influenza preparedness plan and reports of simulation exercises |
| Countries have a preparedness plan related to all infectious hazards that is tested biennially | Yes/No | Yes | 0/22 | 15/22 | Simulation exercise review reports |
| Countries have developed or updated and disseminated public health policies, procedures and laws to support the disease-specific preparedness plan | Yes/No | Yes | 3/22 | 15/22 | Specific public health policies and laws (e.g. the Public Health Act) |
| Countries have established a formal One Health coordination mechanism to improve coordination between animal, human, food and environment sectors | Yes/No | Yes | 5/22 | 15/22 | One Health strategy, policy or similar document |
| Countries have conducted disease hotspot identification and generated public health risk maps for high-priority pathogens and endemic diseases (such as cholera, dengue, Crimean–Congo haemorrhagic fever, chikungunya, etc.) | Yes/No | Yes | 3/22 | 10/22 | Hotspot identification and public health risk mapping reports |
| Countries have conducted burden studies for endemic and high-risk emerging pathogens (seasonal influenza, cholera, dengue etc.), including economic burden | Yes/No | Yes | 2/22 | 12/22 | Burden estimation study reports |
| Countries are generating evidence on the use and effectiveness of vaccines for emergencies, including options to address issues around vaccine misperceptions and hesitancy | Yes/No | Yes | 5/22 | 15/22 | Study reports |

| | | | | | |
|---|---|---|---|---|---|
| Countries have introduced new vaccines for prevention or control of emerging infectious diseases in a systematic manner | Yes/No | Yes | 4/22 | 10/22 | New vaccines introduced targeting emerging infectious diseases |
| Countries have introduced a pyramid-model field epidemiology training programme for health-care workers, including workforce from veterinary and other sectors | Yes/No | Yes | 2/22 | 10/22 | Field epidemiology training curriculum and training reports |
| Countries have trained multisectoral rapid response teams at national and subnational levels | Yes/No | Yes | 15/22 | 22/22 | Training reports |
| Countries have established a mechanism to operationalize EOCs (for countries affected by complex emergencies or major outbreaks) | Yes/No | Yes | 10/22 | 15/22 | Reports/standard operating procedures |
| *Strategic priority 2: Strengthen capacity for the early detection and investigation of outbreaks of emerging and epidemic-prone infectious diseases* | | | | | |
| Countries have established functional testing capacity to test high-risk pathogens using internationally accepted biosafety, biosecurity and quality control practices | Yes/No | Yes | 12 /22 | 22/22 | Copy of national laboratory strategic plan or national laboratory policy defining a tiered laboratory network |
| Countries have developed laboratory capacity to diagnose seasonal and novel influenza viruses | Yes/No | Yes | 18/22 | 22/22 | National influenza centre/influenza report – national laboratory system can conduct 5 or more of the 10 core tests |
| Countries have national public health laboratories with acceptable proficiency test score for high-risk pathogens (organized by WHO) | Yes/No | Yes | 14/22 | 22/22 | External quality assessment results |
| Countries have developed or updated standard operating procedures for specimen referral (collection, transportation, shipping and testing), data sharing and quality control | Yes/No | Yes | 5/22 | 12/22 | Policies, guidelines and standard operating procedures |
| Countries have established/strengthened the early warning surveillance system (for countries affected by complex emergencies) | Yes/No | Yes | 5/12 | 8/8 | Surveillance reports and EWARN tools |
| Countries have an electronic platform for routine and notifiable disease surveillance system | Yes/No | Yes | 6/22 | 15/22 | Functioning electronic platforms |
| Countries are mapping a priority list of emerging diseases, including a vulnerability profile | Yes/No | Yes | 0/12 | 10/22 | Disease prioritization reports |
| Countries are conducting joint investigation and rapid risk assessment at the animal–human interface for emerging zoonotic pathogens | Yes/No | Yes | 5/22 | 15/22 | Investigation/rapid risk assessment reports |

| | | | | | |
|---|---|---|---|---|---|
| *Strategic priority 3: Build capacity to implement high-impact control strategies for rapidly responding to high-risk emerging and epidemic-prone infectious disease* | | | | | |
| Countries have developed policies and programmes for vaccination against seasonal influenza among health care workers and other groups at high risk | Yes/No | Yes | 6/22 | 15/22 | Immunization strategy, policy or similar document |
| Countries have appropriate measures in place to control emerging vector-borne diseases based on entomological surveillance evidence as outlined in a national strategy/plan for the control of VBDs | Yes/No | Yes | 3/22 | 10/22 | Progress report, strategic plan for the control of VBDs |
| Countries are systematically assessing the quality and effectiveness of outbreak response operations (after action review) | Yes/No | Yes | 3/22 | 15/22 | Report of outbreak review |
| Proportion of outbreaks responded to in relation to all outbreaks that required outside support in the previous 12 months | Percent | 80% | – | 80% | Outbreak logs and reports |
| Countries are integrating seasonal influenza vaccines into routine immunization | Yes/No | Yes | 0/22 | 5/22 | Health ministry policy for integrating influenza vaccine into routine immunization |
| Countries have developed and tested emergency risk communication strategy/plans for emerging and high-risk pathogens | Yes/No | Yes | 2/22 | 10/22 | Communication strategy/plan |
| Countries have developed or updated standard operating procedures and other guidelines for surveillance and conducting integrated field investigations during outbreaks | Yes/No | Yes | 4/22 | 12/22 | Standard operating procedures and other guidelines |
| *Strategic priority 4: Enhance knowledge management and innovation* | | | | | |
| Countries are conducting disease and economic burden studies on emerging infectious diseases, including influenza and other diseases for which effective medical countermeasures exist (such as vaccines) | Yes/No | Yes | 0/22 | 5/22 | Progress report |
| Countries are conducting assessments of the effectiveness of non-pharmaceutical prevention and control strategies for infectious diseases, such as vector control and WASH strategies. | Yes/No | Yes | 0/22 | 6/22 | Progress report |
| Countries are participating in exchange research programmes and conferences, regionally and internationally | Yes/No | Yes | 4/22 | 11/22 | Progress report |
| Countries are conducting research to elucidate the mechanisms contributing to transmission of viruses between animals and humans | Yes/No | Yes | 0/22 | 3/22 | Research papers |