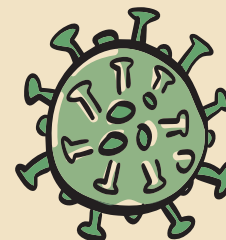


VERSION 1



# Managing epidemics

Key facts about major deadly diseases



World Health  
Organization



# Managing epidemics

Key facts about major deadly diseases

*Managing epidemics: key facts about major deadly diseases*

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# Foreword



This year marks the 100th anniversary of Spanish flu, the deadliest outbreak in recorded history. Up to 50 million people were killed, more than the death toll from the First World War.

Thankfully, we have not seen a public health emergency on that scale since then. But we may at any time. Outbreaks are a fact of life, and the world remains vulnerable. We do not know where or when the next global pandemic will occur, but we do know that it will take a terrible toll, both on human life, and on the global economy.

None of us will ever forget the West African Ebola outbreak in 2014. It taught us a valuable lesson: that global health security is only as strong as its weakest link. No-one is safe until everyone is safe.

Keeping the world safe is one of WHO's three top strategic priorities in our new General Programme of Work. We are setting ourselves a goal that over the next five years, 1 billion more people will be better protected from epidemics and other health emergencies.

This manual is a valuable tool to help countries make progress towards that goal. It offers expert guidance to help WHO's country representatives and others to respond quickly in the earliest stages of an outbreak.

But it's not enough just to respond to outbreaks. We must do our best to prevent them by addressing the root cause of health insecurity: the lack of access of the most vulnerable people to essential health services.

Ultimately, it's the absence of universal health coverage that is the greatest threat to health security. Universal health coverage and health security are two sides of the same coin.

2018 is also a milestone year for WHO.

It's our 70th birthday – a reminder that the reasons we were created are as relevant now as they were at our beginning. WHO was founded on the principle that all people should be able to realize their right to the highest possible level of health. "Health for all" has always been our guiding vision.

Can we create a pandemic-free world? There is no such thing as a guarantee, but with meticulous preparation and rapid response, we can prevent most outbreaks from getting out of control, and limit the impact of those that spread internationally.

First, we must build and sustain resilient capacities at national, regional and global levels to prevent, detect and respond to outbreaks, in accordance with the International Health Regulations.

And second, we must ensure that populations affected by emergencies have rapid access to essential life-saving health services, including medicines and vaccines.

That's why WHO works all around the world to strengthen health systems, built on the foundation of people-centred primary health care that focuses on health promotion and disease prevention, with a strong focus on surveillance systems.

Delivering on these priorities will cost money of course, but only a fraction of what remaining unprepared will cost. In the end, prevention is not only better than cure; it's cheaper.

**Dr Tedros Adhanom Ghebreyesus**  
*Director-General of the World Health Organization*



# About this handbook

## Handbook purpose

Epidemics of infectious diseases are occurring more often, and spreading faster and further than ever, in many different regions of the world. The background factors of this threat are biological, environmental and lifestyle changes, among others.

A potentially fatal combination of newly-discovered diseases, and the re-emergence of many long-established ones, demands urgent responses in all countries. Planning and preparation for epidemic prevention and control are essential.

The purpose of this “Managing epidemics” manual is to provide expert guidance on those responses.

Although this publication is open to a wide readership, it is primarily intended to help the World Health Organization (WHO) country representatives (WRs) to respond effectively and rapidly at the very start of an outbreak.

The manual provides concise and basic up-to-date knowledge with which WRs can advise Ministries of Health in all countries. Specifically, it examines and explains in detail a total of 15 different infectious diseases and the necessary responses to each and every one of them.

These diseases have been selected because they represent potential international threats for which immediate responses are critical. Nearly all of them are subject to WHO’s International Health Regulations (2005) monitoring, and are part of the Global Health Security Agenda.

Perhaps the greatest threat outlined in the manual is an influenza pandemic, which is both unpredictable and inevitable. In the worst-case scenario, there will be no protective vaccine for six months or longer after the virus is identified, and even there will be a global shortage of doses.

On this and other threats, the manual focuses on practical and indispensable things to know about infectious diseases that are most important for national political and operational decision-makers; it also links readers to more exhaustive WHO guidance. It has been developed in parallel with the creation of the WHO MOOCs (Massive Open Online Courses) on openWHO (<https://openwho.org>).

## Handbook structure

The manual is structured in three parts.

- **Part One “Epidemics of the 21st century”** provides vital insights on the main features of the 21st century upsurge and the indispensable elements to manage them.
- **Part Two “Be in the know. 10 key facts about 15 deadly diseases”** contains key information about 15 diseases (Ebola Virus Disease, Lassa Fever, Crimean-Congo haemorrhagic fever, Yellow Fever, Zika, Chikungunya, Avian and Other Zoonotic Influenza, Seasonal Influenza, Pandemic Influenza, Middle East Respiratory Syndrome, Cholera, Monkeypox, Plague, Leptospirosis and Meningococcal Meningitis). This section provides tips on the interventions required to respond to epidemics of all these diseases.
- **Part Three “Tool boxes”** gives an overview and summarized guidance on some other important topics, including: the role of WHO, the International Coordinating Group, laboratory diagnosis and shipment of infectious diseases substances, and vector control.

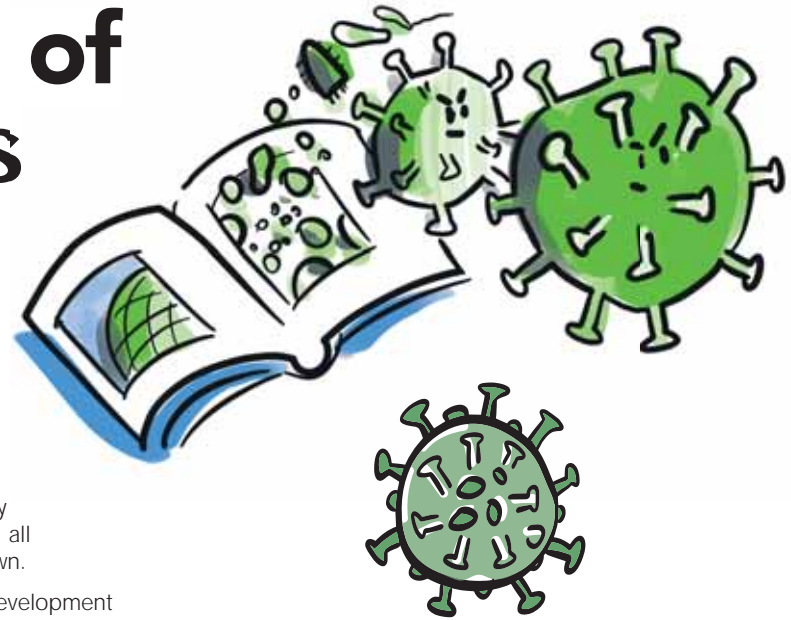
The handbook enables the three levels of WHO – its Headquarters, Regional Offices and Country Offices to work efficiently together by building the foundations of a shared conceptual and thinking framework, which includes common terminology.

This “Managing epidemics” manual will be regularly updated. The next versions will incorporate additional infectious diseases.

PART I

# Epidemics of the 21st century

# The re-emergence of infectious diseases



## The threat continues

We are continuously learning about the unpredictable powers of nature. This is nowhere more true than in the continuous evolution of new infectious threats to human health that emerge – often without warning – from the natural environment.

Already in these first two decades of the 21st century, the world has been sharply reminded time after time of the degree to which people in all countries and on all continents remain chronically vulnerable to infectious diseases, known and unknown.

In the 1970s, and for years afterwards, this remarkable progress, including the development of new vaccines, antibiotics and other treatments and technologies, led to a proclamation of a victory of mankind over microbes. Many experts thought it was “the time to close the book on the problem of infectious diseases” (Jesse Steinfeld, MD, US Surgeon General, 1969).

Here lay the roots of a dangerous complacency. The microbes didn’t go away. They just went out of sight. Instead, the focus turned to chronic, noncommunicable diseases, which came to receive much more attention. But nature was by no means in retreat. In fact, it seemed to return and took many health institutions and decision makers by surprise.

Since 1970, more than 1,500 new pathogens were discovered, of which 70% proved to be of animal origin: a connection that deserves renewed scrutiny. Not all of them have had a public health impact but some of them have become famous. They included the Ebola virus, in 1976, and the human immunodeficiency virus (HIV), in 1983.

Pause for a moment and reflect that HIV, a relatively new disease in human history, has infected about 70 million people in just 35 years, and killed an estimated 35 million people in the same period. Consider also that in the last 40 years, Ebola has surfaced in almost 25 separate and deadly outbreaks, often after long spells in which it has apparently lain dormant. And now ask the question:

## Will history repeat itself?

The answer must be: Yes, it will. A new HIV, a new Ebola, a new plague, a new influenza pandemic are not mere probabilities. Whether transmitted by mosquitoes, other insects, contact with animals or person-to-person, the only major uncertainty is when they, or something equally lethal, will arrive.

The obvious follow-up question is: So what are we doing about it? This purpose of this handbook is to provide as many answers as possible. In doing so it examines a range of challenges and real or potential solutions, ranging from the medical and technological to the social and political.



## The 21st century: already a long series of scourges

In order to try to see the road ahead more clearly, we need frequently to look over our shoulders – all the more so, because these early years of the 21st century have already been deeply scarred by so many major epidemics.

Take plague, one of the most ancient scourges. A thing of the past? By no means. A major outbreak in Madagascar in 2017 led to a total of at least 2,417 confirmed, probable and suspected cases, including 209 deaths. Most cases were of the more fatal pneumonic type which is also transmissible from person to person, but there were also several hundred cases of bubonic plague. Nine countries and territories with trade and travel links to Madagascar were put on plague preparedness alert.

The lesson here is that, over time, diseases very rarely disappear. And there always seems to be room for new ones.

SARS – Severe acute respiratory syndrome - was unheard of before 2003. But it affected more than 8,000 people, killing about one in ten of them, causing fear and panic across the world, and inflicting enormous economic damage, especially in Asian countries.

In 2009, a novel influenza virus, H1N1, started to spread, creating the first influenza pandemic of the 21st century. But – and this is a reason for cautious hope - it was not as severe as expected thanks to recent preparedness efforts. The importance of these efforts is a core issue in this handbook.

In 2012-2013, a new virus surfaced in the Middle East, causing an epidemic of what became MERS – Middle East respiratory syndrome – that spreads fatally into many countries beyond that region.

The Ebola epidemic in West Africa (Guinea, Liberia, and Sierra Leone) in 2014 was unlike the previous 24 localized outbreaks observed since 1976. Instead of being restricted geographically, this one seriously affected three African countries and spread to six other countries in three continents, and sparked alarm worldwide.

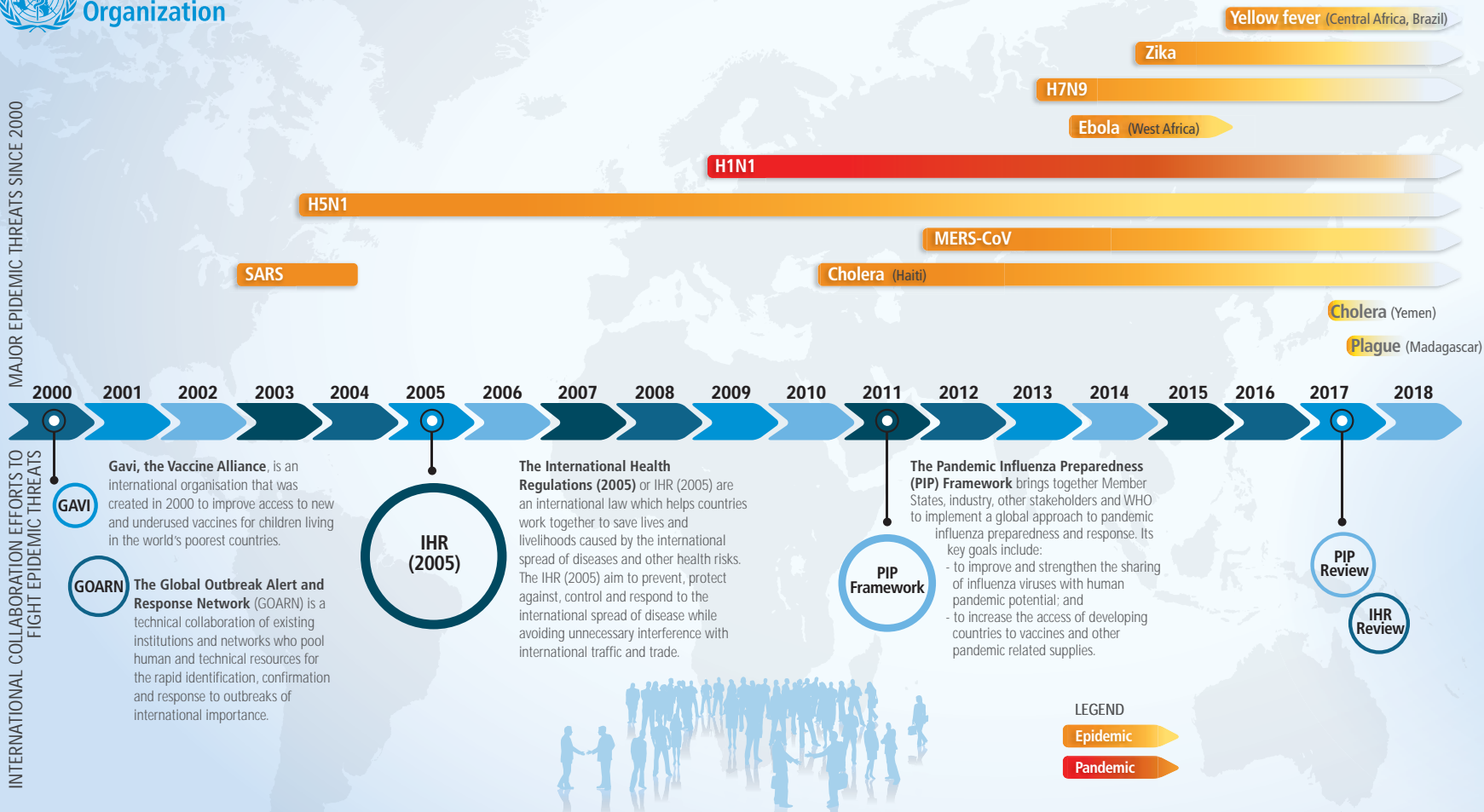
In 2015, the Zika virus, transmitted by the *Aedes Aegypti* mosquito, triggered a wave of microcephaly in Brazil. This disease causes dreadful damage in the brains of unborn babies. Almost 70 countries, one after another, then experienced their own Zika epidemic. There are probably many more to come, because most of the global intertropical zone has a high density of *Aedes Aegypti* that transports the disease.

And so a clear pattern continues to take shape. Old diseases – Cholera, Plague, Yellow fever among them – often return, and new ones invariably arrive to join them. About 40 outbreaks of cholera alone are reported to WHO every year.



MAJOR EPIDEMIC THREATS SINCE 2000

INTERNATIONAL COLLABORATION EFFORTS TO FIGHT EPIDEMIC THREATS



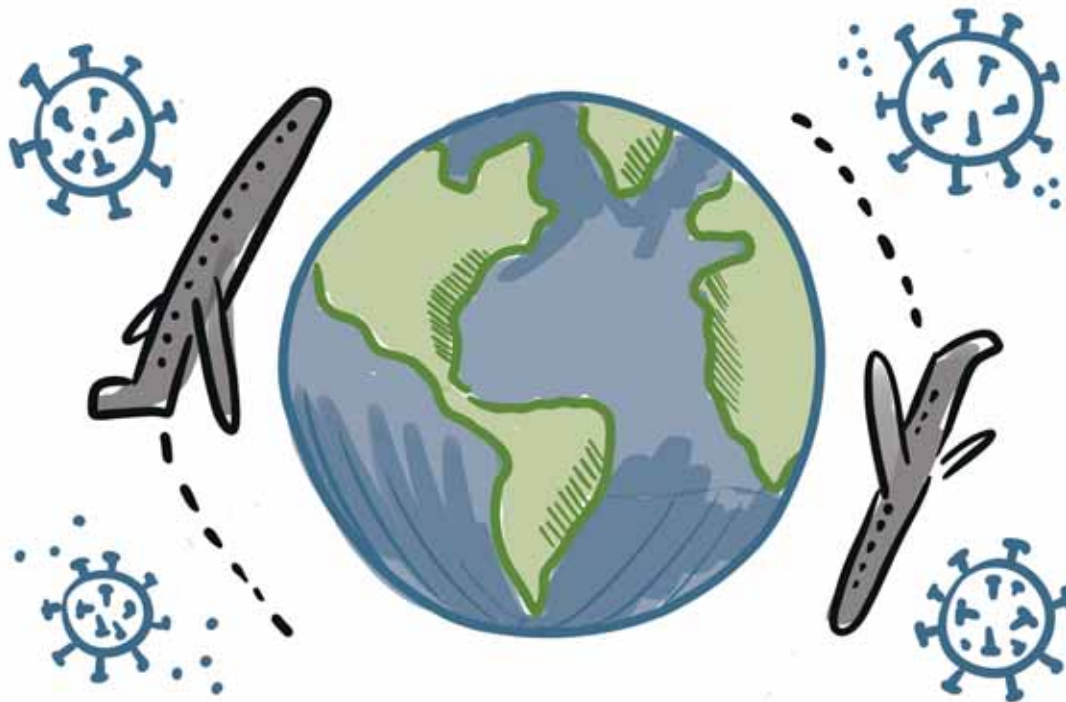
**LEGEND**

- Epidemic (Yellow arrow)
- Pandemic (Orange arrow)



# Timeline

Major infectious threats in the 21st Century & collaboration mechanisms to fight against them



### **Faster and further with a greater impact**

This pattern has another, deeply troubling aspect. The epidemics in the 21st century are spreading faster and further than ever. Outbreaks that were previously localized can now become global very rapidly – just as fast, in fact, as an intercontinental aircraft can fly. Thus, an individual flying from one side of the world can introduce a new disease into the other, within hours, and before even showing symptoms. And in this way, far from its origins, the microbe finds a new home.

For example, the influenza pandemic of 2009 reached all continents in less than nine weeks. In recent outbreaks, yellow fever made it all the way from Angola to China, but, fortunately, there were only imported cases with no sustainable circulation in the mosquito population.

In 2015, it took just one traveler returning home to the Republic of Korea from spending time in the Middle East to bring MERS back with him. The consequences: a Korean outbreak, 186 cases, 36 deaths,

and outbreak-related losses of approximately US\$ 8 billion, all in the space of two months.

Thus, 21st century epidemics can spread more widely and more quickly, potentially affecting ever-greater numbers of people. They also can have a ruinous impact on the economy of the affected country and spill over into to the global economy, disrupting travel, trade and livelihoods.

## Ready and able to detect the next outbreak

Given the effects of globalization, the intense mobility of human populations, and the relentless urbanization, it is likely that the next emerging virus will also spread fast and far. It is impossible to predict the nature of this virus or its source, or where it will start spreading.

But we can say, with a high degree of certainty, that when it comes, there will be (a) an initial delay in recognising it; (b) a serious impact on travel and trade; (c) a public reaction that includes anxiety, or even panic and confusion, and (d) this will be aided and abetted by media coverage.

The concept of global health security, a central issue in this handbook, represents a new determination by, or on behalf of, human society to protect itself from the health impact and social disruption caused by outbreaks. It encompasses a spectrum of ways and means that offer worldwide protection against the threats of infectious diseases, backed by revised and more powerful International Health Regulations (2005).

But to make the world safer, global health security depends crucially on much greater awareness, cooperation and collaboration between individual countries, agencies, organizations and communities. The continuing scientific uncertainty around disease emergence requires even more collaboration and global awareness than has previously existed, not least to improve early detection.

Recent outbreaks, however, show how difficult this can be, even with good public health surveillance systems. Early recognition of emergence typically starts with clinicians who can detect unusual clusters of severe cases, take samples to allow laboratory diagnostics and alert surveillance units.

Often, poorer communities around the world, especially those in remote areas, lack easy access to care. This has major implications when an infectious threat occurs. The Ebola outbreak in West Africa remained undiagnosed for more than two months. This time lag allowed the virus to spread unseen, and to reach capital cities where the outbreaks grew into large epidemics. In such circumstances, it is essential to raise clinicians' awareness and provide them with the relevant knowledge and diagnostic tools to enable them to perform effectively as detectors and first-line responders.

As we have signaled earlier, another indispensable element of increasing health security is preparedness. This should be flexible enough to adapt to any novel agent, but should be directed primarily at known pathogens because some of them are likely to behave differently than previously. The recent plague outbreak in Madagascar, described earlier, is a good example of known diseases with new patterns.

In addition, the fear generated by the emergence of a previously-unknown infection may be greatly out of proportion to its real public health impact. Fear often generates inadequate decisions or inappropriate behaviours, including stigma of certain at-risk populations. The impact on travel and trade and on economies can be disproportionate, as it has been seen in the Republic of Korea during the MERS epidemic. To a certain extent, global health security also encompasses economic and human security. Thus, risk communication is critical to minimise the social, political and subsequently economic impact of an epidemic, and this is also a major focus of this publication.





### One Health and emerging and re-emerging pathogens

Epidemics are sparked either by the re-emergence of pathogens that have been familiar for a long time, but now threaten new, immunologically vulnerable populations, or are newly-emerging ones. They come in a daunting array of species of bacteria, viruses, fungi and parasites. Some are borne in contaminated water or food; others are carried in the air we breathe and by human touch.

As noted earlier, 70% of emerging human pathogens come from animals. This is a burgeoning threat, because animals are intensively farmed, transported for trade and kept in close contact with other species and humans in market places.

Early detection often relies on close collaboration between the animal health and wildlife sectors (the "One Health" approach); otherwise early signals of emergence in animals or the environment are often missed. This collaborative approach, another pivotal element of global health security, can also contain outbreaks at an early stage by reducing animal-to-human transmission.

Because these diseases are rare and outbreaks are generally contained quickly, these epidemics have not been a priority among the research community or manufacturers in the development of medical countermeasures. Nevertheless, more research is needed to identify precisely the modes of transmission and medical countermeasures.

Today's harsh reality is that there is as yet no vaccine or treatment for most emerging diseases. This is not as hopeless as it might seem at first. WHO has developed a Research & Development (R&D) Blueprint for action to prevent epidemics: it is a global strategy and preparedness plan that allows the rapid activation of R&D activities during epidemics. Its aim is to fast-track the availability of effective tests, vaccines and medicines that can be used to save lives and avert large scale crisis. However, public health interventions have to rely primarily on social-distancing measures to reduce human transmission, and on controlling the source of infection (for instance by culling of infected animals/elimination of the reservoir). Thus, to prevent the spread of emerging diseases, it is vitally important to ensure early detection of a new pathogen and the start of human-to-human transmission.

Enhanced international information and virus sharing among laboratories is being actively encouraged and pursued. This is necessary to enable research and development of countermeasures. The results of this sharing are potentially life-saving interventions (vaccines, diagnostics and therapeutics). But they also need to be underpinned by specific mechanisms to ensure they become widely available and accessible on an equitable basis.





### Known epidemics: still a severe threat

Fortunately, control programmes are already long-established and widely-applied for some known epidemic diseases, such as cholera, HIV infection, influenza, meningitis, malaria, tuberculosis and yellow fever.

However, even if medical countermeasures are available, these diseases remain a threat for many of the world's populations, either because of their rapidly evolving nature (e.g. influenza) or because equitable access to effective public health measures is difficult. There are many reasons for limited access to vaccines: production capacity does not meet the demand (e.g. yellow fever, pandemic influenza), explosive outbreaks exhaust the available vaccines (e.g. meningitis), or the absence of markets prevents access to the intervention in case of emergencies (e.g. oral cholera vaccine). In addition, in many affected countries, the weakness of the existing health care system prevents effective access to medical interventions (diagnostics and treatment).

Therefore, although it is reassuring that sound knowledge and a range of potential control interventions are available, expert guidance must be constantly updated to incorporate scientific and technological progress. Equally important, access to life-saving interventions must be improved in all settings worldwide.

The current global strategy is to reach elimination or eradication of these diseases through vaccination or investment in and implementation of other countermeasures.



## Strengthening health systems: essential in epidemics

In order to mitigate the impact of epidemics, protect the health workforce and ensure continuity of health services during and after them, stronger health systems are needed. Epidemics and pandemics put these systems under great pressure and stress. The sudden influx of large numbers of sick individuals to health facilities stretches the systems' capacity and resources, even more so and more noticeably where resources are already scarce.

When an epidemic emerges and spreads, it inevitably draws most of health responders' attention and monopolizes most of the health system's human and financial resources, as well as medical products and technologies.

People, efforts, and medical supplies all shift to respond to the emergency. This often leads to the neglect of basic and regular essential health services. People with health problems unrelated to the epidemic find it harder to get access to health care services. Some may die as a result, if the disruption overwhelms the health system. Mortality rates of other diseases for which people could not get treatment may rise.

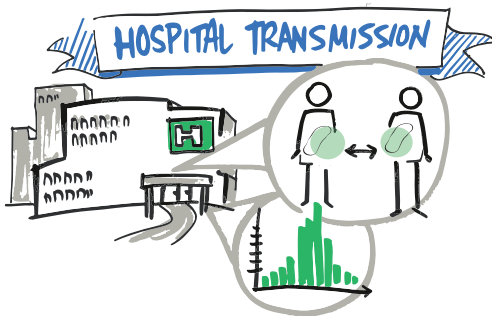
Furthermore, health care settings, and especially emergency rooms, can become hubs of transmission. Many people get infected there, if prevention and control measures are not properly implemented. This is particularly true for unknown and emerging pathogens (for instance, MERS). A delay in the recognition of the disease will lead to delay in applying the right protection measures. Infected patients will be able to transmit the disease because health care workers, family members and other patients will not know how to protect themselves. Because health care settings and emergency rooms are usually crowded, the lack of appropriate infection prevention and control for example through triage, isolation, and other precautions can be very significant.

Health systems resilience after epidemics may be challenging for unprepared health systems. Indeed, if the health system is ill-prepared to cope with epidemics of infectious diseases, health care workers, at the frontline of the response, may themselves become infected and die. Tragic as such cases are,



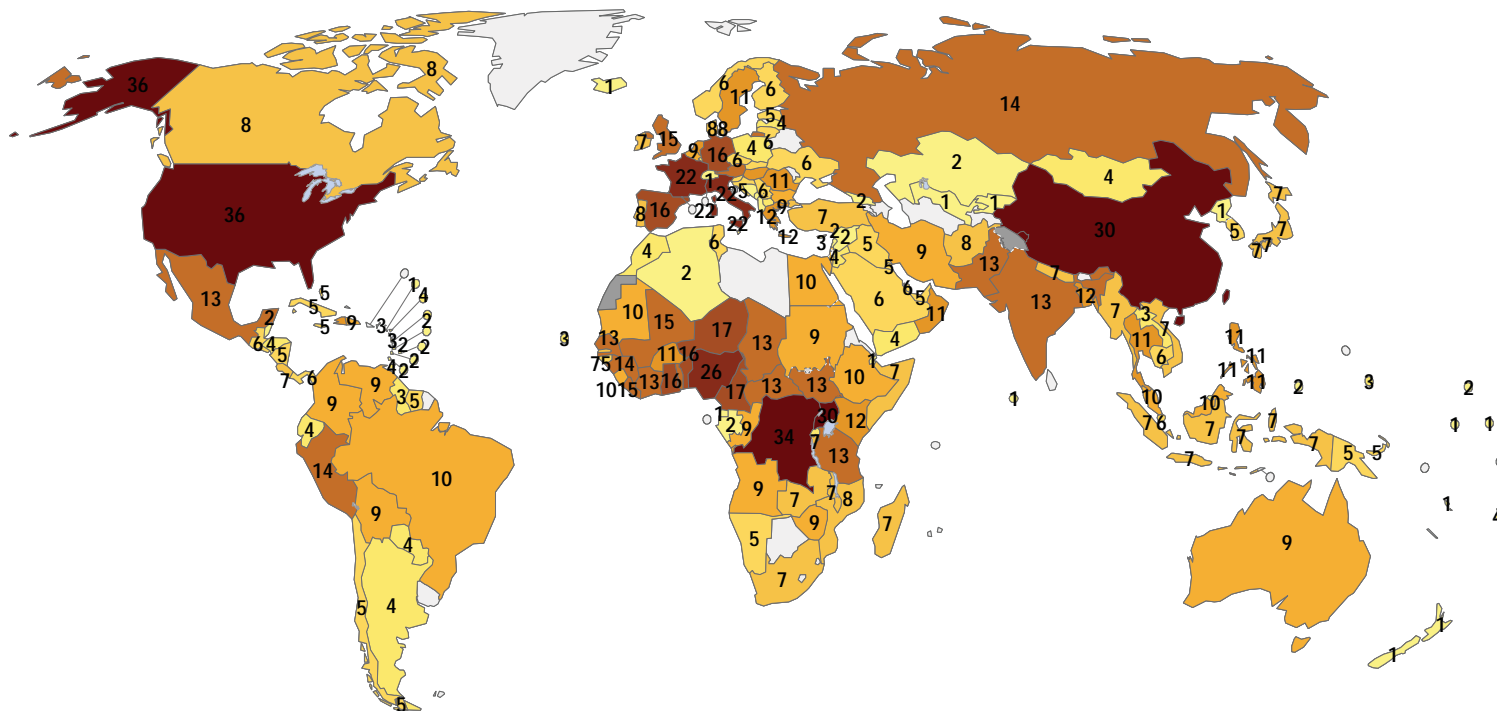
they have wider consequences. In countries where there are health staff shortages, the loss of several more health workers further weakens the health system. It takes years to train new medical staff and rebuild the health workforce. In the meantime, other constraints are burdening the health system that still has to provide the usual and regular services.

Long-term substantial investments should therefore be made to strengthen health systems so they are able to provide safe, effective and qualitative health services before, during and after epidemics. Critical elements include an appropriate health financing system and a fit-for-purpose workforce that is trained, safe and provided with personal protective equipment. In addition, access to essential medical products and technologies and a business continuity plan are essential to ensure that health systems are strong enough to withstand the increased needs and to mitigate the impacts of very disruptive epidemics.



# Burden of epidemics: illustrations

Epidemic events\* globally, 2011 – 2017\*\*: A total of 1,307 epidemic events, in 172 countries



\* Analysis excluded Poliomyelitis. The following *epidemic and pandemic diseases* were analysed: Avian Influenza A(H5N1), A(H7N9), A(H7N6) A(H10N8), A(H3N2), A(H5N6), A(H9N2), Chikungunya, Cholera, Crimean-Congo haemorrhagic fever, Ebola virus disease, Lassa fever, Marburg virus disease, Meningitis, MERS-CoV, Monkeypox, Nodding syndrome, Nipah virus infection, Plague, Rift Valley fever, Shigellosis, Typhoid fever, Viral haemorrhagic fever, West Nile fever, Yellow fever, Zika virus disease. If a disease caused more than 1 epidemic event by year in a country, it was only counted once for the year it occurred in that country. Includes cases imported or locally transmitted.

\*\* WHO/IHM data as of 12 January 2018 (note: 2017 data is not complete)

Source: data reported to WHO and in media

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Epidemic events\* globally, 2011 – 2017\*\*: A total of 1,307 epidemic events  
 Number of epidemic events\* by disease and year

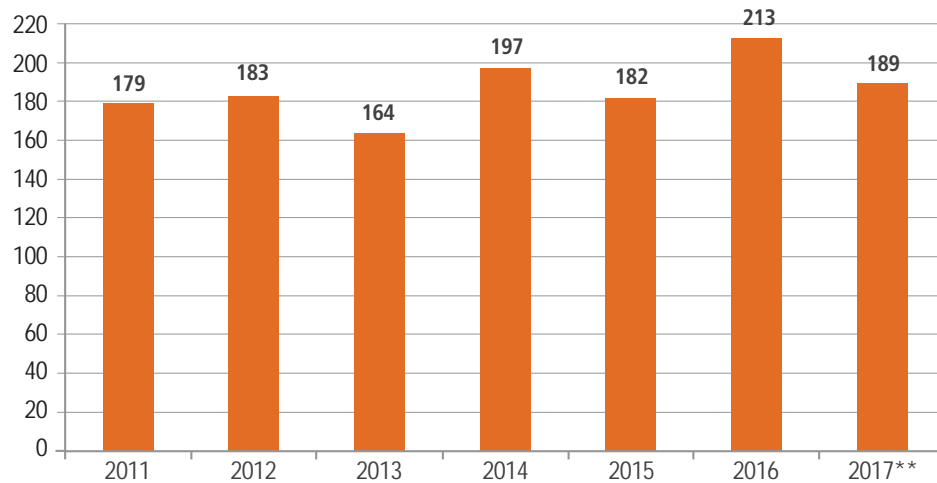
								TOTAL
Yellow fever	17	12	8	2	4	10	4	57
Chikungunya	8	10	3	29	27	14	4	95
Viral haemorrhagic fever						6	4	10
Ebola virus disease	1	2		11	4	3	1	22
Marburg virus disease		1		1			2	4
Crimean-Congo haemorrhagic fever	3	5	6	8	7	7	13	49
Rift Valley fever	1	1	1	1	1	4	5	14
Cholera	62	51	47	37	44	42	25	308
Typhoid fever	20	23	5	2	8	3	14	75
Shigellosis	25	24	28	29	4	2	1	113
Plague	8	7	6	10	7	6	3	47
Lassa fever	2	1	2	3	2	7	6	23
West Nile fever	11	15	15	11	11	18	10	91
Zika virus disease			5	7	19	54	52	137
Meningitis	14	20	19	19	19	23	23	137
MERS-CoV		3	10	17	12	7	8	57
Influenza A	5	6	7	9	10	5	9	51
Monkeypox					2	2	5	10
Nodding syndrome		1	1					2
Nipah virus infection	1	1	1	1	1			5
	2011	2012	2013	2014	2015	2016	2017**	

\* Analysis excluded Poliomyelitis. The following *epidemic and pandemic diseases* were analysed: Avian Influenza A(H5N1), A(H7N9), A(H7N6) A(H10N8), A(H3N2), A(H5N6), A(H9N2), Chikungunya, Cholera, Crimean-Congo haemorrhagic fever, Ebola virus disease, Lassa fever, Marburg virus disease, Meningitis, MERS-CoV, Monkeypox, Nodding syndrome, Nipah virus infection, Plague, Rift Valley fever, Shigellosis, Typhoid fever, Viral haemorrhagic fever, West Nile fever, Yellow fever, Zika virus disease. If a disease caused more than 1 epidemic event by year in a country, it was only counted once for the year it occurred in that country. Includes cases imported or locally transmitted.

\*\* WHO/IHM data as of 12 January 2018 (note: 2017 data is not complete)

Source: data reported to WHO and in media

## Number of epidemic events\* by year\*\*



\* Analysis excluded Poliomyelitis. The following *epidemic and pandemic diseases* were analysed: Avian Influenza A(H5N1), A(H7N9), A(H7N6), A(H10N8), A(H3N2), A(H5N6), A(H9N2), Chikungunya, Cholera, Crimean-Congo haemorrhagic fever, Ebola virus disease, Lassa fever, Marburg virus disease, Meningitis, MERS-CoV, Monkeypox, Nodding syndrome, Nipah virus infection, Plague, Rift Valley fever, Shigellosis, Typhoid fever, Viral haemorrhagic fever, West Nile fever, Yellow fever, Zika virus disease. If a disease caused more than 1 epidemic event by year in a country, it was only counted once for the year it occurred in that country. Includes cases imported or locally transmitted.

\*\* WHO/IHM data as of 12 January 2018 (note: 2017 data is not complete)

Source: data reported to WHO and in media

EPIDEMICS are a BURDEN:



# Challenges and risk factors for 21st century epidemics

The face of epidemics and pandemics has changed in the recent past and continues to do so. Many new factors contribute to an increase in the transmissibility and severity of infectious diseases.

## New lifestyles spread diseases further

New and more intense factors amplify the transmission of diseases, either because they increase contacts between people, or between animals and people. In an era of rapid global change, many of these factors are almost inevitable. Among them are the fast and intense mobility of people, with increased transport and international travel, and greater inter-connectivity between megacities which are major transport hubs for aircraft, trains, road vehicles and ships.

At the same time, globalization means increased trade among countries as well as greater movement of people within and between them. For decades, more and more people have been migrating from the countryside into cities, in search of better jobs and improved living standards. The unprecedented levels of urbanization and swelling populations of city dwellers inescapably pose greater risks of infectious disease transmission.

These risks apply at least equally to densely populated areas on the periphery of cities, where rural areas overlap with them. Here, close and repeated contacts between people and livestock, domestic animals and wild animals. To make matters worse, these peri-urban areas are often densely populated, and local people have less access to health care. The double jeopardy here is that their infections may go undetected and untreated, while the options for detection, diagnosis and control are reduced. The Ebola outbreak in West Africa in 2014 has dramatically demonstrated this.

Regrettably, the early years of the 21st century have seen many humanitarian emergencies, the massive displacement of populations fleeing from civil unrest, political instability, conflicts and natural disasters. Millions of people have been uprooted from their homes and become either refugees, asylum-seekers or economic migrants, and find themselves living in often overcrowded, that also increase infection risks.



Potentially hazardous changes are also taking place in the use of land, agricultural practices and food production, such as live poultry and animal markets, and deforestation – which also leads to increased contact between people and wildlife. Some of these animals – monkeys, for example - are likely sources of new pathogens. Finally, ecological changes, such as climate change, also contribute to disease transmission.

Other factors contribute to increase the virulence and mortality of epidemic diseases. Chief among them, as we have noted earlier, are limited access to health care, and poor health care systems that have inadequate infection prevention and control practices. The conflicts and wars referred to above not only cause civilian casualties and displacements: they destroy health care facilities exactly when and where they are most needed.



## Revisiting traditional control measures

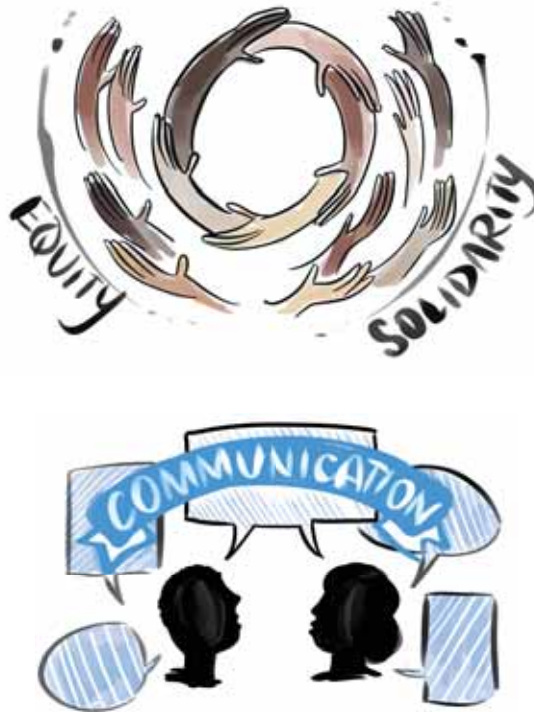
We have also seen that many traditional containment measures are no longer efficient. They should therefore be re-examined in the light of people's expectations of more freedom, including freedom of movement. Measures such as quarantine, for example, once regarded as a matter of fact, would be unacceptable to many populations today.

The use of antibiotics to treat infections has been a turning point in the 20th century. Antimicrobial resistance is now on a rise. This is a major concern because a resistant infection may kill, can spread to others, and requires finding new ways to treat and limit the spread of the disease. Antimicrobial resistance occurs naturally, but is facilitated by the inappropriate use of medicines, for example using antibiotics for viral infections such as cold or flu, or using antibiotics for animal growth in the animal sector. Among major infectious diseases, the treatment of tuberculosis is the most affected, and there are now strains of the microorganism that are multi-drug resistant.

## Equity and solidarity

Epidemics are complex events: complex in their origins, their spread, their effects and their consequences—which can be at one and the same time medical, social, political and economic. The global impact of a single pathogen may vary significantly between settings and there is no one-size-fits-all intervention strategy.

Equity and solidarity issues are often part of the picture: access to medical countermeasures remains difficult, especially for low-income countries and countries facing humanitarian emergencies, and this difficulty is worsened when vaccine or treatment production is limited. Market mechanisms do not ensure a fair distribution of resources based on public health demands. Global mechanisms are needed to ensure fair access to life-saving interventions during crises. A number of organizations are dedicated to this goal (among them are CEPI, the Coalition for Epidemic Preparedness Innovations; the International Coordinating Group; GAVI, the Vaccine Alliance; the Pandemic Influenza Preparedness Framework) but more efforts are required.



## Epidemics of rumours: a new risk to health

A new word has entered the public health vocabulary: “infodemics”. These can be defined as the rapid spread of information of all kinds, including rumours, gossip and unreliable information. They are spread instantly and internationally through the growing popular use of mobile phones, social media, the internet and other communication technologies. A proliferation of web-based “experts” with diverse and often contradictory views can generate confusion, anxiety and even panic in times of serious infectious outbreaks. False or misleading information is dangerous. It can cause widespread public reluctance to adopt well-founded infection control measures promoted by health authorities – and thus delay essential interventions.

This is why *risk communication*, a set of sophisticated skills, is increasingly employed by health authorities, agencies, physicians and professional health personnel. It is more important now than ever to learn and apply them. The latest and most accurate information must be conveyed frequently, and uncertainties related to an epidemic must be acknowledged in order to maintain credibility and public trust.

Thus, we are recognizing that the complexity of 21st century epidemics and their prevention and control require not just new technologies techniques, but new skills and new attitudes all across the public health community. Risk communication is examined at greater length in a later section of this handbook.

# Key insights into infectious disease epidemics



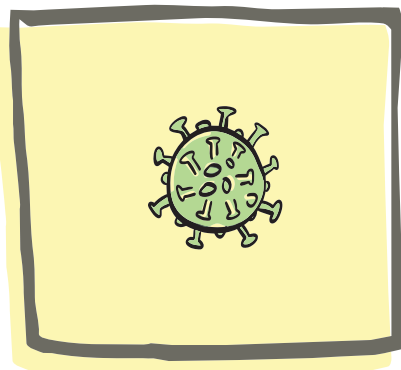
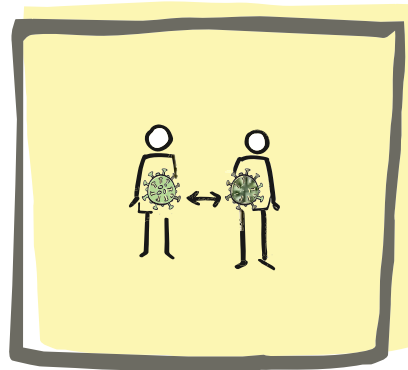
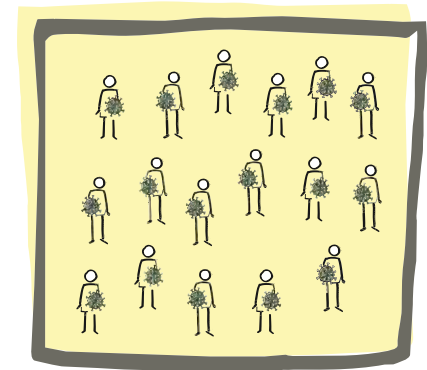
A whole-of-society approach is needed to tackle 21st century epidemics so that all the diverse disease drivers are taken into consideration: genetics and biological factors, ecology and the physical environment; human behaviour and demographics; social, political, and economic factors, and so on.

This increasing convergence of many factors that drive and amplify outbreaks requires multi-disciplinary, multi-sectoral and multi-faceted approaches.

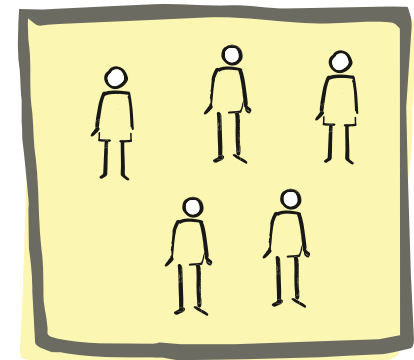
Moreover, because epidemics are social problems as much as medical ones, we need to move beyond the traditional biomedical approaches to them. Social sciences should be an integral part of surge capacities adding anthropologists to the team of first responders. Such a change enables issues of fear and trust to be addressed within the social context. Engaging communities and empowering them in advance as part of preparedness ensures that there is a better understanding of the human ecology. This will link community and biomedical perspectives for enhancing effective partnerships, ensuring that pre-existing relationships are built to respond to epidemics.



## Epidemic phases

INTRODUCTION OR  
EMERGENCELOCALIZED  
TRANSMISSION

AMPLIFICATION

REDUCED TRANSMISSION  
IMMUNITY

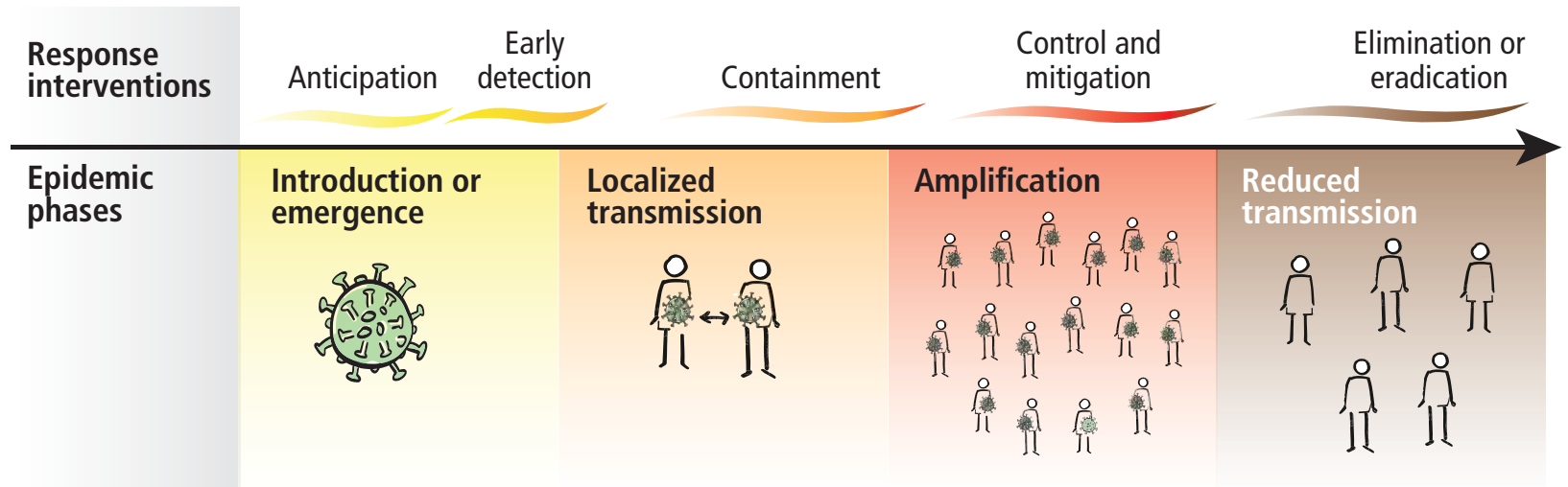
Because new infectious disease threats usually start locally, it is important to understand their dynamics in order to deny them the opportunity to spread further among people and overwhelm health systems. The dynamics of epidemic and pandemic diseases typically occur in four phases, although not all epidemic diseases necessarily go through each phase.

The first phase is the introduction or emergence in a community. The second phase is an outbreak with localized transmission, where sporadic infections with the pathogen occur. In the third phase, the outbreak amplifies into an epidemic or pandemic - the pathogen is able to transmit from human to human and causes a sustained outbreak in the community, threatening to spread beyond it. The fourth phase is reduced transmission when human-to-human transmission of the pathogen decreases, owing to acquired population immunity or effective interventions to control the disease. These four phases are illustrated on this page.

The dynamics of epidemics, as described above, define the response and the sequence of interventions that then become necessary. Here, there are five crucial stages.

First is the *anticipation* of new and re-emerging diseases to facilitate faster detection and response; followed by their *early detection* of emergence in animal and human populations; the third stage is the *containment of the disease* at the early stages of transmission; followed by the *control and mitigation* of the epidemic during its amplification; and fifth, the *elimination* of the risk of outbreak or *eradication* of the infectious disease. These stages are elaborated in the illustration, and in the section that follows it.

## Epidemic phases and response interventions



**Anticipation:** In this first stage of response, emergence cannot be predicted, but it can certainly be anticipated, and the anticipation of risks enables a focus on the most likely threats. Anticipation encompasses forecasting the most likely diseases to emerge, and the quick identification of the drivers that will worsen the impact or facilitate the spread. Preparedness plans, based on lessons learned from past experiences, should contain a variety of scenarios to allow for a reactive response to the unexpected.

**Early detection:** Emerging and re-emerging diseases include new ones about which there is little scientific knowledge. These, therefore, often require investigation into their sources at the same time as the use of coordinated, rapid-containment measures. New diseases require new interventions. And because they appear irregularly or rarely, there is a need for constant vigilance, proactive risk assessment and the development of new management tools.

Early detection allows the rapid implementation of containment measures, which are the key to reducing the risk of amplification and potential international spread. Early detection begins at the health care setting, so health care workers must be trained to recognize potential epidemic disease, report quickly an unusual event (such as an unusual cluster of cases or deaths). Their role is also to reduce the risk of community transmission by isolating severely-ill patients; to prevent household transmission by protecting health care givers at home; and to reduce the mortality rate. Health care workers must also know how to protect themselves and employ infection prevention and control measures and how to avoid outbreaks amplified in health care facilities.



Once a new disease is recognized by the health system, early laboratory confirmation is essential. When this cannot be done at country level, the affected countries must be confident they can count on the support of a network of more sophisticated regional or global laboratories. It is critically important for global health security that there is a system for safely taking samples and shipping specimens to relevant laboratories in full compliance with biosafety and biosecurity regulations.

**Containment:** Effective and rapid containment of emerging diseases is just as vital as early detection in order to avoid a large scale epidemic. Rapid containment should start as soon as the first case is detected regardless of the etiology, which is most likely to be unknown. It requires skilled professionals to safely implement the necessary countermeasures. Pre-training of these professionals is essential to guarantee the safety and efficiency of the operations.

**Control and mitigation:** Once the infectious disease threat reaches an epidemic or pandemic level, the goal of the response is to mitigate its impact and reduce its incidence, morbidity and mortality as well as disruptions to economic, political, and social systems.

**Elimination or eradication:** Control of a disease may lead to its elimination, which means that is sufficiently controlled to prevent an epidemic from occurring in a defined geographical area. Elimination means that the disease is no longer considered as a major public health issue. However, intervention measures (surveillance and control) should continue to prevent its re-emergence.

Eradication of a disease – much more difficult and rarely achieved - involves the permanent elimination of its incidence worldwide. There is no longer a need for interventions measures. Three criteria need to be met in order to eradicate a disease: there must be an available intervention to interrupt its transmission; there must be available efficient diagnostic tools to detect cases that could lead to transmission; and humans must be the only reservoir.



# Response tips and checklists




**A comprehensive outbreak response is always complex, comprising many elements that should be harmoniously coordinated.**

The following response tips are used to organize ideas and to make sure no important point is overlooked. In this handbook, specific tips are listed for each disease which will help keep focus on essential elements of each response. They are organized into four main blocks:

- Coordinating responders (C)
- Health Information (HI)
- Communicating risk (C)
- Health Interventions (HI)

The checklists will help you assess what is important and necessary for the response. The outbreak response varies depending on the disease. For some diseases treatment is essential; for other diseases, vaccination is vital.




**C**

Coordinating responders



**HI**

Health Information



**C**

Communicating risk



**HI**

Health Interventions

**Note:** Although Communicating risk (C) is part of Health Interventions (HI); it is seen here as a separate component in order to underscore the importance of risk communications.



## Coordinating responders

An outbreak is by definition an exceptional event which often requires extra human and financial resources and may also rely on additional partners, agencies and other sectors. Strong coordination is essential at all times to ensure that all those resources and partners are working effectively together to control the outbreak. WHO is often expected to lead the international response to support national health authorities.

Effective coordination requires a **dedicated physical space** (usually an emergency operation centre); **various tools to ensure optimal organization of meetings** and filing of documentation (such as a list of contacts, and a meetings tracking system); **a joint plan of action** regularly updated as the situation evolves, to describe the interventions needed and the distribution of roles and responsibilities among stakeholders; and finally **tools to ensure communication between the various stakeholders** engaged in the response (phone numbers, a dashboard, maps, and a directory).

### Coordinating responders checklist

- ✓ What are the characteristics of the event that describe it as a crisis?
- ✓ Who are the people, groups and organizations who should work for the response?
- ✓ What should they do? (terms of reference, functions)
- ✓ Where can responders meet? (emergency operation centre)
- ✓ How do they share information? (share point, telephone numbers, generic email)



For more information about coordinating responders:

- Public Health Emergency Operations Centre Network (EOC-NET)  
[http://www.who.int/ihr/eoc\\_net/en/](http://www.who.int/ihr/eoc_net/en/)
- WHO Emergency Response Framework (ERF)  
<http://www.who.int/hac/about/erf/en/>

## Health Information

In every event, information is necessary to monitor it, measure the impact of interventions and to guide decision-making throughout the crisis. There are two particular types of information: **surveillance of the disease**, and **information on the interventions** (process and output indicators), which shows the coverage and impact of the interventions being performed. Surveillance provides information on the number of cases and deaths by period and place (people, time, and place). Information on the interventions enables knowing which ones are performed and what is their coverage and impact.

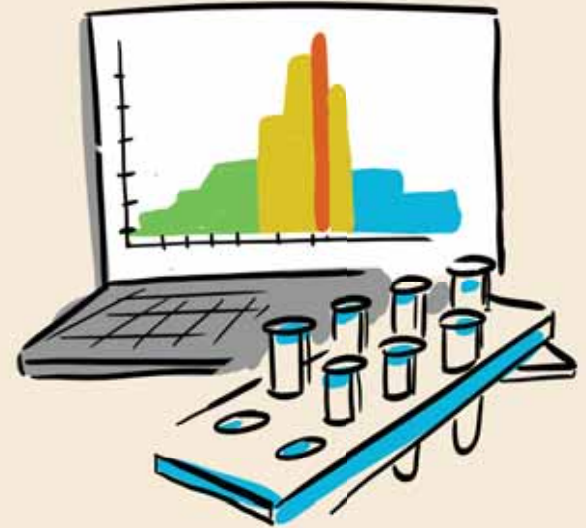
### Health Information checklist

#### Surveillance

- ✓ Is there a case definition shared by all stakeholders?
- ✓ Which laboratories are involved in the testing /confirmation of cases and deaths, and where are they situated?
- ✓ Is there an updated epidemiological curve and mapping of cases and deaths?
- ✓ Which are the risk groups, by gender and age?

#### Interventions

- ✓ What is the target population?
- ✓ What material and human resources are needed and how much?
- ✓ What are the indicators of success? (e.g. vaccine coverage, households targeted, number of people treated)



## Communicating risk

During the evolution of any major outbreak, cases and deaths will inevitably increase. An epidemic is the rapid spread of infectious disease to a large number of people in a given population within a short period of time. Similarly, there may well be another kind of epidemic – the rapid spread of information of all kinds, including rumours, gossip and unreliable information. We describe this phenomenon as an “**infodemic**”.

Infodemics, like epidemics, can be managed. Field epidemiology is an important part of outbreak response. It encompasses three main areas: **(1)** monitoring and identifying health threats, **(2)** outbreaks investigation, and **(3)** actions for mitigation and control. Similarly, successful management of infodemics will be based on **(1)** monitoring and identifying them, **(2)** analysis of them, and **(3)** control and mitigation measures<sup>1</sup>.

Risk communication is an essential intervention in any response to disease outbreaks, and is equally necessary to manage infodemics. Communicating risk in epidemics involves two-way communication that is dynamic and evolving as the outbreak develops.

**Outbreak risk communication involves three main strands that must work together.**

- 1. Talk.** Authorities, experts and response teams must quickly relay information on the nature of the event and the protective measures that people can take. We can use mass media including television, radio, newspapers and internet; social media and text-messaging; community radio; and leaflets and posters. We can use social mobilizers and frontline responders; encourage community engagement; as well as face-to-face communication via trusted interlocutors such as community leaders, religious figures and community health workers. We must use translational communication approaches to develop messages that are appropriate for the target populations in terms of language, educational level and cultural contexts.
- 2. Listen.** Responders, experts and authorities must quickly assess and understand the fears, concerns, perceptions and views of those affected; and tailor their interventions and messages to address such concerns. This requires the use of social science and community engagement expertise and methods.
- 3. Manage rumours.** Disease outbreaks are often accompanied by the presence of false rumours and misinformation. Responders need to have ways to listen to such misinformation and correct examples of it in appropriate ways without delay.



<sup>1</sup> This is called “infodemiology”.



### Communicating about the risks during outbreaks leads to specific outcomes.

First, early, transparent and understandable communication on the event establishes lines of dialogue with affected populations and stakeholders, and builds trust in the response. This type of communication must have facts and information (that cater to the head); and include messages that acknowledge and respond to people's concerns and fears (catering to the heart).

Second, frequent but evolving communication will help create a trusted and dynamic relationship that can deliver advice on protective behaviors that populations and individuals can adopt.

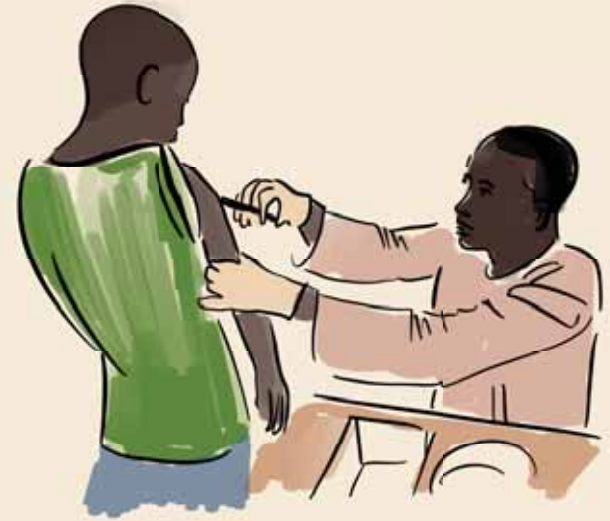
Third, communication must scope the risk in lay language, and also propose practical actions people can take. It must identify and help enable changes in people's behaviours or practice (a temporary change) that can reduce exposure to and protection from the infectious hazard.

Fourth, communication must display accountability by keeping people updated on the situation, on what is being done, and the impact of those actions in bringing the outbreak under control.

#### Communicating risk checklist

- ✓ Has the situation been well analyzed in terms of audience, sources and specificity of the context?
- ✓ Are tools in place in place to monitor an infodemic? Is monitoring reactive and adaptable enough?
- ✓ Has translational communication taken place (to transform scientific information into lay language and format)?
- ✓ Are the communication channels (and messengers) adequate, effective and acceptable to communities? (culturally, cost-effectively)?
- ✓ Is there a plan to communicate regularly with the various audiences?
- ✓ Have all personnel and volunteers in the risk communication response been trained in risk communication approaches, and consistent messaging?





## Health Interventions

Each disease requires a different set of health interventions with the objectives of reducing **(a)** transmission, **(b)** severe morbidity and mortality **(c)** the impact on health systems and also on the political and other sectors.

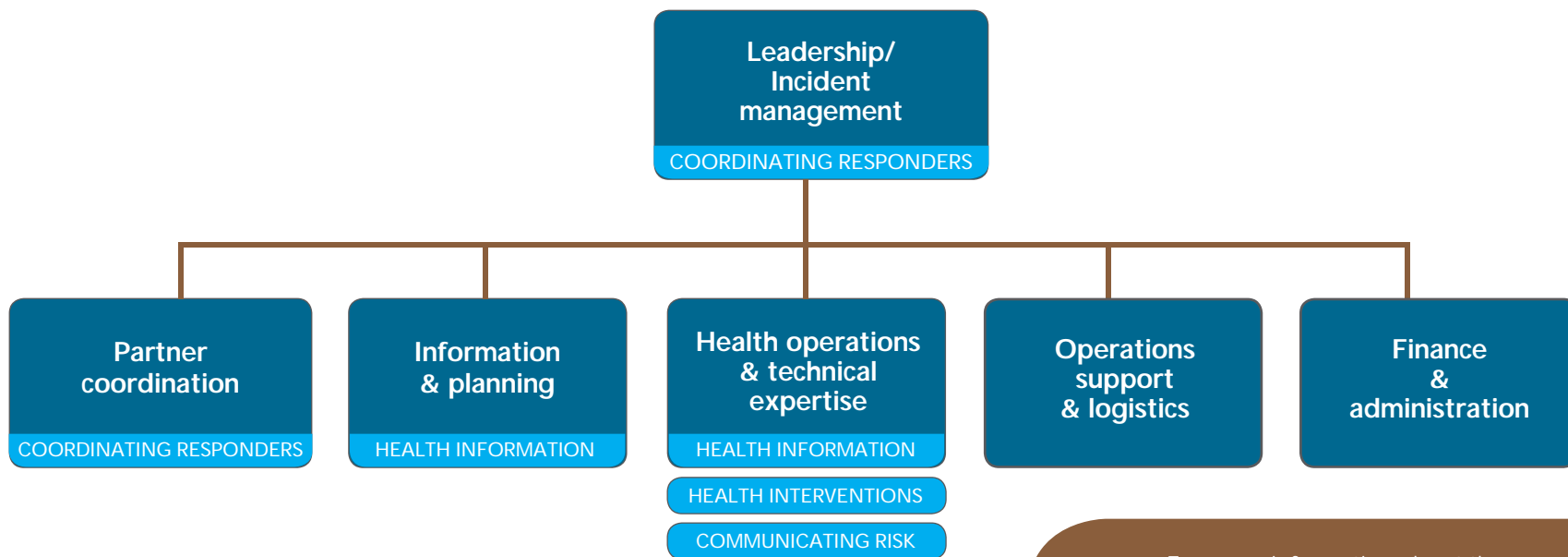
### Health Interventions checklist

- ✓ What are the key interventions needed to control the outbreak at this stage of the event?
- ✓ Who should implement them?
- ✓ How is the impact measured on morbidity, mortality, transmission, and whole of society?



The **Emergency Response Framework (ERF)** is an internal WHO tool that outlines a set of procedures to better respond to emergencies. Under this framework, for any emergency that requires a WHO operational response, the Organization activates the Incident Management System (IMS); recognized best practice for emergency management. WHO has adapted the IMS to consist of six critical functions. The four blocks and response tips are integrated into the Incident Management System. Although, all six functions of the IMS are critical for a successful response, the four blocks will highlight what is specific for each disease.

### Six critical functions of the Incident Management System (IMS)



For more information about the management of events under the ERF:  
<http://www.who.int/hac/about/erf/en/>

## FOCUS 1

# Community engagement during epidemics

## Defining a community

"Community" is a broad term that can be applied to a variety of situations. It defines a distinct group of people who have a sense of belonging together. A community may be defined through the sharing of:

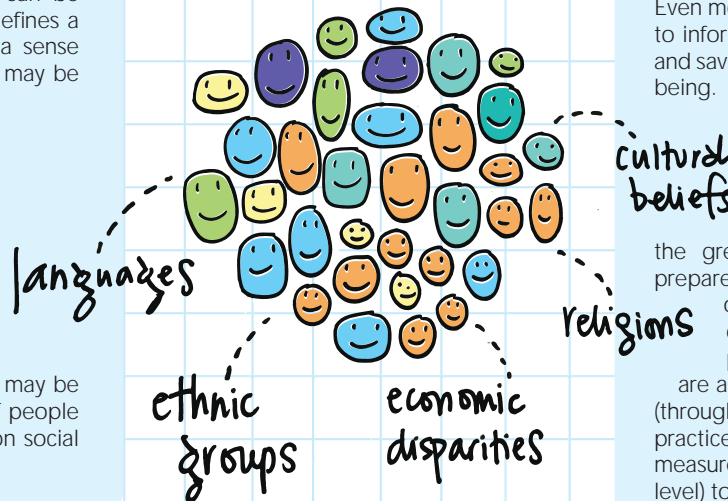
- A common geographical location;
- Common values or interests;
- Common identity;
- Etc.

With new technologies, a community may be totally virtual, for instance a group of people sharing interests and points of view on social media.

few groups are homogeneous



Target to be effective



## Why engage communities

People live in unique social-cultural contexts, with relationship dynamics, and their own perception of risks, and trusted sources of advice. These all influence if they accept health advice or not. Experience has shown that merely telling people what to do, however scientific, does not always work. Engaging them is more effective.

Even more fundamentally, people have a right to information that could protect their health and save lives, social fabric and economic well-being.

Communities, when engaged are the frontline in detecting and managing epidemics. They are most affected and have the greatest influence in anticipation and preparedness as new diseases emerge or old ones re-emerge. They can detect outbreaks, and help in containment to prevent epidemic amplification. They are able to implement mitigation measures (through change of individual and family practices change; implementing community measures and enabling changes at the systems level) to bring epidemics under control.

### Three elements of community engagement

Disease outbreaks and epidemics are complex phenomena with three aspects that are intimately intertwined: medical, social and political. Community engagement is an approach to address the social (and to some degree the political) aspects of epidemics. Community engagement is essential for the effective control of infectious diseases, through acceptance of public health interventions. It is based on three elements:

1. Establishing a dialogue between responders and communities to understand the perceptions and beliefs on both sides, to identify the specific cultural and social patterns of transmission that exist at community level.
2. Building trust through this mutual understanding to find joint solutions to reduce transmission.
3. Empowering communities, providing them with necessary medical and other supplies to implement the measures required to stop the disease, and progressively transferring knowledge for sustained and safe interventions within the community.

A key community to empower during outbreaks are health care workers, and volunteers who are often the frontline responders. These frontline workers are “the face” or representatives of the whole outbreak response, to the community. Their attitude towards community members and their collaboration in implementing health advice can have significant influence on how the advice is perceived and accepted, or rejected by community members.

Key points of health action in epidemics that require intensive engagement of communities (affected populations as well as health care workers and frontline responders themselves) include:

1. Detecting an outbreak and detection of newly infected people (case detection, contact tracing);
2. Minimizing harmful practices (at individual and community levels) that can increase susceptibility and exposure; and adopting protective practices (medical and non-medical);



3. Seeking and providing health care as advised (in the household, community and health facility);
4. Re-integrating of survivors back into the community and to minimizing stigma;
5. Identifying and managing misinformation and rumours.

## Ten things to know

1. Disease outbreaks affect the social fabric of communities. A community is a social network, and infectious diseases outbreaks are deeply linked to the social life, the structure of society and people's interactions. They spread through personal and social contacts and links at home or during professional and recreational activities.
2. Communities are the main actors in preventing, identifying, responding and recovering from the physical, psychological, social and economic impacts of epidemics. Communities are not passive subjects of interventions.
3. Epidemics are by nature rapidly evolving. The time pressure is particularly challenging for community engagement. The beginning of the outbreak is a crucial time to build the necessary trust with the population who can break the transmission cycle. Any outbreak response that builds on existing and trusted community engagement systems and work with trusted individuals and interlocutors are more likely to succeed.
4. Community understanding of diseases and their spread is complex, context-dependent and culturally mediated. Thus, a one-size-fits-all approach is neither desirable nor effective.
5. Communities are multi-layered, and power dynamics exist between individuals, groups and networks. Social scientists can help analyse these dynamics and work with

specialists in health education, health promotion and local communities. There are simple tools that can assess relevant perceptions and beliefs for any outbreaks response. Together they can design the messages and interventions necessary to raise awareness, and adapt or change behaviours to meet the demands of a new infection. Embedding social scientists in response teams will also help to monitor how people adapt public health measures to different social contexts, and whether these are implemented in a way that respects social and cultural systems.

6. Community engagement helps to strengthen and ensure resilience to future outbreaks: when people have already learned how to implement their own solutions, they will be better able to deal with the next outbreak.
7. The approach and messaging directed towards each community has to evolve with the epidemic and incorporate new messages and communication methods as it unfolds. These messages must also proactively detect misinformation and rumours. Effective community engagement limits the opportunities for misunderstandings and the proliferation of rumours, and it mitigates the spread of fear and anxiety.
8. Identify people that the community trusts and build relationships with them. Involve them in decision-making to ensure interventions are collaborative,

contextually appropriate and that communication is community-owned.

9. Two-way communication should be achieved through the most socially-acceptable and effective channels. Messages must be "translated" into local language, local context and to match the education levels and preferences (e.g. visual, written or oral cultures) of the target population. All communication with communities should be transparent, timely, easy-to-understand, acknowledge uncertainty, address affected populations, link to self-efficacy, and be disseminated using multiple platforms, methods and channels.
10. Disease creates fear which often leads to practices that further amplify the epidemic. These can be both individual and collective. They can relate to the transmission of the disease, or the stigma, and extreme stress on the ties that bind communities.



## Ensuring effective community engagement

To ensure effective community engagement: 3 elements are needed for communities and for field responders.

### For communities:

- **Knowledge:** communities must know what the disease is, how it is transmitted, and how to protect against it (social mobilisation messages);
- **Trust:** it is the most important determinant to ensuring communities heed public health advice. Communities must be consulted, engaged, and whenever possible participate in identifying and implementing response measures that communities and responders want above all to treat patients and stop the epidemic;
- **Self-efficacy:** communities must be able to implement control measures (e.g. access to soap and water, to gloves, to waste management services, to transportation, to safe burial teams, etc.).

### For field responders:

- **Understand:** Field responders need to understand the local perceptions of the disease and of the response measures;
- **Listen:** Field responders need to listen to communities' fears and beliefs and adapt their own behaviours accordingly;
- **Support:** Field responders need to support communities' participation, ownership and resilience.



## FOCUS 2

# Risk communication – a life-saving action in public health emergencies



## The essence of risk communication

Risk communication is one of the key pillars of response to outbreaks. It refers to the real-time exchange of information, advice and opinions between health experts or officials and people who face a threat (hazard) to their survival, health or economic or social well-being. Its ultimate goal is that everyone at risk is able to take informed decisions to mitigate the effects a disease outbreak and take protective and preventive action.

Effective risk communication not only saves lives and reduces illness (by informing people on how to protect their health), it also enables countries and communities to preserve their social, economic and political stability in the face of emergencies.

For these reasons, risk communication is one of the core capacities that all countries have agreed to develop in order to prevent the international spread of disease and other dangers as required under the International Health Regulations (2005).



## 21st century aspects change and complicate risk communication

There has been a paradigm shift from telling people what to do (message-based communication) to systematically listening to those affected, mainly due to new communication and media technologies and the way practices have evolved in the 21st century. The three big changes here are:

1. Experts and authorities are less trusted;
2. People now seek health advice mostly on public on-line sources, and their trusted social networks;
3. News media now function all day, every day. In addition, there is an increase of citizenship journalism and social media, as well as the rise of opinion versus well-sourced and referenced stories.

In disease outbreaks and epidemics, life-saving decisions need to be made rapidly and actions must follow promptly, with the support of an informed public. Epidemics are unpredictable and alarming events that generate great anxiety in the general public, which can lead to extreme behaviours. Epidemics and the way they are managed have a high political

profile and capture the news media's attention quickly leading to intense media interest (at national and international levels).

Furthermore, emergency and outbreak communications now take place in a variety of contexts:

- In a shifting complex, crowded environment: information is incomplete and many different actors are exchanging public health information and competing for authority.
- Where communications are diverse: these include public communication, supporting national governments in risk communication, strategic communication, communication with affected communities and response personnel, media relations, knowledge transfer, message development, partner communication, internal communication and health promotion functions, etc.
- Where risk communication is an under-resourced priority with a lack of investment in skills, resources and expertise at country level.
- Where there is an increased public demand for participation in policy-making and for self-determination.



## Making it effective

- Risk communication only works when there is communication based on trust between those who know (experts), those in charge (authorities or response teams) and those affected (communities). Without trust, people are unlikely to follow the advice given. Listening to and understanding peoples' beliefs, concerns and perceptions is just as important as providing them with facts and advice. Explaining honestly what is known and admitting what is uncertain is essential. Effective risk communication thus depends on the credibility of those giving advice; their expressions of caring and empathy; and their ability to identify with people at risk.
- Perception is key:
  - Experts and affected communities may not view the same infectious hazard – e.g. a disease outbreak – the same way. While experts depend on risk analysis based on biomedical and epidemiological data, affected communities use more sub-conscious pathways to define risk;
  - People's perception of risk can be affected by their beliefs, culture, education, political viewpoints, social norms and prior experience amongst others;
  - There are tried and trusted social science methods and approaches which can be used in epidemics to gauge perceptions.



## Ten things to know and do



### 1. Build trust

- People must trust those responsible for managing the outbreak and for issuing information about it. Public confidence that a government or agency is acting first and foremost to safeguard their health will influence compliance with recommended control measures, and thus hasten outbreak containment.
- Accountability is key: communicators must demonstrate that they and outbreak managers are accountable for what they say, promise, and do.
- Evidence shows that to build trust, risk communication interventions should link to functioning and accessible services, be transparent, timely, easy-to-understand, acknowledge uncertainty, address affected populations, link to self-efficacy and be disseminated using multiple platforms, methods and channels.
- The building blocks of trust include:
  - Being perceived as experts with credibility by providing expert advice that is correct

and accurate and being consistent with other trusted agencies and entities;

- Being perceived as having a good character by telling the truth and not omitting important information, and acting on promises;
- Identifying with the affected population as sharing the same concerns and fate;
- Exhibiting good will through empathy and caring in messages and their delivery.

### 2. Communicate uncertainty proactively

- Communication by authorities to the public should include explicit information about uncertainties associated with risks, events and interventions and indicate what is known and not known at a given time.
- Announce the event as early as possible, even when the information is incomplete. This will establish you as the leader to communicate risk; it will build trust in you and the response; it will help enable changes in practice and behaviors to bring the outbreak under control; and it will minimize misinformation and rumours.
- A good template to communicate uncertainty is as follows:
  - State what is known, what is unknown, and what you/your institution is doing about the issue;
  - Communicate early, be first to announce the event if possible, communicate often, communicate regularly;

- Provide information on the risk/danger; but supplement it with some advice on how people can protect themselves;
- Speak as a human being, using empathy appropriately;
- Do not over-reassure.

### 3. Engage communities

- Identify people that the community trusts and build relationships with them and involve them in decision-making to ensure interventions are collaborative, contextually appropriate and that communication is community-owned.
- Community engagement is one important start for communicating risk and facilitating changes in behaviours and practices (see **Focus 1, page 38**).

### 4. Message well

- According to the latest evidence, risk should not be explained in technical terms as this is not helpful for promoting risk mitigation behaviours. Consistent messages should come from different information sources and emerge early in the outbreak. Messages should promote specific actions people can realistically take to protect their health.

### 5. Establish and use listening and feedback systems

- Use multiple means (surveys, focus group discussions, community walk-throughs, key informants, feedback from front-line responders, partners' and stakeholders'

feedback, social media, etc.) to listen to the public and affected communities.

- Use these to understand what concerns people regarding the outbreak or the measures we are asking them to adopt.
- Use these systems to test messaging



and materials developed to support risk communication.

#### 6. Use social media as appropriate

- Social media should be used to engage the public, facilitate peer-to-peer communication, create situational awareness, monitor and respond to rumours, public reactions and concerns during an emergency, and to facilitate local level responses.
- Social media and traditional media should be part of an integrated strategy with other forms of communication to achieve convergence of verified, accurate information.

#### 7. Risk communication operations requires resources

- Risk communication in epidemics is a massive operational undertaking and requires people, logistics, material and funds.
- Different types of expertise in many areas are required: media communications, social media, spokespersons, social mobilization, health promotion, community engagement, behavioral change communication; stakeholder communication, communication related to travel and trade, social science methods, etc.

#### 8. Treat Emergency risk communication as a strategic role, not an add-on

- Emergency risk communication should be a designated strategic role in global and national emergency preparedness and response leadership teams.
- The International Health Regulations (2005) require all Member States to build national capacity to communicate risk in two domains:
  - Systems capacities;
  - People capacities.
- The Joint External Evaluation (JEE) process championed by the Global Health Security Agenda measures national risk communication capacity in six domains:
  - National strategies, policies and plan;
  - Coordination;
  - Stakeholder communication;

- Public communication (using mass media approaches);
- Communicating and engaging with communities;
- Dynamic listening (to misinformation, fears, concerns) and rumour management.

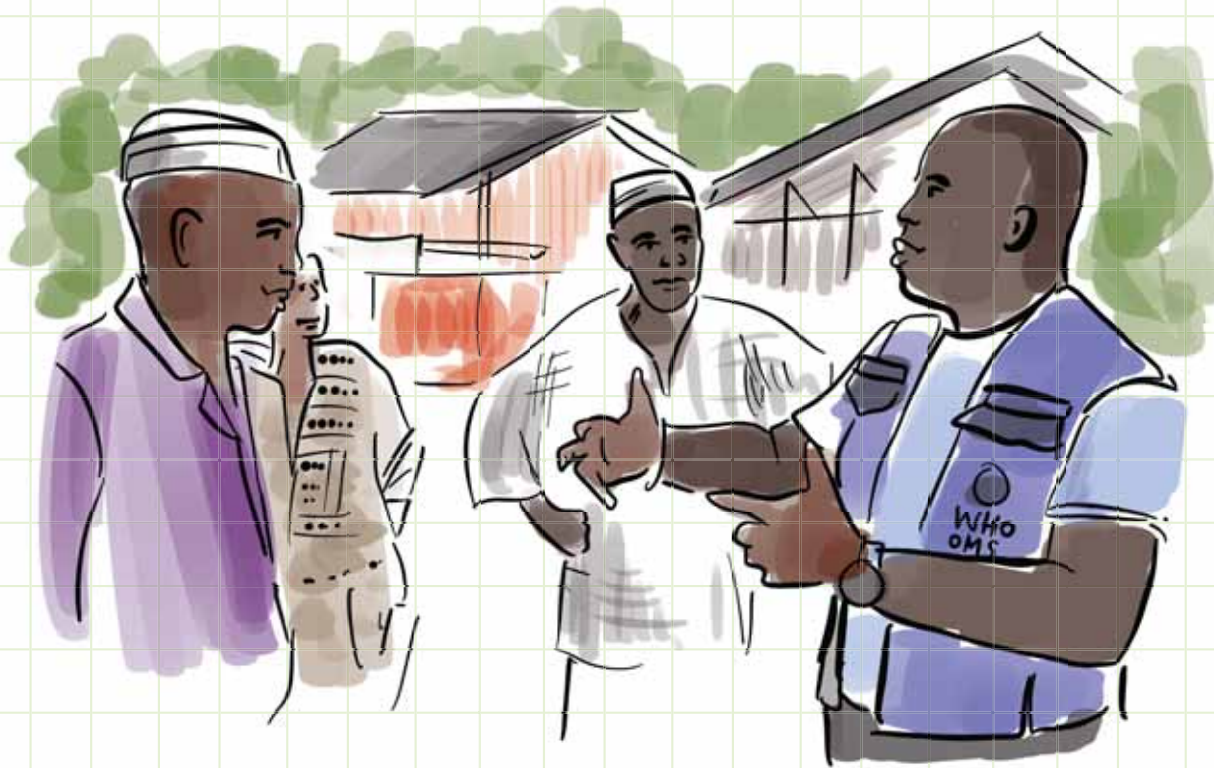
#### 9. Establish coordination and information systems

- Develop and build on agency and organizational networks across geographic, disciplinary and, where appropriate, national boundaries.
- Tailor information and communication systems to the needs of users and involve local stakeholders to guarantee the flow of information across sectors.

#### 10. Build capacity for the next emergency

- Preparation and training of personnel for emergency risk communication should be organized regularly and focus on coordination across agencies.
- Emergency risk communication requires a defined and sustained budget which should be a part of core budgeting for emergency preparedness and response.





### Other factors to remember

While there is an increasing body of evidence as to what constitutes effective risk communication, every outbreak is unique. Therefore risk communication must be adapted to:

- The infectious hazard (its severity, lethality, modes of transmission, how it can be diagnosed, treated or managed);
- The geography of the outbreak: contained or widely distributed; national or international spread; affecting certain vulnerable communities or the general population; in a remote forgotten village or major city; affecting to poor or affecting travel and trade;
- The levels of trust that exist between the affected or at-risk populations and their authorities and experts; or the response teams;
- People's underlying beliefs, cultures, traditions, values and practices;
- Education, levels of awareness, access to understandable information; and trusted channels of communication;
- Self-efficacy: do communities have the ability, resources and environment to follow health advice?

## FOCUS 3

# Treating patients and protecting the health workforce



### Advances in medicine: antibiotics, antivirals, vaccines and new treatments

With the remarkable progress in medicine and related technologies, briefly mentioned at the beginning of this publication, many infectious diseases can now be prevented and treated.

This is the result of a public health revolution that began in the 1940s with the discovery of antibiotics for bacterial diseases, and expanded with improvements in their safety, efficacy and acceptability.

Similarly, the development of vaccines, particularly for infants and young children, has given global protection against a number of childhood killers. For example, WHO estimates that there is now 86% global coverage of the combined diphtheria-tetanus-pertussis vaccine for babies<sup>1</sup>. In recent decades, hundreds of millions of children all over the world have grown up free of the risk of deadly and disabling diseases. Adults have benefited likewise, with protection against a wide range of infections that can explode into epidemics – cholera, influenza and yellow fever, for example. For many deadly diseases, there are vaccines that ideally should be administered in routine, large-scale immunization to prevent the occurrence of the disease. Some vaccines can also be used during a reactive campaign when there is an epidemic in which the immunity of the population is not high enough.

The public health revolution continued towards the end of the 20th century with the discovery

of antivirals, such as that used against HIV.

Meanwhile, there have also been great strides forward in the fields of diagnostics and treatments, such as monoclonal antibodies, that are also becoming more widely available but the price of some of them is still very high and they are not yet available for mass administration.

Such advances – and the early problems that followed them – including a degree of public health complacency, and the emergence of antibiotic resistance - have completely changed the way infectious diseases are confronted today.



<sup>1</sup> WHO data, 2016.

## Treating patients with supportive care

But whether the focus is on antibiotics, antivirals, vaccines or the whole armoury of other treatments, the vital, universal fact is that they can only be beneficial when they are administered by skilled, qualified and dedicated health personnel, all across the spectrum of care. When, for example, no specific treatment is available for a given disease, adequate clinical management can still protect and save lives. This has been shown by a dramatic reduction in deaths from Ebola in West Africa in 2014 – from 75% to 33% mortality, achieved through the provision of better supportive care for patients.



## Protecting frontline responders

The role of the health workforce should never be underestimated nor taken for granted. In general, much of their day-to-day work is mundane and routine, providing tried-and-tested care and treatment for familiar illnesses, disabilities and injuries.

But when an epidemic strikes, they make a vital difference at all levels, whether as community health workers and volunteers, midwives, nurses, or doctors. With little or no warning, they are transformed into frontline responders, thrust into immediate contact with infected communities and individuals. Family members, too, take on the role of caring for their relatives at home, often linking up with health staff in clinics, hospitals and emergency centres.

This transformation is double-edged and dangerous for frontline responders. First, their immediate priorities are to prevent the spread of an epidemic, protect those people who are most at risk, and to care by all possible

means for those who are already infected. The related dangers are obvious: health workers are putting themselves at risk. They find themselves in the most dangerous place at the most dangerous time.

Yet, because their job is to care for the sick and injured, health care workers are often viewed as “immune” to injury or illness. Their patients come first. However, human-to-human transmission is a major factor in many infectious diseases that cause epidemics. Patients are highly contagious and can spread the disease at home, at work, in public spaces, but also in hospitals.

Thus, it is essential to protect them from infection – both for their own safety and for the wider protection of the affected community. It is here that emergency planning, preparation, training and coordination are so essential, as is the urgent provision of practical safeguards, especially the necessary personal protective equipment and the knowledge of how to use it properly.

## Confronting the human resources crisis

These measures may seem obvious, but the role of frontline responders is frequently shackled by a major disadvantage: there are not nearly enough of them. This unpalatable truth applies to the health workforce in general. It is a global problem, but it is most acute in the poorest countries with weakest health systems, where epidemics are most likely to erupt.

Protecting the occupational health of health workers is critical to have an adequate workforce of trained and healthy health personnel. This is nowhere more true than at the heart of an infectious disease epidemic.

Around the world, health care facilities employ over 59 million workers<sup>2</sup>. Yet at the same time, there is a chronic shortage of them in more than 50 countries. This crisis in human resources for health has persisted for decades, despite numerous attempts to tackle it, but recent actions show notable progress.

It is not just a matter of numbers. While there has long been an exclusive focus on how many there are, against how many are needed, there is growing public health agreement on according equal importance to accessibility, acceptability, quality and performance in addition to availability.

<sup>2</sup> WHO data: [http://www.who.int/occupational\\_health/topics/hcworkers/en/](http://www.who.int/occupational_health/topics/hcworkers/en/)



These four factors are inter-related and inter-dependent. The absence or inadequacy of any one of them undermines all the others. Without sufficient availability, accessibility to health workers cannot be guaranteed. If they are available and accessible, without acceptability, the health services may not be used. When the quality of the health workforce is inadequate, improvements in health outcomes will not be satisfactory.

Elaboration of these complex issues at length goes beyond the scope of this handbook. But it is important that they are taken into account in the context of infectious disease prevention, treatment and control. Indeed, they lead to recognition that protecting health care workers has the added benefit to contributing to quality patient care and health system strengthening.

If it is accepted that health begins with health workers, their empowerment is necessary on a general basis. Their voice, rights and responsibilities must play a central role in developing and implementing solid policies and strategies towards universal health coverage. This applies to the context of epidemic disease control as much as it does to other health issues more widely. The engagement of communities during epidemics, including health workforce community, needs to be at the center of the epidemic response.



For more information about protecting the health workforce:  
 WHO global health workforce alliance website  
<http://www.who.int/workforcealliance/en/>

## Major modes of transmission and interventions per disease

DISEASE	MAJOR MODE OF TRANSMISSION	Clinical management						
		SPECIFIC	SUPPORTIVE	ENHANCED INFECTION PREVENTION & CONTROL	VACCINATION	SAFE & DIGNIFIED BURIALS	VECTOR CONTROL	WATER & SANITATION
<b>Crimean-Congo haemorrhagic fever (CCHF)</b>	Animals (mainly ticks) / contact	✓ <sup>1</sup>	✓	✓		✓	✓	
<a href="http://www.who.int/csr/disease/cremean_congoHF/en/">http://www.who.int/csr/disease/cremean_congoHF/en/</a>								
<b>Chikungunya</b>	Vector		✓				✓	
<a href="http://www.who.int/csr/disease/chikungunya/en/">http://www.who.int/csr/disease/chikungunya/en/</a>								
<b>Cholera</b>	Fecal oral / water	✓	✓	✓	✓ <sup>2</sup>			✓
<a href="http://www.who.int/cholera/en/">http://www.who.int/cholera/en/</a>								
<b>Dengue</b>	Vector		✓		✓ <sup>3</sup>		✓	
<a href="http://www.who.int/denguecontrol/en/">http://www.who.int/denguecontrol/en/</a>								
<b>Ebola virus disease</b>	Animals / contact		✓	✓	✓	✓		
<a href="http://www.who.int/ebola/en/">http://www.who.int/ebola/en/</a>								
<b>Hepatitis E</b>	Fecal oral / water		✓		✓			✓
<a href="http://www.who.int/mediacentre/factsheets/fs280/en/">http://www.who.int/mediacentre/factsheets/fs280/en/</a>								
<b>Influenza</b>	Respiratory	✓	✓	✓	✓ <sup>4</sup>	✓ <sup>5</sup>		
<a href="http://www.who.int/influenza/en/">http://www.who.int/influenza/en/</a>								
<b>Lassa fever</b>	Rodent / contact	✓	✓	✓			✓	
<a href="http://www.who.int/csr/disease/lassafever/en/">http://www.who.int/csr/disease/lassafever/en/</a>								
<b>Leptospirosis</b>	Rodent	✓	✓				✓	
<a href="http://www.who.int/topics/leptospirosis/en/">http://www.who.int/topics/leptospirosis/en/</a>								
<b>Malaria</b>	Vector	✓	✓				✓	
<a href="http://www.who.int/malaria/en/">http://www.who.int/malaria/en/</a>								
<b>Marburg virus disease</b>	Animals / contact		✓	✓	✓			
<a href="http://www.who.int/csr/disease/marburg/en/">http://www.who.int/csr/disease/marburg/en/</a>								

<sup>1</sup> Ribavirin use currently under review by WHO;

<sup>2</sup> Oral vaccines;

<sup>3</sup> There is a vaccine (Dengvaxia®) currently under assessment;

<sup>4</sup> Intramuscular and intranasal vaccines;

<sup>5</sup> Safe and dignified burials for highly pathogenic non-human influenza;



DISEASE	MAJOR MODE OF TRANSMISSION	Clinical management						
		SPECIFIC	SUPPORTIVE	ENHANCED INFECTION PREVENTION & CONTROL	VACCINATION	SAFE & DIGNIFIED BURIALS	VECTOR CONTROL	WATER & SANITATION
<b>Measles</b>	Respiratory		✓	✓	✓			
<a href="http://www.who.int/immunization/diseases/measles/en/">http://www.who.int/immunization/diseases/measles/en/</a>								
<b>Meningitis</b>	Respiratory	✓	✓	✓				
<a href="http://www.who.int/csr/disease/meningococcal/en/">http://www.who.int/csr/disease/meningococcal/en/</a>								
<b>MERS/SARS</b>	Respiratory		✓	✓				
<a href="http://www.who.int/topics/coronavirus_infections/en/">http://www.who.int/topics/coronavirus_infections/en/</a>								
<b>Monkeypox</b>	Animals / contact		✓			✓		
<a href="http://www.who.int/mediacentre/factsheets/fs161/en/">http://www.who.int/mediacentre/factsheets/fs161/en/</a>								
<b>Plague (pneumonic)</b>	Respiratory	✓	✓	✓		✓		
<a href="http://www.who.int/csr/disease/plague/en/">http://www.who.int/csr/disease/plague/en/</a>								
<b>Plague (bubonic)</b>	Rodent	✓	✓	✓		✓	✓	
<a href="http://www.who.int/csr/disease/plague/en/">http://www.who.int/csr/disease/plague/en/</a>								
<b>Polio</b>	Fecal oral		✓	✓	✓ <sup>6</sup>			
<a href="http://www.who.int/topics/poliomyelitis/en/">http://www.who.int/topics/poliomyelitis/en/</a>								
<b>Rickettsia</b>	Vector	✓	✓				✓	
<b>Rift valley fever</b>	Animals / vector		✓	✓			✓	
<a href="http://www.who.int/csr/disease/riftvalleyfev/en/">http://www.who.int/csr/disease/riftvalleyfev/en/</a>								
<b>Shigellosis</b>	Fecal oral / food	✓	✓					✓
<b>Smallpox</b>	Respiratory		✓	✓	✓ <sup>7</sup>			
<a href="http://www.who.int/csr/disease/smallpox/en/">http://www.who.int/csr/disease/smallpox/en/</a>								
<b>Typhoid fever</b>	Food	✓	✓		✓			✓
<a href="http://www.who.int/immunization/diseases/typhoid/en/">http://www.who.int/immunization/diseases/typhoid/en/</a>								
<b>West Nile fever</b>	Vector		✓				✓	
<a href="http://www.who.int/mediacentre/factsheets/fs354/en/">http://www.who.int/mediacentre/factsheets/fs354/en/</a>								
<b>Yellow fever</b>	Vector		✓		✓ <sup>8</sup>		✓	
<a href="http://www.who.int/csr/disease/yellowfev/en/">http://www.who.int/csr/disease/yellowfev/en/</a>								
<b>Zika</b>	Vector		✓				✓	
<a href="http://www.who.int/topics/zika/en/">http://www.who.int/topics/zika/en/</a>								

<sup>6</sup> Oral and intramuscular/subcutaneous polio vaccines;

<sup>7</sup> Intramuscular and scarification vaccines;

<sup>8</sup> Intramuscular/subcutaneous vaccines.



## PART II

# Be in the know

10 KEY FACTS ABOUT 15 DEADLY DISEASES

EBOLA VIRUS DISEASE

LASSA FEVER

CRIMEAN-CONGO HAEMORRHAGIC FEVER (CCHF)

YELLOW FEVER

ZIKA

CHIKUNGUNYA

AVIAN AND OTHER ZONOTIC INFLUENZA

SEASONAL INFLUENZA

PANDEMIC INFLUENZA

MIDDLE EAST RESPIRATORY SYNDROME (MERS)

CHOLERA

MONKEYPOX

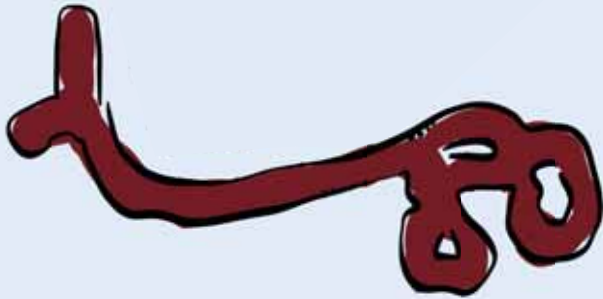
PLAGUE

LEPTOSPIROSIS

MENINGOCOCCAL MENINGITIS

# Ebola virus disease

## 10 THINGS YOU SHOULD KNOW



1. Ebola virus disease transmits from person to person through close contact
2. Health care workers, mourners and family members are the most at risk to get infected
3. At-risk persons should be informed about Infection Prevention and Control (IPC) measures and be provided with appropriate personal protective equipment
4. Community engagement, active case finding, contact tracing, laboratory support, and safe and dignified burials are key to control outbreaks
5. Early supportive care improves survival
6. Ebola is difficult to distinguish from other diseases with haemorrhage presentation
7. The Ebola virus can persist in people recovering from the disease for several months
8. Ebola survivors may suffer from stigma and sequelae
9. There are ongoing researches for vaccines, diagnostics and treatments
10. Ebola is a viral haemorrhagic fever that occurs mostly in rural and remote areas of Africa

# Ebola virus disease response tips

## Coordinating responders

- Engage with partners involved in the response (community engagement, surveillance, laboratory, case management and IPC)
- Engage with religious and community leaders

## Communicating risk

- Encourage health authorities to:
  - Implement active case finding and contact tracing
  - Ensure protection of health care workers through IPC measures
  - Communicate early and frequently
- Key messages are:
  - Ebola is transmitted through contact with body fluids of infected animals and humans
  - Dead bodies of patients are contagious
  - Apply IPC measures when in contact with sick or dead patients and animals
  - People are not infectious if they do not show symptoms
  - People with symptoms should seek medical advice as supportive treatment increases chances of survival

## Health Information

- Ensure early laboratory confirmation of suspected cases
- Notify cases to WHO, under the IHR (2005)

## Health Interventions

- Community engagement and health promotion
- Case management and IPC:
  - Isolation of cases
  - Early supportive treatment
  - Protect health care workers
- Surveillance, contact finding and contact tracing
- Safe and dignified burials
- Vaccination under expanded access (rVSV-ZEBOV vaccine for Zaire Ebola virus)

## 1

**Ebola virus disease transmits from person to person through close contact**

- Incubation period ranges from 2 to 21 days.
- Humans are not infectious as long as they do not develop symptoms. During the course of the disease, they remain infectious as long as their blood contains the virus.
- Ebola is first introduced into the human population through close contact with the blood, secretions, organs or other body fluids of infected animals such as fruit bats, chimpanzees, gorillas, monkeys, forest antelopes and porcupines found ill or dead, often in the rainforest.
- Ebola then spreads through human-to-human transmission via direct contact (through broken skin or mucous membranes) with the blood, secretions, organs or other body fluids of infected people.
- Infection can also occur if the broken skin or the mucous membranes of a healthy person comes into contact with items or environments contaminated with body fluids from an infected person. These may include soiled clothing, bed linen, gloves, and protective equipment;
- Medical waste, such as used syringes, should be disposed carefully, as they are a source of health care workers infection.
- Ebola virus disease has not been reported to be transmitted by aerosols. It is not airborne.

## 2

**Health care workers, mourners and family members are the most at risk to get infected**

Population at high-risk of being infected include:

- Health care workers if Infection Prevention and Control (IPC) measures are not in place or not well followed while caring for patients.
- Mourners, as burial ceremonies involve direct contact with the body or body fluids of the deceased (washing, touching...) because levels of Ebola virus remain high after death.
- Family members or others in close contact with infected people and caring for them in contact with body fluids or contaminated items.

*contact with  
bodily fluids*



# 3

## At-risk persons should be informed about IPC measures and be provided with appropriate personal protective equipment

- All health care providers working at all levels of the health system, and family members caring for the sick, should be fully informed about the disease and its mode of transmission and should follow recommended Infection Prevention and Control (IPC) measures strictly.
- They should be provided with appropriate Personal Protective Equipment (PPE).
- Standard precautions with all patients should be applied. They include: hand hygiene; use of gloves before contact with body fluids, mucous membrane, non-intact skin and contaminated items; gown and eye protection before procedures and patient-care activities likely to involve contact with or projection of blood or body fluids; injection safety practices; safe cleaning, disinfection and waste management; isolation of cases and appropriate flow of patients.



# 4

## Community engagement, active case finding, contact tracing, laboratory support, and safe and dignified burials are key to control outbreaks

- The aim of Ebola response is to contain the outbreak at its source. Ebola virus transmission is stopped by :
  1. Community engagement as communities are essential for responding to Ebola outbreaks. They have a role to play in the detection of new cases. Communities should be engaged in the response since the early stage and be provided by the necessary information so that they can adapt the public health measures to their socio-cultural beliefs and ensure compliance of the community members.
  2. Active case finding, rapid isolation of patient and early laboratory confirmation of suspected cases. Active



case finding refers to actively searching for new cases (for instance, going from house to house in the community, asking if people are sick or if people have died). New (suspected) cases should be rapidly and safely referred to treatment centres for isolation and treatment.

3. Laboratory testing in Ebola treatment units is crucial for classification of cases, to streamline contact tracing, for patient triage and management and to support research and development (to develop and validate new point-of-care diagnostics, new therapeutics and new vaccines).
4. Contact tracing which refers to the follow-up of persons who may have come into contact with a person infected with the Ebola virus (or their body fluids, exposed environment such as linens, a dead animal, etc.). Contacts should be followed-up over a period of 21 days after the last exposure, looking for symptoms such as fever, and referred to treatment centres if they become ill.



5. Early supportive care (rehydration and pain relief) should be provided to patients as early as possible as it reduces mortality.

6. Safe and dignified burials teams are necessary to facilitate mourning by affected families and communities and to stop transmission of Ebola virus from deceased patients.

- Other key elements to put in place to control outbreaks are:
  - Surveillance and follow-up of survivors as the virus may persist in their body fluids and they may be infectious;
  - Psychosocial support to patients and their families;
  - Public health emergency plans and standard operational procedures at designated points of entry, in accordance with the International Health Regulations (IHR) (2005).
  - After 42 days (two 21-day maximum incubation period for Ebola virus) with no new cases, the human-to-human transmission is controlled and the outbreak can be declared over.

# 5

## Early supportive care improves survival

- Early supportive care, especially rehydration with oral or intravenous fluids, and treatment of specific symptoms, improves survival.
- Other treatments being used to help people survive Ebola virus disease include, where available and IPC measures strictly implemented, kidney dialysis, blood transfusions and plasma replacement therapy.
- It is important that patients and families trust health workers to accept being care of in dedicated treatment facilities.
- Care should be patient-centered and respect patients' preferences.
- There is, as yet, no commercially treatment available for Ebola. However, a range of potential treatments including blood products, immune therapies and drug therapies are currently being evaluated.





# 6

## Ebola is difficult to distinguish from other diseases with haemorrhage presentation

- First symptoms are common to many other diseases, they are not specific: sudden onset of fever, fatigue, muscle pain, headache and sore throat.
- These first symptoms are usually followed by: vomiting, diarrhoea, rash, symptoms of impaired kidney and liver function, and in some cases, both internal and external bleeding (e.g. oozing from the gums, blood in the stools).
- Ebola virus infection can be confirmed with laboratory diagnostics:
  - The diagnostic methods are the following:
    - o Reverse Transcription Polymerase Chain Reaction (RT-PCR) assay;
    - o Antibody-capture Enzyme-Linked Immunosorbent Assay (ELISA);
    - o Antigen-capture detection test;
    - o Serum neutralization test;
    - o Electron microscopy;
    - o Virus isolation by cell culture.
  - Current WHO recommended tests include:
    - o Automated or semi-automated Nucleic Acid Tests (NAT) for routine diagnostic management;
    - o Rapid antigen detection tests for use in remote settings where NAT are

not readily available. These tests are recommended for screening purposes as part of surveillance activities. However reactive tests should be confirmed with NAT.

- The preferred specimens for diagnosis include:
  - o Whole blood collected from live patients exhibiting symptoms;
  - o Oral fluid specimen stored in universal transport medium collected from deceased patients or when blood collection is not possible (swab for dead bodies).

- Recommended case definitions for Ebola or Marburg virus diseases can be found on: <http://www.who.int/csr/resources/publications/ebola/case-definition/en/>. During an outbreak, case definitions are likely to be adapted to new clinical presentation(s) or different modes of transmission related to the local event.



## 7

### The Ebola virus can persist in people recovering from the disease for several months

- People can survive from Ebola virus disease.
- Ebola virus is known to persist in immune-privileged sites in some people who have recovered from Ebola virus disease. These sites include the testicles, the inside of the eye, and the central nervous system. In women who have been infected while pregnant, the virus may persist in the placenta, amniotic fluid and fetus. In women who have been infected while breastfeeding, the virus may persist in breast milk.
- Several cases of sexual transmission have been reported. All Ebola survivors and their sexual partners should receive counselling to ensure safe sexual practices, be provided with condoms when discharged from Ebola treatment unit and enrolled in national semen and body fluid testing programmes.
- Male Ebola survivors should be offered semen testing when discharged from Ebola treatment unit, and then, for those who test positive, every month thereafter until their semen tests negative for virus twice by RT-PCR, with a minimum interval of two weeks between tests. Relapse-symptomatic illness in someone who has recovered from EVD due to increased replication of the virus in a specific site is a rare event, but has been documented. Reasons for this phenomenon are not yet fully understood.

## 8

### Ebola survivors may suffer from stigma and sequelae

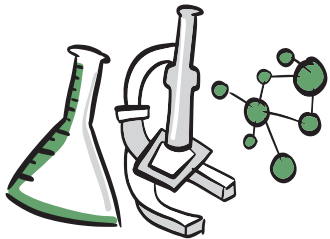
- Survivors may suffer from physical sequelae and should be followed-up. Most common physical sequelae are: musculoskeletal, ocular, auditory, abdominal, neurological, and sexual issues.
- Survivors may suffer from stigma. They may be rejected from their community and should be followed-up and assisted, if needed, regarding employment, living conditions, family, social support from their community, etc.
- They should receive education and counselling regarding the possible sequelae and psycho-social challenges they might face.
- Specific follow-up considerations should be applied for children and pregnant women.



# 9

## There are ongoing researches for vaccines, diagnostics and treatments

- Research is ongoing to develop and evaluate vaccines, diagnostics tools and therapeutics. Currently, no vaccine, or new therapeutic has been licensed.
- An experimental Ebola vaccine was highly protective against the deadly virus in a major trial in Guinea. The vaccine, called rVSV-ZEBOV, was studied in a trial involving 11 841 people during 2015. Results of efficacy trial show to be 100% effective in those who received it as part of a ring vaccination trial.
- There are 12 candidate vaccines and one (rVSV- ZEBOV, efficient against Zaire Ebola virus) that could be used under expedited access during outbreaks.
- A range of potential treatments including blood products, immune therapies and drug therapies are currently being evaluated.
- Four Nucleic Acid Tests (NAT) and three Rapid Diagnostic Tests (RDT) were approved for emergency use during the Ebola crisis 2014-2016. These tests could be used during outbreak situation, in remote settings.



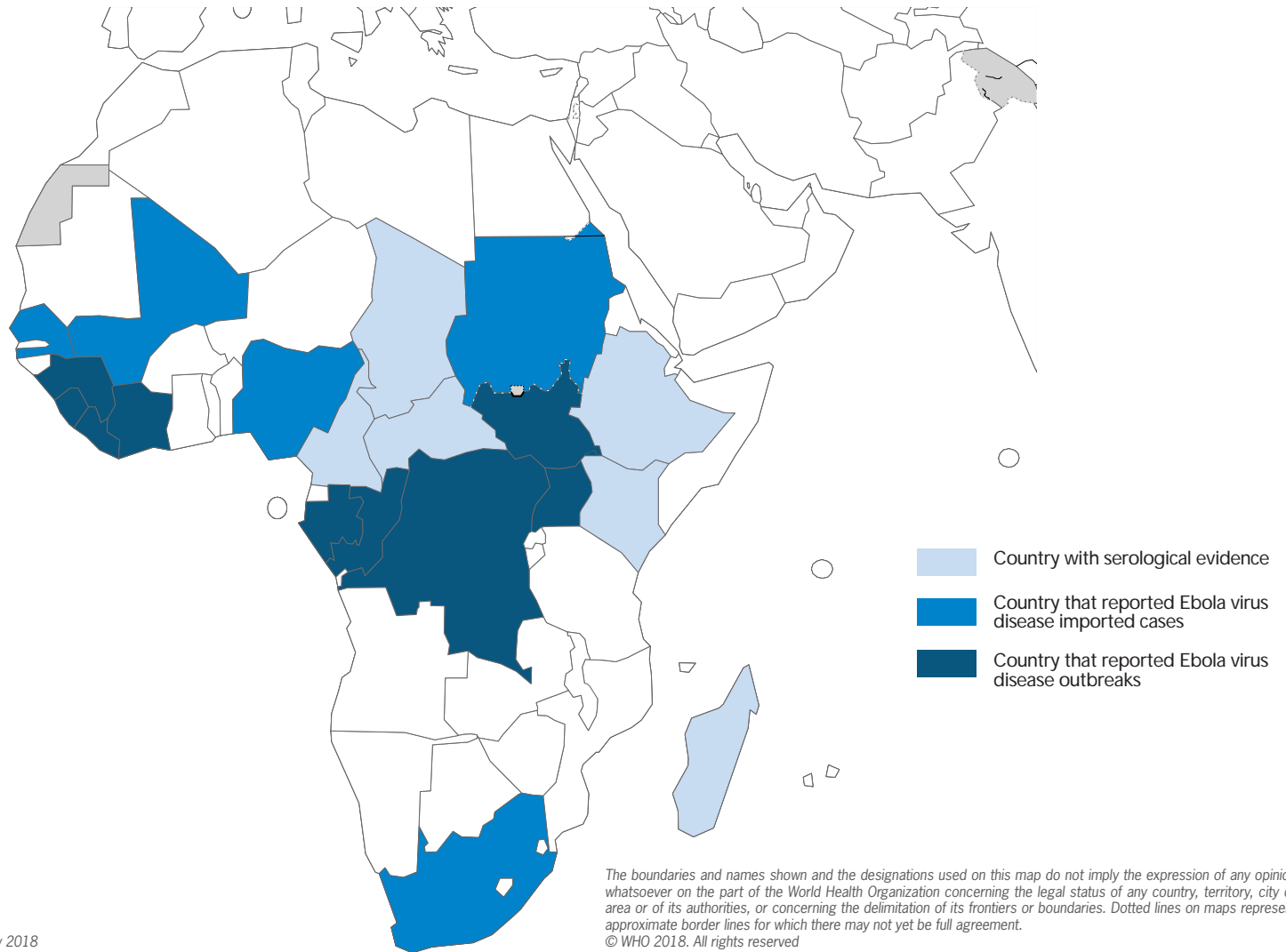
# 10

## Ebola is a viral haemorrhagic fever that occurs mostly in rural and remote areas of Africa

- Ebola virus disease (EVD), formerly known as Ebola haemorrhagic fever, is a severe illness in humans. The average case fatality rate is around 50%. It has varied from 25% to 90% in past outbreaks.
- Ebola virus disease is a zoonotic disease, transmittable from wild animals to humans.
- Reservoir of the disease is fruit bats. The disease is also found in monkeys, apes, antelope and porcupines. Ebola virus disease should be suspected if any of these animals is found ill or dead in the rainforest.



Geographic distribution of Ebola virus disease outbreaks (1976-2018)



Source: WHO/IHM, as of 15 February 2018

## More information about Ebola virus disease:

- Ebola WHO webpage:  
<http://www.who.int/ebola/en/>
- Ebola WHO fact sheet:  
<http://www.who.int/mediacentre/factsheets/fs103/en/>
- Ebola and Marburg virus disease epidemics: preparedness, alert, control and evaluation  
[http://www.who.int/csr/resources/publications/ebola/manual\\_EVD/en/](http://www.who.int/csr/resources/publications/ebola/manual_EVD/en/)
- Case definitions:  
<http://www.who.int/csr/resources/publications/ebola/case-definition/en/>
- Laboratory diagnosis:  
<http://www.who.int/csr/resources/publications/ebola/laboratory-guidance/en/>
- Clinical management:  
<http://www.who.int/csr/resources/publications/clinical-management-patients/en/>
- Clinical care for survivors of EVD:  
<http://www.who.int/csr/resources/publications/ebola/guidance-survivors/en/>
- Infection prevention and control guidance for care of patients in health care settings, with focus on Ebola:  
[http://www.who.int/csr/resources/publications/ebola/filovirus\\_infection\\_control/en/](http://www.who.int/csr/resources/publications/ebola/filovirus_infection_control/en/)
- Safe and dignified burials:  
<http://www.who.int/csr/resources/publications/ebola/safe-burials/en/>
- Ebola WHO MOOC:  
<https://openwho.org/courses/pandemic-epidemic-diseases>



# Lassa fever

## 10 THINGS YOU SHOULD KNOW

1. The reservoir of Lassa fever is a rat
2. Humans are primarily infected through exposure to rats' urine or faeces
3. Human-to-human transmission occurs then through direct contact with body fluids of infected persons
4. Pregnant women and infants may experience severe disease
5. Lassa fever is hard to distinguish from other viral diseases
6. Hygiene and rodent control are the best prevention in communities
7. Strict implementation of infection prevention and control measures in health care settings is critical to prevent the spread of the disease
8. Early supportive treatment reduces mortality
9. Outbreak control relies on community engagement, active case finding, contact tracing and safe and dignified burials
10. Lassa fever is a viral haemorrhagic fever that occurs in West Africa



# Lassa fever response tips

## Coordinating responders

- Engage with partners involved in the response (surveillance, laboratory, case management, infection prevention and control (IPC) and community engagement)
- Engage with religious and community leaders

## Communicating risk

- Encourage health authorities to:
  - Implement active case finding and contact tracing
  - Ensure protection of health care workers through IPC measures
  - Communicate about how to protect from becoming infected
  - Provide targeted communication to at-risk groups such as pregnant women
- Key messages to general public:
  - Humans are primarily infected through exposure to rats' urine or faeces
  - Avoid contact with body fluids of sick people
  - Seek health advice rapidly if you show symptoms
  - Wash your hands regularly
  - Implement measures to reduce contact with rodents

## Health Information

- Ensure early laboratory confirmation of suspected cases
- Notify cases to WHO, under the IHR (2005)

## Health Interventions

- Community engagement and health promotion
- Case management and IPC:
  - Isolation of cases
  - Early supportive treatment
  - Protect health care workers
- Surveillance, contact finding and contact tracing
- Safe and dignified burials
- Rodent control

## 1

**The reservoir of Lassa fever is a rat**

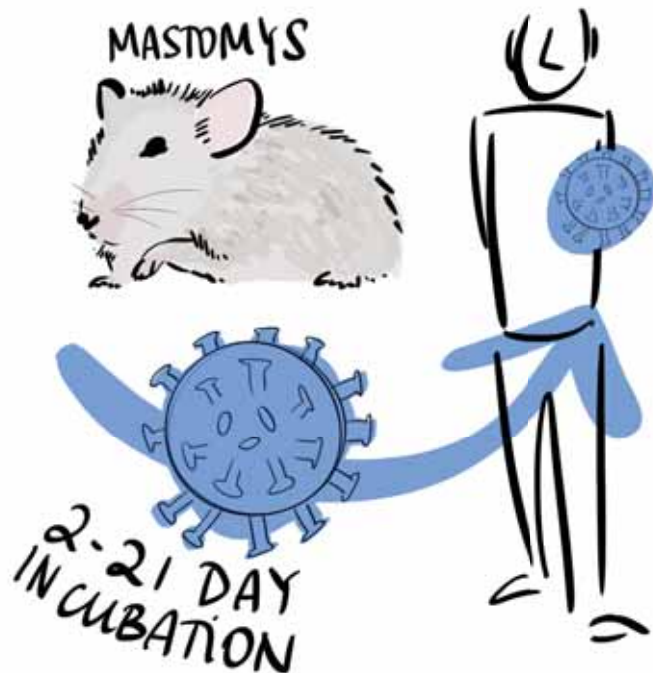
- The animal reservoir of Lassa virus is a rodent : the Mastomys rat, commonly know as the "multimammate rat".
- Rat are infected at birth and are chronic asymptomatic carriers of Lassa virus.
- The infected rats do not become ill but can shed the virus in their urine and faeces.
- The virus is present in aerosolized excreta, particularly urine.

## 2

**Humans are primarily infected through exposure to rats' urine or faeces**

- Humans usually become infected with Lassa virus from exposure to urine or faeces of infected rats.
- Humans are infected through:
  - Direct contact by catching, handling and preparing Mastomys as a food source (more frequent);
  - Ingestion of food contaminated by infected rodent excreta;
  - Direct contact with objects and surfaces contaminated by rats' urine and faeces;
  - Inhalation of aerosolized virus (rare).

- Transmission of Lassa fever virus from rats to humans is common, since these rodents scavenge on human food items and readily colonize areas where humans live.
- People at high risk of being infected, through rat-to-human transmission, are:
  - Persons living in rural areas where Mastomys are usually found, especially in communities with poor sanitation or crowded living conditions;
  - Persons hunting and consuming rodent products.





# 3

## Human-to-human transmission occurs then through direct contact with body fluids of infected persons

- Lassa virus may spread from human to human through direct contact with the blood, urine, faeces, or other body secretions of a person infected with Lassa fever.
- Humans can also be infected through direct contact with contaminated bedding or clothing.
- Human-to-human and laboratory transmission also occur, particularly in hospitals lacking adequate infection prevention and control measures (e.g. the virus may be spread by contaminated medical equipment, such as re-used needles).
- People most at risk of being infected, through human-to-human transmission, are:
  - Health care workers or anyone caring for Lassa fever patients in the absence of proper infection prevention and control practices;
  - People handling dead bodies of infected patients (e.g. during funerals).
- Sexual transmission of Lassa virus has also been reported.
- There is no evidence supporting airborne spread between humans.

# 4

## Pregnant women and infants may experience severe disease

- Lassa fever occurs in all age groups and both sexes.
- The disease is especially severe late in pregnancy:
  - Maternal mortality can be greater than 30% in third trimester and 50% in the last month;
  - Fetal loss is occurring in more than 80% of cases during the third trimester;
  - Pregnant women show increased level of viraemia (virus levels in the blood).
- Infection in infants is also associated with a very high case fatality rate.
- Infants (up to two years old) can present a “swollen baby syndrome” (edema, abdominal distension and bleeding, often leading to death). Older children experience similar symptoms as adults.

*contact with bodily fluids*



## 5

**Lassa fever is hard to distinguish from other viral diseases**

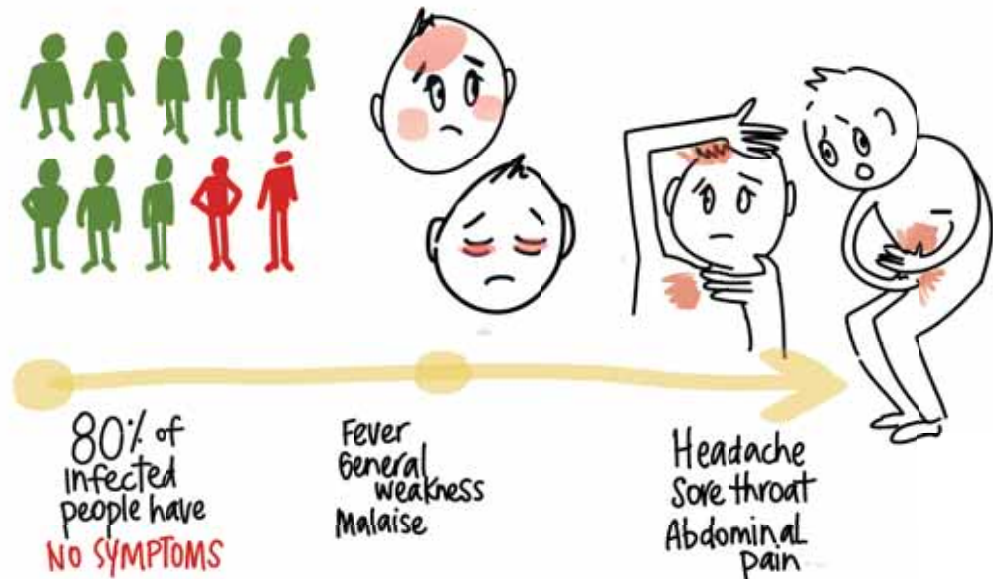
- Symptoms of Lassa fever are very varied and non-specific, which makes clinical diagnosis difficult, especially early in the course of the disease. Lassa fever can be difficult to distinguish from other viral haemorrhagic fevers (e.g. Ebola virus disease) as well as from other diseases that cause fever such as Malaria, Typhoid fever, Yellow fever, Influenza, Measles, Shigellosis, Cholera, Leptospirosis, Rickettsial infections, Relapsing fever, Meningitis, Bacterial sepsis, Hepatitis.
- Symptoms of Lassa fever can occur from 2 to 21 days after coming into contact with the virus. The incubation period is usually from 7 to 10 days.
- About 80% of infected people do not show symptoms (they are asymptomatic) or experience a mild disease.
- The onset of the disease, when it is symptomatic, is usually gradual. Symptoms usually start with fever, general weakness, and malaise.
- After a few days, headache, sore throat, muscle pain, chest pain, nausea, vomiting, diarrhoea, cough, and abdominal pain may follow.
- In mild cases, the patient usually recovers rapidly.
- In severe cases (20%) facial swelling, fluid in the lung cavity, bleeding from the mouth, nose, vagina or gastrointestinal tract and low blood pressure may develop. Severe cases require hospitalization.

- Shock, seizures, tremor, disorientation, and coma may also be seen in the later stages. Death (1 to 2% of total infected symptomatic people: severe and mild cases) usually occurs within 14 days of onset in fatal cases.
- Various degrees of deafness occur in 25% of severe cases who survive the disease. In half of these cases, hearing returns partially after 1–3 months. Transient hair loss and gait disturbance may occur during recovery.
- Lassa fever should be considered in febrile patients returning from West Africa, especially if they have had exposures in rural areas or hospitals in countries where Lassa fever is known to be endemic.
- Patient history is essential for diagnosis.

**Suspected case:** Illness with gradual onset with one or more of the following: malaise, fever, headache, sore throat, cough, nausea, vomiting, diarrhoea, myalgia, chest pain hearing loss and a history of contact with rodents or with a case of Lassa fever.

**Probable case:** A deceased suspected case (where it has not been able to collect specimen for laboratory confirmation) that has an epidemiological link with a laboratory confirmed case.

**Confirmed case:** A suspected case that is laboratory confirmed (positive for IgM antibodies, positive for Lassa virus antigen, positive for Lassa RNA by RT-PCR or virus isolation).



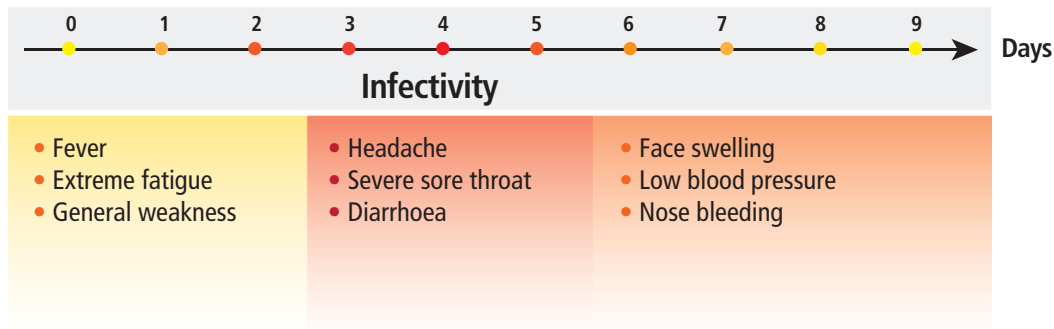
- Lassa virus infections can only be diagnosed definitively in the laboratory using the following tests:
  - Reverse Transcription Polymerase Chain Reaction (RT-PCR) assay;
  - Antibody Enzyme-Linked Immunosorbent Assay (ELISA);
  - Antigen detection tests;
  - Virus isolation by cell culture.
- Laboratory specimens may be hazardous and must be handled with extreme care. Handling specimens with live virus requires Biosafety level 4.
- Diagnostic assays have also been made commercially available, but none have been evaluated by WHO prequalification process.

# 6

## Hygiene and rodent control are the best prevention in communities

- To prevent infection, people should follow basic hygiene practices:
  - Wash their hands regularly;
  - Cook food thoroughly.
- Raising awareness is a first step towards better rodent management.
- At the community level, to reduce human-rodent contacts, people are advised to:
  - Store food in covered rodent-proof containers;
  - Keep homes clean and clear away any rubbish in or around the house;

- Keep a cat;
- Implement measures to reduce rodent populations. This would require strong political commitment and sustained efforts. Techniques that could be used include:
  - o Trapping and poisoning;
  - o Using non-lethal, non-toxic alternatives to chemical rodenticides (research ongoing);
  - o Reducing reproduction (fertility control);
  - o Etc.



## 7

### Strict implementation of infection prevention and control measures in health care settings is critical to prevent the spread of the disease

- In health care settings, staff should always apply standard infection prevention and control precautions when caring for patients, regardless of their presumed diagnosis. These include:
  - Hand hygiene;
  - Respiratory hygiene;
  - Use of personal protective equipment (to block splashes or other contact with infected materials);
  - Safe injection practices;
  - Safe and dignified burial practices.
- Health care workers caring for patients with suspected or confirmed Lassa fever should apply extra infection control measures to prevent contact with the patient's blood and body fluids and contaminated surfaces or materials such as clothing and bedding. When in close contact (within 1 metre) of patients with Lassa fever, health care workers should wear face protection (a face shield or a medical mask and goggles), a clean, non-sterile long-sleeved gown, and gloves (sterile gloves for some procedures).
- Health care workers should remember that maternity wards are potential sites of amplification as miscarriage and natural abortion with massive bleeding may conclude from women with Lassa fever.

## 8

### Early supportive treatment reduces mortality

- Treatment is supportive: it consists in symptomatic treatment, rehydration, monitoring fluid and electrolyte balance and renal function.
- Antiviral drug ribavirin seems to be effective if given early in course of the disease.
- There is no post-exposure prophylactic treatment.
- There is currently no licensed or commercially available vaccine. New candidate vaccines are under development.
- New candidate drugs are in development.



# 9

## Outbreak control relies on community engagement, active case finding, contact tracing and safe and dignified burials

The transmission of the disease can be stopped through:

1. Community engagement as communities are essential for controlling Lassa fever outbreaks. They have a role to play in the detection of new cases, and reduction of transmission through safe caring of the sick at home and safe and dignified burial. Communities should be engaged in the response since the early stage and be provided with the necessary information and personal protective equipment so that they can adapt the public health measures to their socio-cultural beliefs and ensure compliance of the community members.
2. Active case finding, rapid isolation of patients and early laboratory confirmation of suspected cases. Active case finding refers to actively searching for new cases (for instance, going from house to house in the community, asking if people are sick or if people have died). New (suspected) cases should be rapidly and safely referred to treatment centres for isolation and treatment.

3. Contact tracing which refers to the follow-up of persons who may have come into contact with a person infected with the Lassa virus (or their body fluids, exposed environment such as linens, etc.). Contacts should be followed-up over a period of 21 days after the last exposure, looking for symptoms such as fever, and referred to treatment centres if they become ill.
4. Safe and dignified burials. It is necessary to train people who will have close contact with dead bodies and provide them with the necessary personal protective equipment. People can be buried in a safe manner while respecting traditional beliefs.
5. Early supportive care (rehydration and pain relief) should be provided to patients as early as possible as it reduces mortality (see point 8).



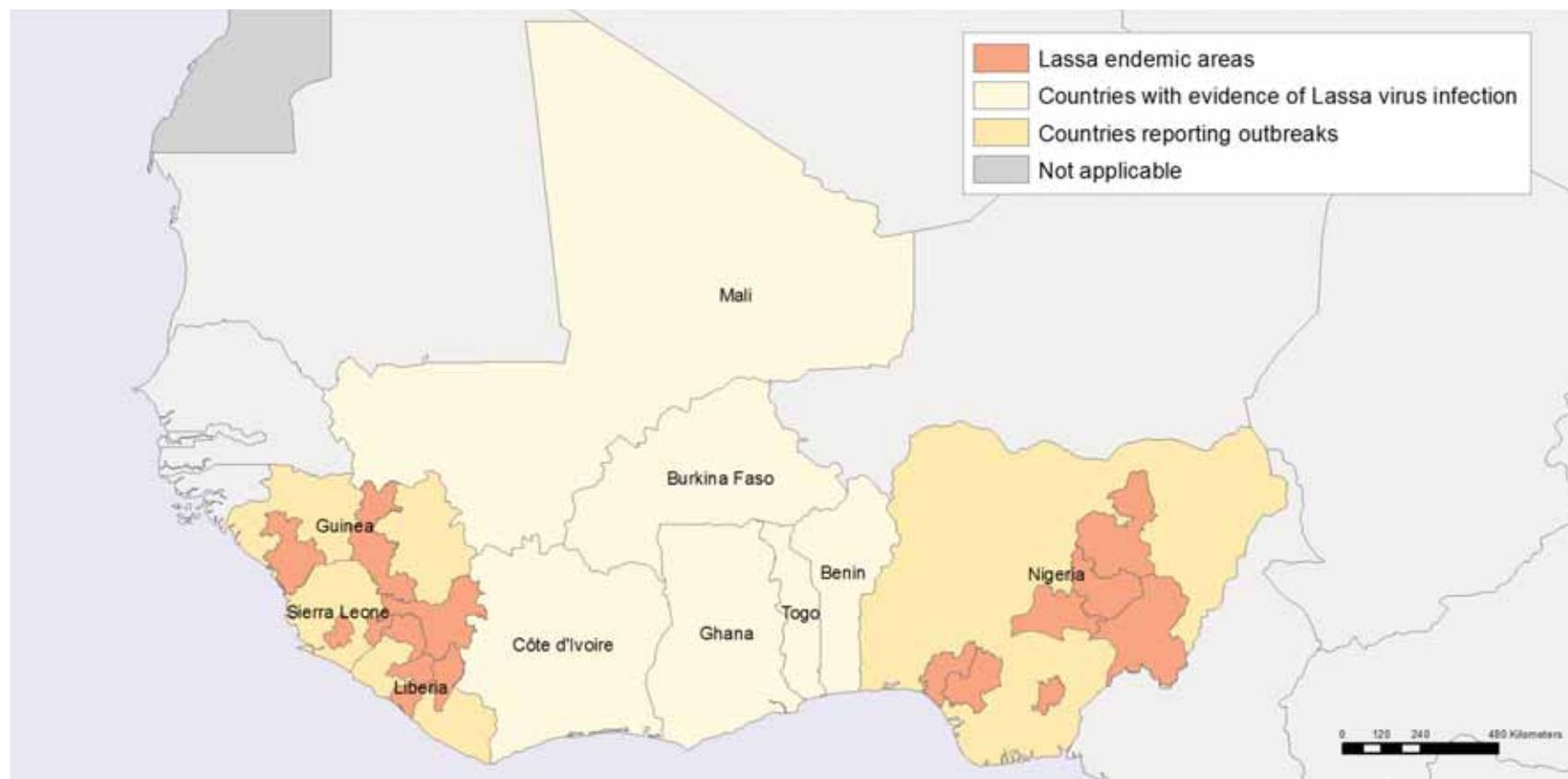
# 10

## Lassa fever is a viral haemorrhagic fever that occurs in West Africa

- Lassa fever is a viral haemorrhagic illness of 2-21 days duration that occurs in West Africa.
- Lassa fever has been reported in Benin, Burkina Faso, Côte d'Ivoire, Ghana, Guinea, Liberia, Mali, Nigeria, Sierra Leone, and Togo, but should be considered endemic in other West African countries.
- The overall case fatality rate is 1%.
- Observed case fatality rate among patients hospitalized with severe presentation of Lassa fever is 15%.



## Geographic distribution of Lassa fever in West African affected countries, 1969–2018



The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted lines on maps represent approximate border lines for which there may not yet be full agreement.  
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## More information about Lassa fever:

- Lassa fever WHO webpage  
<http://www.who.int/csr/disease/lassafever/en/>
- Lassa fever WHO fact sheet  
<http://www.who.int/mediacentre/factsheets/fs179/en/>
- Lassa fever WHO MOOC  
<https://openwho.org/courses/pandemic-epidemic-diseases>



# Crimean-Congo haemorrhagic fever (CCHF)

## 10 THINGS YOU SHOULD KNOW



1. The CCHF virus is transmitted by ticks and the disease is endemic where the tick vector is present
2. Humans are primarily infected through tick bite and secondary human-to-human transmission occurs through direct contact with the body fluids of infected persons
3. Infected animals are not sick which makes it difficult to control the disease in animals and anticipate and prevent infection in humans
4. CCHF is a severe disease with high case fatality ratio
5. Early supportive care improves survival
6. Infection prevention and control measures are critical to control the infection when caring for patients or during burial ceremonies
7. Raising awareness on risk factors and preventive measures is key to reduce infection in people
8. Efficient vector control measures are currently lacking
9. CCHF can be misdiagnosed with other viral haemorrhagic fevers and early laboratory confirmation of suspected cases is critical to mount the response
10. CCHF is one of the priority disease for research and development in public health emergency contexts (R&D Blueprint)



# Crimean-Congo haemorrhagic fever (CCHF) response tips

## Coordinating responders

- Engage with partners involved in the response (community engagement, surveillance, laboratory, case management, IPC, and vector control)
- Engage with the animal health and food production sectors

## Communicating risk

- Encourage health authorities to:
  - Implement active case finding and contact tracing
  - Ensure protection of health care workers through IPC measures
  - Communicate about how to protect from becoming infected
- Key messages are:
  - CCHF is transmitted by ticks or through contact with body fluids of infected animals and humans
  - Bodies of deceased patients are contagious
  - Apply IPC measures when in contact with sick or dead patients and animals
  - People with symptoms should seek medical advice as early treatment increases chances of survival

## Health Information

- Ensure early laboratory confirmation of suspected cases
- Notify cases to WHO, under the IHR (2005)

## Health Interventions

- Community engagement and health promotion
- Case management and IPC:
  - Isolation of cases
  - Early supportive and antiviral treatment
  - Protect health care workers
- Surveillance, and contact tracing
- Safe and dignified burials

## 1

**The CCHF virus is transmitted by ticks and the disease is endemic where the tick vector is present**

- Ticks of the genus *Hyalomma* are the principal vector of the disease, although a number of tick are capable of becoming infected with CCHF virus.
- Animals become infected by the bite of infected ticks and the virus remains in their bloodstream for about one week after infection, allowing the tick-animal-tick cycle to continue when another tick bites.
- The hosts of the CCHF virus include a wide range of wild and domestic animals such as cattle, sheep and goats. Many birds are resistant to infection, but ostriches are susceptible and may show a high prevalence of infection in endemic areas.
- CCHF is a viral haemorrhagic fever that is endemic where the tick vector is present: in Africa, the Balkans, the Middle East and Asian countries south of the 50th parallel north – the geographical limit of the principal tick vector.



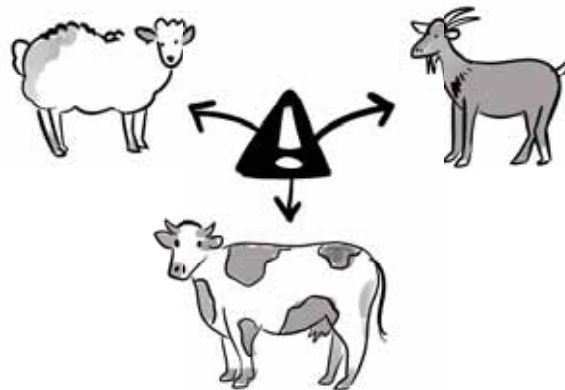
## 2

**Humans are primarily infected through tick bite and secondary human-to-human transmission occurs through direct contact with the body fluids of infected persons**

- CCHF can cause severe outbreaks in humans.
- Humans are infected either by ticks bite or through direct contact with blood or tissues of infected ticks or viraemic vertebrates including wild animals and livestock.
- Most at-risk people for the animal-to-human transmission are people involved in the livestock industry, such as agricultural workers, slaughterhouse workers and veterinarians.
- Secondary human-to-human transmission occurs through direct contact with the blood, secretions, organs or other body fluids of infected persons.

- There is high human-to-human transmission risk when providing direct patient care or handling bodies of deceased individuals (funerals).
- Hospital-acquired infections can also occur due to inappropriate infection prevention and control.

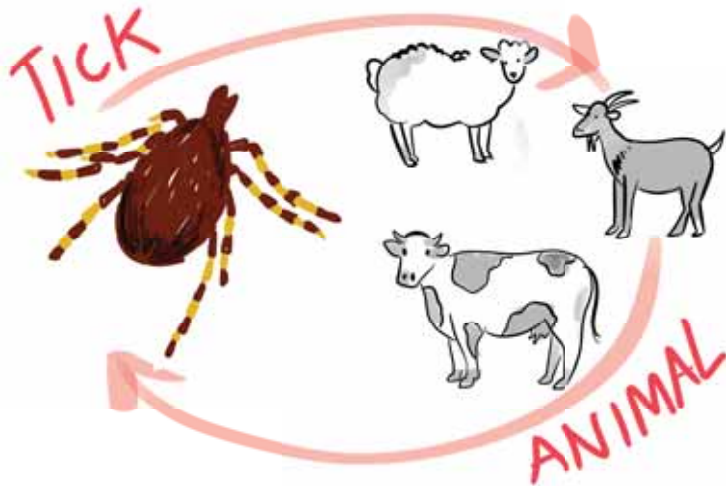
contact with  
bodily fluids

# 3

## Infected animals are not sick which makes it difficult to control the disease in animals and anticipate and prevent infection in humans

- Infected animals are not sick and do not show any symptoms. This allows the virus to maintain itself in nature in unnoticed enzootic tick-vertebrate-ticks cycles and makes difficult to anticipate and prevent potential infection in humans.



# 4

## CCHF is a severe disease with high case fatality ratio

- The mortality rate from CCHF is approximately 30% (it ranges from 10 to 50%), with death occurring in the second week of illness. In patients who recover, improvement generally begins on the ninth or tenth day after the onset of illness.
- The length of the incubation period depends on the mode of acquisition of the virus. Following infection by a tick bite, the incubation period is usually one to three days, with a maximum of nine days. The incubation period following contact with infected blood or tissues is usually five to seven days, with a documented maximum of thirteen days.
- Onset of symptoms is sudden, with fever, myalgia (muscle ache), dizziness, neck pain and stiffness, backache, headache, sore eyes and photophobia (sensitivity to light). There may be nausea, vomiting, diarrhoea, abdominal pain and sore

throat early on, followed by sharp mood swings and confusion. After two to four days, the agitation may be replaced by sleepiness, depression and lassitude, and the abdominal pain may localize to the upper right quadrant, with detectable hepatomegaly (liver enlargement).

- Other clinical signs include tachycardia (fast heart rate), lymphadenopathy (enlarged lymph nodes), and a petechial rash (a rash caused by bleeding into the skin) on internal mucosal surfaces, such as in the mouth and throat, and on the skin. The petechiae may give way to larger rashes called ecchymoses, and other haemorrhagic phenomena. There is usually evidence of hepatitis, and severely ill patients may experience rapid kidney and liver failure or pulmonary failure after the fifth day of illness.



**SEVERE DISEASE  
WITH HIGH CASE  
FATALITY RATIO**

# 5

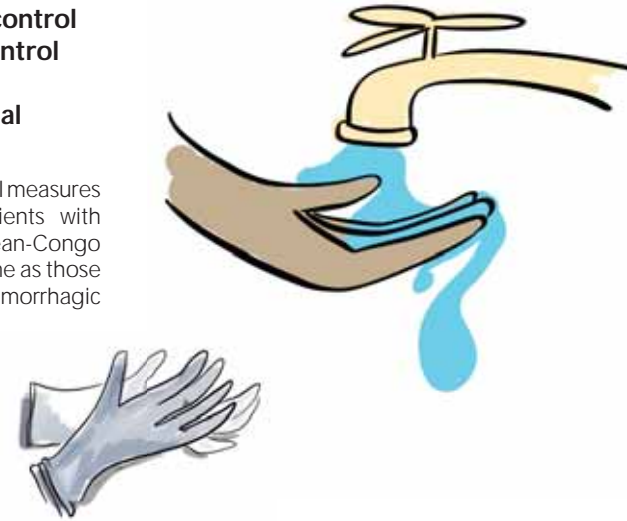
## Early supportive care improves survival

- General supportive care with treatment of symptoms is the main approach to managing CCHF in people.
- The antiviral drug ribavirin has been used to treat CCHF infection and may be beneficial if used early in the course of the illness. Both oral and intravenous formulations exist and seem to be effective. Currently, WHO is reviewing evidence for ribavirin use for the treatment of CCHF.
- There is currently no licensed or commercially available vaccine against CCHF for humans and the animal hosts.

# 6

## Infection prevention and control measures are critical to control the infection when caring for patients or during burial ceremonies

- Infection prevention and control measures while providing care to patients with suspected or confirmed Crimean-Congo haemorrhagic fever are the same as those for Ebola and Marburg haemorrhagic fever.



### PRECAUTIONS TO BE TAKEN:

<p><b>When caring for patients</b></p>	<p><b>Standards precautions regardless of the diagnosis</b></p>	<ul style="list-style-type: none"> <li>• Hand hygiene</li> <li>• Respiratory hygiene</li> <li>• Use of personal protective equipment (to block splashes / other contact with infected material)</li> <li>• Safe injection practices</li> </ul>
	<p><b>Health care workers caring for patients with suspected or confirmed CCHF virus</b></p>	<ul style="list-style-type: none"> <li>• Extra infection control measures to prevent contact with patient’s blood and body fluids and contaminated surface or material such as clothing or bedding</li> <li>• Face protection (a face shield or a medical mask and goggles), a clean, non-sterile long-sleeved gown, and gloves (sterile gloves for some procedures) should be worn when in close contact (within 1 metre) of patients with CCHF</li> </ul>
	<p><b>Caring of patients at home</b></p>	<ul style="list-style-type: none"> <li>• Gloves and appropriate personal protective equipment should be worn</li> <li>• Regular hand washing</li> </ul>
<p><b>During burial ceremonies</b></p>		<ul style="list-style-type: none"> <li>• Only trained burial team should handle the bodies of people who may have died from CCHF</li> <li>• Burial teams should be trained &amp; equipped to properly, safely and with dignity bury the dead</li> </ul>

# 7

## Raising awareness on risk factors and preventive measures is key to reduce infection in people

- In the absence of a vaccine, the best way to reduce infection in people is by raising awareness of the risk factors and educating people about the measures they can take to reduce exposure to the virus. People should be informed about:
  - Wearing protective clothing (long sleeves, long trousers);
  - Wearing light coloured clothing to allow easy detection of ticks on the clothes;
  - Using approved acaricides (chemicals intended to kill ticks) on clothing;
  - Using approved repellent on the skin and clothing;
  - Regularly examining clothing and skin for ticks; if found, removing them safely;
  - Seeking to eliminate or control tick infestations on animals or in stables and barns;
  - Avoiding areas where ticks are abundant and seasons when they are most active.
- Measures to reduce the risk of animal-to-human transmission include:
  - Wearing gloves and other protective clothing while handling animals or their tissues in endemic areas, notably during slaughtering, butchering and culling procedures in slaughterhouses or at home;



- Quarantining animals before they enter slaughterhouses or routinely treating animals with approved acaricides two weeks prior to slaughter.
- Measures to reduce the risk of human-to-human transmission in the community include:
  - Avoiding close physical contact with CCHF-infected people;
  - Wearing gloves and protective equipment when taking care of ill people;
  - Washing hands regularly after caring for or visiting ill people.

# 8

## Efficient vector control measures are currently lacking

- Current vector control measures are not fully satisfactory:
  - Chemicals produce resistant ticks, food contamination, and environmental pollution. Furthermore, the tick vectors are numerous and widespread, so tick control with acaricides (chemicals intended to kill ticks) is only a realistic option for well-managed livestock production facilities;
  - Physical measures (heavy grazing, burning of grasslands) have an important negative impact on the environment;
  - Biological measures (e.g. use of hormones and growth regulators, use of predators, bacteria, nematodes and fungi) have not demonstrated full efficacy.
- An animal vaccine effective against *Hyalomma* ticks that prevent the tick-animal-tick cycle would decrease tick population, decrease CCHF prevalence in animals, and therefore decrease human exposure, being a cost effective CCHF prevention measure.



A VACCINE EFFECTIVE  
AGAINST HYALOMMA  
— TICKS? —

## 9

### CCHF can be misdiagnosed with other viral haemorrhagic fevers and early laboratory confirmation of suspected cases is critical to mount the response

- Due to lack of standardized case definition and knowledge about CCHF, the disease can be misdiagnosed. This is why laboratory confirmation is critical to guide response activities.

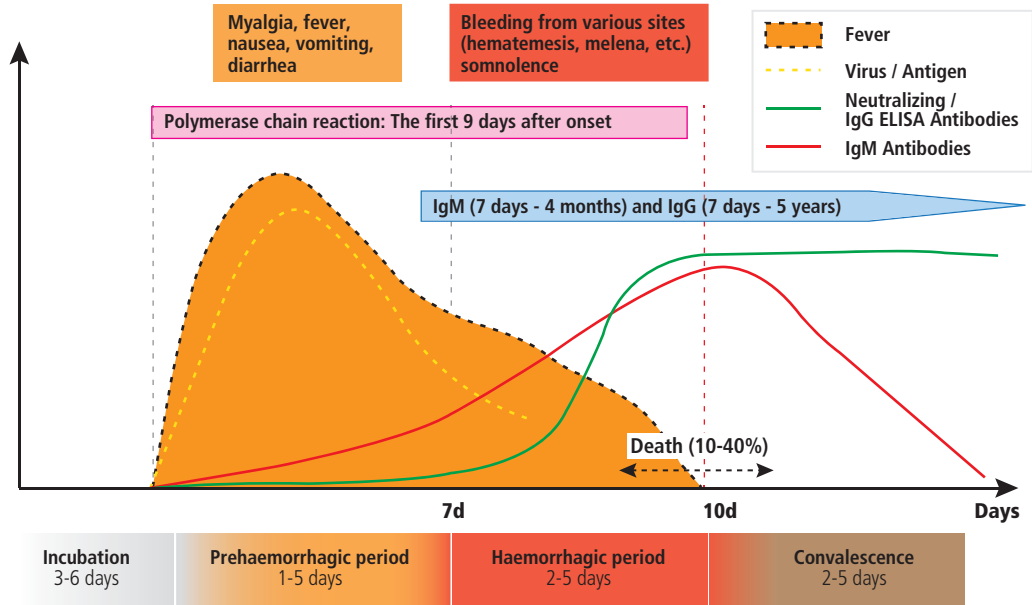
#### Proposed case definition:

**Suspected case:** Illness with sudden onset of fever with one or more of the following: headache, myalgia, nausea, vomiting, diarrhoea, myalgia, abdominal pain and a history of tick bite or contact with wild animals or livestock or contact with a case of CCHF.

**Probable case:** A deceased suspected case (where it has not been able to collect specimen for laboratory confirmation) that has an epidemiological link with a laboratory confirmed case.

**Confirmed case:** A suspected case that is laboratory confirmed (positive for IgM antibodies, positive for CCHF virus antigen, positive for CCHF RNA by RT-PCR or virus isolation).

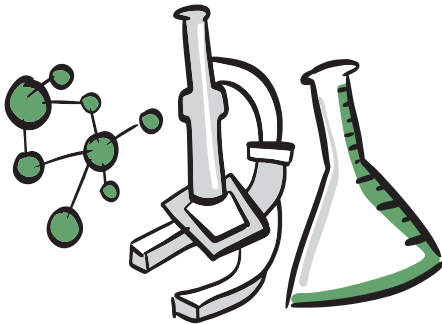
- Samples taken from people with suspected CCHF should be handled by trained staff working in suitably equipped laboratories.
- CCHF virus infection can be diagnosed by several different laboratory tests:
  - Enzyme-Linked Immunosorbent Assay (ELISA);
  - Antigen detection;
  - Serum neutralization;
  - Reverse Transcription Polymerase Chain Reaction (RT-PCR) assay;
  - Virus isolation by cell culture.
- Patients with fatal disease, as well as in patients in the first few days of illness, do not usually develop a measurable antibody response and so diagnosis in these individuals is achieved by virus or RNA detection in blood or tissue samples.
- Tests on patient samples present an extreme biohazard risk and should only be conducted under maximum biological containment conditions (BSL4). However, if samples have been inactivated (e.g. with virucides, gamma rays, formaldehyde, heat, etc.), they can be manipulated in a basic biosafety environment.



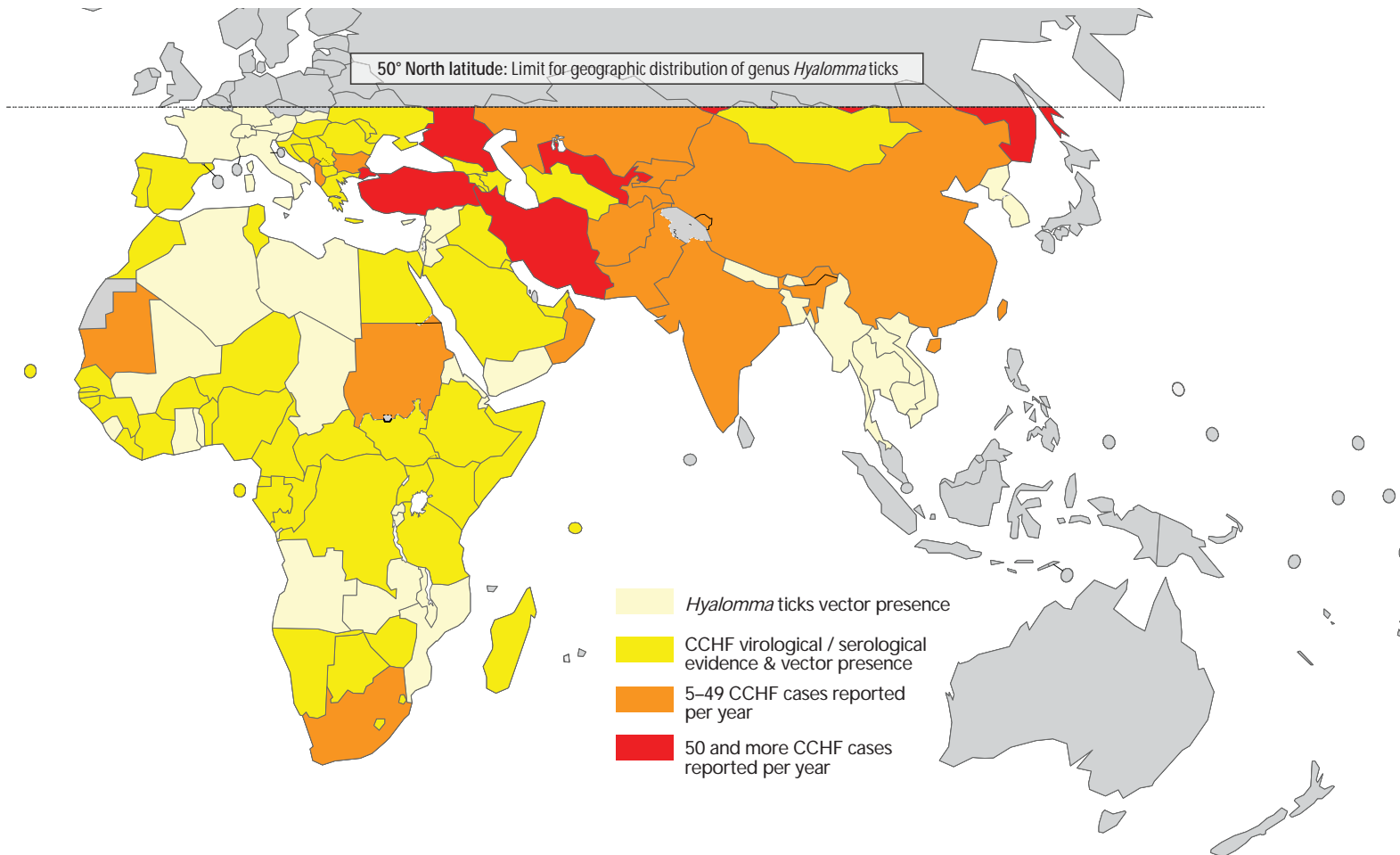
# 10

## CCHF is one of the priority disease for research and development in public health emergency contexts (R&D Blueprint)

- Research and Development roadmaps and target product profiles are being developed in consultation with experts and stakeholders (as part of the R&D Blueprint).
- Research is ongoing for therapeutics (ribavirin, favipiravir, intravenous immunoglobulin, monoclonal antibodies), for rapid diagnostics and for an animal anti-tick vaccine effective against Hyalomma ticks.
- Given the epidemiology of CCHF, with a limited number of cases reported yearly, a human vaccine might not be the most cost-effective and viable control measure.



Geographic distribution of Crimean-Congo haemorrhagic fever



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SEVERE DISEASE  
WITH HIGH CASE  
FATALITY RATIO

## More information about Crimean-Congo haemorrhagic fever (CCHF):

- CCHF WHO webpage  
[http://www.who.int/csr/disease/crimean\\_congoHF/en/](http://www.who.int/csr/disease/crimean_congoHF/en/)
- CCHF WHO fact sheet:  
<http://www.who.int/mediacentre/factsheets/fs208/en/>
- R&D Blueprint:  
<http://www.who.int/blueprint/en/>
- Infection prevention and control guidance for care of patients in health care settings, with focus on Ebola:  
[http://www.who.int/csr/resources/publications/ebola/filovirus\\_infection\\_control/en/?ua=1](http://www.who.int/csr/resources/publications/ebola/filovirus_infection_control/en/?ua=1)

# Yellow fever

## 10 THINGS YOU SHOULD KNOW

1. Urban Yellow fever (YF), the most threatening form of YF epidemics, is transmitted through *Aedes aegypti* mosquito bites
2. Outbreaks of YF in urban areas can be devastating
3. Emergency mass vaccination and vector control are the two main pillars of YF outbreak response
4. YF vaccine is safe and provides lifelong immunity
5. Vaccine production is limited but there is a global emergency stockpile
6. Routine immunization in children is the key to preventing outbreaks
7. The risk of YF international spread exists but can be prevented by applying the International Health Regulations (IHR) recommendations
8. YF is hard to distinguish from some other diseases with similar symptoms
9. Early clinical management improves survival
10. African Ministers of Health (MOH) are committed to eliminating YF epidemics



# Yellow fever response tips

## Coordinating responders

- Contact WHO/ICG for emergency vaccines
- Engage partners and communities for vector control around cases
- Organize emergency mass vaccination campaigns including cold chain and waste management

## Health Information

- Laboratory diagnosis may be difficult (serological tests cross-react with Dengue and other flaviviruses)
  - Think of differential diagnosis of febrile jaundice
- Distribute vaccination cards
- Notify cases to WHO, under the IHR (2005)

## Communicating risk

- Encourage health authorities to:
  - Engage communities for vector control
  - Work with partners for social mobilization for vaccination campaigns
  - Ensure vector control in health facilities
- Key messages are:
  - YF is transmitted by mosquitoes
  - Vaccine is safe and provides lifelong immunity
  - Seek medical care early as this increases chances of survival

## Health Interventions

- Community engagement
- Emergency mass vaccination
- Vector control
- Control at borders (airports)
- Patient supportive care, with bed nets (also during the day)

## 1

## Urban Yellow fever (YF), the most threatening form of YF epidemics, is transmitted through *Aedes aegypti* mosquito bites

- The yellow fever virus is transmitted to humans by infected mosquitoes, most commonly from the *Aedes* species (*Aedes aegypti*, which can transmit the disease from human to human in urban settings) – it is the same mosquito that spreads Zika, Chikungunya and Dengue viruses.
- Outbreaks usually occur in areas where mosquitoes breed.
- The current distribution of *Aedes aegypti* is the widest ever recorded and *Aedes* mosquitoes are present in all continents. Urbanization with resulting increased population densities, further enhanced by man-made larval habitats, amplifies mosquito-transmitted diseases.
- *Aedes* mosquitoes usually bite during the day, peaking during early morning and late afternoon/evening.



## 2

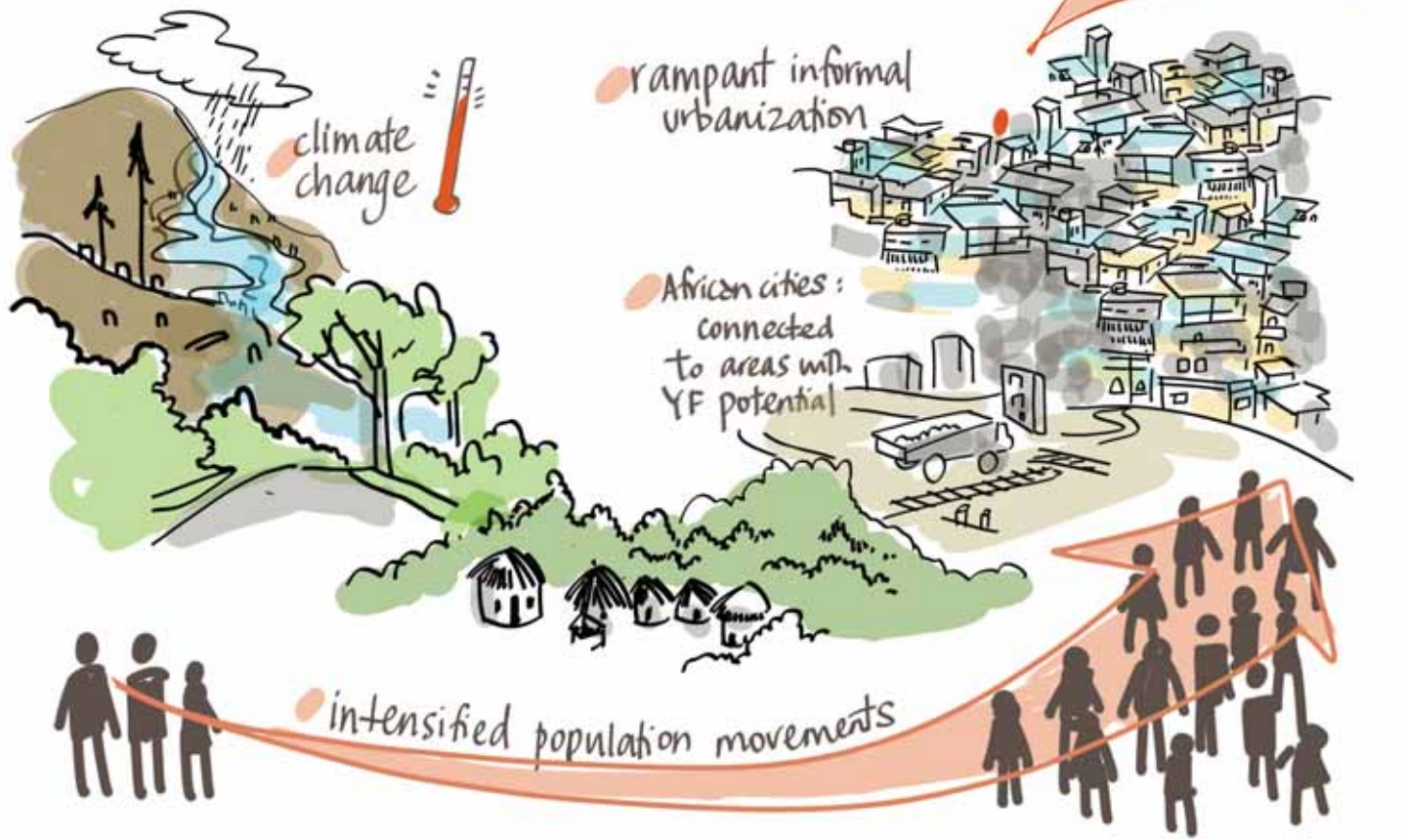
## Outbreaks of YF in urban areas can be devastating

- YF outbreaks in urban settings can be very devastating as they have the potential to amplify rapidly and spread widely, especially to other countries, because of:
  - Increased human population densities that lead to rapid amplification of the disease;
  - Increased density of the mosquito vector of urban YF epidemics that breeds in man-made containers of water, feeds predominantly on human blood and bites multiple individuals in a single blood meal, and lives in close association with human dwellings;
  - Ease and speed of population movements, as well as easy access to airports, facilitate spread of the disease and its exportation to other countries;



- Difficulties in assessing target populations, and in mounting reactive interventions in informal urban settings.
- **There are three types of transmission cycles.** However, with climate and demographic change in endemic settings, this classification may be reviewed.
  - *Sylvatic (or jungle) Yellow fever:* In tropical rainforests, monkeys, which are the primary reservoir of yellow fever, are bitten by wild mosquitoes which pass the virus on to other monkeys. Occasionally, humans working or travelling in the forest are bitten by infected mosquitoes and develop yellow fever. This is the most common type of outbreak in the Americas;
  - *Intermediate Yellow fever:* In this type of transmission, semi-domestic mosquitoes (those that breed both in the wild and around households) infect both monkeys and people. Increased contact between people and infected mosquitoes leads to increased transmission and many separate villages in an area can develop outbreaks at the same time;
  - *Urban Yellow fever:* Large epidemics occur when infected people introduce the virus into heavily populated areas with high mosquito density and where most people have little or no immunity, due to lack of vaccination. In these conditions, infected *Aedes Aegypti* mosquitoes transmit the virus from person to person. This is the most serious outbreak because it amplifies quickly.

# INCREASED RISK OF URBAN OUTBREAK WITH INTERNATIONAL SPREAD



## 3

## Emergency mass vaccination and vector control are the two main pillars of YF outbreak response

### Vector control:

- Vector control strategies should address all life stages of the *Aedes* mosquito from the egg, to larva and adult. Community engagement is essential for these interventions:
  - Elimination of breeding sites and eggs/larvae/pupae in standing water (e.g. cleaning roof gutters, clean-up campaigns, etc.);
  - Targeted residual spraying of adult mosquitoes (in areas known to be resting sites for *Aedes* mosquitoes) and space spraying when there is an outbreak;
  - Mosquito control programmes targeting wild mosquitoes in forested areas are not practical and not recommended for preventing jungle (or sylvatic) yellow fever transmission.



- Additionally, personal preventive measures such as clothing minimizing skin exposure, use of repellents, as well as window screens and air conditioning are recommended to avoid mosquito bites. The use of insecticide-treated bed nets is limited by the fact that *Aedes* mosquitoes bite during daytime.
- Mosquito surveillance is part of vector control and helps improve timeliness of decisions to control mosquito populations and prevent disease. Both larval and adult vector populations should be targeted for surveillance.
- Eventually, economic development will reduce mosquito-borne diseases by improving standards of living (e.g. people living in houses with solid floors and roofs, window screens, and air conditioning).

### Emergency mass vaccination:

- Reactive mass vaccination campaigns, by increasing immunity in the population, reduce the possibility of transmission of the virus. Vaccine coverages greater than 80%, with a 60-80% security threshold, are necessary to interrupt autochthonous transmission (human-mosquito-human) of YF virus within a community and ensure that sporadic unvaccinated cases do not generate secondary cases.



# 4

## YF vaccine is safe and provides lifelong immunity

- There is a good vaccine against YF. It has been used for many decades and is safe and affordable, providing effective immunity against yellow fever within 10 days for more than 90% of people vaccinated and within 30 days for 99% of people vaccinated. A single dose provides lifelong protection. A booster dose of yellow fever vaccine is not needed.
- Adverse effects of the Yellow fever vaccine are generally mild and may include headaches, muscle aches, and low-grade fevers. Serious adverse effects are rare.
- In Yellow fever endemic countries, WHO strongly recommends routine vaccination for everyone older than 9 months. People over 60 years of age should be given the vaccine after a careful risk-benefit assessment. Some people should not be routinely vaccinated, including:
  - Infants aged less than 9 months;
  - Pregnant women (unless during an outbreak if the risk of disease outweighs the potential adverse effect of the vaccine);
  - People with severe allergies to egg protein; and
  - People with severe immunodeficiency.



# 5

## Vaccine production is limited but there is a global emergency stockpile

- They are four prequalified vaccine manufacturers and global supply production is limited. There is a global emergency stockpile of six million vaccine doses, which can be accessed by any country facing an outbreak, through a request to the International Coordinating Group (ICG).
- For outbreak response, in case of shortage of vaccine, it is possible to use a fraction of the vaccine doses (1/5), in order to rapidly increase the population immunity and stop human-to-human transmission.
  - Children under two years of age should be offered a full dose, as they may have a weaker immune response to the vaccine than older people;
  - There is no evidence of increased serious adverse effects when using a fractional dose.

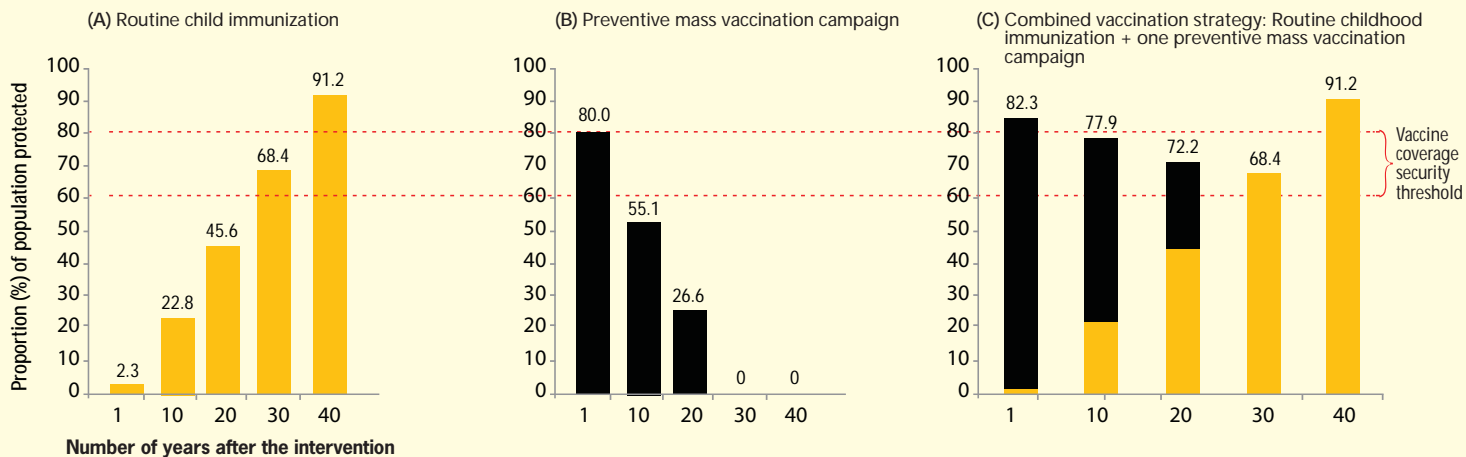
# 6

## Routine immunization in children is the key to preventing outbreaks

- Vaccination is the single most important measure for preventing yellow fever. The prevention of outbreaks can only be achieved if the majority of the population is immunized.
- YF routine immunization in the Expanded Programme on Immunization (EPI) can provide sufficient population immunity. However, it takes about 30 years to build the population immunity to adequate levels to stop potentially large scale outbreaks. Mass preventive vaccination campaigns to other age groups accelerate the building of population immunity through what is called the YF "combined vaccination strategy".



Population protected by routine immunization, preventive mass campaigns and combined vaccination strategy





# 7



The risk of YF international spread exists but can be prevented by applying the *International Health Regulations (IHR)* recommendations

- With the increasing occurrence of urban YF outbreaks comes an increased risk of international spread of diseases, because big cities are transport hubs with frequent transport connections. A particularly concerning scenario would be exportation of the disease to a country where the vector is present and population immunity levels are low, which could lead to local transmission.
- For Yellow fever, exportation of cases to Asia is especially worrisome as all favorable conditions for local transmission (vector such as *Aedes aegypti*, non-immune populations) are present in this continent, as demonstrated by dengue activity.
- It is recommended that major sectors recruiting international workers, with potential sylvatic exposure (extractive, mining, construction and forestry industries), take measures to ensure their staff and families are vaccinated.
- To prevent international spread, it is essential that the International Health Regulations (2005) are applied and that travelers present yellow fever vaccination certificates. Under the IHR (2005), it is also essential to notify YF cases that have a serious public health impact and/or are unusual or unexpected, and/or could lead to international spread and/or present a significant risk of travel or trade restrictions.
- Vector control measures may be applied in various forms of transport, in accordance with the IHR (2005).



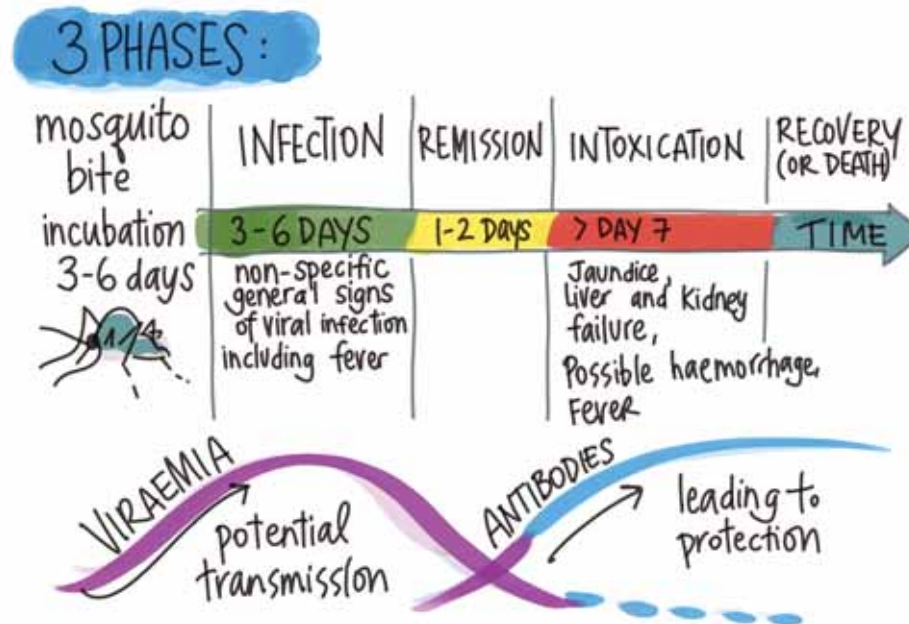
# 8

## YF is hard to distinguish from some other diseases with similar symptoms

- Yellow fever is difficult to diagnose (especially during the early stages) because its symptoms are not specific and can be confused with other common diseases such as Malaria, Viral Hepatitis (when jaundice), Dengue, Leptospirosis (when jaundice), other arbovirus diseases, Ebola virus disease (when haemorrhagic) as well as with poisoning.
- Once contracted, the Yellow fever virus incubates in the body for three to six days;
- Most people (about 88% of those infected) do not experience symptoms;
- Symptoms usually develop in two phases:
  - o First to occur are common, unspecific symptoms, including fever, muscle pain with prominent backache, headache, loss of appetite, and nausea or vomiting. In most cases, symptoms disappear after three to four days.
  - o A small percentage of patients (about 2-3% of infected people) will then enter a second, more toxic phase within 24 hours of recovering from initial symptoms. High fever returns and several body systems are affected, usually the liver and the kidney, hence the characteristic jaundice – which gives yellow fever its name - dark urine and abdominal pain with vomiting. Bleeding can occur from the mouth, nose, eyes or stomach. Half of the patients who enter the toxic phase die within seven to ten days. The rest recover without significant organ damage.

- Laboratory tests are necessary to confirm yellow fever and access the global stockpile:
  - In the first phase, blood is collected for RT-PCR – Reverse Transcription Polymerase Chain Reaction, to confirm the presence of the virus (viremia);
  - In later stages of the disease, serology testing to identify antibodies is needed (ELISA, Enzyme-Linked Immunosorbent Assay and PRNT, Plaque Reduction Neutralization Test, for neutralizing antibodies). The detection of antibodies indicates that the person has either been infected or vaccinated, but it cannot

- distinguish between the two. The level of antibodies' titres and their evolution over time, on a second sample, can provide indication of how acute the infection might be;
- Whenever YF is suspected, there should also be systematic testing by serology and PCR for other arboviruses (such as Dengue, Zika, Chikungunya, West Nile, Rift Valley Fever) and viral haemorrhagic fever (VHF, such as Ebola, Lassa, Crimean-Congo haemorrhagic fever);
- YF tests should be realized in laboratories with appropriate capacity to test for both YF and the differential diagnosis.



# 9

## Early clinical management improves survival

- Good and early supportive treatment in hospitals improves survival rates.
- There is currently no specific anti-viral drug for yellow fever but specific care to treat dehydration, liver and kidney failure, and fever improves outcomes.
- Patients need to stay under mosquito nets during the day to limit the risk of spread to others through bites of mosquitoes.



# 10

## African Ministers of Health (MOH) are committed to eliminating YF epidemics

- Yellow fever is an acute viral haemorrhagic disease. The virus is endemic in tropical areas of Africa and the Americas. Susceptible non-human primates are the animal reservoir, they are necessary to maintain the endemicity.
- Forty of the 47 YF-affected countries have been identified as priority nations by the Eliminate Yellow Fever Epidemics (EYE) Strategy. The updated Strategy was developed by a coalition of countries and partners to respond to

the disease's changing epidemiology, resurgence of mosquitoes, and the increased risk of urban outbreaks and international spread.

- African Member States endorsed the (EYE) Strategy in 2017 and agreed on ten priority actions to guide countries to the elimination of YF epidemics by 2026.



Yellow fever (YF) risk classification, by country - Africa, 2016



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## Yellow fever (YF) risk classification, by country – LAC\* countries, 2016



This map illustrates a public-health-intervention oriented YF risk approach at country level. Its purpose is different from the YF risk area maps for travellers in the context of IHR.

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## More information about Yellow fever

- Yellow fever WHO webpage  
<http://www.who.int/csr/disease/yellowfev/en/>
- Yellow fever WHO fact sheet:  
<http://www.who.int/mediacentre/factsheets/fs100/en/>
- EYE Strategy  
<http://apps.who.int/iris/bitstream/10665/255040/1/WER9216.pdf?ua=1>
- Yellow fever WHO MOOC  
<https://openwho.org/courses/pandemic-epidemic-diseases>
- WHO standard case definitions  
<http://www.who.int/csr/disease/yellowfev/case-definition/en/>





# Zika

## 10 THINGS YOU SHOULD KNOW

1. Zika virus is transmitted by *Aedes* mosquitoes, which primarily bite during the day
2. This virus infection is usually asymptomatic, but can lead to severe complications
3. Infection during pregnancy presents many serious hazards for mother and child (microcephaly in children)
4. Zika virus is a trigger of Guillain-Barré syndrome
5. The virus is also transmissible through sexual contact, blood transfusion, and organ transplantation
6. Vector control strategies are important for prevention and control
7. Individuals should protect themselves from mosquito bites
8. Access to laboratory testing is critical for pregnant women
9. There is no vaccine or specific treatment for Zika virus infection
10. Warnings have been issued for pregnant women and their male partners





# Zika response tips

## Coordinating responders

- Coordination of public health, maternal and child health, vector control and clinical services
- Social services to support affected children and families

## Communicating risk

- Encourage health authorities to:
  - Engage communities for eliminating mosquito breeding sites
  - Communicate with at-risk groups through their trusted sources of information
- Key messages:
  - Zika is transmitted through mosquito bites during the day
  - The babies of pregnant women are at risk for adverse pregnancy outcomes
  - Zika can be sexually transmitted
  - Women of reproductive age should seek advice before getting pregnant during outbreaks and should seek medical advice if they fall pregnant

## Health Information

- Early detection, reporting, and monitoring of cases
- Laboratory capacity for diagnosis especially in pregnant women
- Laboratory diagnosis may be difficult (serological tests cross-react with Dengue and other flaviviruses)

## Health Interventions

- Community engagement and health promotion
- Early response
- Prevention of infection by *Aedes* mosquitoes, particularly pregnant women
- Reduce breeding sites of *Aedes* mosquitoes around dwellings
- Clinical supportive care of patients with Guillain-Barré and severe symptoms
- Support to babies born with microcephaly
- Psychosocial counselling and support

## 1

**Zika virus is transmitted by *Aedes* mosquitoes, which primarily bite during the day**

- The Zika virus is transmitted to humans by infected mosquitoes, most commonly from the *Aedes* species – it is the same mosquito that spreads Yellow fever, Chikungunya and Dengue viruses.
- Outbreaks usually occur in areas where mosquitoes breed.
- The current distribution of *Aedes aegypti* is the widest ever recorded and *Aedes* mosquitoes are present in all continents. Urbanization with resulting increased population densities, further enhanced by man-made larval habitats, amplifies mosquito-transmitted diseases.
- *Aedes* mosquitoes usually bite during the day, peaking during early morning and late afternoon/evening.
- Local transmission of Zika virus by *Aedes* mosquitoes has been reported on the continents of Africa, the Americas, South-East Asia and the Western Pacific.
- There are 2 types of *Aedes* mosquitoes known to be capable of transmitting Zika virus:
  - In most cases, Zika is spread through the *Aedes aegypti* mosquito in tropical and subtropical regions;
  - *Aedes albopictus* mosquitoes can also transmit Zika virus and can tolerate cooler temperatures;
  - Both species are found biting outdoors but *Aedes aegypti* will also feed indoors.

## 2

**This virus infection is usually asymptomatic, but can lead to severe complications**

- About 80% of infected people do not develop symptoms.
- People with symptoms usually present with mild fever, rash, conjunctivitis (inflammation of the eyes), muscle and joint pain, malaise, and headache.



- Symptoms normally last two to seven days.
- The incubation period (the time from exposure to onset of symptoms) of Zika virus disease is unknown but is most likely less than one week if it is similar to that of other mosquito-borne flaviviruses.
- Zika virus infection can lead to severe neurological complications in a relatively small proportion of those infected:
  - Microcephaly and other congenital abnormalities;
  - Preterm birth and fetal death;
  - Guillain-Barré syndrome;
  - Investigations are ongoing on the links between Zika virus and other adverse outcomes.
- Zika virus can be classified into two main lineages: the Asian lineage and African lineage. To date, the Asian lineage Zika virus strain is responsible for the recent 2015/2016 epidemics. It is not known whether the African lineage Zika virus strains would produce neurological symptoms with similar or worse gravity than those observed in the 2015/2016 epidemics.

# 3

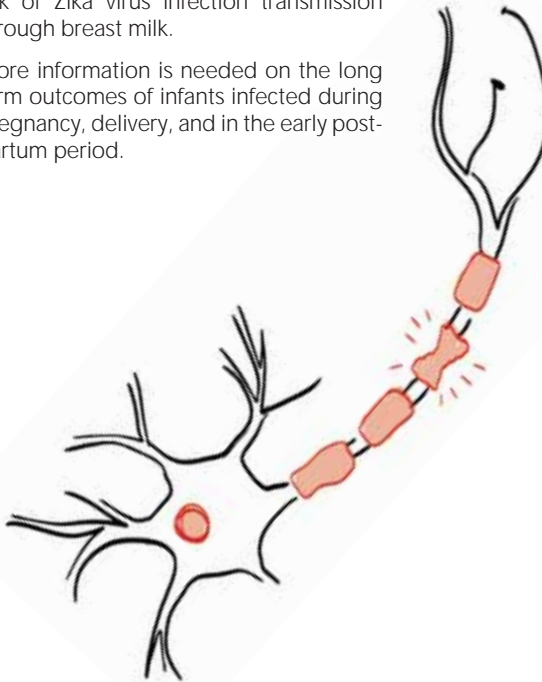
## Infection during pregnancy presents many serious hazards for mother and child (microcephaly in children)

- Zika virus can be transmitted from mother to child during pregnancy, and can result in congenital abnormalities:
- Microcephaly is a condition where the infant's head is smaller than those of other babies of the same age and sex (more than three standard deviations below average for gestational age). Infants born with microcephaly are at risk for severe intellectual disability and may also develop convulsions and physical disabilities as they grow older. There is no specific treatment for microcephaly;
  - o Diagnosis of microcephaly is often made at birth. All infants should have head circumference measured and recorded within 24 hours of birth. Early diagnosis of microcephaly can sometimes be made by fetal ultrasound. Prenatal diagnosis by ultrasound is more accurate in the second and third trimesters.
- Other newborn complications associated with in-utero Zika infection include brain calcifications, seizures, irritability, brainstem dysfunction such as swallowing



problems, limb contractures, developmental delay, hearing and sight abnormalities, and other brain abnormalities;

- Support services for affected infants and families are an important component of Zika programmes.
- Other adverse pregnancy outcomes associated with Zika virus infection include preterm birth, miscarriage, and still birth.
- Zika virus has been identified in breast milk, but transmission by breastfeeding has not yet been reported. Current evidence suggests that the benefits of breastfeeding outweigh the theoretical risk of Zika virus infection transmission through breast milk.
- More information is needed on the long term outcomes of infants infected during pregnancy, delivery, and in the early post-partum period.



# 4

## Zika virus is a trigger of Guillain-Barré syndrome

- Guillain-Barré syndrome (GBS) is a rare condition in which a person's immune system attacks the peripheral nerves.
- People of all ages can be affected, but it is more common in adults and in males.
- Symptoms typically last a few weeks. If supported through the critical stages of disease, most individuals can recover without long-term complications.
- The first symptoms of Guillain-Barré syndrome include weakness or tingling, usually starting in the legs and can spread to the arms and face;
- Some patients can develop paralysis of the legs, arms, or muscles in the face. In 20%–30 % of people, the chest muscles are affected, making it difficult to breathe;
- The ability to speak and swallow may become affected in severe cases of Guillain-Barré syndrome;
- Severe cases of Guillain-Barré syndrome are rare, but can result in near-total paralysis.
- Guillain-Barré syndrome is therefore potentially life-threatening. People with Guillain-Barré syndrome should be treated and closely monitored; severe cases may require intensive care including ventilatory respiratory support. Treatment includes supportive care and some immunological therapies.
- Even in the best of settings, 3%–5% of Guillain-Barré syndrome patients die from complications, which include paralysis of the muscles that control breathing, infection, sepsis, or cardiac arrest.

## 5

## The virus is also transmissible through sexual contact, blood transfusion, and organ transplantation

- Zika virus can be transmitted through sexual intercourse. This is of concern because of the association between Zika virus infection and adverse pregnancy outcomes.
- In regions with active Zika virus transmission, health programmes should ensure that:
  - All people with Zika virus infection and their sexual partners (particularly pregnant women) receive information about the risks of sexual transmission of Zika virus;
  - Men and women receive counselling on safe sexual practices and are offered condoms;
  - Sexually active men and women should be counselled and offered a full range of contraceptive methods to make informed choices about whether and when to become pregnant, to prevent unintended pregnancies, and prevent possible adverse pregnancy outcomes;
  - Pregnant women should be advised not to travel to areas of ongoing Zika virus outbreaks.
- Other modes of person-to-person Zika transmission include: blood transfusion, organ transplantation and laboratory or other blood-borne exposure.

## 6

## Vector control strategies are important for prevention and control

- Vector control strategies should address all life stages of the *Aedes* mosquito from the egg, to larva and adult. Community engagement is essential for these interventions:
  - Elimination of breeding sites and eggs/larvae/pupae in standing water (e.g. cleaning roof gutters, clean-up campaigns, etc.);
  - Targeted residual spraying of adult mosquitoes (in areas known to be resting sites for *Aedes* mosquitoes) and space spraying when there is an outbreak.
- Mosquito surveillance is part of vector control and helps improve timeliness of decisions to control mosquito populations and prevent disease. Both larval and adult vector populations should be targeted for surveillance.

- Standard WHO recommendations regarding vector control at airports should be implemented in accordance with the IHR (2005). Countries should consider disinfection of aircraft.



# 7

## Individuals should protect themselves from mosquito bites

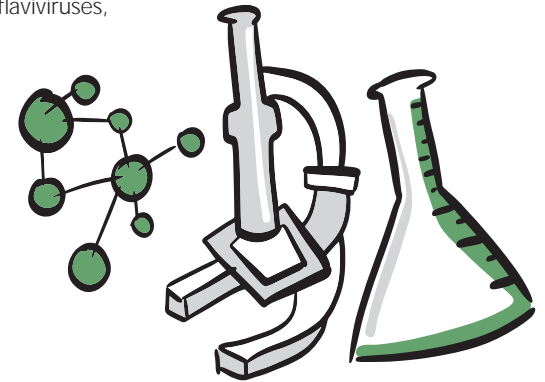
- The community, and particularly pregnant women and women of reproductive age, should be educated about the risk of transmission and how to minimize this risk by reducing contact with mosquitoes.
- Personal preventive measures to avoid mosquito bites include clothing minimizing skin exposure, use of repellents, as well as windows screens and air conditioning. The use of insecticide-treated bed nets is limited by the fact that *Aedes* mosquitos bite during daytime.
- Eventually, economic development will reduce mosquito-borne diseases by improving standards of living (e.g. people living in houses with solid floors and roofs, window screens, and air conditioning).



# 8

## Access to laboratory testing is critical for pregnant women

- Because of the association between Zika virus infection and adverse pregnancy and infant outcomes, it is important that women have access to laboratory testing. The woman (and her partner if she/he wishes) should be offered non-directive counselling so that she, in consultation with her health care provider, can make a fully informed choice about the next steps in the management of her pregnancy.
- Laboratories should have the capacity to test for Zika:
  - Laboratory tests are done on blood or other body fluids (e.g. urine, saliva, semen):
    - o Polymerase Chain Reaction (PCR) during the acute phase of the disease;
    - o Serological (IgM) testing and Nucleic Acid Tests (NAT) testing with Plaque Reduction Neutralization Test (PRNT). Infection with Zika virus is difficult to confirm retrospectively because serological tests cross react with other flaviviruses, especially Dengue virus.



## 9

**There is no vaccine or specific treatment for Zika virus infection**

- Currently, there are no antiviral drugs or specific treatment for people with Zika virus disease. Zika virus disease in individuals including non-pregnant women is usually mild and requires no specific treatment. Individuals with more severe symptoms should receive supportive care including rest, fluids, and management of pain and fever. They should be offered psychosocial support.
- Research is ongoing for potential therapies, for vaccines to prevent Zika virus infection or Congenital Zika Syndrome, and for diagnostic tests.



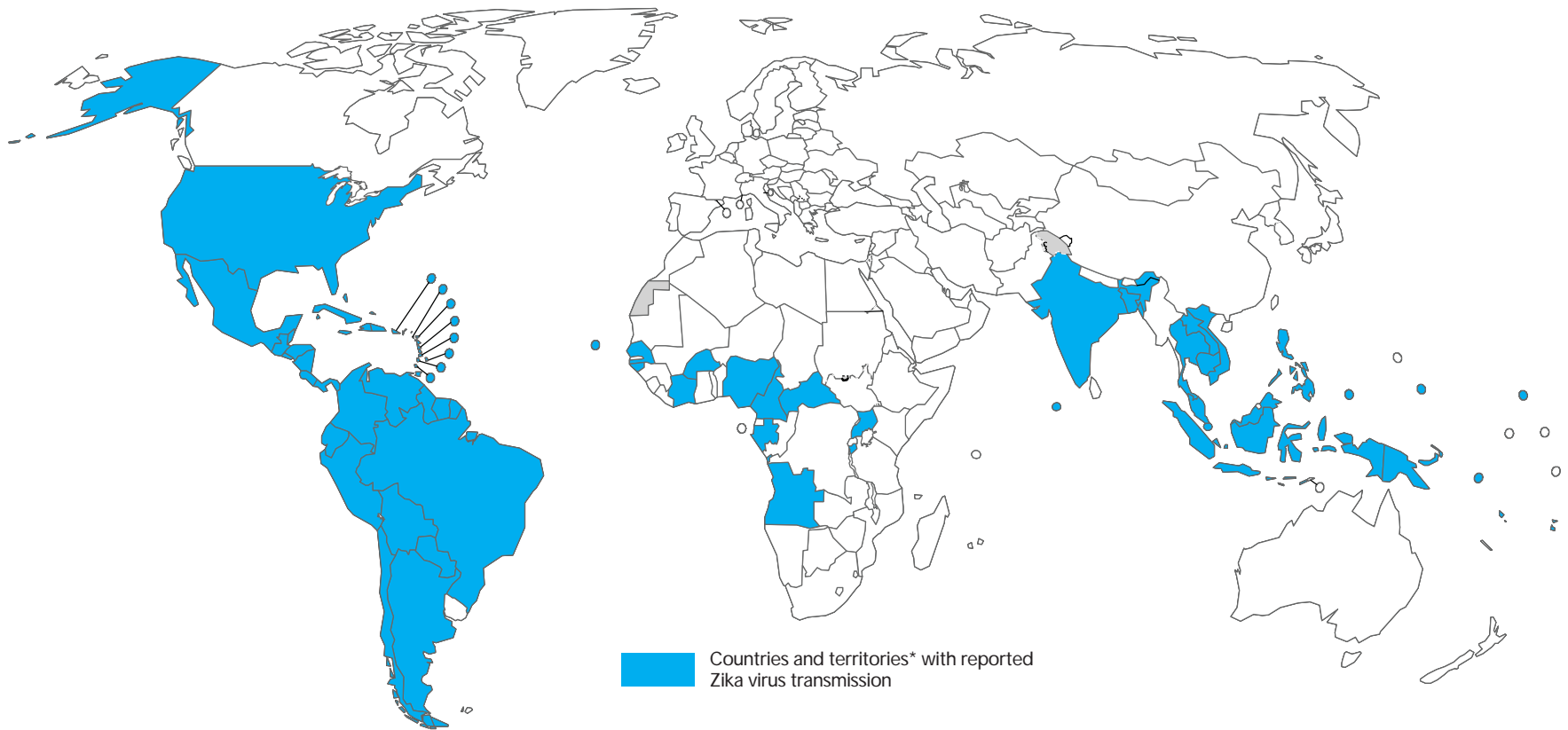
## 10

**Warnings have been issued for pregnant women and their male partners**

- There are no general restrictions on travel or trade with countries, areas and/or territories with Zika virus transmission.
- However, WHO is advising pregnant women not to travel to the following Zika-affected areas:
  - Areas with new introduction of Zika virus since 2015 or where the virus has been re-introduced, with ongoing transmission;
  - Areas with evidence of Zika virus circulation before 2015 or with ongoing transmission (but not satisfying the category above).
- Health authorities are responsible for advising travellers on risks and preventive measures.



## Countries and territories\* with reported Zika virus transmission



\*Note: This includes areas with new introduction or re-introduction with ongoing transmission; areas either with evidence of virus circulation before 2015 or area with ongoing transmission that is no longer in the new or re-introduction phase, but where there is no evidence of interruption; and areas with interrupted transmission and with potential for future transmission.

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Source: WHO/IHM; as of 15 January 2018



## More information about Zika

- Zika WHO webpage:  
<http://www.who.int/csr/disease/zika/en/>
- Zika virus WHO fact sheet:  
<http://www.who.int/mediacentre/factsheets/zika/en/>
- Risk communications and community engagement  
<http://www.who.int/csr/resources/publications/zika/community-engagement/en/>
- Pregnancy management in the context of Zika virus infection:  
<http://www.who.int/csr/resources/publications/zika/pregnancy-management/en/>
- Care and support of people affected by complications associated with Zika virus:  
[http://www.who.int/mental\\_health/neurology/zika\\_toolkit/en/](http://www.who.int/mental_health/neurology/zika_toolkit/en/)
- Prevention of sexual transmission:  
<http://www.who.int/csr/resources/publications/zika/sexual-transmission-prevention/en/>
- Identification and management of Guillain-Barré syndrome in the context of Zika virus:  
<http://www.who.int/csr/resources/publications/zika/guillain-barre-syndrome/en/>

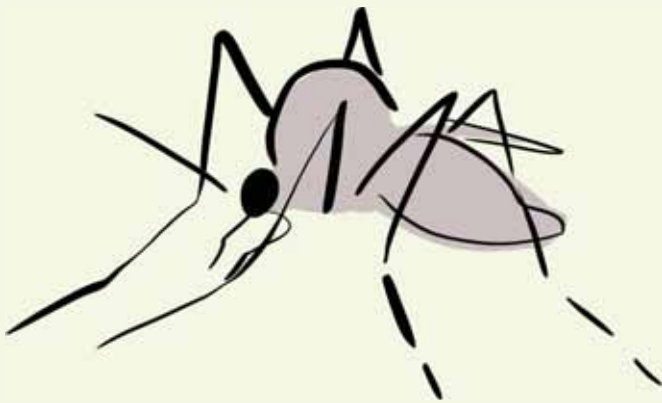




# Chikungunya

## 10 THINGS YOU SHOULD KNOW

1. Chikungunya is transmitted by *Aedes* mosquitoes, which primarily bite during the day
2. Chikungunya outbreaks occur typically in urban settings
3. Chikungunya causes an acute febrile illness
4. Convalescence may be long and patients may present complications and sequelae
5. Treatment is directed primarily at relieving symptoms
6. Chikungunya is often misdiagnosed with Dengue and other diseases
7. Controlling the mosquito vector is key to outbreak prevention and control
8. Vector surveillance is critical to determine vector control strategies
9. Chikungunya virus infection seems to elicit long-lasting protective immunity
10. Chikungunya is emerging as a global disease



# Chikungunya response tips

## Coordinating responders

- Coordination of public health, environmental, clinical services and vector control

## Communicating risk

- Encourage health authorities to:
  - Communicate to the public about how to protect from the disease
  - Advise on seeking health care for high-risk groups
  - Eliminate mosquito breeding grounds
- Key messages:
  - Chikungunya can cause acute and chronic illness
  - Chikungunya is transmitted by mosquitoes

## Health Information

- Laboratory capacity for diagnosis and surveillance
- Vector distribution surveillance
- Early detection, reporting, response and monitoring

## Health Interventions

- Community engagement and health promotion
- Vector control:
  - Reduce breeding sites of *Aedes* mosquitoes around dwellings
  - Prevent mosquito bites during the day
- Supportive care
- Patient care with bed nets (also during the day)

## 1

## Chikungunya is transmitted by *Aedes* mosquitoes, which primarily bite during the day

- The Chikungunya virus is transmitted to humans by infected mosquitoes, most commonly from the *Aedes* species – it is the same mosquito that spreads Yellow fever, Zika and Dengue viruses.
- Outbreaks usually occur in areas where mosquitoes breed.
- The current distribution of *Aedes aegypti* is the widest ever recorded and *Aedes* mosquitoes are present in all continents. Urbanization with resulting increased population densities, further enhanced by man-made larval habitats, amplifies mosquito-transmitted diseases.
- *Aedes* mosquitoes usually bite during the day, peaking during early morning and late afternoon/evening.
- There are 2 types of *Aedes* mosquitoes known to be capable of transmitting Chikungunya virus:
  - In most cases, Chikungunya is spread through the *Aedes aegypti* mosquito in tropical and subtropical regions;
  - *Aedes albopictus* mosquitoes can also transmit Chikungunya virus and can tolerate cooler temperatures;
  - Both species are found biting outdoors but *Aedes aegypti* will also feed indoors.
- Transmission of the virus can also occur through blood transfusion and laboratory or other blood-borne exposure.

## 2

## Chikungunya outbreaks occur typically in urban settings

- Human beings serve as the Chikungunya virus reservoir during epidemic periods.
- Urban Chikungunya virus transmission follows those observed for Dengue virus.



# 3

## Chikungunya causes an acute febrile illness

- Chikungunya causes an acute febrile illness typically accompanied by arthralgia.
- Other common symptoms and signs include muscle pain, headache, nausea, fatigue and rash.
- The joint pain is often debilitating, usually lasting a few days, but may be prolonged to weeks. Hence, the virus can cause acute, subacute or chronic disease.
- The disease shares some clinical signs with Dengue and can be misdiagnosed in areas where Dengue is common.
- Children may experience other symptoms such as minor hemorrhagic manifestations, arthralgia/arthritis, lymphadenopathy, conjunctival injection, swelling of eyelids and pharyngitis. Rare clinical features include neurological manifestations including seizures, altered level of consciousness, and blindness due to retrobulbular neuritis and acute flaccid paralysis.
- The disease is generally not fatal. Symptomatic treatment along with rest usually suffices.
- After the bite of an infected mosquito, onset of illness occurs usually between four and eight days but can range from two to 12 days.
- The acute phase of Chikungunya lasts for three to 10 days but convalescence can be prolonged up to one year and more.
- There are asymptomatic patients but it is unknown how frequently it occurs.

# 4

## Convalescence may be long and patients may present complications and sequelae

- Rare clinical manifestations of Chikungunya include neurological, hemorrhagic, and ocular and severe multiple organs system involvement.
- In older people, the disease can contribute to earlier death that may be due to the frequency of concomitant underlying diseases or decreased immunologic response.
- Some patients have reported disabling joint pain or arthritis, which may last for weeks or months. These patients may require long-term anti-inflammatory therapy.
- Patients with Chikungunya should be assisted from their communities and enabled to seek occupational and social rehabilitation.



## 5

**Treatment is directed primarily at relieving symptoms**

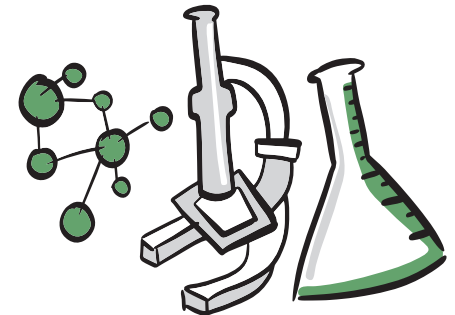
- There is no specific antiviral drug treatment for Chikungunya.
- Treatment is directed primarily at relieving the symptoms using anti-pyretics (paracetamol is the drug of choice), optimal analgesics and fluids. Applying cold compresses have been reported to lessen the joint symptoms.
- People with Chikungunya should rest and consume plenty of water.
- Aspirin should be avoided due to its effect on platelets. Paracetamol or nonsteroidal anti-inflammatory drugs may be used for symptom relief.
- All suspected cases should be kept under mosquito nets during the febrile period.
- Patients and their families should be provided with psychosocial support.
- There is no Chikungunya vaccine although some candidate vaccines are being tested in human beings.



## 6

**Chikungunya is often misdiagnosed with Dengue and other diseases**

- Chikungunya patients may present nonspecific symptoms that could be confused with many other diseases such as Dengue, Leptospirosis, Malaria, Meningitis, and Rheumatic fever. Laboratory diagnosis is thus critical to establish the cause of diagnosis and initiate specific public health response.
- Several methods can be used for diagnosis:
  - Molecular technique: Polymerase Chain Reaction (PCR);
  - Virus isolation: the virus may be isolated from the blood during the first few days of infection. Various Reverse Transcription Polymerase Chain Reaction (RT-PCR) methods are available but are of variable sensitivity;
  - Serological tests such as Enzyme-Linked Immunosorbent Assays (ELISA), may confirm the presence of IgM and IgG anti-chikungunya antibodies. IgM antibody levels are highest three to five weeks after the onset of illness and persist for about two months.



# 7

## Controlling the mosquito vector is key to outbreak prevention and control

- Vector control strategies should address all life stages of the *Aedes* mosquito from the egg, to larva and adult. Community engagement is essential for these interventions:
  - Elimination of breeding sites and eggs/larvae/pupae in standing water (e.g. cleaning roof gutters, clean-up campaigns, etc.);
  - Targeted residual spraying of adult mosquitoes (in areas known to be resting sites for *Aedes* mosquitoes) and space spraying when there is an outbreak.
- Additionally, personal preventive measures such as clothing minimizing skin exposure, use of repellents, as well as window screens and air conditioning are recommended to avoid mosquito bites. The use of insecticide-treated bed nets is limited by the fact that *Aedes* mosquitoes bite during daytime.
- Eventually, economic development will reduce mosquito-borne diseases by improving standards of living (e.g. people living in houses with solid floors and roofs, window screens, and air conditioning).



- Standard WHO recommendations regarding vector control at airports should be implemented in keeping with the IHR (2005). Countries should consider disinfection of aircraft.

# 8

## Vector surveillance is critical to determine vector control strategies

- Mosquito surveillance is part of vector control and helps improve timeliness of decisions to control mosquito populations and prevent disease. Both larval and adult vector populations should be targeted for surveillance.
- These data will enable the selection and use of the most appropriate vector control tools, and can be used to monitor their effectiveness.



## 9

**Chikungunya virus infection seems to elicit long-lasting protective immunity**

- There are still a lot of unknowns (including the clinical spectrum of the disease) and research is ongoing to fill scientific gaps in our understanding of the disease.
- The reasons for the mysterious behavior of dramatic outbreaks interspersed by periods of prolonged absence, virus survival in nature and factors triggering outbreaks need to be further studied.
- Research also focuses on diagnostics tests, treatments and vaccines.



## 10

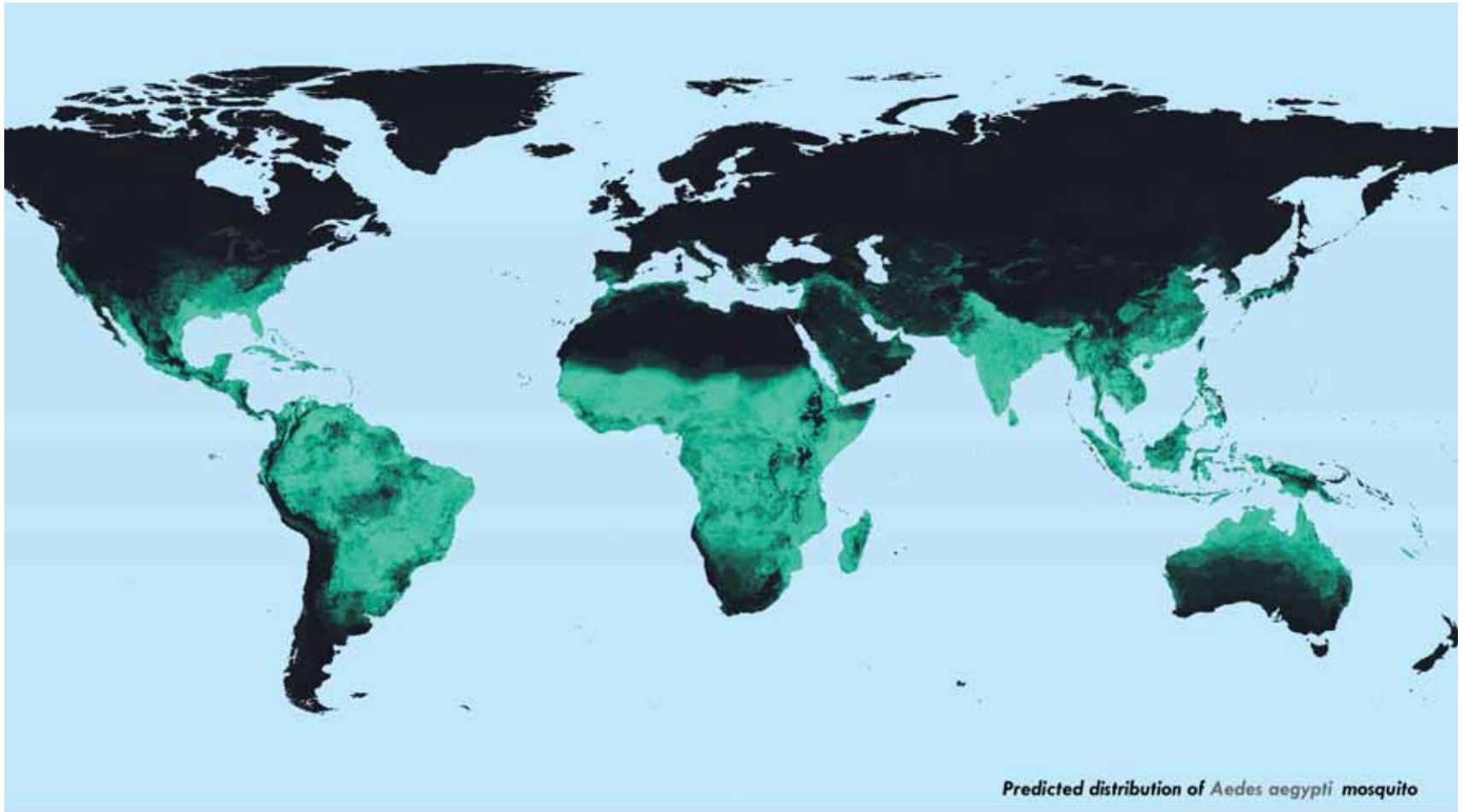
**Chikungunya is emerging as a global disease**

- Urbanization, human travel, viral adaptation, lack of effective control measures, and spread of new vectors likely have contributed to recent re-emergence of Chikungunya.
- There is a risk of epidemics in subtropical and temperate regions of the world where *Aedes albopictus* is a potential vector.
- The dramatic spread of the Dengue, Chikungunya, and Zika viruses in recent years highlights the urgent need to identify *Aedes* control options.





## Predicted distribution of the *Aedes Aegypti* mosquito



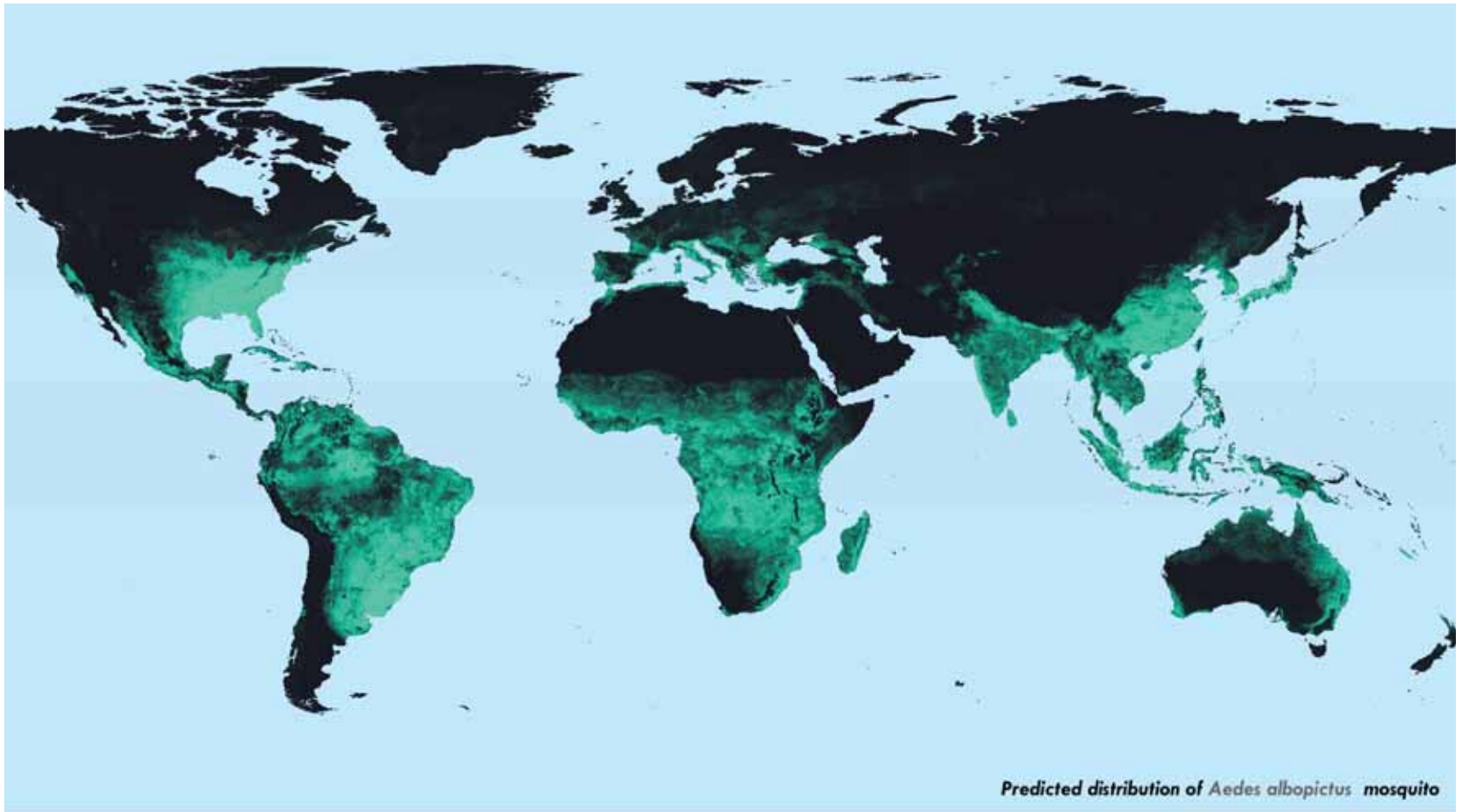
High Low

Map redrawn using service layers from <http://eprints.who.int/content/4/e08247/11>, Kraemer MUG et al. *eLife* (Published June 30, 2015)

The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, or area, or of its authority, or concerning the delimitation of its frontiers or boundaries. Dotted lines and dashed lines on maps represent approximate frontiers that may still be in dispute.



Predicted distribution of the *Aedes Albopictus* mosquito



*Predicted distribution of Aedes albopictus mosquito*



Map redrawn using service layers from <http://eprints.who.int/content/4/e02347/1>, Kraemer MUG et al. eLife (Published June 20, 2015)

The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, or city, or the status of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted lines and dashed lines on maps represent approximate frontiers that have not yet been established.



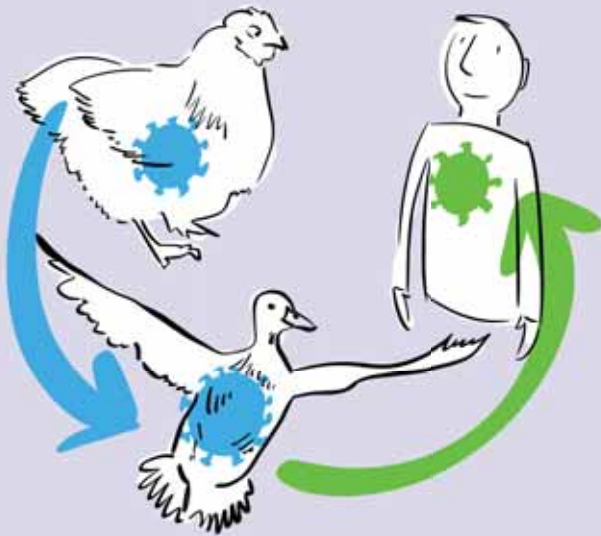
## More information about Chikungunya:

- Chikungunya WHO webpage:  
<http://www.who.int/emergencies/diseases/chikungunya/en/>
- Chikungunya WHO fact sheet:  
<http://www.who.int/mediacentre/factsheets/fs327/en/>
- Prevention and control:  
[http://www.wpro.who.int/mvp/topics/ntd/Chikungunya\\_WHO\\_SEARO.pdf](http://www.wpro.who.int/mvp/topics/ntd/Chikungunya_WHO_SEARO.pdf)
- WHO standard case definitions:  
<http://www.who.int/wer/2015/wer9033.pdf?ua=1>



# Avian and other zoonotic influenza

## 10 THINGS YOU SHOULD KNOW



1. Animal influenza viruses have occasionally infected humans (Avian, swine and other zoonotic influenza viruses)
2. Multisectoral coordination and communication are essential parts of any outbreak response
3. Protect all individuals with occupational or other risks of exposure
4. Eggs, poultry and poultry products can be safely consumed, provided these items are properly cooked and properly handled during food preparation
5. To minimize exposure of the public, encourage proper personal hygiene and instruct the public to seek medical help if illness develops
6. Increase surveillance for human cases of Avian influenza
7. Collecting appropriate samples, and rapid and precise characterization of virus isolates are essential for early detection and management of patients
8. Health care facilities need to be ready to manage patients with Avian influenza virus infections
9. The animal health sector is in charge of preventing and controlling outbreaks of disease in animals, including Avian influenza
10. Influenza A(H5N1) vaccines are not widely available and the decision to use them depends on the risk of infection

# Avian and other zoonotic influenza response tips

## Coordinating responders

- Multisectoral response: collaboration between animal health sector and public health sector is key in surveillance, response and prevention activities

## Communicating risk

- Encourage health authorities to:
  - Have a way to compensate owners/farmers for the loss of sick animals to encourage early reporting
  - Have a multisector communications strategy in place
- Key messages:
  - Avian influenza is transmitted primarily from infected animals to human through direct contact
  - There is usually no sustained human-to-human transmission
  - Promote good personal hygiene (i.e. handwashing)
  - Promote proper food safety guidance
  - Report sick animals to the authorities

## Health Information

- Sharing information from the animal health sector with human health sector supports preventive action in the affected areas
- Sharing information on human cases with the animal health sector is equally important so that they can target their response activities
- Ensure sharing of viruses from human cases with WHO Collaborating Centres
- Report cases to WHO, under the IHR (2005)

## Health Interventions

- Investigate cases and enhance surveillance
- Collect appropriate specimens
- Antiviral and supportive treatment for cases
- Monitoring of contacts
- Vaccination of high-risk groups
- Infection prevention and control measures:
  - Prevent nosocomial infections
  - Personal Protective Equipment

## 1

### Animal influenza viruses have occasionally infected humans (Avian, swine and other zoonotic influenza viruses)

- Wild aquatic birds are the reservoir for influenza A viruses. The emergence of a new and very different influenza A virus with the ability to infect people and have sustained human-to-human transmission, can cause an influenza pandemic.
- Humans can be infected with Avian, swine and other zoonotic influenza viruses.
- Avian influenza is a disease of domestic and wild birds with severe consequences for the poultry sector when outbreaks of disease occur. Domesticated populations (poultry: chickens, ducks, turkeys) can become infected by contact with wild birds. Avian influenza viruses are categorized as either low pathogenic (LP) or highly pathogenic (HP) viruses, depending on the severity of the disease they cause in birds and poultry. These two terms do not refer to the disease in humans infected with these viruses.
- Avian influenza A viruses are distinct from human influenza viruses and do not easily transmit between humans. Human infections are primarily acquired through direct contact with infected animals or contaminated environments, but do not result in efficient transmission of these viruses between people.
- Avian and other zoonotic influenza infections in humans may cause disease ranging from mild conjunctivitis to severe pneumonia and even death.

## 2

### Multisectoral coordination and communication are essential parts of any outbreak response

- The first occurrence of a poultry outbreak of highly pathogenic Avian influenza in a country often creates widespread concern and can disrupt social and economic life. Therefore, effective communication with all stakeholders is an essential part of any outbreak response.
- Strong coordination between sectors (animals and human health) is needed for surveillance, risk communications and interventions monitoring.



# 3

## Protect all individuals with occupational or other risks of exposure

- Protect people involved in specific, high-risk tasks such as sampling sick birds, culling and disposing of infected birds and cleaning of contaminated premises.
- Provide appropriate personal protective equipment and training on how to use it properly.
- All persons involved in these tasks should be registered and monitored closely by local health authorities for seven days following the last day of contact with poultry or their environments.
- Symptomatic persons should be treated according to WHO guidelines with influenza-specific antivirals.
- If sufficient antivirals are available, antiviral chemoprophylaxis can be considered (recommendations for regimen of antiviral prophylaxis can be found in the WHO guidelines).
- Consideration should be given to the immunization of persons with high potential to be exposed to Avian influenza using the seasonal influenza vaccine.

# 4

## Eggs, poultry and poultry products can be safely consumed, provided these items are properly cooked and properly handled during food preparation

- Inform the public about ways to promote safe food consumption. Promote thorough cooking of poultry and poultry products. Separate raw meat from cooked or ready-to-eat foods. Keep clean and wash your hands. Handle and store meat properly.
- Live animal market hygiene and biosecurity should be assessed and improved where possible.
- National food safety authorities and poultry producers should develop and implement quality assurance schemes in line with HACCP (Hazard Analysis Critical Control Point) principles and steps.
- Carefully treat drinking water supplied from open surface water to minimize any potential risks. Be aware that properly treated waste water seems to pose only a small risk for humans. Be aware that in some cases, recreational water might be contaminated. And consider that faeces from infected animals can be infectious.



## 5

### To minimize exposure of the public, encourage proper personal hygiene and instruct the public to seek medical help if illness develops

- Minimize exposure of the public to potentially infected birds and other sources of contamination and encourage proper personal hygiene, especially frequent hand washing, and instruct people to seek medical help if illness develops.
- When Avian influenza viruses circulate in an area, all the people who are exposed to infected birds are at risk, especially those who: keep live poultry in their backyards or homes, or purchase live poultry or birds at markets; slaughter, de-feather, or butcher poultry handle and prepare raw poultry for further cooking and consumption; transport or sell live poultry or carcasses; are involved in culling / depopulating / disposing of

poultry work in the poultry industry, including farmers and veterinarians; have contact with poultry by-products (e.g. viscera, manure, feathers) or water contaminated with these by-products (e.g. waste water from a live bird market or a slaughtering facility); or consume raw poultry products.

- The general public should minimize contact with chickens, ducks or other birds and avoid areas where poultry are housed, slaughtered or prepared. They also should:
  - Keep children away from birds and their waste, including feathers and manure. Children should neither collect eggs nor assist with slaughtering or food preparation;
  - Report sick or unexpectedly dead poultry to the authorities immediately;
  - Comply with all official measures (e.g. animal movement restrictions) that are put in place;
  - Do not slaughter and/or consume birds that are showing signs of disease or that have unexpectedly died.



## 6

### Increase surveillance for human cases of Avian influenza

- Avian influenza is not easily transmitted from infected animals to humans and there has not been sustained human-to-human transmission.
- However, it is important to ensure suspected human cases are investigated in order to give them the best possible treatment; to identify other potential human contacts in those cases and monitor them for occurrence of illness; and to identify if there is human-to-human transmission of the virus.
- The most important goal for investigations of human cases of infections with Avian influenza viruses is to assess the extent of potential human-to-human transmission, especially in clusters of human cases and contacts of confirmed cases.
- Enhanced surveillance should consider the health care seeking behaviour of the population and can include a range of options such as active and passive approaches that are health care and/or community-based.
- Persons with exposure to Avian influenza should monitor their health for the duration of the known exposure period plus an additional seven days. This will facilitate early detection of illness and timely commencement of antiviral treatment and isolation precautions. They should report any relevant health problems to a health care facility.

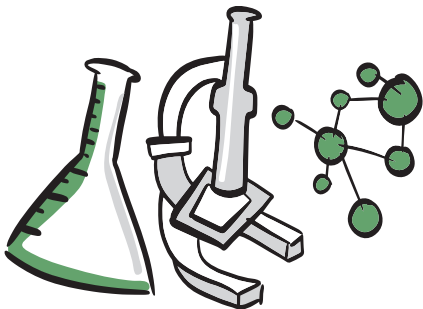




# 7

## Collecting appropriate samples and rapid and precise characterization of virus isolates are essential for early detection and management of patients

- Collection of appropriate specimens from suspected human cases for identification by a qualified laboratory, together with rapid and precise characterization of virus isolates at specialized reference laboratories, are essential for early detection of cases, proper management of patients, and understanding the epidemiology of the disease.
- In addition, appropriate specimen collection is important for monitoring the development of resistance to antivirals, producing effective vaccines, and evaluating laboratory methods.
- Ensure that specimen collection materials are available and collection of specimens is done safely, correctly and in a timely manner.
- Promote virus/sample sharing with WHO-recognized laboratories.



# 8

## Health care facilities need to be ready to manage patients with Avian influenza virus infections

- Implement early infection control precautions to prevent nosocomial (originating in a hospital) spread of the disease.
- Manage cases properly to prevent severe illness and death. Administer neuraminidase inhibitors (oseltamivir, zanamivir) treatment as the primary choice of antiviral treatment, using the standard regimen for seasonal influenza virus infection, as soon as possible (ideally, within 48 hours following symptom onset) to maximize therapeutic benefits. Monitor patients and viruses for indications of antiviral resistance.
- If there is an insufficient in-country supply of neuraminidase inhibitors, WHO can provide it from its strategic global stockpile.
- Report laboratory-confirmed cases to WHO, under the International Health Regulations (2005).



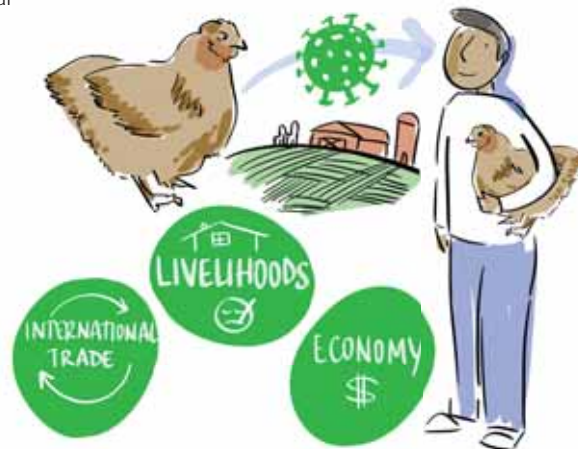
## 9

**The animal health sector is in charge of preventing and controlling outbreaks of disease in animals, including Avian influenza**

- Controlling the disease in the animal source is critical to decrease risk to humans.
- Reporting new and ongoing outbreaks in animals is important for focusing human health prevention action in the affected areas and raising awareness among professionals working with potentially infected animals, as well as with the public. The sharing of information on human cases with the animal health sector is equally important so that they can target their response activities.
- The Food and Agriculture Organization (FAO) of the United Nations (UN) promotes food security and good nutrition by providing access to knowledge, policy advice and technical

assistance to Member Countries. FAO publishes information and guidance on Avian influenza, provides direct technical assistance to countries and works closely with many stakeholders.

- The World Organization for Animal Health (OIE) sets international standards for animal health and zoonoses, through the 'OIE Code' and 'OIE Manual' and is responsible for collecting and disseminating official animal disease information from Member Countries. It collaborates with National Veterinary Services as well as with FAO at national, regional and global levels to provide technical assistance to countries (e.g. laboratory support).
- National veterinary services, often located within the Ministry of Agriculture, are responsible for implementation of national Avian influenza measures to control and prevent the spread of the disease in poultry.

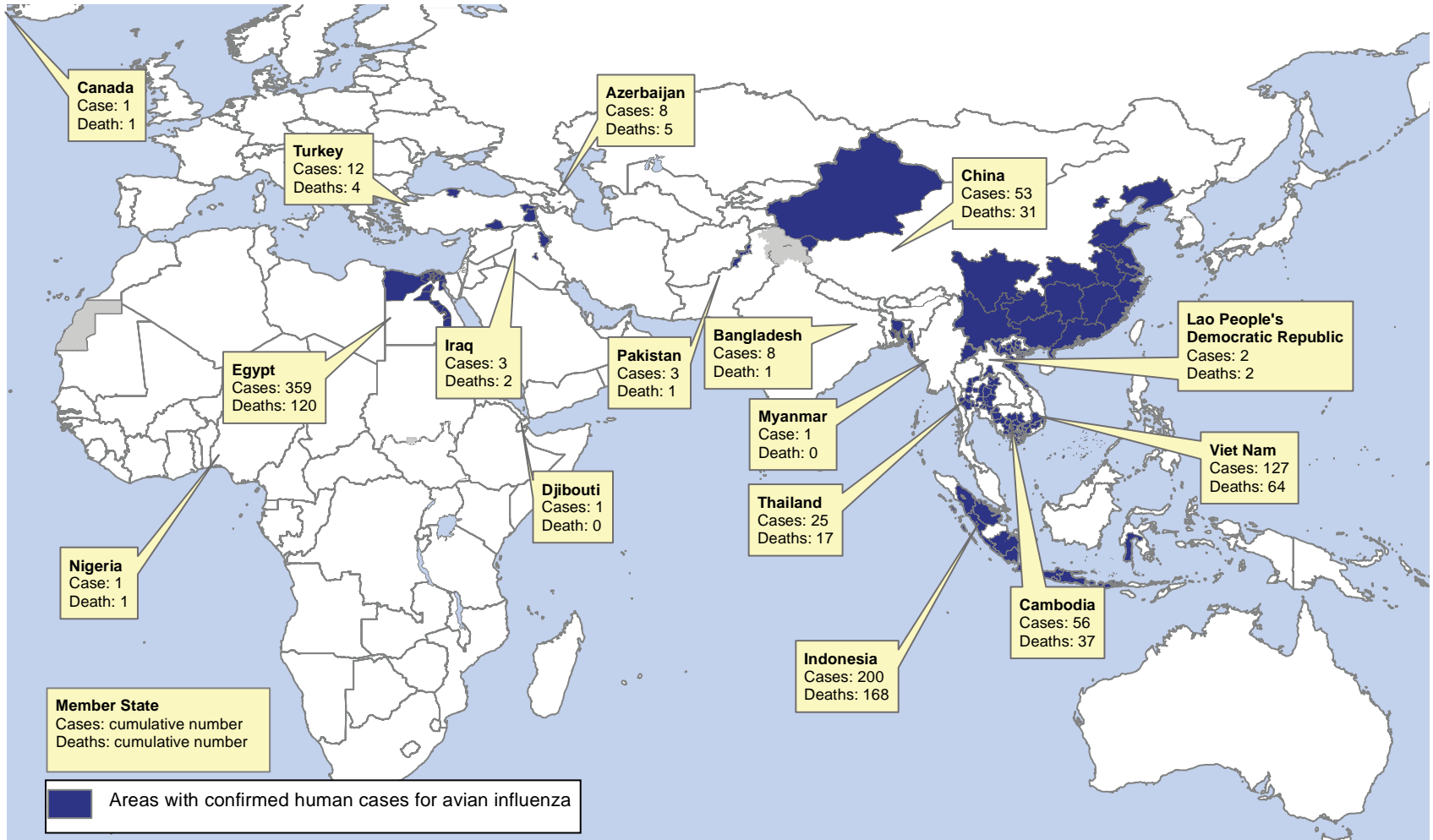


## 10

**Influenza A(H5N1) vaccines are not widely available and the decision to use them depends on the risk of infection**

- WHO recommends the targeted administration of seasonal influenza vaccine to health care workers in all countries in order to protect their patients from seasonal influenza infections. In addition, WHO recommends vaccination against seasonal influenza infection to selected groups at increased risk of exposure to Avian influenza viruses, as one of several measures for reducing opportunities for the simultaneous infection of humans with Avian and human influenza viruses.
- Vaccines for A(H5N1) virus for human use have been developed based on WHO-recommended candidate vaccine viruses and licensed in several countries. They are not widely available. Vaccination with A(H5N1) vaccines for human use are recommended for first responders to human or animal A(H5N1) outbreaks, and for health care workers who evaluate or manage patients with suspected or confirmed A(H5N1) virus infection in designated referral facilities. Be aware that WHO has no stockpile of A(H5N1) vaccines.

Areas with confirmed human cases for avian influenza A(H5N1) reported to WHO, 2003–2018\*



\* All dates refer to onset of illness

Source: WHO/IHM, as of 16 February 2018

The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted lines on maps represent approximate border lines for which there may not yet be full agreement.  
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## More information about Avian and other zoonotic influenza:

- Avian and other zoonotic influenza WHO webpage:  
[http://www.who.int/influenza/human\\_animal\\_interface/en/](http://www.who.int/influenza/human_animal_interface/en/)
- Avian and other zoonotic influenza WHO fact sheet:  
[http://www.who.int/mediacentre/factsheets/avian\\_influenza/en/](http://www.who.int/mediacentre/factsheets/avian_influenza/en/)
- Avian and other zoonotic influenza WHO MOOC:  
<https://openwho.org/courses/avian-and-other-zoonotic-influenza-introduction>
- WHO Summary Of Key Information Practical To Countries Experiencing Outbreaks Of A(H5N1) And Other Subtypes Of Avian Influenza, First Edition July 2016  
<http://apps.who.int/iris/bitstream/10665/246251/1/WHO-OHE-PED-GIP-EPI-2016.1-eng.pdf?ua=1>
- Case definitions for the four diseases requiring notification to WHO in all circumstances under the IHR (2005)  
[http://www.who.int/ihr/surveillance\\_response/case\\_definitions/en/](http://www.who.int/ihr/surveillance_response/case_definitions/en/)
- Pandemic Influenza Preparedness Framework for sharing of influenza virus and access to vaccines and other benefits  
[http://www.who.int/influenza/resources/pip\\_framework/en/](http://www.who.int/influenza/resources/pip_framework/en/)





# Seasonal influenza

## 10 THINGS YOU SHOULD KNOW



1. Seasonal influenza is a respiratory disease transmitted through droplets
2. Influenza disease appears in seasonal epidemics and may be very disruptive
3. Influenza A and B viruses can cause epidemics
4. Influenza can be severe and fatal
5. Annual vaccination is the best way to prevent infection
6. Early treatment with antiviral drugs may reduce complications and deaths
7. Seasonal influenza is hard to differentiate clinically from other respiratory diseases
8. Non-pharmaceutical measures prevent and reduce transmission
9. Monitoring, regular surveillance and sharing of data and viruses are important
10. Border controls do not reduce international spread

# Seasonal influenza response tips

## Coordinating responders

- WHO Global Influenza Surveillance and Response System (GISRS) monitors influenza activity globally and provides recommendations in areas including laboratory diagnostics, vaccines, antiviral susceptibility and risk assessment

## Health Information

- Regular sharing of epidemiological information and viruses helps to develop policy to reduce the influenza burden

## Communicating risk

- Encourage health authorities to:
  - Educate on prevention measures
  - Communicate about vaccine effectiveness and safety, especially for high-risk groups
- Promote hand and respiratory hygiene, and cough etiquette
- Key messages:
  - Seasonal influenza is highly contagious
  - It spreads through droplets
  - Annual vaccination is the best prevention
  - High-risk groups such as the elderly, pregnant women, infants and people with underlying conditions are most at risk and should seek medical care

## Health Interventions

- Annual vaccination
- Antiviral drugs
- Non-pharmaceutical interventions:
  - Social distancing (e.g. school closure)
  - Hygiene: cough etiquette, hand hygiene

## 1

**Seasonal influenza is a respiratory disease transmitted through droplets**

- Seasonal influenza (or “flu”) is an acute respiratory disease.
- It is highly contagious: it spreads easily from person to person through droplets when an infected individual coughs or sneezes. Sometimes, the transmission can be airborne, especially when aerosol-generating procedures are performed.
- It can also be transmitted by touching contaminated surfaces or hands.
- Therefore, rapid transmission can occur in crowded areas (e.g. schools or nursing homes).
- Precautionary measures to limit transmission include: hand hygiene, respiratory hygiene and cough etiquette, and droplet precautions in hospital settings.

## 2

**Influenza disease appears in Seasonal epidemics and may be very disruptive**

- In temperate climates, seasonal epidemics occur mainly during winter. The epidemics generally last from eight to 10 weeks in temperate areas.
- In tropical regions, the pattern of influenza epidemics is not always as regular. Some countries have two peaks and some do not have very regular epidemics.
- Epidemics can be very disruptive. While the yearly burden is variable and the average burden is currently being evaluated, influenza does cause considerable disease in all countries. In addition to illness, epidemics can have a high economic impact because of work and school absenteeism, productivity losses and overwhelmed hospital capacity.

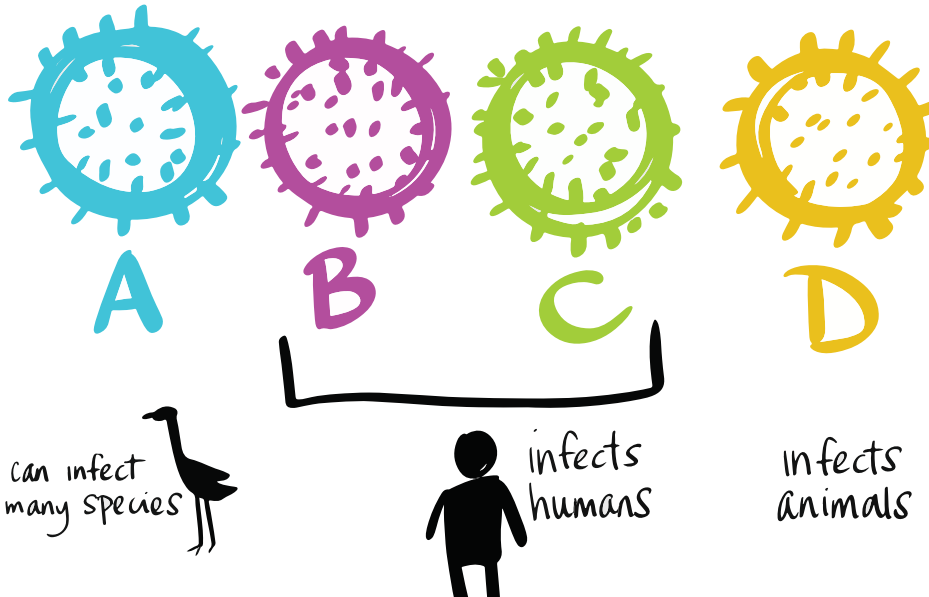




# 3

## Influenza A and B viruses can cause epidemics

- There are four types of influenza viruses - types A, B, C and D - but only influenza A and B cause epidemics. Influenza A can infect many species (birds, humans, pigs, horses, etc.). Influenza B and C infect mainly humans. Influenza type C virus is less frequent and usually causes mild infections, thus presents less significant public health implications.
- The A type of influenza viruses are further classified in subtypes based on their surface proteins. There are 18 different haemagglutinin (H) types and 11 different neuraminidase (N) types. Different combinations are possible. Currently, H3N2, H1N1pdm09 are circulating in humans as Seasonal influenza A viruses.



- Influenza viruses are in constant mutation. This is called antigenic drift and results in changes to the viruses which make people susceptible to catch flu every year, as they do not have immunity against the drifted viruses.



# 4

## Influenza can be severe and fatal

- Influenza can cause severe illness or death in any person.
- A wide range of complications can be caused by influenza virus infection of the upper respiratory tract (nasal passages, throat) and lower respiratory tract (lungs). Sinus and ear infections are examples of moderate complications from flu, while pneumonia is a serious flu complication, that people with chronic lung disease are at higher risk of developing.
- Other possible serious complications triggered by flu can include inflammation of the heart (myocarditis), brain (encephalitis) or muscle (myositis, rhabdomyolysis) tissues, and multi-organ failure (for example, respiratory and kidney failure). Flu virus infection of the respiratory tract can trigger an extreme inflammatory response in the body and can lead to sepsis.
- People at higher risk of developing complications and severe Seasonal influenza are:
  - a. Children younger than five years;
  - b. People older than 65 years;
  - c. People with chronic medical conditions such as HIV/AIDS, asthma, heart and lung diseases and diabetes.
- Flu also can make chronic medical problems worse. For example, people with asthma may experience asthma attacks while they have the flu, and people with chronic heart disease may experience a worsening of this condition triggered by flu.

## 5

**Annual vaccination is the best way to prevent infection**

- The most effective way to prevent the disease is getting vaccinated every year.
- Vaccination is especially important for pregnant women, people at high risk of exposure, people at higher risk of serious influenza complications, and for people who live with, or care for, high-risk individuals (health care workers).
- Ideally, people should get vaccinated just before the influenza season begins for the most effective coverage, although getting vaccinated at any time during the influenza season can still help prevent infections.
- Influenza viruses evolve constantly, and twice a year, WHO makes recommendations to update the vaccine compositions, based on the monitoring done through the Global Influenza

Surveillance and Response System (GISRS). This maximises the effectiveness of the vaccines, as circulating viruses need to be well-matched with the viruses contained in the vaccines.

- A number of inactivated influenza vaccines and recombinant influenza vaccines are available in injectable form. Live attenuated influenza vaccine is available as a nasal spray.

**GROUPS AT RISK**

## 6

**Early treatment with antiviral drugs may reduce complications and deaths**

- Antiviral drugs may reduce severe complications and deaths. Ideally, they need to be administered early in the disease (within 48 hours of onset of symptoms). They are especially important for high-risk groups.
- They are two types of drugs: *neuraminidase* inhibitors and *adamantanes*. Currently, the majority of circulating influenza viruses are resistant to the *adamantanes*, limiting their effectiveness. Therefore, *neuraminidase* inhibitors (oseltamivir and zanamivir, peramivir and laninamivir) are the recommended first-line treatment.
- People with Seasonal influenza should always drink plenty of water, rest and not go to work, in order to reduce transmission.

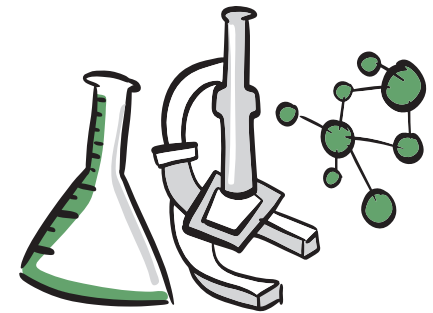


# 7

## Seasonal influenza is hard to differentiate clinically from other respiratory diseases

- People with Seasonal influenza usually show non-specific symptoms. They include: sudden onset of fever, cough (usually dry), headache, muscle and joint pain, fatigue, and a runny nose.
- The cough can be severe and can last two or more weeks. Most people recover within a week without requiring medical attention.
- Incubation period is usually two days but may be from one to five days.
- An infected person may be infectious from one to two days before and until four to five days after the onset of symptoms (children may be infectious for longer).

- Laboratory diagnosis is critical to differentiate Seasonal influenza from other respiratory diseases:
  - The most appropriate specimens for the diagnosis of influenza are upper respiratory tract specimens. Samples should be taken from the deep nostrils (nasal swab), throat (oropharyngeal swab) and nasopharynx (nasopharyngeal swab). Nasopharyngeal aspirate and bronchial aspirate are also useful;
  - The Reverse Transcription Polymerase Chain Reaction (RT-PCR) is the preferred technique for diagnosis;
  - In addition to RT-PCR, other laboratory techniques are available for the detection, identification and characterization of influenza virus including virus isolation in cell culture and the identification of viral antigens (fluorescent antibodies, FA, test or Enzyme-Linked Immunosorbent Assay, ELISA). Single serum is not ideal for diagnosis of an acute infection.



## 8

**Non-pharmaceutical measures prevent and reduce transmission**

- The implementation of non-pharmaceutical measures helps to prevent and slow transmission and control epidemics.
- Before an epidemic, to reduce the potential disruptive effects of Seasonal influenza, it is critical that:
  - There is effective health planning in place so health education and immunization for at-risk patients, their close contacts and health care workers are implemented;
  - Increased demand for medical care and possible absenteeism of health care workers during the epidemic period are anticipated.
- During an epidemic, to reduce transmission:
  - Health education should continue;
  - Hand hygiene, respiratory hygiene and cough hygiene (e.g. covering mouth and nose with a tissue when coughing and then throwing it out and washing hands) should be strictly observed by all;
  - Personal protective equipment in health care settings (masks) should be used when in contact with people with Seasonal influenza (the sick are wearing the mask);
  - Social distancing may help. It includes isolation of patients, staying at home when sick, and school closure. School closures have the greatest benefit when applied early in the course of the outbreak. The benefit has to be weighed against the cost of disruption;

- Risk communication and community engagement should be implemented so populations comply with recommended public health measures (especially needed to implement vaccination recommendations).



# 9

## Monitoring, regular surveillance and sharing of data and viruses are important

- Regular monitoring and surveillance are important to anticipate severe epidemics and plan health care services as well as to be prepared for a pandemic.
- Since 1952, WHO has been coordinating a network which now has more than 150 laboratories and experts to analyse the spread of influenza and recommend the vaccine composition.
- Sharing of viruses and data is also important to be able to update the vaccine and antiviral treatments.

# 10

## Border controls do not reduce international spread

- Border control measures such as entry and exit screening and quarantining of travellers crossing international borders are generally not recommended, as they have not been shown to reduce the spread of influenza.
- Screening for detecting people with fever might be inefficient as:
  - Infected people may travel during the incubation period, during which they will not show symptoms but will be able to transmit the disease;
  - People may be using anti-pyretics and not show fever.
- Implementing... may also be v



## More information about Seasonal influenza:

- Influenza WHO webpage:  
<http://www.who.int/influenza/en/>
- Seasonal influenza WHO fact sheet:  
<http://www.who.int/mediacentre/factsheets/fs211/en/>
- Seasonal influenza WHO MOOC:  
<https://openwho.org/courses/seasonal-influenza-introduction>
- Patient care:  
[http://www.who.int/influenza/patient\\_care/en/](http://www.who.int/influenza/patient_care/en/)
- Global Influenza Surveillance and Response System (GISRS):  
[http://www.who.int/influenza/gisrs\\_laboratory/en/](http://www.who.int/influenza/gisrs_laboratory/en/)





# Pandemic influenza

## 10 THINGS YOU SHOULD KNOW



1. Another influenza pandemic is inevitable but unpredictable
2. Pandemics require global concerted actions
3. A pandemic happens when an influenza virus emerges to which most people have no immunity
4. Influenza pandemics may be mild or severe and can have a global impact
5. Vaccines will probably not be available in the first months
6. Risk groups and symptoms will be unknown until the pandemic occurs
7. Early treatment with antivirals and other medical support can reduce complications and deaths
8. Non-pharmaceutical interventions may be the only effective initial measures in most countries
9. Communicating risk is critical
10. Pandemic response capacity can be built through Seasonal influenza



# Pandemic influenza response tips

## Coordinating responders

- Multisectoral coordination
- Whole-of-society approach

## Communicating risk

- Encourage health authorities to:
  - Have a plan on the use of antivirals and vaccines
  - Have a multisectoral risk communication plan in place
  - Communicate early and frequently about how to protect from the disease
- Engage communities and individuals to practice good hygiene
- Key messages:
  - Pandemic influenza is caused by a new virus to which no one has immunity and protection
  - You can protect yourself by using proper cough hygiene, effective hand washing and by distancing yourself away from others if you fall sick
  - Stay at home, drink plenty of fluids
  - Seek medical advice if you have severe symptoms or you already have other medical conditions that may put you at further risk of severe disease
  - Take the new vaccine when it became available if you are asked to do so

## Health Information

- Notify a case of novel influenza to WHO, under the IHR (2005)
- Share viruses and information with the WHO GISRS (Global Influenza Surveillance and Response System)
- Consult WHO surveillance and severity assessment guidance

## Health Interventions

- Vaccines
- Antiviral treatment
- Non-pharmaceutical interventions (at personal and community level): hygiene, social distancing etc.

# 1

## Another influenza pandemic is inevitable but unpredictable

- It is not possible to predict when or where the next Pandemic influenza will occur, what subtype it will be, and what morbidity and mortality impact it will have, but it is certain that there will be one.
- History has shown pandemics occur at 10- to 50-year intervals, with varying severity and impact. During the 20th century, there have been three influenza pandemics (in 1918, 1957 and 1968). Since 2000, there has been one influenza pandemic, in 2009.
- Influenza viruses are very unstable and constantly mutating. They undergo small mutations (antigenic drift) and cause Seasonal influenza epidemics and out-of-season outbreaks. But a substantial change (antigenic shift) can occur at any time. It will result in a new virus (different subtype) which may lead to a pandemic. This antigenic shift can be the re-assortment of human influenza viruses with Avian or swine viruses, or significant point mutations of Avian or swine viruses.

# When?

# 2

## Pandemics require global concerted actions

- Influenza pandemics are very disruptive events that can cause severe social, economic, and political stress. Preparedness requires a whole-of-society approach to ensure that when the next pandemic strikes, the world will be able to respond rapidly and effectively to reduce morbidity and mortality. Not only the health sector but also all other sectors, individuals, families and communities, have a role to play in mitigating the effects of a pandemic.



# 3

## A pandemic happens when an influenza virus emerges to which most people have no immunity

- There are three necessary factors for the emergence of Pandemic influenza:
  - A new influenza virus emerges and causes illness in humans;
  - This virus has the ability to cause sustained human-to-human transmission;
  - Human population has little or no immunity to the virus.
- Because it is a new virus to which people have not yet been exposed, the population has no or little immunity and the virus is able to spread quickly and cause illness in people.
- A Pandemic influenza virus may arise when:
  - Genes from animal and human influenza viruses mix together to create a human-animal influenza re-assortant virus (genetic re-assortment);
  - Genes in an animal influenza virus change allowing the virus to infect humans and transmit easily among them (genetic mutation).
- It is mandatory to notify a human influenza case caused by a new subtype to WHO, under the IHR (2005).



# 4

## Influenza pandemics may be mild or severe and can have a global impact

- Influenza pandemics have various levels of severity and impact.
- It is hard to predict the characteristics, including level of severity, of the next pandemic.
- During an influenza pandemic, severity assessments should be conducted regularly at local, national and global levels, to inform public health decisions (vaccine production and use, antivirals use, school closures, social distancing strategies, etc.). Key elements to take into consideration are: the transmissibility of the disease, its seriousness (complications, for which group of people, etc.), the impact on the health sector (whether it is overwhelmed or not).

# 5

## Vaccines will probably not be available in the first months

- Vaccines are one of the most effective ways to protect people during influenza epidemics and pandemics.
- However, the availability of a pandemic vaccine will be delayed by several months because of the requirements for vaccine formulation and production lead-time. It is expected that it takes about 24 weeks (almost six months) for a vaccine to be available after the identification of the pandemic virus.
- It is probable that the worldwide production capacity will still be insufficient and restrict global access to the vaccine, at least during the first phase of the pandemic. In the best case scenario, it has been estimated (2015) that annual production could reach about 6.2 billion



doses of vaccines, which is still insufficient to cover the world population because two doses of vaccines will probably be needed to fully protect against the virus. Furthermore, it is challenging to maintain this production capacity.

- Vaccination should target the most at risk of exposure (health care workers, people living in crowded areas) and those most at risk of complications.
- Antigen-sparing strategies can be used to increase vaccine availability.
- Some countries are stockpiling pre-pandemic vaccines against some Avian influenza viruses.

### Characteristics of the past four influenza pandemics

Pandemic year of emergence and common name	Area of origin	Influenza A virus sub-type (type of animal genetic introduction/recombination event)	Estimated reproductive number	Estimated case fatality	Estimated attributable excess mortality worldwide	Age group most affected
1918 "Spanish flu"	Unclear	H1N1 (unknown)	1.2–3.0	2–3%	20–50 million	Young adults
1957–1958 "Asian flu"	Southern China	H2N2 (avian)	1.5	<0.2%	1–4 million	All age groups
1968–1969 "Hong Kong flu"	Southern China	H3N2 (avian)	1.3–1.6	<0.2%	1–4 million	All age groups
2009–2010 "influenza A(H1N1) 2009"	North America	H1N1 (swine)	1.1–1.8	0.02%	100 000–400 000	Children and young adults

Source: *Pandemics of the 20th–21st centuries*. Stockholm, European Centre for Disease Prevention and Control.

# 6

## Risk groups and symptoms will be unknown until the pandemic occurs

- Although we start with the assumption that the risk groups for infection and severe outcome are the same as in Seasonal influenza, there might be differences.
- Historical knowledge from the 1918 and 2009 pandemics indicates that healthy, young adults can be disproportionately and more severely affected.
- Pandemic influenza might present differently from Seasonal influenza and symptoms may be more severe and complications more frequent.
- People with influenza will usually develop the following symptoms: sudden onset of fever, cough (usually dry), headache, muscle and joint pain, fatigue, sore throat and a runny nose;
- Complication can include pneumonia, sepsis, and inflammation of the heart (myocarditis), brain (encephalitis) or muscle (myositis);
- The incubation period is usually two days but may be from one to five days.



# 7

## Early treatment with antivirals and other medical support can reduce complications and deaths

- Antiviral drugs may reduce severe complications and deaths. Ideally, they need to be administered early in the disease (within 48 hours of onset of symptoms). They are especially important for high-risk groups.
- During an influenza pandemic, antiviral drugs are an important tool to prevent the spread of the disease and severe outcome and complications, as vaccines will most likely not be available at an early stage.
- Effectiveness of the drugs on the novel pandemic virus must be monitored, as some influenza viruses may be (or become) resistant to them.
- Pharmaceutical interventions typically encompass the application of antivirals treatments and other drug treatment (e.g. antibiotics to target complications of influenza).



## 8

### Non-pharmaceutical interventions may be the only effective initial measures in most countries

- Vaccination is the primary intervention to prevent infection and severe outcomes caused by influenza virus. However, at the beginning of a pandemic, Pandemic influenza vaccines, matching the new virus, will most likely not be available.
- In addition to antiviral drugs administration (which might also be short in supply), non-pharmaceutical interventions (NPI) should be put in place, at the early stage of a pandemic, to slow transmission and reduce its impact. NPI include (but are not limited to):
  - Social distancing: staying at home when sick;
  - Hygiene such as cough etiquette (covering coughs and sneezes with a tissue), hand washing and cleaning of touched surfaces and objects;
  - During severe pandemics, more extreme measures can be implemented: using facemasks when sick, schools closures, decreasing the amount of contacts among people.
- NPI will help to reduce the number of people who are exposed and then infected.



# 9

## Communicating risk is critical

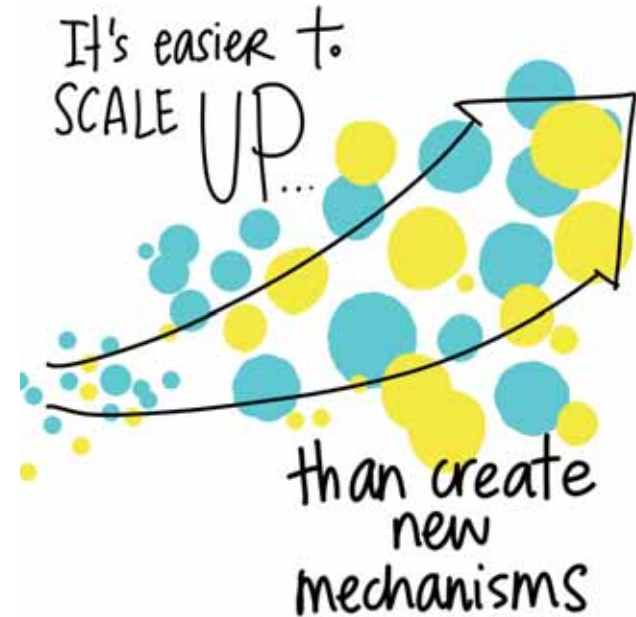
- Risk communication is particularly important in a rapidly evolving situation and when there is little known about an epidemic, which will be the case at the beginning of an influenza pandemic (novel virus). Without effective communication, the many unknowns give enough space for rumors to develop.
- As the pandemic requires a whole-of-society approach, individuals and communities must be engaged, listened to and see that their concerns are addressed. People need to be informed on how to protect themselves and stop the spread of the disease.
- Strong risk communication must be built before the emergency occurs.



# 10

## Pandemic response capacity can be built through Seasonal influenza

- Pandemic influenza would require the implementation of the same control measures, on a larger scale: Infection Prevention and Control and Hygiene; Health Education; Vaccination; Early treatment; Social distancing; Risk communication and Community engagement.



## Highlight: the PIP Framework

- The Pandemic influenza Preparedness Framework or “PIP Framework” is an innovative public health instrument that seeks to better prepare the world to respond to Pandemic influenza.
- It brings together Member States, industry, other stakeholders and WHO to implement a global approach to Pandemic influenza preparedness and response.
- The PIP Framework has two objectives which are to be pursued on equal footing:
  - To improve the sharing of influenza viruses with the potential to cause a human pandemic;
  - To establish more predictable, efficient, and equitable access to the benefits that result from the sharing of such viruses, notably vaccines and antiviral medicines.
- The Framework, developed by Member States, came into effect on 24 May 2011, unanimously adopted by the World Health Assembly.







## More information about Pandemic influenza:

- Influenza WHO webpage:  
<http://www.who.int/influenza/en/>
- Pandemic Influenza WHO MOOC:  
<https://openwho.org/courses/pandemic-influenza-introduction>
- WHO Global Epidemiological Surveillance Standards for Influenza  
[http://www.who.int/influenza/resources/documents/influenza\\_surveillance\\_manual/en/](http://www.who.int/influenza/resources/documents/influenza_surveillance_manual/en/)
- WHO surveillance case definitions for influenza-like illness (ILI) and severe acute respiratory infections (SARI)  
[http://www.who.int/influenza/surveillance\\_monitoring/ili\\_sari\\_surveillance\\_case\\_definition/en/](http://www.who.int/influenza/surveillance_monitoring/ili_sari_surveillance_case_definition/en/)
- Pandemic Influenza Risk Management, WHO interim guidance, 2013  
[http://www.who.int/influenza/preparedness/pandemic/influenza\\_risk\\_management/en/](http://www.who.int/influenza/preparedness/pandemic/influenza_risk_management/en/)
- WHO Checklist for Pandemic Influenza Risk and Impact Management  
<http://www.who.int/influenza/preparedness/pandemic/en/>
- WHO Pandemic Influenza Severity Assessment (PISA)  
[http://www.who.int/influenza/surveillance\\_monitoring/pisa/guidance/en/](http://www.who.int/influenza/surveillance_monitoring/pisa/guidance/en/)
- Pandemic Influenza Preparedness Framework:  
<http://www.who.int/influenza/pip/en/>

# Middle East respiratory syndrome (MERS)

## 10 THINGS YOU SHOULD KNOW



1. MERS (Middle East respiratory syndrome) is a respiratory disease caused by a coronavirus whose reservoir is dromedary camels
2. Humans can be infected through direct or indirect contact with infected dromedary camels and potentially from camel products
3. The impact ranges from asymptomatic infection to severe pneumonia and death
4. People with weakened immune systems and chronic diseases are at high risk of severe disease
5. Early supportive clinical management reduces mortality
6. Infection prevention and control measures are critical to prevent the spread of human-to-human transmission
7. Laboratory diagnostics are available for MERS
8. Thorough case and outbreak investigation and other measures will help to prevent spread
9. Research is ongoing for treatment in humans and vaccines for camels and humans
10. MERS coronavirus (MERS-CoV) infection is a notifiable disease under the International Health Regulations (2005)

# MERS response tips

## Coordinating responders

- Coordination between animal and human health sectors is essential for:
  - Surveillance
  - Risk assessment
  - Investigation
  - Mitigation

## Communicating risk

- Encourage health authorities to:
  - Identify and target at-risk populations with information on how to protect themselves and prevent further transmission
  - Have a multi-sectoral risk communication plan and to activate it
- Key messages:
  - Precautions for people at high risk of developing severe disease include: practicing good personal hygiene, avoiding contact with camels; not drinking raw camel milk or camel urine; and not eating camel meat that has not been thoroughly cooked
  - Enhance infection prevention and control in health care facilities
  - Seek health care early on and follow medical advice

## Health Information

- Report cases to WHO, under the IHR (2005)
- WHO regularly conducts global risk assessments for MERS-CoV, these can be found here: [http://www.who.int/csr/disease/coronavirus\\_infections/archive\\_updates/en/](http://www.who.int/csr/disease/coronavirus_infections/archive_updates/en/)
- WHO has developed standard case reporting forms for data analysis and to guide actions

## Health Interventions

- Active case finding and contact tracing
- Supportive case management
- Infection prevention and control measures to prevent health care workers infections

## 1

**MERS (Middle East respiratory syndrome) is a respiratory disease caused by a coronavirus whose reservoir is dromedary camels**

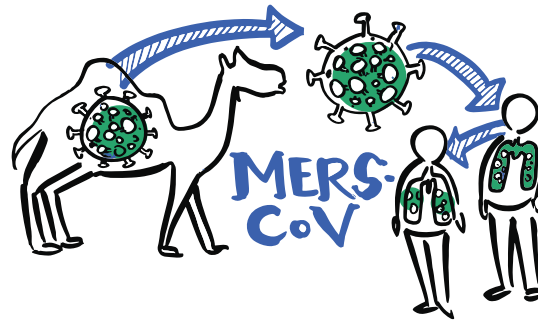
- Middle East respiratory syndrome (MERS) is a viral respiratory illness caused by a coronavirus (Middle East respiratory syndrome coronavirus, or MERS-CoV) that was first identified in humans in the Kingdom of Saudi Arabia in 2012.
- Coronaviruses are a large family of viruses that can cause diseases in humans, ranging from the common cold to Severe Acute Respiratory Syndrome (SARS).
- Dromedary camels (one-humped camels) are the reservoir host for MERS-CoV.
- Since 2012, MERS has been reported in 27 countries. Approximately 80% of human cases have been reported by the Kingdom of Saudi Arabia. Cases identified outside the Middle East are people who were infected in the Middle East and then travelled elsewhere. On rare occasions, small outbreaks have occurred in areas outside the Middle East.



## 2

**Humans can be infected through direct or indirect contact with infected dromedary camels and potentially from camel products**

- MERS-CoV is a zoonotic virus: it is transmitted between animal and people.
- Dromedary camels are the main source of infection in humans: humans are infected through direct or indirect contact with infected dromedary camels.
- At-risk groups of infection, because they are in contact with dromedary camels, include: camel farm workers; slaughterhouse workers; market workers; veterinarians; anyone handling dromedary camels or dromedary camels'



products (e.g. cooking). Health care workers caring for MERS patients without adequate personal protective equipment are also at high risk of infection.

- It is recommended that these high-risk groups practice good personal hygiene, including frequent hand hygiene. Hands should be washed with soap and water

and/or alcohol gel after every contact with an animal. Workers should wear facial protection where feasible; and protective clothing, which should be removed after work (followed by hand hygiene) and washed daily.

- The consumption of raw or undercooked animal products, including milk and meat, carries a potential risk. Animal products that are processed appropriately through cooking or pasteurization are safe for consumption. Properly cooked products should also be handled with care to avoid cross contamination with uncooked foods.
- As a general precaution, anyone visiting farms, markets, barns, or other places where dromedary camels and other animals are present should practice general hygiene measures, including regular hand washing before and after touching animals, and should avoid contact with sick animals. People should avoid unprotected direct contact with any animal that has been confirmed positive for MERS-CoV infection.
- There is no evidence of sustained human-to-human transmission: the virus does not pass easily from person to person unless there is close and unprotected contact. There has been limited human-to-human transmission among family members. However, human-to-human transmission has been repeatedly shown to be amplified in health care settings, especially when infection prevention and control measures are inadequate.

# 3

## The impact ranges from asymptomatic infection to severe pneumonia and death

- The clinical spectrum of MERS-CoV infection ranges from no symptoms (asymptomatic) or mild respiratory symptoms to severe acute respiratory disease and death.
- MERS symptoms are non-specific and can include headache, tiredness, feverishness, mild cough, sore throat, and runny nose. Some patients may present with gastrointestinal symptoms such as

mild diarrhoea. Pneumonia is a common finding, but not always present.

- Severe illness can cause respiratory failure that requires mechanical ventilation and support in an intensive care unit.
- The average incubation period is estimated to be approximately five days but may range from two to 14 days.
- It is not always easy to detect cases early because symptoms are non-specific and this may lead to spread of the disease in health care settings.



# 4

## People with weakened immune systems and chronic diseases are at high risk of severe disease

- The virus causes a more severe disease in older people, people with weakened immune systems, and those with chronic diseases such as renal disease, cancer, chronic lung disease, blood disease and diabetes. These people are also at increased risk of infection.
- People at high risk of developing severe disease (people with underlying conditions) should avoid contact with camels.

# 5

## Early supportive clinical management reduces mortality

- Supportive therapies prevent complications and increase chances of survival. They include: oxygen, antimicrobials, specific treatment for underlying conditions such as diabetes, kidney failure, etc.
- Treatment is based on a person's clinical condition.
- There is no specific treatment or vaccine available for MERS currently.



# 6

## Infection prevention and control measures are critical to prevent the spread of human-to-human transmission

- Standard precautions should be routinely applied to all patients. They include hand hygiene, respiratory hygiene, use of Personal Protective Equipment (PPE), safe waste management, cleaning and disinfection of equipment and cleaning of the environment.
- Triage policies should be implemented to rapidly detect potential MERS-CoV cases and all cases with acute respiratory symptoms.
- Triage, waiting areas and patient rooms should be adequately ventilated.
- Health care workers involved in aerosol-generating procedures are at greater risk of infection.
- Droplet precautions should be added to the standard precautions when providing care to any patient with symptoms of acute

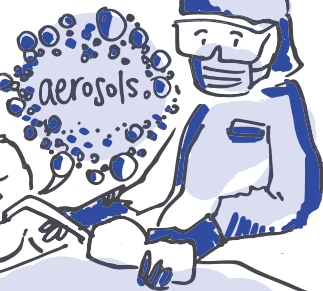


respiratory infection (ARI). They include the use of a mask and eye-protection when working within 1-2 metres of the patient and patient isolation (organization of the space and processes to allow separation of at least 1-2 metres between patient with ARI and other individuals not wearing PPE).

- When performing an aerosol-generating procedure in patient with ARI, airborne precautions should be applied. They include wearing an appropriate PPE, appropriate ventilation, avoiding unnecessary individuals in the room.
- Health care workers should be educated and trained in infection prevention and control and should refresh these skills regularly.
- Hospital cleaning staff should also be informed of and trained to take proper precautions when cleaning rooms of MERS patients.

## AIRBORNE PRECAUTIONS

aspiration or open suctioning, intubation + more ...



- USE PPE
- ensure ventilation

## Infection prevention and control when caring for patients with MERS or suspected MERS

All patients	Standard precautions, triage procedures
Patients with ARI	Droplet precautions
When performing aerosol-generating procedures in patients with ARI	Airborne precautions

# 7

## Laboratory diagnostics are available for MERS

- Laboratory confirmation of MERS-CoV infection requires good samples, high levels of biosafety and good laboratory capacities.

### Testing:

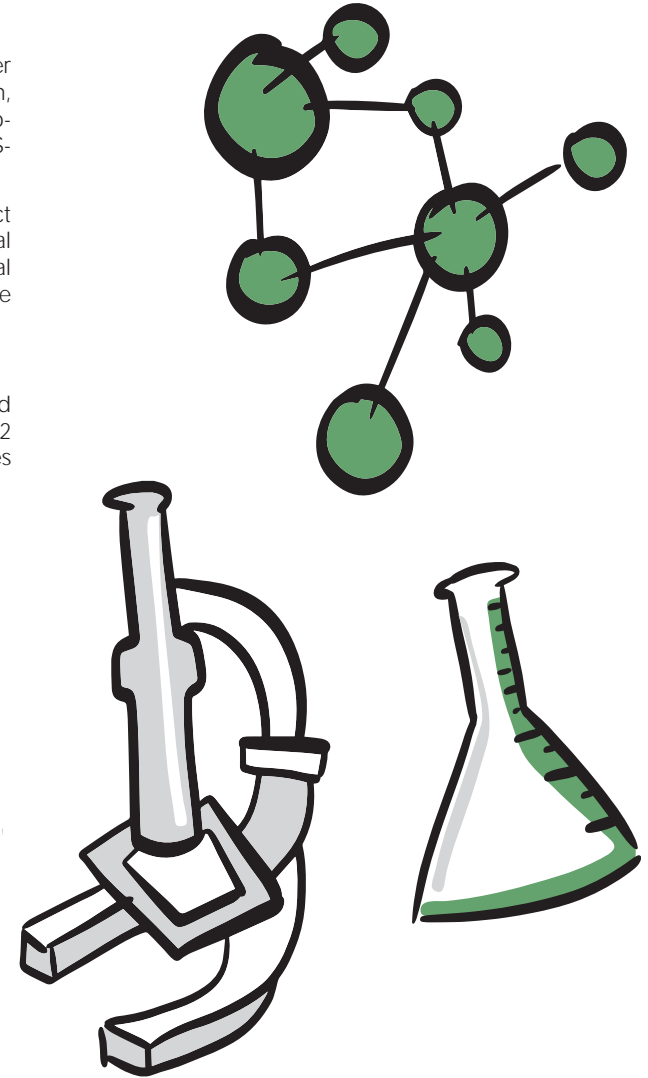
- A case of MERS-CoV infection may be laboratory confirmed by detection of viral nucleic acid or by using serology to demonstrate antibodies.
- The presence of viral nucleic acid can be confirmed by either:
  - A positive real-time Reverse Transcription Polymerase Chain Reaction (RT-PCR) on at least two specific genomic targets;
    - A case with a positive RT-PCR result for a single specific target without further testing but with a history of potential exposure and consistent clinical signs is considered a probable case.
  - Or a single positive target with sequencing.
- If initial testing is negative in patient who is strongly suspected to have MERS-CoV infection, the patient should be resampled and include lower respiratory specimens. To confirm clearance of the virus, respiratory samples should continue to be collected until there are two consecutive negative results at least 24 hours apart in clinically recovered persons.

### Samples:

- It is strongly recommended that lower respiratory specimens such as sputum, endotracheal aspirate or bronchoalveolar lavage are collected for MERS-CoV when possible.
- If not possible, upper respiratory tract specimens such as nasopharyngeal aspirate or combined nasopharyngeal and oropharyngeal swab should be collected.

### Biosafety:

- Molecular testing for MERS-CoV should be conducted under Biosafety level 2 (BSL-2) conditions. Virus culture requires BSL-3 biosafety conditions.



## 8

### Thorough case and outbreak investigation and other measures will help to prevent spread

- Each human case of MERS requires thorough investigation to understand the source of infection and the potential human-to-human spread amongst contacts.
- Thorough case investigation includes the investigation of potential human, animal, and/or environmental sources of exposure(s) and risk factors for infection. Patients (confirmed and suspected cases) and family members should be interviewed to collect: Essential basic information; Exposure information and travel history; and Clinical information. WHO has generated case report forms identifying the minimum amount of information that should be collected for each case of MERS.

- Once a case has been confirmed, to prevent further spread of the disease, active case finding should be implemented in the community and in health care settings:
  - All close contacts should be identified and monitored for the presence of symptoms for 14 days. A contact is any person who has cared for or lived with a confirmed case, or had unprotected contact with that person's respiratory secretions, body fluids and/or excretions when that person was symptomatic;
  - Contacts should be placed under active surveillance for 14 days after last exposure to the confirmed or probable case with monitoring for respiratory symptoms (a health care worker should visit or call them on a daily basis);
  - Any contacts who develop symptoms should be isolated in a health care facility and tested for MERS-CoV infection;
  - Health care workers with direct contact with a MERS patient should be closely monitored.
- Health Education, including basic information about MERS, how to prevent against MERS-CoV infection for different groups (e.g. contacts of confirmed patients, health care workers caring for MERS patients, occupational groups who work with dromedary camels, and populations at higher risk of severe disease) and what to do should an individual suspect they have MERS-CoV infection, should be provided by trained individuals.



### management of close contacts

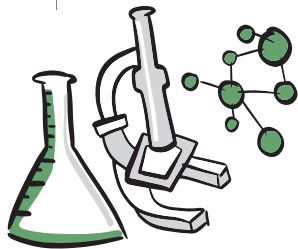




# 9

## Research is ongoing for treatment in humans and vaccines for camels and humans

- WHO has developed a MERS-CoV research agenda to address key unknowns for this virus focusing on five major areas of research: i) virus origin and characteristics, ii) epidemiology and transmission, iii) clinical management and infection prevention and control measures, iv) product development and implementation, and v) impact of interventions and operational research.
- WHO's Research and Development Blueprint is working to accelerate the development of medical interventions for MERS.
- Currently, there are no licensed treatments for MERS;
- Currently, a dozen vaccine candidates for both humans and dromedary camels are in preclinical development.



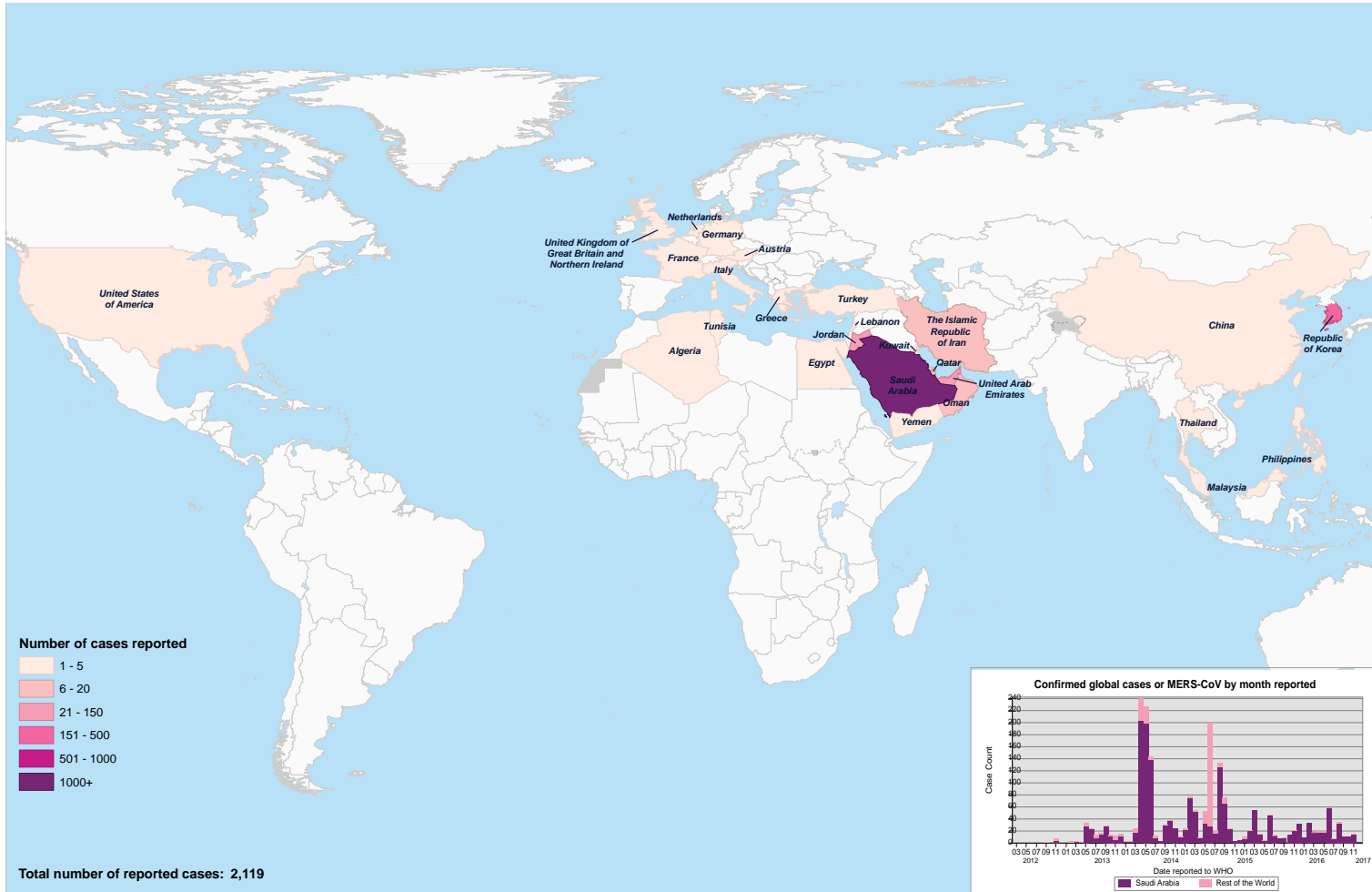
# 10

## MERS-CoV infection is a notifiable disease under the International Health Regulations (2005)

- Probable and confirmed cases must be reported within 24 hours of classification, with information about their exposure, testing and clinical course. MERS case definitions for reporting to WHO can be found here: [http://www.who.int/csr/disease/coronavirus\\_infections/case\\_definition/en/](http://www.who.int/csr/disease/coronavirus_infections/case_definition/en/)



Confirmed global cases of MERS-CoV 2012 – 2017

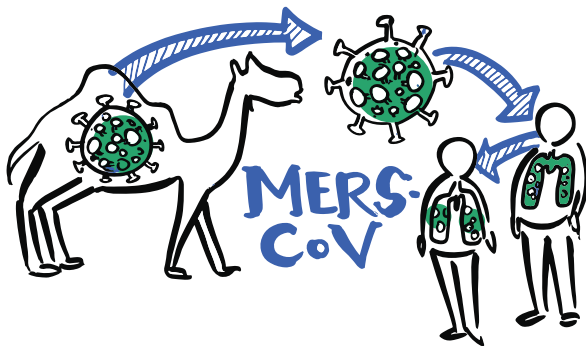


Data as 12 December 2017

The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted lines on maps represent approximate border lines for which there may not yet be full agreement. © WHO 2018.

## More information about MERS:

- MERS-CoV WHO website:  
<http://www.who.int/emergencies/mers-cov/en/>
- MERS WHO MOOC:  
<https://openwho.org/courses/pandemic-epidemic-diseases>
- Latest global risk assessment for MERS-CoV:  
[http://www.who.int/csr/disease/coronavirus\\_infections/archive\\_updates/en/](http://www.who.int/csr/disease/coronavirus_infections/archive_updates/en/)
- Guidance on laboratory testing:  
[http://www.who.int/csr/disease/coronavirus\\_infections/mers-laboratory-testing/en/](http://www.who.int/csr/disease/coronavirus_infections/mers-laboratory-testing/en/)
- Surveillance guidance including recommendations on criteria for case investigation and testing:  
[http://www.who.int/csr/disease/coronavirus\\_infections/surveillance-human-infection-mers/en/](http://www.who.int/csr/disease/coronavirus_infections/surveillance-human-infection-mers/en/)
- Guidance on the investigation of cases of MERS-CoV infection:  
[http://www.who.int/csr/disease/coronavirus\\_infections/mers-investigation-cases/en/](http://www.who.int/csr/disease/coronavirus_infections/mers-investigation-cases/en/)
- WHO case investigation form for MERS-CoV:  
[http://www.who.int/csr/disease/coronavirus\\_infections/MERS\\_case\\_investigation\\_questionnaire.pdf?ua=1](http://www.who.int/csr/disease/coronavirus_infections/MERS_case_investigation_questionnaire.pdf?ua=1)
- MERS case definitions for reporting to WHO:  
[http://www.who.int/csr/disease/coronavirus\\_infections/case\\_definition/en/](http://www.who.int/csr/disease/coronavirus_infections/case_definition/en/)
- Guidance on case management and Infection Prevention and Control:  
[http://www.who.int/csr/disease/coronavirus\\_infections/technical-guidance-infection/en/](http://www.who.int/csr/disease/coronavirus_infections/technical-guidance-infection/en/)
- Information about MERS-CoV Research and Development:  
<http://www.who.int/blueprint/priority-diseases/key-action/mers-cov/en/>



# Cholera

## 10 THINGS YOU SHOULD KNOW



1. Cholera is closely linked to inadequate access to clean water and sanitation
2. Cholera is transmitted by faecally-contaminated water and food
3. Cholera outbreaks can be explosive
4. Rapid detection of suspected cases and laboratory confirmation are essential
5. People with Cholera experience acute watery diarrhoea with no fever
6. Severe forms of Cholera can kill within hours: early rehydration is the cornerstone of treatment
7. Oral Cholera Vaccines are safe and should be used with other prevention and control strategies
8. Populations at risk should be provided with safe water and basic sanitation
9. Mapping the origin of cases is critical to orient control activities
10. WHO can provide countries with Cholera kits

# Cholera response tips

## Coordinating responders

- Intersectoral coordination at national and local level is critical to outbreak response
- Epidemiological data on the origin of cases should drive the multisectoral response
- Cholera kits are available for preparedness and immediate outbreak response
- Contact WHO/ICG for emergency Oral Cholera Vaccines
- Technical support is available through the Global Task Force on Cholera Control (GTFCC)

## Communicating risk

- Encourage health authorities to:
  - Engage communities to enhance hygiene and food safety practices
  - Set up treatment facilities and let the public know how to access them
  - Make sure Oral Rehydration Salts are available
- Key messages:
  - Cholera is transmitted through contaminated water or food
  - Cholera can rapidly lead to severe dehydration and death if left untreated: seek treatment quickly
  - Wash hands at critical moments
  - Mild cases can be treated at home with oral rehydration
  - Take the Cholera vaccine if advised, when there is a Cholera outbreak or its threat, in your area

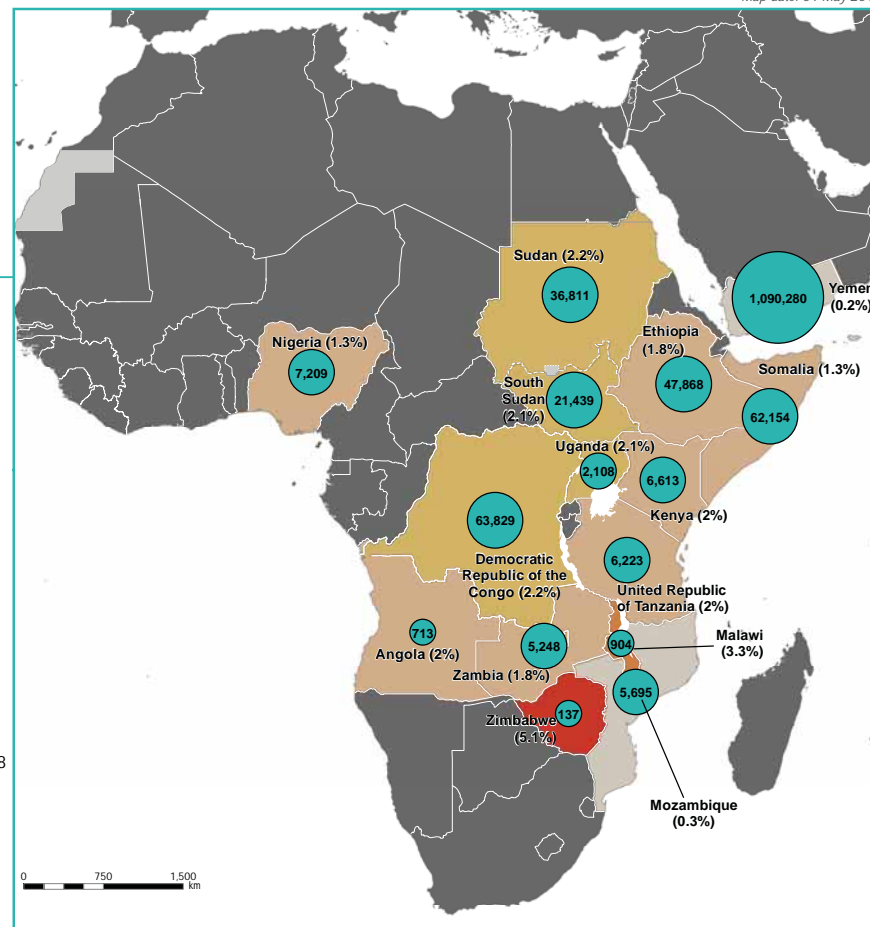
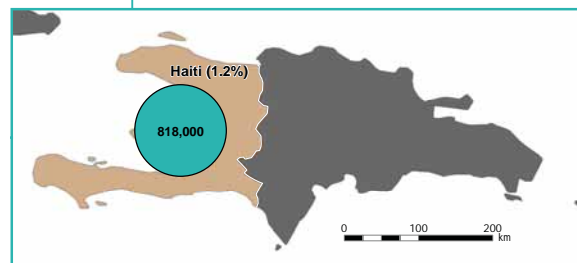
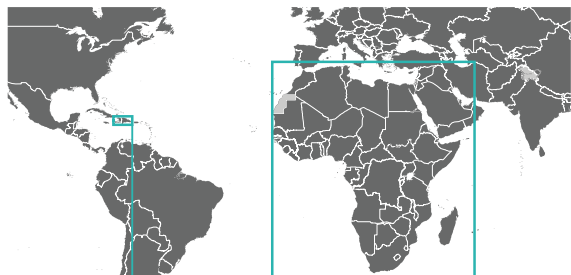
## Health Information

- Investigate the source of the outbreak
- Once *Vibrio Cholerae* has been confirmed by culture or PCR, the WHO clinical case definition is sufficient to identify cases. Periodic sampling and testing on suspected cases should be carried out throughout the epidemic to monitor antimicrobial sensitivity

## Health Interventions

- Provide populations with safe water and sanitation
- Treat early (rehydration):
  - Oral rehydration points (ORPs) in the community facilitate early access to treatment
  - Cholera treatment centres (CTCs) provide 24-hour care for patients with more severe forms of Cholera
- Infection prevention and control practices must be implemented in all health facilities receiving Cholera patients
- Vaccination with Oral Cholera Vaccines in humanitarian emergencies and to prevent further spread of epidemics

### Major Cholera Outbreaks in 2017 - 2018



<b>Number of Cases</b>	<b>Case Fatality Rate (CFR)*</b>	<b>Period of Report</b>
< 1000	< 1%	Angola: Dec 2017-March 2018
1000 to 5000	>1% to 2%	Democratic Republic of the Congo: Jan 2017 – April 2018
5000 to 20,000	>2% to 3%	Ethiopia: Jan 2017 – April 2018
20,000 to 100,000	>3% to 4%	Haiti: Oct 2010 – Feb 2018
> 100,000	>4% to 5.1%	Kenya: Jan 2017-mid April 2018
	<b>*CFR Labelled for Each Country</b>	Malawi: Nov 2017 – April 2018
	Not Applicable	Mozambique: Jan 2017 - 8 April 2018
		Nigeria: Aug 2017 – April 2018
		Somalia: March 2017 – March 2018
		South Sudan: Aug 2016 – Dec 2017
		Sudan: Aug 2016 – Feb 2018
		United Republic of Tanzania: Jan 2017- mid April 2018
		Uganda: Feb 2018 – April 2018
		Yemen: April 2017 – April 2018
		Zambia: Oct 2017 – April 2018
		Zimbabwe: Jan – April 2018
		Ethiopia and Sudan: Reported as AWD

Source: WHO, 2018

The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted lines on maps represent approximate border lines for which there may not yet be full agreement. © WHO 2018. All rights reserved

# 1

## Cholera is closely linked to inadequate access to clean water and sanitation

- The long-term solution for Cholera control lies in economic development and universal access to safe drinking water and adequate sanitation. These measures prevent both epidemic and endemic Cholera as well as other faeco-orally transmitted and water-borne diseases. They may require substantial long-term investments.
- Cholera is closely linked to poor environmental conditions. The absence or shortage of safe water and of proper sanitation are the main contributors to the spread of the disease. Typical at-risk areas are peri-urban slums, with precarious basic infrastructure, as well as internally displaced or refugee camps.



- Actions to reduce the transmission of Cholera include:
  - The implementation of adapted long-term sustainable WASH (Water Sanitation and Hygiene) solutions to ensure use of safe water, basic sanitation and good hygiene practice to populations most at risk of Cholera:
    - o Interventions at the household level (water filtration, chemical or solar disinfection of water, safe water storage and the construction of systems for safe sewage disposal including latrines);
    - o Adoption of basic hygiene practices;
    - o Access to safe water and sanitation in public areas such as health facilities and schools.
  - Rapid access to treatment;
  - Implementation of adapted infection control practices in treatment structures;
  - Vaccination.



# 2

## Cholera is transmitted by faecally-contaminated water and food

- A person can become infected by drinking water or eating food contaminated by the bacterium *Vibrio Cholerae*.

Bacteria present in the faeces of an infected person are the main source of contamination.

Food may be contaminated by soiled hands during preparation, or while eating by some irrigation practices.

During funeral ceremonies, transmission may occur through consumption of food and beverages contaminated by someone who touched the corpse of the deceased and also prepared the food without adequately washing their hands, or by funeral attendees touching the corpse.

- Beverages prepared with contaminated water and sold by street vendors are vehicles of Cholera transmission, as well as vegetables and fruits "freshened" with contaminated water and raw or undercooked seafood.
- The bacterium can persist in water for long periods and multiply in moist leftover food.



## 3

**Cholera outbreaks can be explosive**

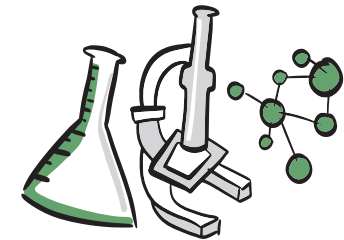
- The incubation period is very short. It ranges from two hours to five days, usually two to three days.
- This leads to explosive epidemics as the numbers of cases can rise extremely quickly.
- Early detection and treatment of cases and rapid initiation of control activities are critical.
- Asymptomatic carriers can transmit the infection. As long as stools are positive, infected people can transmit the disease. Even among asymptomatic carriers, the pathogens stay in their faeces for up to 14 days and are shed back into the environment, possibly infecting other individuals.

## 4

**Rapid detection of suspected cases and laboratory confirmation are essential**

- When an outbreak is suspected, a multidisciplinary team should be sent to the field in order to confirm the outbreak and to take the first measures to control the spread of the disease. These teams should carry sampling materials, rapid diagnostic tests, the means to make clean water and ORS (Oral Rehydration Salts) at a minimum. More medical materials should be carried if a treatment facility is visited.
- Rapid diagnostic tests (RDTs) should be used to reinforce suspicion of Cholera. This allows quick testing without the need for a laboratory and is frequently used to increase suspicion during outbreak investigations. The sensitivity and specificity of Cholera RDTs are not sufficient for them to be used as individual diagnostic tests. Send the RDT positive stool samples to the laboratory for confirmation.
- Cholera is confirmed by identifying *V. Cholerae* in stool samples from affected patients using:
  - Culture for confirmation and antibiotic sensitivity testing;
  - PCR (Polymerase Chain Reaction) for confirmation.
- Laboratory confirmation is essential to confirm that this is a Cholera outbreak. Once an outbreak is confirmed, a clinical diagnosis using WHO standard case definition is sufficient.

- Laboratory confirmation should be carried out in each new area (district or region) reporting cases to confirm extension of the outbreak.
- Sporadic sampling and testing on suspected cases should be performed throughout an outbreak to monitor the outbreak, determine antibiotic sensitivity, and monitor the strain.
- An outbreak is considered over when all samples from all suspected patients test negative by RDT, culture or PCR for a period of two weeks.
- Do not wait for laboratory confirmation before starting control activities. Access to clean water and basic sanitation, hygiene promotion and access to treatment are important public health interventions even if the outbreak is not confirmed.





# 5

## People with Cholera experience acute watery diarrhoea with no fever

- Most people infected with Cholera (approximately 80%) do not develop any symptoms although the bacteria are present in their faeces for up to 14 days after infection.
- Among people developing symptoms, approximately 80% present with mild to moderate watery diarrhoea resulting in no or only minor signs of dehydration. The remaining 20% rapidly develop profuse watery diarrhoea that can lead to severe dehydration and to death if not treated.
- Other signs and symptoms may include:
  - Profuse vomiting;
  - Abdominal or muscle cramps;
  - Hypoglycemia;
  - Hypokalaemia.
- There is a high risk of fetal loss in pregnant woman with Cholera.
- Fever is not a symptom of Cholera, but may be a result of co-morbidity in patients with Cholera.

# 6

## Severe forms of Cholera can kill within hours: early rehydration is the cornerstone of treatment

- The most important treatment is rehydration, which consists of prompt replacement of the fluid and salts loss through severe diarrhoea and vomiting. Early rehydration can save the lives of nearly all Cholera patients. With early and proper treatment, the case fatality rate should remain below 1%.
- Good assessment of the state of dehydration is key to appropriate treatment (see the assessment tool in the manual "First steps for managing an outbreak of acute diarrhoea").
- Patients with no signs or some signs of dehydration (approximately 80% of patients), both adults and children, can be rehydrated quickly and easily by following standard protocols for treatment with Oral Rehydration Solution (ORS). ORS should be given early at home, by volunteers and family members, to avert delays in rehydration and death.
- Patients who become severely dehydrated need to receive fluids intravenously (Ringer's Lactate solution).
- Continued breastfeeding of infants and young children is encouraged.
- Zinc is also an important adjunctive therapy for children under five years, which also reduces the duration of diarrhoea and may prevent future episodes of other causes on acute watery diarrhoea.



## 7

### Oral Cholera Vaccines are safe and should be used with other prevention and control strategies

- There are three Oral Cholera Vaccines (OCV):
  - Shanchol™ and Euvichol® are essentially the same vaccine. One dose can be used to contain epidemics (protection for at least six months). Two doses are required for longer protection (both vaccines provide sustained protection of >65% for at least three years after two doses). The two doses can be administered to all individuals over the age of one year with a minimum two-week interval between doses;
  - There is a third vaccine, Dukoral®, that is primarily used for travellers. It also confers significant short-term protection against Enterotoxigenic Escherichia coli (ETEC). The vaccine is administered with a buffer solution. It can be given to all individuals over the age of two years with a minimum of a week between doses.

### ORAL CHOLERA VACCINE



- Oral Cholera Vaccines are considered safe for pregnant women.
- OCV can be used for emergencies:
  - In humanitarian crises, OCV can be used to prevent Cholera, even before any suspected cases are reported;
  - For outbreak response, OCV is used to prevent further spread of Cholera. It should be used as early as possible to prevent the greatest number of cases;
  - All OCVs currently require cold chain (2-8°C), but use out of cold chain is currently under review;
  - For emergency use of OCV, there is a global emergency stockpile of Oral Cholera Vaccine doses (Shanchol™ or Euvichol®) managed by the International Coordinating Group (ICG).
- In endemic settings, Oral Cholera Vaccines are used as part of a longer-term Cholera control plan, including reinforcement of surveillance and laboratory diagnostic capacity and improving water, sanitation and hygiene conditions. OCV is used to provide mid-term protection to the population while longer term water, sanitation and hygiene solutions are being implemented.
- OCV for endemic use is available via the Global Task Force on Cholera Control.



# 8

## Populations at risk should be provided with safe water and basic sanitation

- During outbreaks:
  - People should be provided with safe water or means to prepare and store safe water at home;
  - Awareness campaigns should be organized, and information should be provided to the community about the potential risks and symptoms of Cholera, precautions to take to avoid Cholera, when and where to report cases, and to seek immediate treatment when symptoms appear. The location of appropriate treatment sites should also be shared.
- Community engagement is critical, at any time, so that communities adopt preventive behaviors to avert contamination:



- Health education campaigns promote the adoption of appropriate hygiene practices such as handwashing with soap, safe preparation and of food and safe disposal of the feces of children;
- Handwashing should be promoted at multiple times;
- Funeral practices for individuals from Cholera must be adapted to prevent infection among attendees;
- Breastfeeding should be promoted;
- Health campaigns should be adapted to local culture and beliefs.



## 9

**Mapping the origin of cases is critical to orient control activities**

- Mapping the origin of cases can help identify priority areas for water and sanitation activities and hygiene promotion. The more precise the mapping, the more effectively interventions can be targeted.
- Access to treatment for people living in priority areas should also be ensured.
- Oral rehydration points in key areas and transport services to Cholera treatment centres can save lives.
- Active case finding should also be carried out in these areas.
- In areas with community health programmes, the community health workers or volunteers can be trained to identify and report suspected Cholera, to safely make and give ORS, and to refer patients for treatment.

## 10

**WHO can provide countries with Cholera kits**

- WHO can provide necessary materials for the investigation and confirmation of Cholera outbreaks, as well as for the treatment of Cholera patients. Cholera kits are designed to help prepare for a potential Cholera outbreak and to support the first month of the initial response.
- There are six kits:
  - One kit provides the necessary materials for the investigation of Cholera outbreaks;
  - One provides the supplies for laboratory confirmation of suspected Cholera cases.

Note: triple packaging for sample transport is NOT included;

- Three kits are designed for the treatment of Cholera patients within existing structures at the central, peripheral and community levels;
- One kit provides the necessary material to set up a provisional structure for patient care when no existing structure is in place.
- There is a tool that quickly estimates needs of Cholera kits (see link on next page).





## More information about Cholera:

- Cholera WHO webpage  
<http://who.int/cholera/en/>
- Cholera WHO factsheet  
<http://who.int/mediacentre/factsheets/fs107/en/>
- Ending Cholera: a global roadmap to 2030  
<http://www.who.int/cholera/publications/global-roadmap/en/>
- Cholera kits  
<http://who.int/cholera/kit/en/>
- Cholera outbreak: assessing the outbreak response and improving preparedness  
<http://who.int/cholera/publications/OutbreakAssessment/en/>
- First steps for managing an outbreak of acute diarrhoea  
<http://who.int/cholera/publications/firststeps/en/>
- Interim guidance document for Cholera surveillance, Global Task Force on Cholera Control, Surveillance Working Group  
[http://www.who.int/cholera/task\\_force/GTFCC-Guidance-cholera-surveillance.pdf?ua=1](http://www.who.int/cholera/task_force/GTFCC-Guidance-cholera-surveillance.pdf?ua=1)
- Interim technical notes on the Use of Cholera Rapid Diagnostic Tests, Global Task Force on Cholera Control, Surveillance and Laboratory Working Group  
[http://www.who.int/cholera/task\\_force/Interim-guidance-cholera-RDT.pdf?ua=1](http://www.who.int/cholera/task_force/Interim-guidance-cholera-RDT.pdf?ua=1)
- Oral Cholera Vaccine and technical notes on the use of OCV in pregnant women and travellers  
<http://www.who.int/cholera/vaccines/en/>
- WHO Oral Cholera Vaccines position paper – 2017  
<http://apps.who.int/iris/bitstream/10665/258763/1/WER9234.pdf?ua=1>

# Monkeypox

## 10 THINGS YOU SHOULD KNOW



1. Monkeypox virus is in the same family of viruses as Smallpox virus (Orthopoxviruses)
2. Primary infection occurs through direct contact with body fluids or lesions of infected animals
3. Secondary human-to-human transmission exists
4. Isolation of patients and standard infection prevention and control (IPC) measures are key to minimizing any possibility of human-to-human transmission
5. Avoid contact with animals that could harbour the virus, especially rodents and sick or dead animals
6. Active surveillance to ensure rapid identification of new cases is critical for outbreak containment
7. There is no specific treatment or vaccine recommended for Monkeypox
8. Health education and raising population awareness are the best preventive measures in at-risk populations
9. Many animal species host the Monkeypox virus, primarily rodent species (rather than monkeys, after which the disease is named)
10. Monkeypox is a rare disease that occurs sporadically in remote tropical rainforest areas of Central and West Africa

# Monkeypox response tips

## Coordinating responders

- Establish an Emergency Operations Centre if cases are above what is expected
- Ensure the animal and wildlife sector is involved from the very beginning
- Engage communities

## Communicating risk

- Encourage health authorities to:
  - Engage communities to prevent exposure
  - Ensure training of clinicians for early detection, sampling and treatment
- Key messages:
  - Avoid contact with dead animals (rats, squirrels and monkeys)
  - Human-to-human transmission occurs through respiratory droplets, contact with infected persons or contaminated materials
  - If you think you might have been exposed to Monkeypox and have any symptoms, go to the nearest health facility and avoid self-medication
  - Protect yourself when caring for patients with a rash

## Health Information

- Develop a case definition and a case investigation form adapted to the context
- Develop a consolidated laboratory/ surveillance database
- Map cases residence
- Notify cases to WHO, under the IHR (2005)

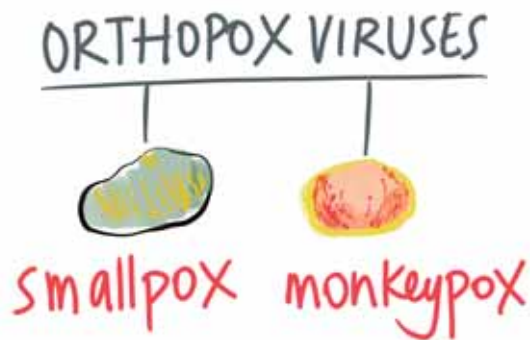
## Health Interventions

- Community engagement and strong risk communication
- Contact tracing
- Isolation and supportive care for cases
- Psychosocial support for all suspected cases and families
- Safe and dignified burials

## 1

### Monkeypox virus is in the same family of viruses as Smallpox virus (Orthopoxviruses)

- Monkeypox is a rare viral zoonosis with symptoms similar to those seen in Smallpox patients, although less severe. Monkeypox and Smallpox are members of the Orthopoxvirus family. Smallpox was eradicated in 1980 and, along with it, the vaccination programme was discontinued.
- The incubation period of Monkeypox is usually from six to 16 days but can range from five to 21 days.
- Monkeypox infection can be divided into two periods :
  - the invasion period (up to the first five days) characterized by fever, intense headache, lymphadenopathy (swelling of the lymph node), back pain, myalgia (muscle ache) and an intense asthenia (lack of energy);
  - the skin eruption period (within one to three days after appearance of fever)



where the various stages of the rash appears, often beginning on the face and then spreading elsewhere on the body. The face (in 95% of cases), palms of the hands and soles of the feet (75%) are most affected. Evolution of the rash from maculopapules (lesions with a flat bases) to vesicles (small fluid-filled blisters), pustules, followed by crusts occurs in approximately 10 days. Three weeks might be necessary before the complete disappearance of the crusts.

- The number of the lesions varies from a few to several thousand, affecting oral mucous membranes (in 70% of cases), genitalia (30%), and conjunctivae (eyelid) (20%), as well as the cornea (eyeball).
- Monkeypox is usually a self-limited disease with the symptoms lasting from two to three weeks.
- Severe cases occur more commonly among children and are related to the extent of virus exposure, patient health status and severity of complications.
- Case fatality rate in outbreaks has been between one percent and 10% depending on the clade of the virus. There are two distinct clades, the Congo Basin which has case fatality ratio (CFR) of up to 10% and the Western Africa clade with a CFR up to one percent.

## 2

### Primary infection occurs through direct contact with body fluids or lesions of infected animals

- Primary infection occurs through direct contact with the blood, body fluids, or cutaneous or mucosal lesions of infected animals.
- Hunters in tropical forests of West and Central Africa and people who may be exposed to animals infected with Monkeypox are at higher risk of infection.
- People living in or near the forested areas may have indirect or low-level exposure to infected animals, possibly leading to subclinical (asymptomatic) infection and concomitant acquisition of immunity, although this needs to be further explored.





# 3

## Secondary human-to-human transmission exists

- It can result from close contact with infected respiratory tract secretions, skin lesions of an infected person or objects recently contaminated by patient fluids or lesion materials. The virus does not transmit easily from human to human.
- Persons become infectious to others once the rash appears.
- As transmission occurs primarily via droplet respiratory particles and usually require prolonged face-to-face contact, household members of active cases and people caring for the sick are at greater risk of infection.
- Transmission can also occur by parenteral means such as inoculation of the virus or via the placenta (congenital Monkeypox).
- There is no evidence to date that person-to-person transmission alone can sustain Monkeypox infections in the human



# 4

## Isolation of patients and standard infection prevention and control (IPC) measures are key to minimizing any possibility of human-to-human transmission

- Patients should be isolated and treated symptomatically. Close physical contact with Monkeypox infected people should be avoided until the person has fully recovered.
- Gloves and personal protective equipment should be worn when taking care of ill people.
- Regular hand washing should be carried out after caring for or visiting sick people.
- Health care workers caring for patients with suspected or confirmed Monkeypox virus infection, or handling specimens from them, should implement standard infection control precautions.



## 5

**Avoid contact with animals that could harbour the virus, especially rodents and sick or dead animals**

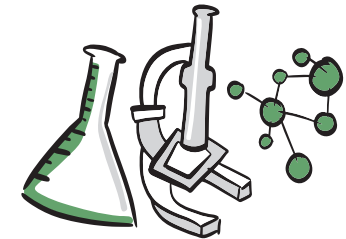
- In areas where Monkeypox occurs:
  - avoid contact with animals that could harbour the virus;
  - use appropriate infection prevention and control measures when handling animals. Gloves and other personal protective clothing should be worn while handling animals, their tissues, and during slaughtering procedures.
- Eating thoroughly cooked animal products (blood, meat) is safe. However, preparation using animal products represents a significant risk.
- Not all animals show signs of illness but they can still be contagious, making risk communication difficult, especially in areas where communities rely on hunting. Risk communications need to take this into account.

## 6

**Active surveillance to ensure rapid identification of new cases is critical for outbreak containment**

- Laboratory confirmation is important as Monkeypox is difficult to distinguish from other pox-like illnesses. The differential diagnoses to be considered include other rash illnesses, such as Chickenpox, Measles, bacterial skin infections, Scabies, Syphilis, Smallpox and medication-associated allergies. The development of severe lymphadenopathy before the appearance of the rash, in some patients, is a distinctive feature of Monkeypox compared to other similar diseases.
- Monkeypox can be confirmed in laboratory through several tests (Enzyme-Linked Immunosorbent Assay - ELISA, antigen detection, Polymerase Chain Reaction - PCR, or virus isolation in cell culture). The optimal diagnostic specimens are from lesions, either vesicular swabs of lesion exudate or crusts, stored in a dry, sterile tube (no viral transport media) and kept cold. Blood and serum do not give definitive results.

- Once a case of Monkeypox is detected, support enhanced surveillance measures to ensure additional Monkeypox cases are detected and that control measures are implemented.
- At the beginning of an outbreak, develop a consolidated laboratory and surveillance database to keep track of the information collected in case report forms during outbreak investigation.
- Contact tracing should be conducted for all suspected and confirmed Monkeypox cases.



## Clinical differential diagnosis between Monkeypox, Smallpox and Chickenpox

Symptoms	Monkeypox	Smallpox	Chickenpox
Fever	1-3 days before the rash	2-4 days before the rash	At the rash onset
Rash appearance	The rash evolves from maculopapules to vesicles, pustules, followed by crusts in approximately 10 days	Pocks at the same stage	Pocks in several stages
Rash development	Rapid	Low	Rapid
Rash distribution	Typically starts on face and spreads to arms and legs, then hands and feet including palm and soles	More dense on face and extremities; present on palms and soles	More dense on the body; absent on palms and soles
Other distinctive feature	Patients present with lymphadenopathy (swollen lymph nodes) before the appearance of the rash	No lymphadenopathy	The rash itches
Death	1-10%	Around 30%	Rare

**Note:** Smallpox has been eradicated and the information on disease comes from evidence gathered before 1980.

# 7

## There is no specific treatment or vaccine recommended for Monkeypox

- To date, there are no specific treatments or vaccines available for Monkeypox infection.
- Given the genomic conservation among Orthopoxviruses, it is likely that Smallpox vaccine is protective against Monkeypox (estimated at 85% effectiveness) but the vaccine is no longer available to the general public, after Smallpox eradication in 1980.
- Currently, studies are underway to better understand how effective newer Smallpox vaccines are at providing cross-protection against Monkeypox.
- Prior Smallpox vaccination will likely result in a milder Monkeypox disease course.

# 8

## Health education and raising population awareness are the best preventive measures in at-risk populations

- In the absence of specific treatment or vaccine, the only way to limit infection in people is by raising awareness of the risk factors and educating people about the measures they can take to avoid exposure to the virus.
- Health care workers should be trained to recognize the symptoms of the disease, ensure samples are collected for testing and manage patients. Most importantly, they should be trained on appropriate isolation and infection prevention and control procedures.



# 9

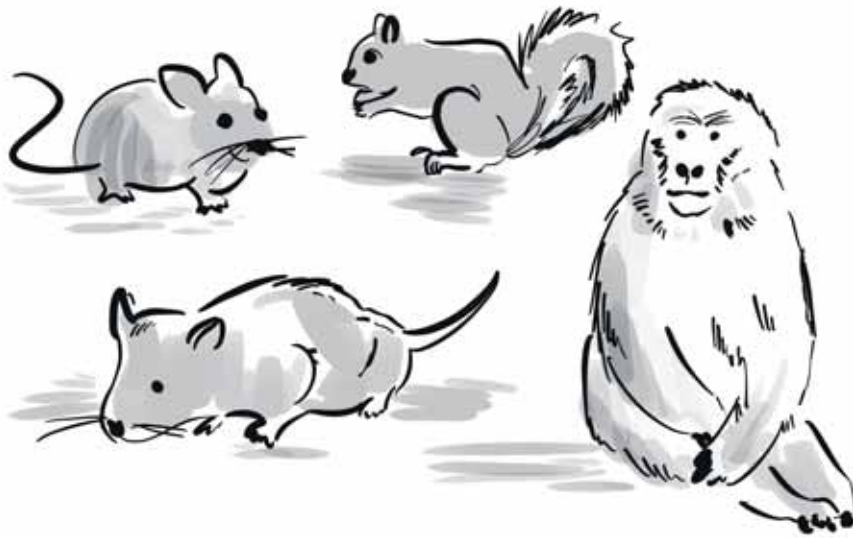
Many animal species host the Monkeypox virus, primarily rodent species (rather than monkeys, after which the disease is named)

- The name Monkeypox is misleading as the disease does not solely come from monkeys. In Africa, Monkeypox infection has been found in many animal species: rope squirrels, tree squirrels, Gambian rats, rodents, striped mice, dormice and monkeys.
- Doubts persist on the natural history of the virus and further studies are needed to identify the major reservoir of the Monkeypox virus and how it is maintained in nature.

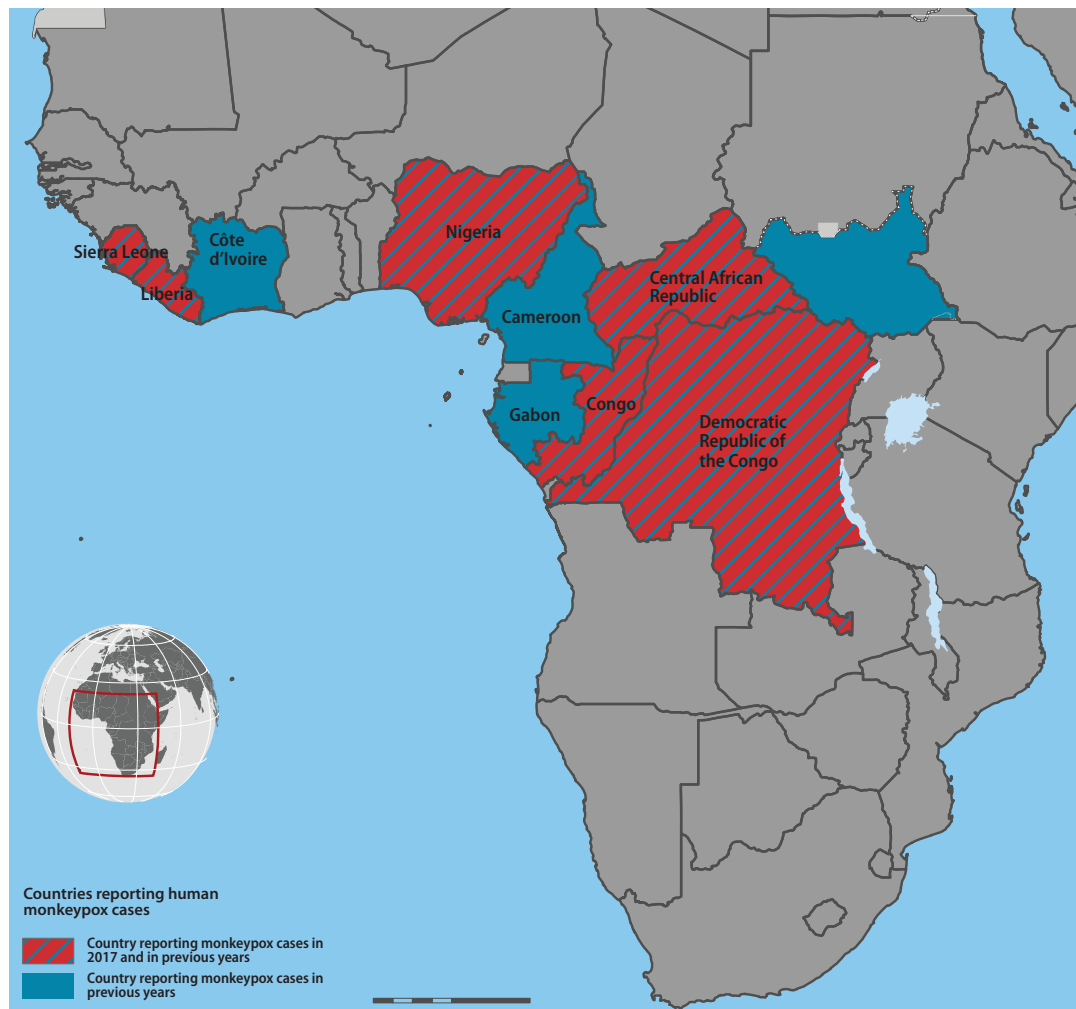
# 10

Monkeypox is a rare disease that occurs sporadically in remote tropical rainforest areas of Central and West Africa

- Human Monkeypox is sporadically reported in Central and West Africa, particularly areas close to tropical rainforest where humans have frequent contact with animals.
- Outbreaks have occurred outside Africa (e.g. in the Midwest of the United States of America in 2003 due to imported animals) and outside Central and West Africa (e.g. in Sudan in 2005).



## Historical distribution of human monkeypox cases



The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted lines on maps represent approximate border lines for which there may not yet be full agreement.  
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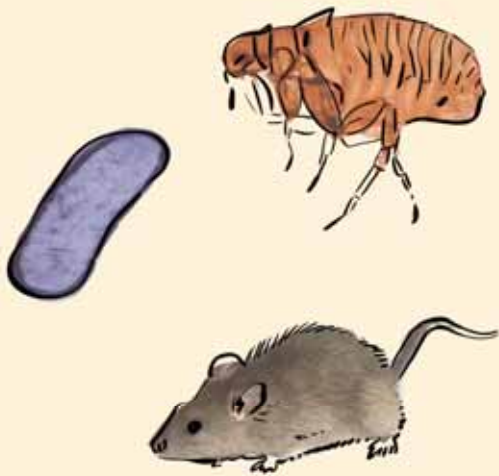
## More information about Monkeypox:

- Monkeypox WHO factsheet  
<http://www.who.int/mediacentre/factsheets/fs161/en/>



# Plague

## 10 THINGS YOU SHOULD KNOW



1. Pneumonic Plague can cause widespread epidemics and is difficult to control
2. The most common form of Plague – Bubonic Plague - is not transmittable from human to human
3. Early diagnosis and treatment are essential for survival
4. Health education, infection prevention and control and vector and rodent control are critical to prevent and manage epidemics
5. Safe and dignified burials should be conducted to avoid further transmission
6. Initial symptoms of Plague are non-specific and difficult to distinguish from other acute febrile diseases
7. The potential Plague natural foci are distributed worldwide and are extending
8. Plague is a disease that usually affects disproportionately vulnerable populations
9. Septicaemic Plague is the third type of Plague, in addition to the Pneumonic and Bubonic forms, that occurs when the bacteria is circulating in the bloodstream
10. Plague is a zoonotic disease caused by bacteria usually found in small mammals (mostly rodents)



# Plague response tips

## Coordinating responders

- Engage with partners and communities for vector control in endemic areas

## Communicating risk

- Encourage health authorities to:
  - Initiate health education and community engagement for vector control in endemic areas
- Key messages:
  - Plague is treatable: people who have symptoms or have exposure to the disease should receive treatment
  - Transmission of Bubonic and Pneumonic Plague are different
  - Human-to-human transmission of Pneumonic Plague can occur through respiratory droplets
  - Patients with Bubonic Plague are not contagious
  - For Bubonic Plague, take precautions against flea bites and do not handle animal carcasses

## Health Information

- There is a robust and sensitive rapid diagnostic test for Bubonic Plague
- Find the source of infection for targeted control measures
- Notify cases to WHO, under the IHR (2005)

## Health Interventions

- Treat early with antibiotics
- Ensure safe and dignified burials
- For Pneumonic Plague:
  - Closely follow close contacts and provide them with prophylaxis for seven days
  - Give chemoprophylaxis to health care workers
  - Infection prevention and control: Standard precautions and droplet precautions (Protective Personal Equipment- PPE)
- For Bubonic Plague:
  - Vector and rodent control
  - Give chemoprophylaxis for people living in the same house as patients
  - Infection prevention and control (standard precautions)

## 1

### Pneumonic Plague can cause widespread epidemics and is difficult to control

- Pneumonic Plague can be transmitted from person to person via droplets in the air (coughing, respiratory secretions), so it has high epidemic potential and is the most difficult form of Plague to control.
- It is the most virulent form of Plague: the incubation period can be as short as 24 hours, and untreated Pneumonic Plague is always fatal.
- Pneumonic Plague occurs when it reaches the lungs, from the evolution of an advanced Bubonic Plague, through bloodstream, or directly from inhalation of infected respiratory droplets.
- Patients with Pneumonic Plague should be isolated so they do not infect others via respiratory droplets and should be cared for by trained medical staff. Medical staff should wear Personal Protective Equipment and potentially receive chemoprophylaxis to prevent nosocomial transmission.
- Close contacts must be kept under medical surveillance and must receive a prophylaxis with antibiotics for seven days.
- Any suspect case should be treated.
- In case of interhuman transmission, the incubation period is usually one to three days, followed by sudden onset of fever, headache, chills, pain, weakness, chest discomfort, shortness of breath, cough, and sometimes bloody or mucous secretions.

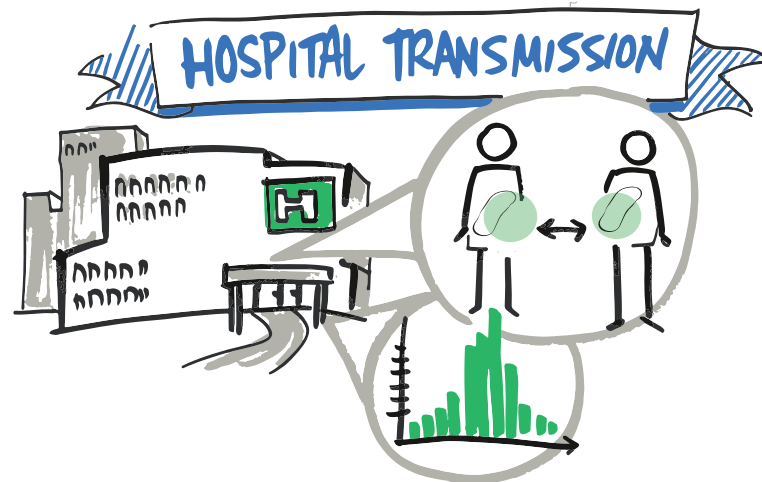
## 2

### The most common form of Plague – Bubonic Plague - is not transmittable from human to human

- Bubonic Plague is the most common form of Plague. It cannot be transmitted from human to human unless there is contact with pus from suppurating buboes.
- Around 10% of people with Bubonic Plague will develop Pneumonic Plague.
- Bubonic Plague results from flea bites or direct contamination of an open skin lesion by Plague-infected materials or body fluids (mostly nosocomial infections). Infection can occur when handling dead animals without the appropriate protective measures. The infection spreads via the lymphatic system to the nearest lymph node where

it replicates itself. The lymph node then becomes inflamed, tense and painful, and is called a "bubo". At advanced stages of the infection, the inflamed lymph nodes can turn into suppurating open sores.

- The incubation period is two to six days followed by sudden onset of illness: headaches, chills, fever, malaise and pain in the affected regional lymph nodes. Bubonic Plague forms buboes, inflammation and swelling in the neck, groin, etc.
- Measures to control an epidemic of Bubonic Plague include: chemoprophylaxis for people living in the same house as patients, and vector and rodent control.



# 3

## Early diagnosis and treatment are essential for survival

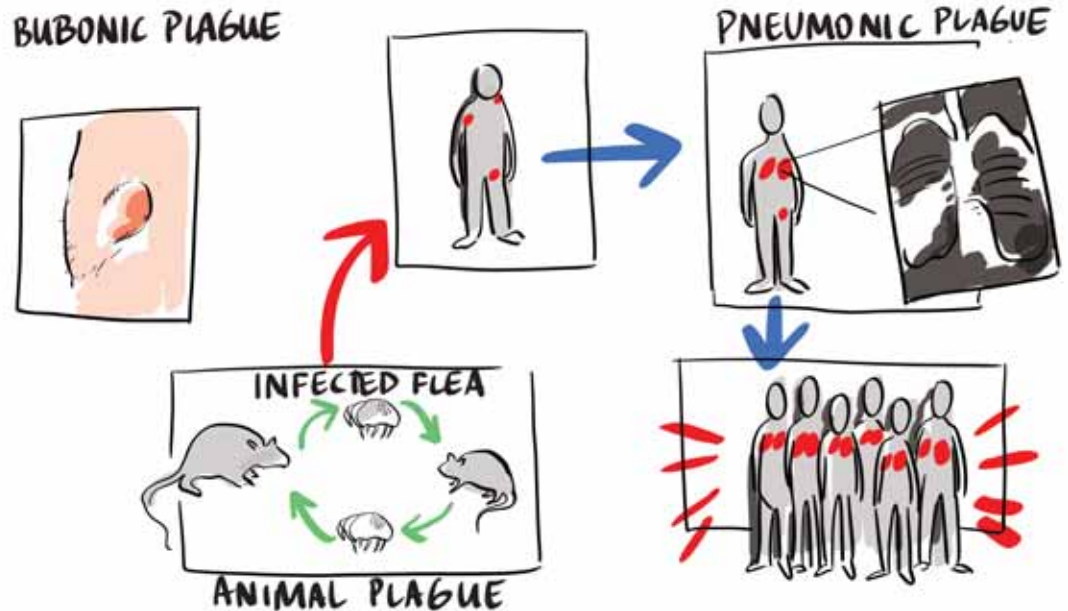
- Plague is treatable.
- Treatment with common antibiotics and supportive care are very efficient in curing human Plague but their efficacy depends on early administration, which presumes early detection. This is especially important for the Pneumonic form, which is highly contagious, can kill in less than 24 hours, and is invariably fatal in the absence of treatment. If people are treated in time, both forms have good recovery rates.
- Recommended antibiotics are:
  - For Bubonic Plague: tetracycline, doxycycline, chloramphenicol;
  - For Pneumonic or Septicaemic Plague: aminoglycosides, fluoroquinolones;
  - For post-exposure presumptive treatment: tetracycline, doxycycline, sulfamethoxazole/trimethoprim.
- Early treatment requires early diagnosis. Confirmation of Plague requires laboratory testing. The best practice is to identify the



bacteria *Y. Pestis* in a sample of puss from a bubo, blood or sputum. It can be detected by different techniques:

- Microscopy: Staining, Fluorescent Antibody test;
- Isolation: Colony morphology, Biochemical reactions, Phage lysis;
- Detection of antigen/antibody: ELISA (Enzyme-Linked Immunosorbent Assay), Fluorescent antibody test, PCR (Polymerase Chain Reaction).

- There is an easy-to-use, robust, reliable and sensitive rapid diagnostic test for Bubonic Plague (dipstick test), that detects antigen and produces reliable results in 15 minutes, greatly facilitating containment efforts. It is recommended that this rapid diagnostic test is used in all endemic regions.



## 4

### Health education, infection prevention and control and vector and rodent control are critical to prevent and manage epidemics

- In Plague endemic areas, it is critical to educate people on the disease, its symptoms and modes of transmission. People should be informed when zoonotic Plague is active in their environment and be advised to take precautions against flea bites and not to handle animal carcasses.
- Avoiding touching dead animals and wearing insect repellent will help prevent Bubonic Plague in endemic areas.
- Avoiding close contact (less than two metres) with suspected Pneumonic Plague patients who are coughing will help to prevent Pneumonic Plague.
- Plague, “the Black Death”, can be a very scary disease as it has caused millions of deaths in the past, so health education is particularly essential to prevent panic during outbreaks.
- Health care workers should specifically be informed and trained in infection prevention and control. They should be provided with the appropriate personal protective equipment and trained in how to use it.
- In Plague endemic areas and during Bubonic Plague outbreaks, flea and reservoir (usually rodents) controls must be implemented.



## 5

### Safe and dignified burials should be conducted to avoid further transmission

- The bacteria present in the body fluids of deceased Plague patients can be a source of infection for people in contact with them during burials ceremonies. Safe burials, respecting local cultures and beliefs, must be implemented.



# 6

## Initial symptoms of Plague are non-specific and difficult to distinguish from other acute febrile diseases

- People infected with Plague begin to develop non-specific symptoms after an incubation period of one to seven days. Typical symptoms are the sudden onset of fever, chills, head and body-aches and weakness, vomiting and nausea. These symptoms are difficult to differentiate from other common endemic pathogens.
- Painful and inflamed lymph nodes secondarily appear during Bubonic Plague.
- Symptoms of Pneumonic Plague appear quickly after infection (sometimes less than 24 hours). They include severe respiratory symptoms, such as shortness of breath and coughing, often with blood-tainted sputum.
- The clinical picture is not very specific and misdiagnosis is common, thus the importance of Rapid Diagnostic Test, for rapid diagnosis and early treatment.

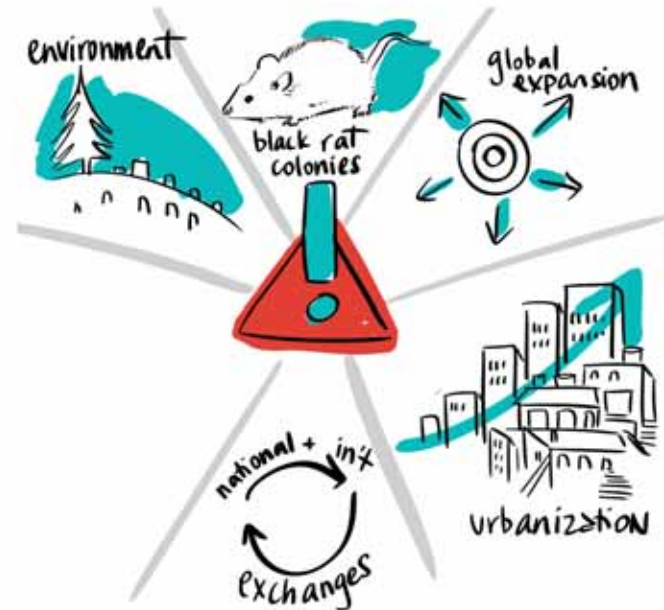


# 7

## The potential Plague natural foci are distributed worldwide and are extending

- Although Plague is most common in Madagascar, the Democratic Republic of the Congo and Peru, the potential Plague natural foci (the bacteria, an animal reservoir and a vector) are distributed worldwide.
- We are currently witnessing the reemergence of the disease in some places where it had disappeared and its emergence in other places where it had never occurred.
- The natural foci are also expanding. This could be due to:

- Environmental modifications (e.g. deforestation);
- Ongoing colonization of the black rat (one of the reservoirs);
- Increased national and international exchanges;
- Uncontrolled urbanization.
- Furthermore, in endemic countries, entomological and zoological surveillance activities are expensive and complicated to maintain. They are very often neglected in the absence of any human cases and it is hard to obtain detailed knowledge about the status or development of natural foci.



## 8

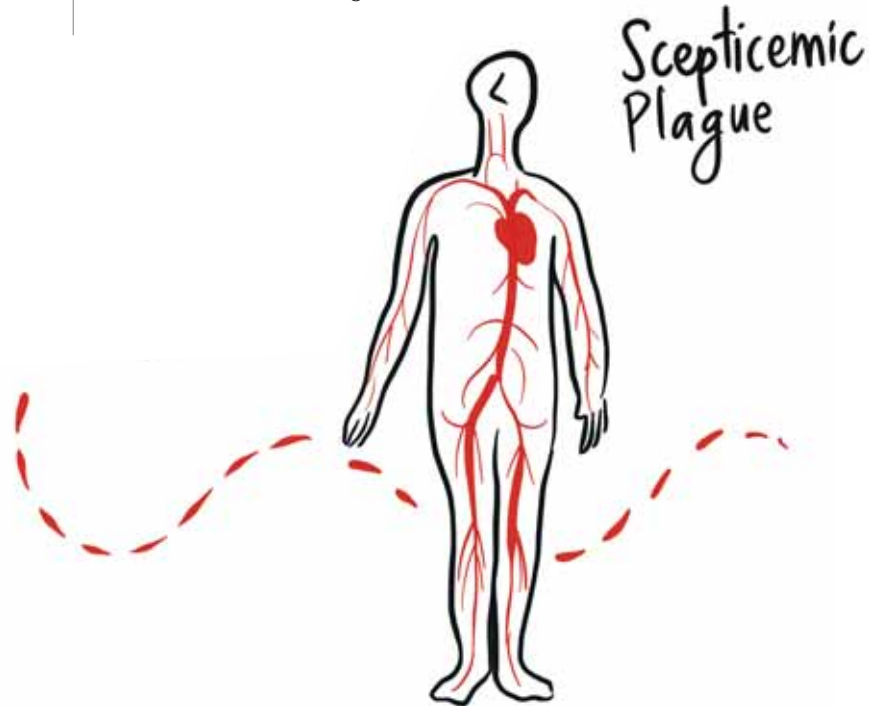
**Plague is a disease that usually affects disproportionately vulnerable populations**

- Plague is a disease that affects disproportionately vulnerable populations, because it thrives in overcrowded places with poor sanitary conditions and inadequate health services.
- Outbreaks of Plague are often linked to civil disturbances and war, and when the health infrastructure and facilities have broken down.
- Strengthening health systems thus reduces the risk of epidemics.

## 9

**Septicaemic Plague is the third type of Plague, in addition to the Pneumonic and Bubonic forms, that occurs when the bacteria is circulating in the bloodstream**

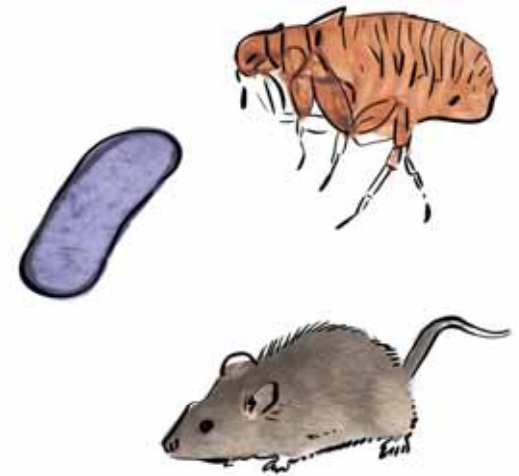
- Septicaemic Plague is the third form of Plague which occurs when the infection spreads through the bloodstream.
- Septicaemic Plague may result from flea bites and from direct contact with infective materials through cracks in the skin or follow a Bubonic Plague. It could result in Pneumonic Plague.



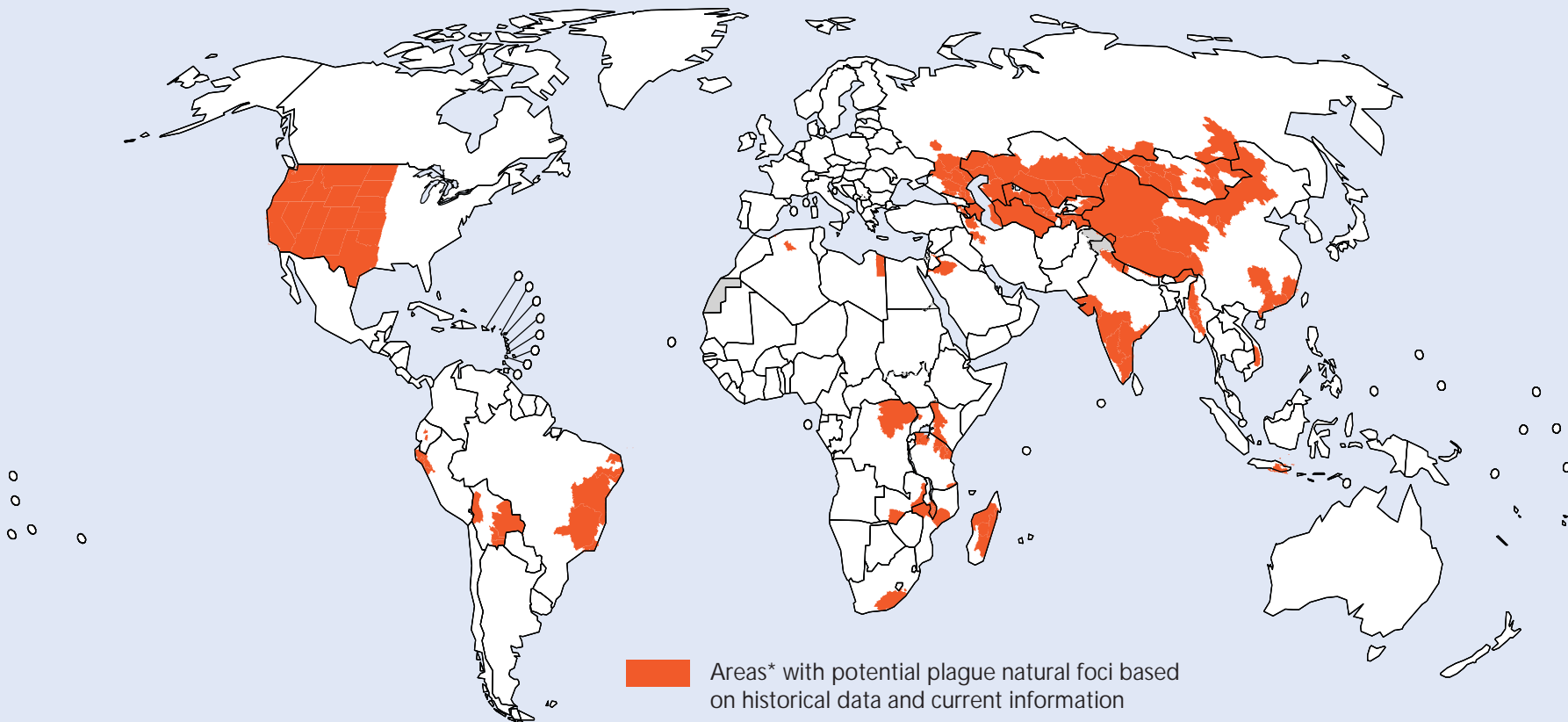
# 10

## Plague is a zoonotic disease caused by bacteria usually found in small mammals (mostly rodents)

- Plague is a zoonotic disease caused by the bacteria *Yersinia pestis*, usually found in small mammals (mostly rodents). It is transmitted between animals by their fleas.
  - There is a risk of human Plague wherever the presence of Plague natural foci (the bacteria, an animal reservoir and a vector) and human populations co-exist.
  - There are three main forms of Plague infection, depending on the clinical presentation of infection: Bubonic, Septicaemic and Pneumonic. Humans can become infected by the bite of infected fleas, by direct contact with infected materials, or by inhalation of infectious respiratory particles from another sick person with Pneumonic Plague.
  - There is a great risk of nosocomial (hospital) infection, especially for the Pneumonic form.
  - Human Plague is a severe disease, with a 30-100 % case fatality ratio, depending on the clinical form.
- However, when rapidly diagnosed and promptly treated, Plague may be successfully managed with antibiotics, reducing mortality to less than 15%.
  - Plague epidemics have occurred in Africa, Asia and South America. Since the 1990s, most human cases have occurred in Africa. The three most endemic countries are Madagascar, the Democratic Republic of Congo and Peru.



Global distribution of natural Plague foci, as of March 2016



\* First administrative level representation

Source: WHO / IHM, as of March 2016

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## More information about Plague

- WHO Fact sheet  
<http://www.who.int/mediacentre/factsheets/fs267/en/>
- Plague WHO webpage  
<http://www.who.int/csr/disease/plague/en/>
- Plague WHO MOOC  
<https://openwho.org/courses/knowledge-resources-plague>
- Plague manual: epidemiology, distribution, surveillance and control  
[http://who.int/csr/resources/publications/plague/WHO\\_CDS\\_CSR\\_EDC\\_99\\_2\\_EN/en/](http://who.int/csr/resources/publications/plague/WHO_CDS_CSR_EDC_99_2_EN/en/)

# Leptospirosis

## 10 THINGS YOU SHOULD KNOW



1. Leptospirosis is a disease that usually follows natural disasters in tropical or subtropical climates
2. Rodents are the main reservoir of the *Leptospira*, causative bacteria of Leptospirosis but all kinds of mammals can play a role in human transmission
3. Humans are infected through direct or indirect exposure to infected animals' urine
4. Risk of infection is increased in some activities and socioeconomic situations
5. Common antibiotics, if given early, are effective against Leptospirosis
6. Leptospirosis is under-recognized and often mistaken for others diseases
7. Laboratory diagnosis is challenging but critical to confirm leptospirosis
8. Prevention and control measures should target the infection source, the route of transmission and the disease in humans
9. Climate change and urbanization will increase the frequency and intensity of outbreaks
10. A multi-sectorial and holistic approach is critical for prevention and control

# Leptospirosis response tips

## Coordinating responders

- Engage with animal health sector

## Health Information

- Ensure laboratory confirmation of suspected cases

## Communicating risk

- Encourage health authorities to:
  - Engage communities
  - Ensure training of clinicians for early detection and treatment
  - Prepare hospitals to receive severe cases requesting intensive care
- Key messages:
  - Humans are infected through direct or indirect exposure to the urine of infected animals
  - Avoid contact with rodents
  - Exposure can occur through contaminated water
  - Immediately disinfect all skin injuries and avoid contact with untreated water
  - Seek treatment early if showing symptoms

## Health Interventions

- Early detection of cases
- Provide empirical treatment (antibiotics) for all probable cases
- Provide population with treated water
- Provide targeted chemoprophylaxis and protective equipment to very high-risk populations (rescue, sewage and sanitation workers)

## 1

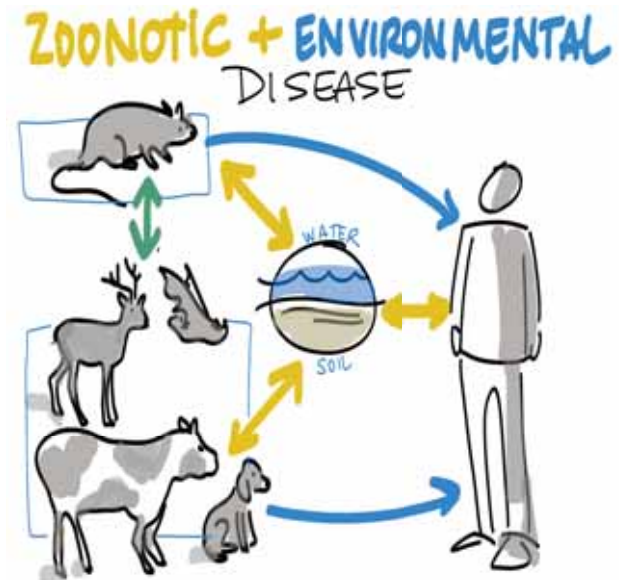
**Leptospirosis is a disease that usually follows natural disasters in tropical or subtropical climates**

- Leptospirosis is an infectious disease caused by bacteria belonging to the genus *Leptospira*.
- Leptospirosis occurs worldwide, but is most prevalent in tropical and subtropical regions.
- It often has a seasonal distribution, increasing with heavy rainfall or higher temperatures.
- Outbreaks classically occur in association with natural disasters, especially flooding.

## 2

**Rodents are the main reservoir of the *Leptospira*, causative bacteria of Leptospirosis but all kinds of mammals can play a role in human transmission**

- Rodents are considered the primary source of infection to humans.
- Virtually all wild and domestic mammals can harbour the bacteria that cause leptospirosis in their kidneys and genital tracts and act as source of infection to humans and to other animals.
- Cattle, buffaloes, horses, sheep, goats, pigs and dogs are also considered common reservoirs of the bacteria that cause leptospirosis.
- Natural history of the disease depends on the local ecological conditions.



# 3

## Humans are infected through direct or indirect exposure to infected animals' urine

- Leptospirosis is a zoonosis, transmitted directly or indirectly from animals to humans.
- Humans become infected through direct contact with the urine of infected animals or with a urine-contaminated environment.
- The bacteria enter the body through cuts or abrasions on the skin, or through the mucous membranes of the mouth, nose and eyes.
- Exposure through water contaminated by urine from infected animals is the most common route of infection. Leptospirosis can occasionally also be transmitted through the drinking of water or ingestion of food contaminated with urine of infected animals and when handling infected animal tissues.
- Human-to-human transmission occurs only very rarely.

# 4

## Risk of infection is increased in some activities and socioeconomic situations

- The risk of infection depends on exposure. Some people have more contact with waters contaminated by rodents or other domestic animals.
- People can be exposed through their occupation: Outdoor and agricultural workers (rice-paddy and sugarcane workers, for example); Abattoir workers; Veterinarians; Meat handlers; Pet-shop workers; Sewer workers.
- People can also be exposed through recreational activities, through water sports such as swimming or canoeing. Survivors from natural disasters (e.g. flooding) are also at higher risk of infection.



# 5

## Common antibiotics, if given early, are effective against Leptospirosis

- Leptospirosis can be treated with antibiotics that should be given as early in the course of illness as possible, preferably before the fifth day after the onset of illness.
- Clinicians should never wait for the results of laboratory tests before starting treatment with antibiotics.
- Treatment options include antibiotics such as amoxicillin, tetracycline, ampicillin and doxycycline, etc.
- In severe cases, admission to a hospital is necessary. These severe cases should be treated with high doses of intravenous penicillin. Peritoneal or haemodialysis are indicated in case of renal failure. Mechanical ventilation is indicated for lung hemorrhagic manifestation. Severe forms, which require intensive care, make case management logistically complex to organize in an outbreak context.

# 6

## Leptospirosis is under-recognized and often mistaken for others diseases

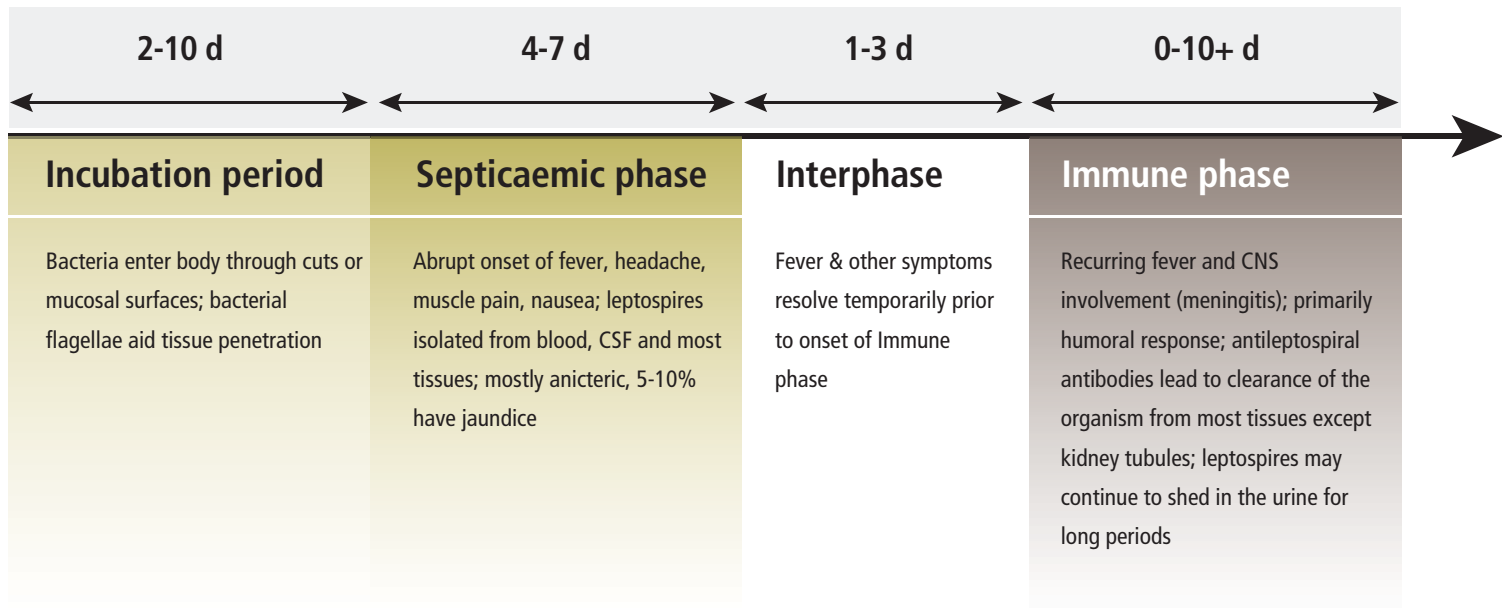
- Misdiagnosis is common because of Leptospirosis' variable symptoms and non-specific presentations that can mimic many other infectious diseases.
- The usual presentation is an acute illness with sudden onset of fever, headache, myalgia (particularly calf muscle) and prostration associated with any of the following symptoms/signs: conjunctival suffusion, anuria or oliguria, jaundice, cough, haemoptysis and breathlessness, haemorrhages (from the intestines, lung bleeding is notorious in some areas), meningeal irritation, cardiac arrhythmia or failure, and skin rash. Other common symptoms include nausea, vomiting, abdominal pain, diarrhoea and arthralgia.
- The incubation period of Leptospirosis is usually five to 14 days, with a range of two to 30 days. Although the disease is a self-limiting and often clinically unapparent illness in the majority of cases (there are

asymptomatic cases), 5-15% of untreated cases can progress to a more severe and potentially fatal stage.

- There are four broad clinical categories of leptospirosis:
  - Mild influenza-like illness;
  - Weil's syndrome (jaundice, renal failure, hemorrhage, myocarditis);
  - Meningitis;
  - Pulmonary hemorrhage and respiratory failure.
- Suspicion of Leptospirosis is further increased for patients presenting the above symptoms if there is a history of occupational or recreational exposure to infected animals or to an environment potentially contaminated with animal urine. It is also important for clinicians to consider Leptospirosis in the differential diagnosis of febrile illnesses after flooding.
- Misdiagnosis or delayed diagnosis have significant clinical implications because early treatment of Leptospirosis is crucial to minimize morbidity and mortality and timely implement control measures.

Leptospirosis presentations	Diseases it could be confused with
Mild forms	Malaria, Dengue, Influenza
Febrile hemorrhagic forms	Viral haemorrhagic fevers
With severe pneumonia	Plague
When icteric fever	Yellow fever or Hepatitis

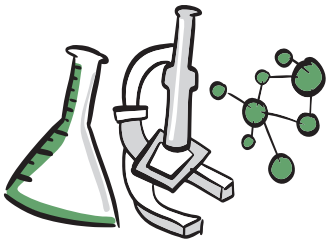
## Typical course of Leptospirosis



## 7

**Laboratory diagnosis is challenging but critical to confirm leptospirosis**

- Laboratory diagnostic is not easy because of the complexity of the pathogen: there are 300 species and 25 serogroups, divided into 250 serovars.
- Laboratory support is needed:
  - To confirm the diagnosis and distinguish it from other diseases;
  - To determine the serovar responsible for infection, which will help guide the control strategies.
- Current recommendations for laboratory testing are:
  - Serology: Microscopic Agglutination Test (MAT) is the gold standard serologic test, due to its high specificity;
  - Polymerase Chain Reaction – PCR.
- IgM Enzyme-Linked Immunosorbent Assay (ELISA) test may be used but it requires a lag period after infection before antibodies become detectable. The results need to be interpreted carefully due to varying sensitivity and specificity of the test method.



## 8

**Prevention and control measures should target the infection source, the route of transmission and the disease in humans**

- Control measures at the infection source (usually local reservoir species of animals) include: Reducing certain animal reservoir populations; Separating animal reservoirs from human habitations (by fences and screens); Immunizing dogs and livestock; Removing rubbish and keeping areas around human habitations clean; Disposing of excreta from domestic animals in such a way as to avoid contamination; Encouraging people not to leave food around, especially in recreational areas where rats may be present; Improving living conditions and sanitation systems, etc.
- Measures to prevent transmission through avoiding contact with animal urine, infected animals or an infected environment, include: Wearing protective clothing; Covering skin lesions with waterproof dressings; Preventing access to, or giving adequate warning about water bodies known or suspected to be contaminated; Washing or showering after exposure to urine splashes or contaminated soil or water; Washing and cleaning wounds; Strictly maintaining hygienic measures during care or handling of all animals; Where feasible, disinfecting contaminated areas (scrubbing floors in stables, butcheries, abattoirs, etc.); Consuming clean drinking-water, etc.
- Interventions at the level of the human host include:
  - Raising awareness in both the general population and at-risk groups. People need to understand the disease and how to avoid risks, but also that timely medication helps. Doctors and veterinarians should consider leptospirosis as part of the differential diagnosis in appropriate cases;
  - Antibiotic prophylaxis should be used if exposure is known to have occurred (e.g. as a result of a laboratory accident or other high-risk exposure);
  - Immunization in humans is not recommended. Vaccines do not induce long-term protection against infection and do not provide cross-protective immunity against heterogenous leptospiral serovars (protective antibodies are produced only against the serovars present in the particular vaccine used).
  - In epidemic situations, strategic control measures include:
    - Detecting cases early;
    - Providing empirical treatment for all probable cases;
    - Providing the population with treated water;
    - Providing targeted chemoprophylaxis and protective equipment to very high-risk populations (rescue, sewage and sanitation workers);
    - Rodent control and animal immunization are useless at this stage.



# 9

## Climate change and urbanization will increase the frequency and intensity of outbreaks

- Leptospirosis infections are closely linked to the environment and climate change will lead to an escalation of the global burden of leptospirosis:
- Climate change is expected to increase the occurrence of heavy rainfall and flooding and the intensity of tropical cyclones and storms, due to the rise of sea levels and the rise of sea and land surface temperatures;
- Natural disasters also increase the risk of infectious disease by disrupting health services and infrastructures and damaging water and sanitation networks.
- Urbanization also increases the incidence and intensity of leptospirosis. Fast urbanization usually goes with the development of urban slums, where overcrowding, poor sanitation, poor health care, poverty and abundance of rats and other animal reservoirs are risk factors of being infected.



# 10

## A multi-sectorial and holistic approach is critical for prevention and control

- Leptospirosis remains an unknown disease: transmission dynamics are poorly understood, symptoms are not specific, laboratory diagnosis is complex and laboratory confirmation is often not available.
- A One Health approach is critical to prevent and control this environmental disease that affects both humans and animal:
  - Relationships between animals, humans and ecosystems needs to be considered to better understand and manage the disease;
  - Research and control efforts require a truly integrated, multi-disciplinary and coordinated approach to improve prediction, detection, prevention and response to outbreaks of Leptospirosis.



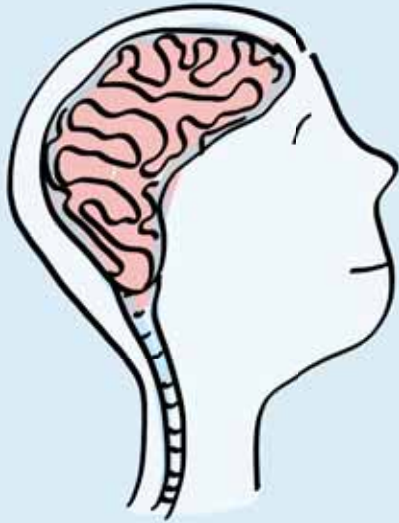
## More information about Leptospirosis:

- Leptospirosis WHO webpage  
<http://www.who.int/topics/leptospirosis/en/>
- Leptospirosis WHO Western Pacific Region Office factsheet:  
[http://www.wpro.who.int/mediacentre/factsheets/fs\\_13082012\\_leptospirosis/en/](http://www.wpro.who.int/mediacentre/factsheets/fs_13082012_leptospirosis/en/)
- Leptospirosis WHO MOOC:  
<https://openwho.org/courses/pandemic-epidemic-diseases>
- Global Leptospirosis Environmental Action Network (GLEAN) website  
<https://sites.google.com/site/gleanlepto/>
- Human Leptospirosis: guidance for diagnosis, surveillance and control:  
[http://apps.who.int/iris/bitstream/10665/42667/1/WHO\\_CDS\\_CSR\\_EPH\\_2002.23.pdf](http://apps.who.int/iris/bitstream/10665/42667/1/WHO_CDS_CSR_EPH_2002.23.pdf)



# Meningococcal meningitis

## 10 THINGS YOU SHOULD KNOW



1. Meningococcal meningitis (MM) is an acute bacterial form of meningitis due to *Neisseria meningitidis* (*N.m*), a serious infection of the meninges (brain membranes)
2. MM occurs worldwide but its highest burden is in the African meningitis belt
3. Several types of *N.m* can cause epidemics
4. Humans are the only reservoir of MM, transmitted through direct contact and respiratory droplets
5. MM can have a fatality rate of up to 50% when untreated
6. Specific vaccines are used for prevention and outbreak response
7. Laboratory diagnosis is essential to ascertain whether *N.m* is the pathogen causing meningitis
8. Surveillance is critical to detect outbreaks and inform the epidemic response
9. Early antibiotic treatment is the most important factor to save life and reduce complications
10. Antibiotics reduce transmission risk for close contacts when given promptly

# Meningococcal meningitis response tips

## Coordinating responders

- Make sure the epidemic preparedness and response committee is established before the epidemic season
- Contact WHO/ICG for emergency vaccines and antibiotics

## Health Information

- Identify the meningococcal serogroup through laboratory testing
- Monitor thresholds that have been defined according to specific regional or country epidemiology

## Communicating risk

- Ensure populations receive the vaccine to prevent this disease
- Key messages are:
  - Human-to-human transmission occurs through droplets of respiratory or throat secretions
  - Asymptomatic carriers can transmit the disease
  - Practice hand hygiene and respiratory hygiene
  - Early antibiotic treatment reduces mortality and complications and therefore sick people should seek medical treatment early on

## Health Interventions

- Early antibiotic treatment
- Conduct vaccination campaigns promptly (according to local epidemiology)
- Prophylaxis to close contacts (according to local epidemiology)

1

Meningococcal meningitis (MM) is an acute bacterial form of meningitis due to *Neisseria meningitidis* (*N.m*), a serious infection of the meninges (brain membranes)

- MM is due to the bacteria *Neisseria meningitidis*.
- A variety of other organisms including bacteria, fungi or viruses, can cause meningitis.
- MM causes sporadic cases and also very large outbreaks.

2

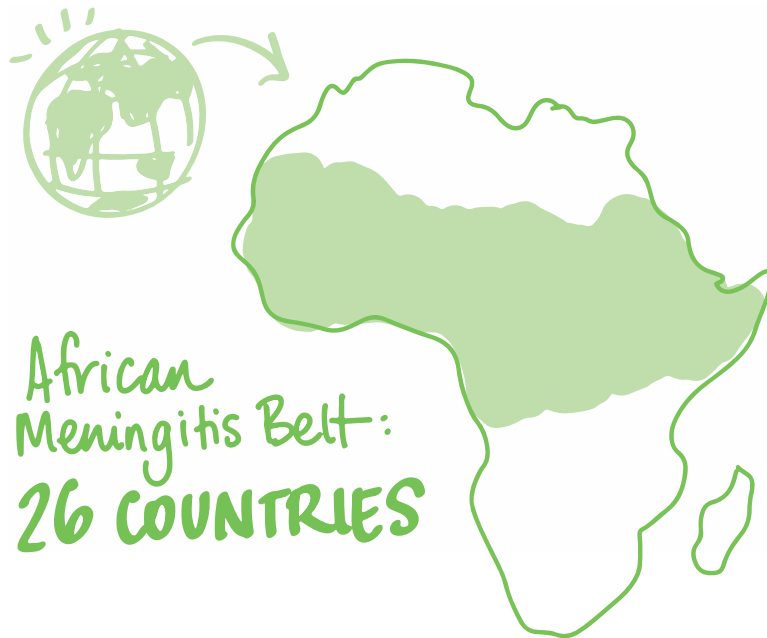
MM occurs worldwide but its highest burden is in the African meningitis belt

- The highest burden is observed in the meningitis belt (26 countries) that stretches across Africa from Senegal to Ethiopia.
- The meningitis belt is affected by seasonal endemicity and cyclical large scale epidemics, during the dry season (December to June).

3

Several types of *N.m* can cause epidemics

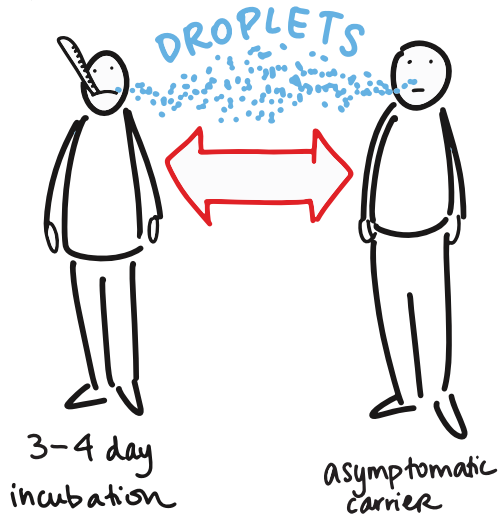
- Serogroups are named by a letter (A, B, C, etc.). 6 (out of 12) serogroups can cause large epidemics (A, B, C, W, X, Y). Geographic distribution differs according to serogroup.
- In the meningitis belt, before 2010, serogroup A meningococcus accounted for an estimated 80–85% of all cases. Since the introduction of a new and very efficient meningococcal A conjugate vaccine through mass preventive immunization campaigns, the proportion of *N. meningitidis* A has declined dramatically.
- In Europe, the introduction of routine vaccination for *N. meningitidis* C led to the decline of serogroup C outbreaks.
- Independently of the vaccination strategies, the epidemiology of serogroups fluctuates over time and space for reasons that are not fully understood.



# 4

## Humans are the only reservoir of MM, transmitted through direct contact and respiratory droplets

- *Neisseria meningitidis* only infects humans. There is no animal reservoir.
- The bacteria can be carried in the throat (asymptomatic carrier). By chance, it can overwhelm the body's defenses allowing the bacteria to spread through the bloodstream to the brain.
- The bacteria are transmitted from person-to-person through droplets of respiratory or throat secretions from carriers. Smoking, close and prolonged contact – such as kissing, sneezing or coughing on someone, or living in close quarters with an infected person (a carrier) – facilitate the spread of the disease.

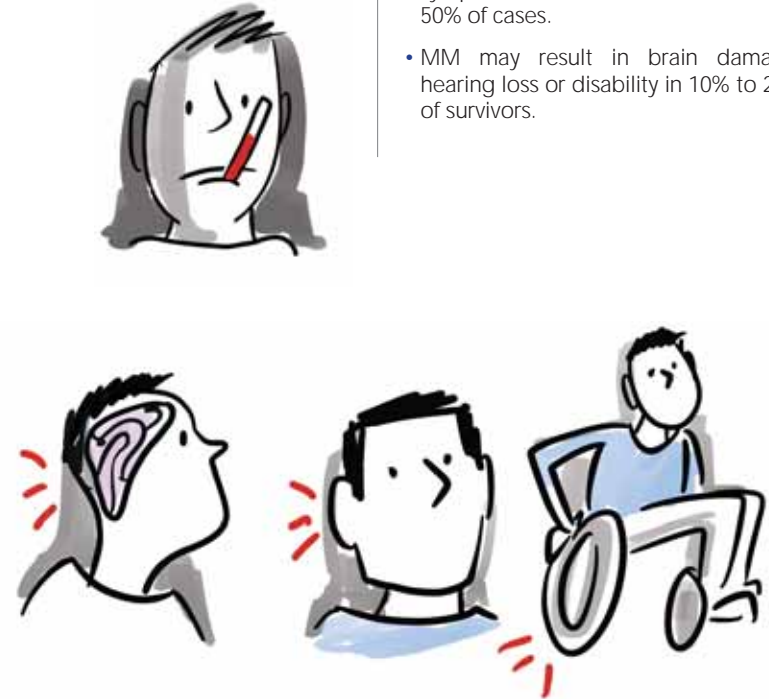


- Asymptomatic carriers can transmit the disease. It is believed that 1% to 10% of the population carries *N. meningitidis* in their throat in endemic situations. In epidemics, the carriage rate is higher (10% to 25%).
- Infants and young adults are the most at risk of getting infected.
- The incubation period is 2 to 10 days, usually 3 to 4 days.
- Transmission of *N. meningitidis* is facilitated during mass gatherings (recent examples include the Haj pilgrimage, jamborees, etc.).

# 5

## MM can have a fatality rate of up to 50% when untreated

- The most common symptoms of the disease are high fever, headaches, stiff neck, vomiting, confusion, sensitivity to light and bulging of the fontanelle in infants. Sometimes, a haemorrhagic rash, ranging from a few petechiae to widespread ecchymoses, occurs as a result of septicaemia.
- Even when the disease is diagnosed early and adequate treatment is started, 8–15% of patients die, often within 24 to 48 hours after the onset of symptoms. If untreated, MM is fatal in 50% of cases.
- MM may result in brain damage, hearing loss or disability in 10% to 20% of survivors.



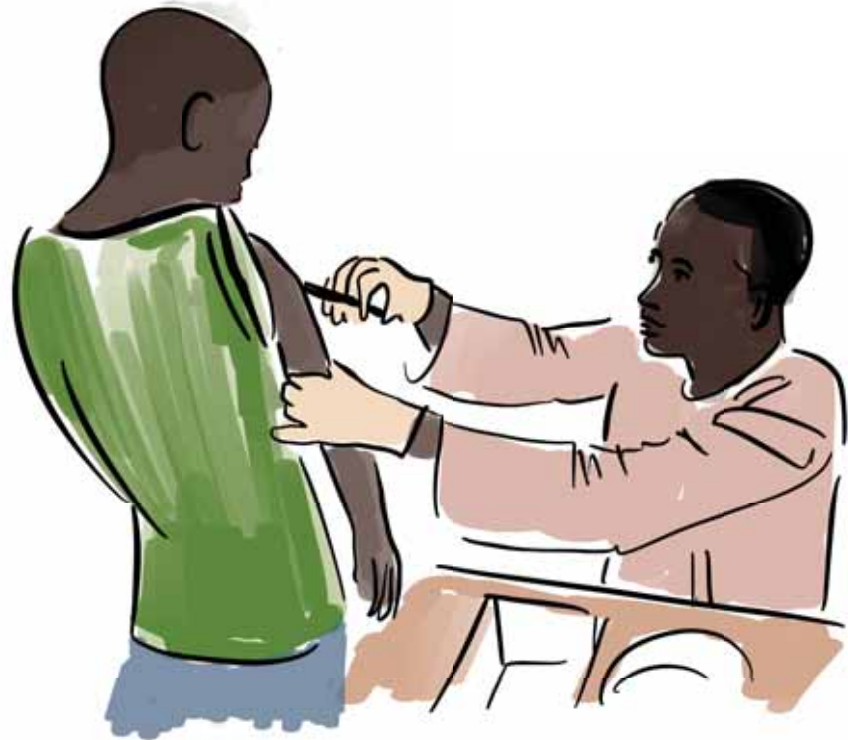
## 6

**Specific vaccines are used for prevention and outbreak response**

- Vaccines are serogroup specific and confer varying degrees of duration of protection.
- There are 3 types of vaccines available:
  - Polysaccharide vaccines are used for outbreak response mainly in Africa:
    - They are either bivalent (serogroups A and C), trivalent (A, C and W), or tetravalent (A, C, Y and W);
    - They are not effective before 2 years of age;
    - They offer a 3-year protection but do not induce herd immunity.
  - Conjugate vaccines are used in prevention (into routine immunization schedules) and outbreak response:
    - They confer longer-lasting immunity, prevent carriage and induce herd immunity;
    - They can be used as soon as one year of age;
- Available vaccines include:

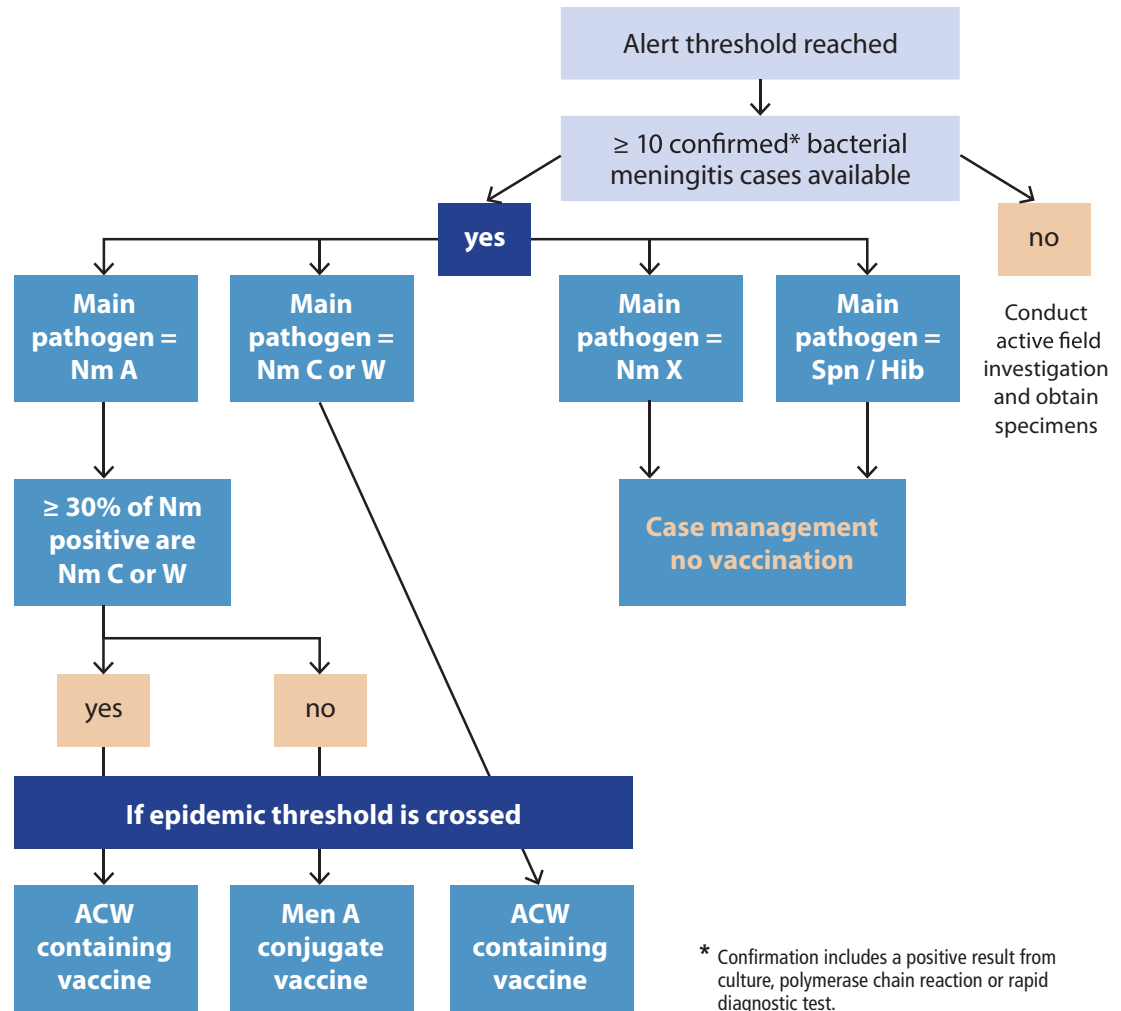
- Monovalent C and Tetravalent (serogroups A, C, Y, W). Both are currently expensive and mostly used in Canada, United States of America and Europe.
- Monovalent A, used for mass preventive campaigns and routine infant immunization.
- Protein-based vaccine against *N. meningitidis* B. It has been used in prevention (into the routine immunization schedule of one country, the UK) and outbreak response.

- Reactive vaccination in affected and at-risk populations should be conducted promptly to prevent the spread of the disease.
- In Africa, it is essential that a vaccination campaign is conducted within four weeks of crossing the epidemic threshold.
- An international stockpile of vaccine has been constituted, that can be accessed by any country facing an outbreak, through a request to the International Coordinating Group on vaccine provision for Meningitis.





Indicative decision tree for meningitis vaccine choice in a reactive vaccination campaign



**REMEMBER**

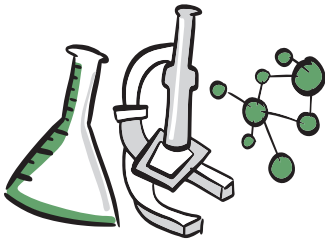
If there are NmA cases in the population already vaccinated with MenA conjugate, conduct field investigation.

Source: WHO, *Managing meningitis epidemics in Africa*, Revised 2015

## 7

### Laboratory diagnosis is essential to ascertain whether *N.m* is the pathogen causing Meningitis

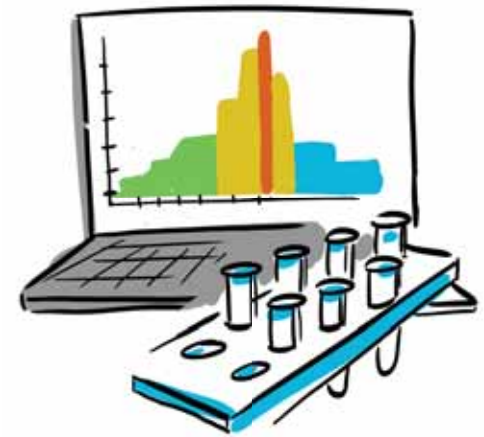
- Confirmation of the disease needs a laboratory test performed on Cerebrospinal Fluid (CSF) obtained through lumbar puncture: tests include culture (growing the bacteria), agglutination tests and Polymerase Chain Reaction (PCR).
- At the field level, to rapidly identify the *N. meningitidis* bacteria and the serogroups, rapid point-of-care diagnostic tests should be used. Rapid confirmation of the pathogen is critical to determine appropriate treatment and epidemic response.



## 8

### Surveillance is critical to detect outbreaks and inform the epidemic response

- Surveillance systems should be tailored to detect outbreaks, monitor disease trends and impact of vaccine.
- Epidemiological and laboratory data should be linked.
- The definition of a Meningococcal meningitis outbreak varies from country to country, based on local epidemiology and a comprehensive analysis of surveillance data.
- In the African belt, standard case definitions are:
  - Suspected case (based on clinical presentation): any person with sudden onset of fever ( $>38.5$  °C rectal or 38.0 °C axillary) and neck stiffness or another meningeal sign including bulging fontanelle in toddlers;
  - Probable case (based on non-specific laboratory test): any suspected case with macroscopic aspect of CSF turbid, cloudy or purulent; or with a CSF leukocyte count  $>10$  cells/mm<sup>3</sup>; or with bacteria identified by Gram stain in CSF;



- In infants: CSF leucocyte count  $>100$  cells/mm<sup>3</sup>; or CSF leucocyte count 10–100 cells/mm<sup>3</sup> AND either an elevated protein ( $>100$  mg/dl) or decreased glucose ( $<40$  mg/dl) level.
- Confirmed (based on laboratory test): any suspected or probable case that is laboratory confirmed by culturing or identifying of *Neisseria meningitidis* in the CSF or blood.
- In the African belt, incidence thresholds that will trigger prevention and control interventions are shown in the table on the following page.



## Incidence thresholds for detection and control of epidemic Meningococcal meningitis (2014)

Intervention	POPULATION	
	30,000 – 100,000	Under 30,000
<b>Alert threshold</b> — Inform authorities — Strengthen surveillance — Investigate — Confirm (including laboratory) — Prepare for eventual response	<ul style="list-style-type: none"> <li>3 suspected cases / 100,000 inhabitants / week (Minimum of 2 cases in one week)</li> </ul>	<ul style="list-style-type: none"> <li>2 suspected cases in one week</li> </ul> Or <ul style="list-style-type: none"> <li>An increased incidence compared to previous non-epidemic years</li> </ul>
<b>Epidemic threshold</b> — Mass vaccination within four weeks of crossing the epidemic threshold — Distribute treatment to health centres — Treat according to epidemic protocol — Inform the public	<ul style="list-style-type: none"> <li>10 suspected cases / 100,000 inhabitants / week</li> </ul>	<ul style="list-style-type: none"> <li>5 suspected cases in one week</li> </ul> Or <ul style="list-style-type: none"> <li>Doubling of the number of cases in a three-week period (e.g. <i>Week 1</i>: 1 case, <i>Week 2</i>: 2 cases, <i>Week 3</i>: 4 cases)</li> </ul>
	If a neighbouring area to a population targeted for vaccination is considered to be at risk (e.g. cases early in the dry season, no recent relevant vaccination campaign, high population density), it should be included in a vaccination programme.	
	In special situations such as mass gatherings, refugees, displaced persons or closed institutions, two confirmed cases in a week should prompt mass vaccination.	

Source: WHO, *Managing meningitis epidemics in Africa*, Revised 2015

## 9

**Early antibiotic treatment is the most important factor to save life and reduce complications**

- Prompt treatment (within one hour of diagnosis) is crucial to prevent death and complications:
- 5 days ceftriaxone (IV) - 7 days in infants (0-2 months old) - is recommended as a standard treatment during epidemics in the African belt.
- Admission to a hospital or health centre is necessary, although isolation of the patient is not necessary.
- If there is no improvement of patients' condition within 48 hours of treatment or if exhibiting convulsions or comatose, they should be transferred to higher-level health facility.

## 10

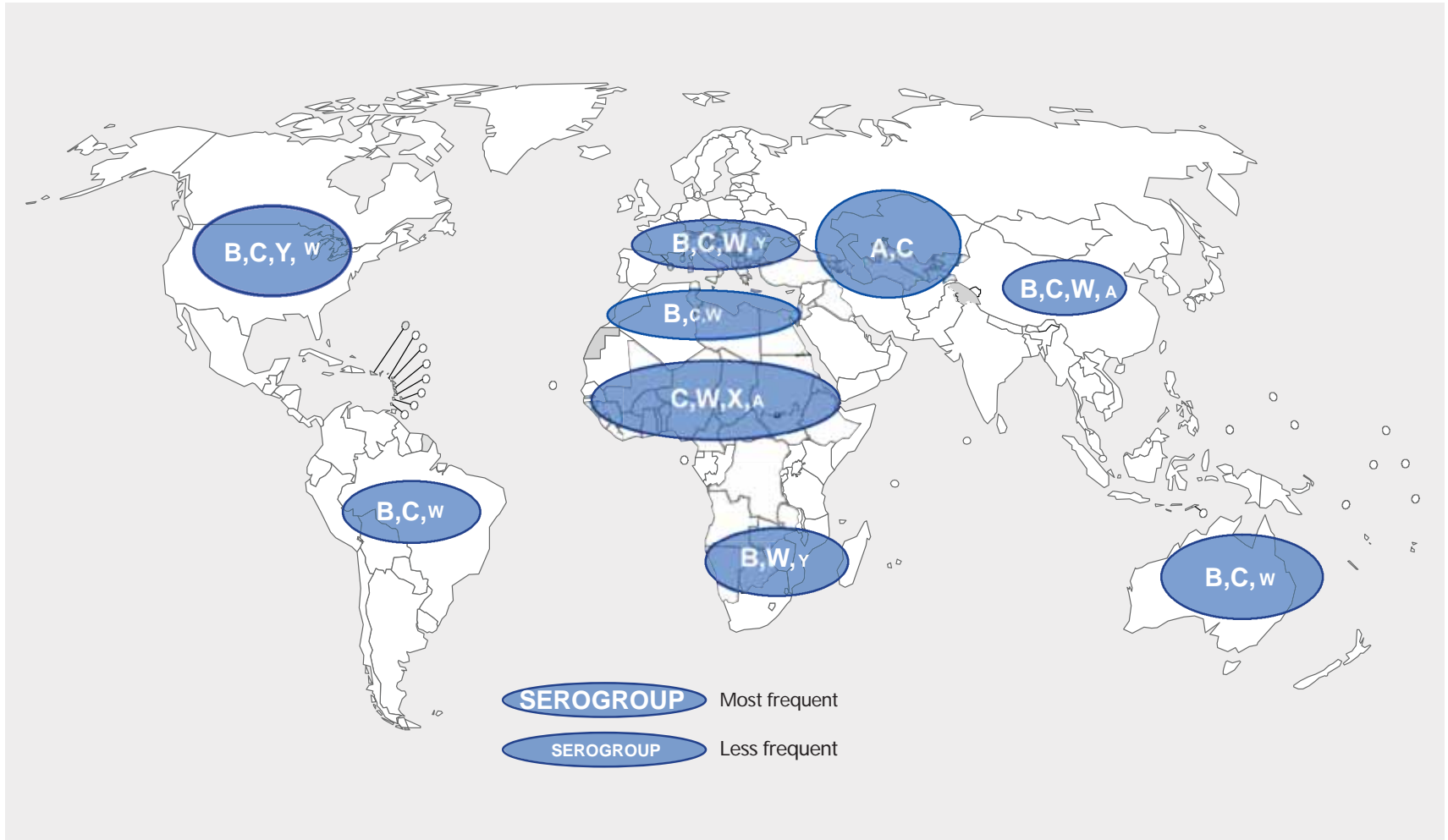
**Antibiotics reduce transmission risk for close contacts when given promptly**

- Outside the African meningitis belt, chemoprophylaxis is recommended for close contacts within the household.
- In the meningitis belt, chemoprophylaxis for close contacts is recommended in non-epidemic situations.
- Ciprofloxacin antibiotic is the antibiotic of choice, and ceftriaxone an alternative.

# EFFECTIVE ANTIBIOTICS



## Invasive Meningococcal Disease – Serogroup distribution, 2018



Source: WHO/IHM, as of 16 February 2018

The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted lines on maps represent approximate border lines for which there may not yet be full agreement.  
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## More information about Meningococcal meningitis:

- Meningococcal meningitis WHO webpage:  
<http://www.who.int/csr/disease/meningococcal/en/>
- Meningitis WHO MOOC:  
<https://openwho.org/courses/pandemic-epidemic-diseases>
- Meningococcal meningitis WHO fact sheet:  
<http://www.who.int/mediacentre/factsheets/fs141/en/>
- Managing meningitis epidemics in Africa  
[http://www.who.int/csr/resources/publications/HSE\\_GAR\\_ERI\\_2010\\_4/en/](http://www.who.int/csr/resources/publications/HSE_GAR_ERI_2010_4/en/)
- International Coordinating Group (ICG) on Vaccine Provision  
<http://www.who.int/csr/disease/icg/en/>





PART III

# Tool boxes



## TOOL BOX 1

# The role of WHO

## *WHO mandate – in light of infectious diseases*

WHO is directing and coordinating authority on international health within the United Nations' system, by its six main functions:

### 1. Providing leadership on matters critical to health and engaging in partnerships where joint action is needed;

#### Example

- WHO is:
  - Working with countries to increase and sustain access to prevention, treatment and care;
  - Identifying priorities and setting strategies;
  - Leading and coordinating the health response during emergencies.
- Through the International Health Regulations (2005), WHO helps the countries to strengthen their national core capacities for emergency risk management to prevent, prepare for, respond to and recover from health emergencies.





## 2. Shaping the research agenda and stimulating the generation, translation and dissemination of valuable knowledge;

### Example

- WHO Research & Development Blueprint is a global strategy and preparedness plan that allows the rapid activation of R&D activities during epidemics. Its aim is to fast-track the availability of effective tests, vaccines and medicines that can be used to save lives and avert large scale crisis. <http://www.who.int/blueprint/en/>
- The WHO public health research agenda for influenza provides a framework reflecting public health research priorities for pandemic, zoonotic and seasonal epidemic influenza to reduce the risk of emergence of pandemic influenza, limit the spread of pandemic, zoonotic and seasonal epidemic influenza, minimize the impact of epidemics, optimize the treatment of patients and promote the development of modern public health tools. <http://www.who.int/influenza/resources/research/en/>
- The MERS-CoV research agenda has been developed by WHO to address key unknowns for this virus focusing on five major areas of research: **i)** virus origin and characteristics, **ii)** epidemiology and transmission, **iii)** clinical management and infection prevention and control measures, **iv)** product development and implementation, and **v)** impact of interventions and operational research. <http://www.who.int/emergencies/mers-cov/en/>

## TOOL BOX 1



### 3. Setting norms and standards and promoting and monitoring their implementation;

**Example**

- WHO developed a pocketbook to provide guidance on best management practices for Viral Haemorrhagic Fevers across health care facilities. <http://www.who.int/csr/resources/publications/clinical-management-patients/en/>
- WHO developed a rapid advance guideline on recommendations for the use of Personal Protective Equipment for use in a filovirus disease outbreak <http://www.who.int/csr/resources/publications/ebola/personal-protective-equipment/en/>

### 4. Articulating ethical and evidence-based policy options;

**Example**

- WHO publishes vaccine position papers, providing global vaccine and immunization recommendations that have an international public health impact. WHO position papers follow the recommendations of the WHO Strategic Advisory Group (SAGE) on immunization. The update of vaccine position paper depends on the availability of new scientific evidence and public health priorities. [http://www.who.int/immunization/documents/positionpapers\\_intro/en/](http://www.who.int/immunization/documents/positionpapers_intro/en/)



## 5. Providing technical support, catalysing change, and building sustainable institutional capacity;

### Example

- WHO has developed a web-based platform offering online courses to transfer knowledge on infectious diseases and improve preparedness and response to epidemics. Courses include global knowledge on managing epidemics and public health interventions, as well as disease-specific knowledge.

WHO Massive Open Online Courses:  
<https://openwho.org/>

## 6. Monitoring the health situation and assessing health trends.

### Example

- WHO conducts regular global risk assessments regarding infectious diseases and assesses the risk for any event which could have public health impact.
- WHO publishes a summary of epidemiological situation and risk assessments of events that are being monitored through the disease outbreak news.  
<http://who.int/csr/don/en/>
- WHO also disseminates epidemiological information on outbreaks and on communicable diseases of public health importance through the Weekly Epidemiological Record.  
<http://www.who.int/wer/en/>

## TOOL BOX 1



### ***WHO and the International Health Regulations (IHR) creation: A need for global cooperation in public health***

The Cholera epidemics that overran Europe between 1830 and 1847 were catalysts for intensive infectious disease diplomacy and multilateral cooperation in public health. They showed that collaboration between countries was needed to control the spread of dangerous diseases across the world. This led to the first International Sanitary Conference in Paris in 1851. In 1948, the WHO Constitution entered into force and in 1951, WHO Member States adopted the International Sanitary Regulations, which were replaced by and renamed the International Health Regulations in 1969. The 1969 Regulations were subject to minor modifications in 1973 and 1981.

The IHR were primarily intended to monitor and control six serious infectious diseases: Cholera, Plague, Yellow fever, Smallpox, Relapsing fever and Typhus. Under the IHR (1969), only Cholera, Plague and Yellow fever remain notifiable, meaning that States are required to notify WHO if and when these diseases occur on their territory.

Increase in cross-border travel and trade, the development of information and communication technologies, the resurgence of some well-known epidemic diseases, such as Cholera and Plague and the emergence of new infectious agents such as Ebola virus disease, as well as the limitations of IHR (1969) (narrow scope of three diseases and dependence on official country notifications), led to their revision. The World Health Assembly adopted the IHR (2005) on 23 May 2005 and they entered into force on 15 June 2007. The International Health Regulations (2005) represent a binding international legal agreement involving 196 countries across the globe. They aim to prevent, protect against, control and respond to the international spread of disease while avoiding unnecessary interference with international traffic and trade.



## Questions & Answers

### 1. What are the major changes between IHR (1969) and IHR (2005)?

- The scope of the IHR (2005) is purposely broader and more inclusive in respect of the public health event to which they have application in order to maximize the probability that all such events that could have serious international consequences are identified early and promptly reported by States Parties to WHO for assessment.
- The IHR (2005) explicitly allow WHO to take into account information from sources other than official notifications and consultations, and, after assessment, to seek verification of specific events from the concerned States Parties.

### 2. What are the general obligations of States under the IHR 2005?

Under the IHR (2005), States parties are required to:

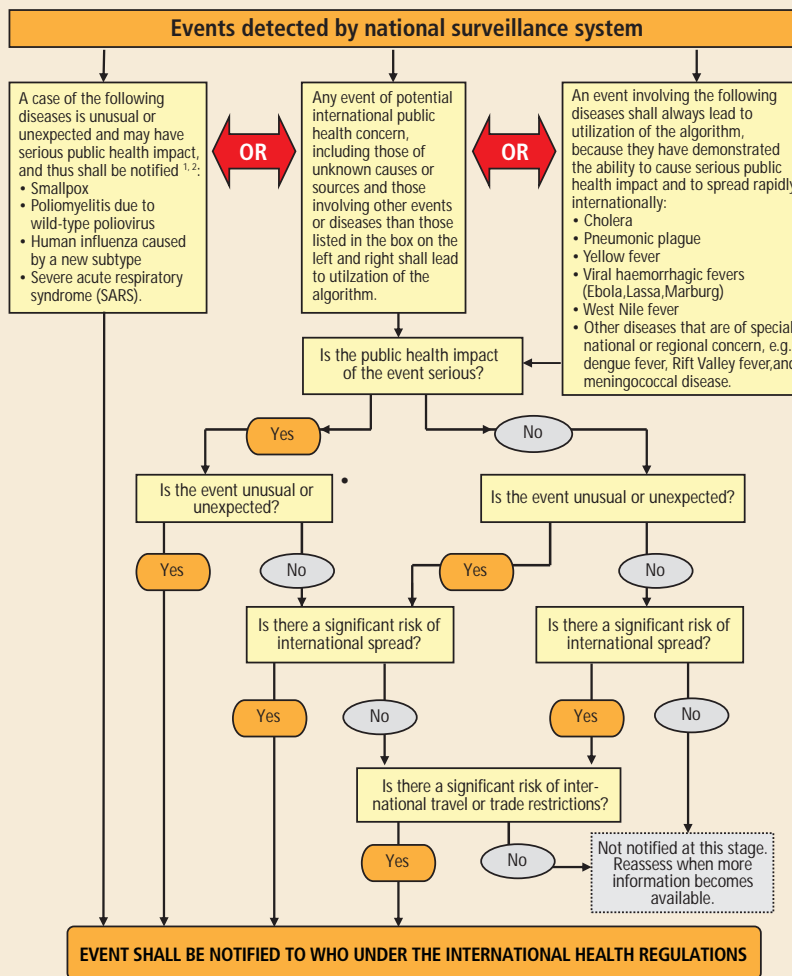
- Designate a National IHR Focal Point (it may be a team). Focal points are required to be available on a 24-hour basis, 7 days a week.
- Assess events occurring in their territory and to notify WHO of all events that may constitute a public health emergency of international concern using the decision instrument.
- Respond to requests for verification of information regarding events that may constitute a public health emergency of international concern, to respond to public health risks which may spread internationally.

# TOOL BOX 1



- Develop, strengthen and maintain the capacity to detect, report and respond to public health events; to provide routine facilities, services, inspections and control activities at designated international airports, ports and ground crossings to prevent the international spread of disease.
- Report to WHO evidence of a public health risk identified outside their territory which may cause international disease spread, manifested by exported/imported human cases, vectors carrying infection or contamination, contaminated goods.
- Respond appropriately to WHO-recommended measures.
- Collaborate with other States Parties and with WHO on IHR (2005) implementation.

## Decision instrument for the assessment & notification of events that may constitute a public health emergency of international concern



<sup>1</sup> As per WHO case definitions.

<sup>2</sup> The disease list shall be used only for the purposes of these Regulations.

Source: Annex 2, International Health Regulations (2005)

## TOOL BOX 1

### 3. What events should States Parties notify to WHO?

Under the IHR, States Parties are required to notify WHO of all events that are assessed as possibly constituting a Public Health Event of International Concern (PHEIC), taking into account the context in which an event occurs.

A decision instrument, provided in Annex 2 of the Regulations, identifies four criteria that States Parties must follow in their assessment of events within their territories and their decision as to whether an event is notifiable to WHO:

- Is the public health impact of the event serious?
- Is the event unusual or unexpected?
- Is there a significant risk of international spread?
- Is there a significant risk of international restriction(s) to travel and trade?

### 4. What if States Parties have difficulties to assess an event?

State Parties have an option of initiating confidential consultations with WHO and seeking advice on evaluation, assessment and appropriate health measures to be taken, in case they are unable to complete a definitive assessment.

### 5. How and when to report these events?

- These notifications must occur within 24 hours of assessment by the country.
- Notifications must be followed by ongoing communication of detailed public health information on the event, including, where possible, case definition, laboratory results, source and type of the risk, number of cases and deaths, conditions affecting the spread of the disease and the health measures employed.

### 6. What States Parties should do if they identify a public health risk outside their territory?

States Parties must inform WHO through the National IHR Focal Point within 24 hours of receipt of evidence of a public health risk identified outside their territory that may cause international disease spread, as manifested by imported or exported human cases, vectors which carry infection or contamination, or by contaminated goods.

### 7. Can WHO require more information to States Parties about events unofficially reported?

States Parties are required under the IHR to respond to WHO Requests for Verification. WHO has an express mandate to obtain verification from States Parties concerning unofficial reports or communications, received

from various sources, about events arising within their territories which may constitute a PHEIC. States Parties must acknowledge verification requests by WHO within 24 hours and provide public health information on the status of the event, followed, in a timely manner.

### 8. What are the diseases that should be mandatorily notified to WHO?

Under the IHR (2005), all cases of four diseases must be automatically notified to WHO: Smallpox, Poliomyelitis due to wild-type poliovirus, SARS and cases of human Influenza caused by a new subtype.

### 9. What are the core capacities?

- Under the IHR (2005), each State Party is required to develop, strengthen and maintain core public health capacities for surveillance and response.



## TOOL BOX 1

- Public health capacity under the IHR (2005) is defined as the indispensable, fundamental actions that are the primary responsibility of each State Party for achieving the goal of national health security, i.e. to prevent the spread of diseases and to detect and investigate health risks in the community by efficient multisectoral action (e.g. integrated disease surveillance systems, laboratory services and national, regional and global networks).
- Core capacities at the local (community), intermediate and national levels, as well as key sanitary and health services needed at designated international airports, ports and ground crossings are described in Annex 1 of the IHR (2005).

### 10. What are the specific requirements for Yellow fever?

- A proof of vaccination or prophylaxis against Yellow fever may be required for travellers as a condition of entry to a State.
- States Parties must designate at least one Yellow fever vaccination centre.

### 11. Why developing the necessary public health capacities at points of entry will limit the spread of public health hazards?

Today's high traffic at airports, ports and ground crossings – points of entry, can play a key role in the international spread

of diseases through persons, conveyances and goods. This is why countries should be prepared to detect and respond to any health event that may be of international concern and contain risks at source, limiting unnecessary health-based restrictions on international traffic and trade and protecting the health of travellers and populations.

### 12. What are the guiding principles for preparedness at points of entry?

- Simplicity;
- Proportionality and practicality: one size does not fit all;
- Minimal disruption;
- Collaboration: multisectoral approach;
- (Risk) Communication.



## For more information:

- International Health Regulations (2005)  
<http://www.who.int/ihr/publications/9789241580496/en/>
- More information about IHR  
<http://www.who.int/ihr/about/en/>
- More information about implementing IHR  
<http://www.who.int/ihr/procedures/implementation/en/>
- More about public health at points of entry:  
[http://www.who.int/ihr/ports\\_airports/en/](http://www.who.int/ihr/ports_airports/en/)
- Joint External Evaluation Tool and Process Overview  
<http://apps.who.int/iris/bitstream/10665/252755/1/WHO-HSE-GCR-2016.18-eng.pdf?ua=1>





## TOOL BOX 1

### *WHO management of events under the Emergency Response Framework (ERF)*

The ERF is an internal WHO tool that outlines a set of procedures to better respond to emergencies. The ERF provides WHO staff with essential guidance on how the Organization manages the assessment, grading and response to public health events and emergencies with health consequences, in support of Member States and affected communities.



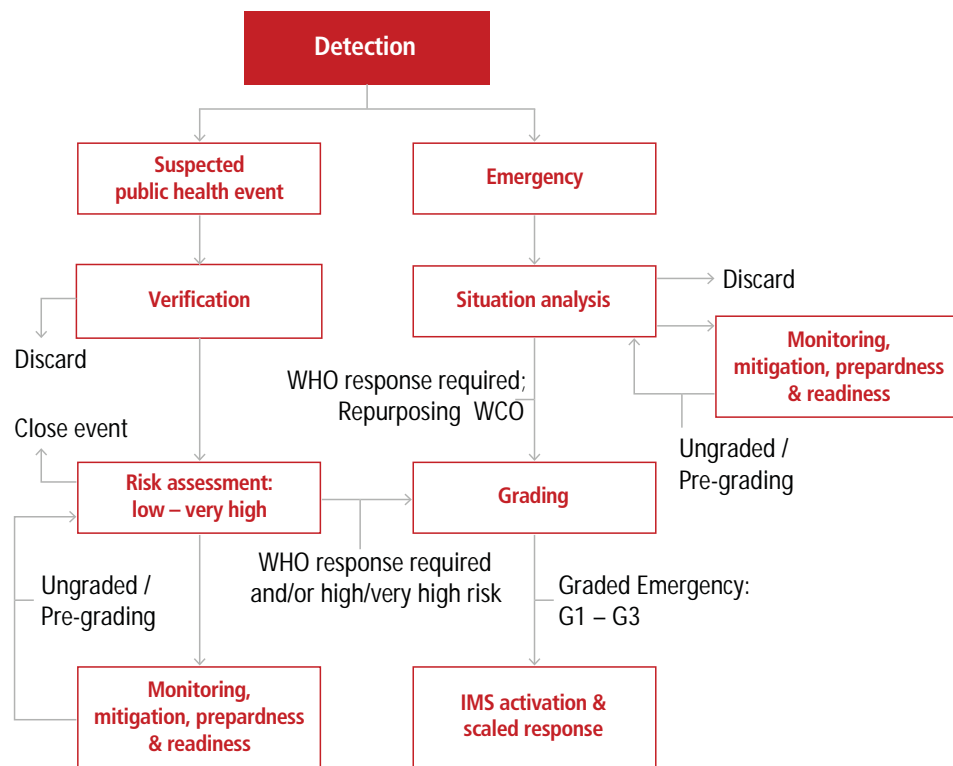
### Levels for graded emergencies

<b>Ungraded</b>	A public health event or emergency that is being monitored by WHO but that does not require a WHO operational response.
<b>Grade 1</b>	A single country emergency requiring a limited response by WHO, but that still exceeds the usual country-level cooperation that the WHO Country Office (WCO) has with the Member State. Most of the WHO response can be managed with in-country assets. Organizational and/or external support required by the WCO is limited. The provision of support to the WCO is coordinated by an Emergency Coordinator in the Regional Office.
<b>Grade 2</b>	A single country or multiple country emergency, requiring a moderate response by WHO. The level of response required by WHO always exceeds the capacity of the WCO. Organizational and/or external support required by the WCO is moderate. The provision of support to the WCO is coordinated by an Emergency Coordinator in the Regional Office. An Emergency Officer is also appointed at headquarters to assist with the coordination of Organization-wide support.
<b>Grade 3</b>	A single country or multiple country emergency, requiring a major/maximal WHO response. Organizational and/or external support required by the WCO is major and requires the mobilization of Organization-wide assets. The provision of support to the WCO is coordinated by an Emergency Coordinator in the Regional Office(s). An Emergency Officer is also appointed at headquarters, to assist with the coordination of Organizationwide inputs. On occasion, the WHE Executive Director and the Regional Director may agree to have the Emergency Coordinator based in headquarters. For events or emergencies involving multiple regions, an Incident Management Support Team at headquarters will coordinate the response across the regions.

Source: Emergency Response Framework, second edition, WHO

# TOOL BOX 1

## Linking risk assessment and situation analysis to WHO grading and operational response



For acute events and emergencies, grading occurs within 24 hours of risk assessment/situation analysis

Source: Emergency Response Framework, second edition, WHO

## WHO internal grading of events

- Once an event is detected or notified to WHO, it will be verified and analysed. Risk assessment would be conducted if the event is confirmed. Risk assessment by WHO team may result in:
  - Monitoring, mitigation, preparedness and readiness if the risk is low or very low;
  - Grading the event and activating the Incident Management System and scaled response if the risk is high or very high.
- Grading an event is a WHO internal process which purpose is to define the level of operational response required by WHO. Grading takes into consideration 5 criteria: scale, complexity, urgency of the event, capacity to respond at local and national levels and reputational risk for WHO.
- They are four levels for graded emergencies shown here at left.

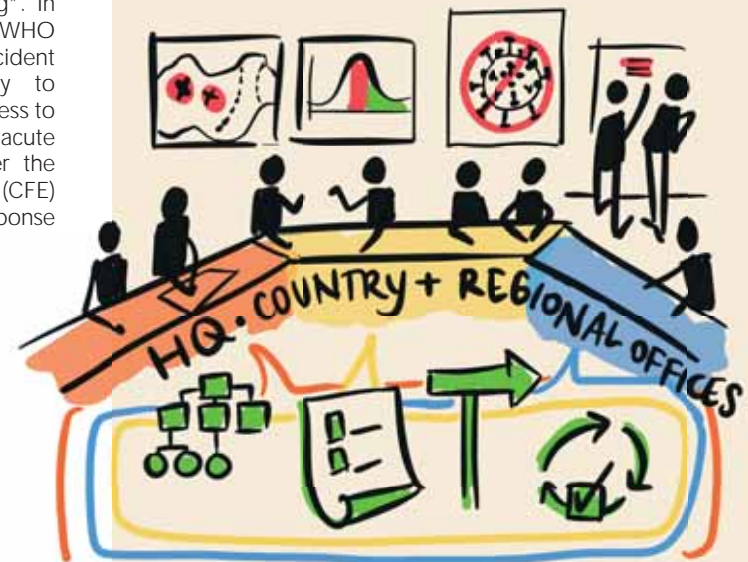
## TOOL BOX 1

### WHO operational response through the ERF

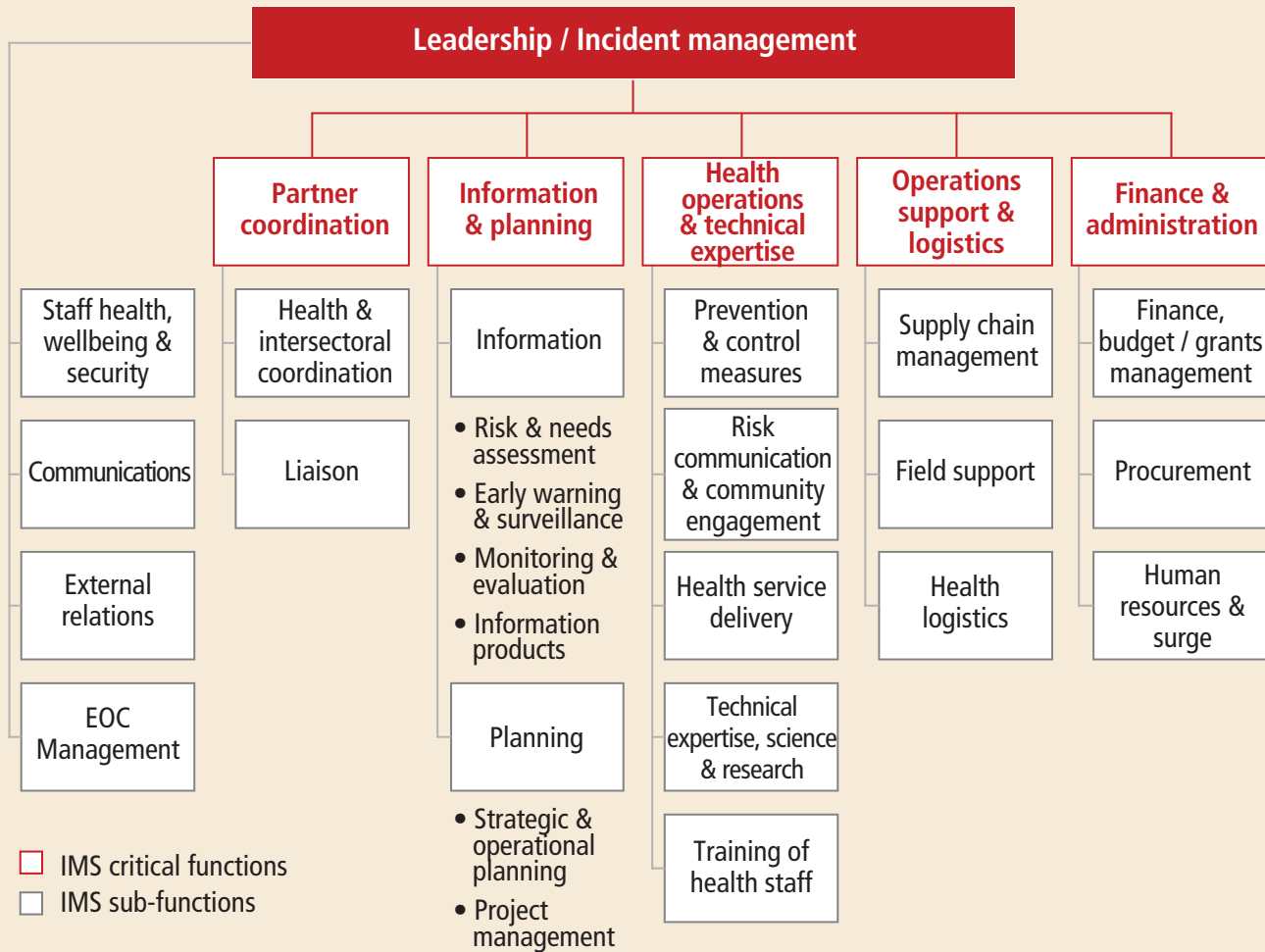
- Grading will trigger WHO emergency procedures and activities for the management of the response. It will activate the Incident Management System (IMS). The IMS is recognized best practice for emergency management. It is simple, flexible and adaptable to any scenario: it may be applied in small, simple, or large, complex incidents. Scaling up or down the response can be quickly done to suit the changing needs.
- The IMS is the combination of facilities, equipment, personnel, procedures and communications operating within a common organizational structure. It enables:
  - Common terminology and structure that enhance interoperability;
  - Clarification of roles and responsibilities;
  - Flow of information and resources;
  - Rapid mobilization, deployment and tracking of resources.
- The IMS implies:
  - Determining the overarching objectives (e.g. stop transmission of an infectious agent);
  - Establishing specific and measurable objectives for various functional activities;

- Developing strategies and issuing plans, directions, procedures, and protocols;
- Assigning tasks;
- Establishing an evaluation process.
- WHO has adapted the Incident Management System to consist of six critical functions: Leadership, Partner Coordination, Information and Planning, Health Operations and Technical Expertise, Operations Support and Logistics, and Finance and Administration.
- WHO applies a no regret policy which affirms that "it is better to err on the side of over-resourcing the critical functions rather than risk failure by under-resourcing". In terms of financial resources, the WHO representative and/or the Incident Manager has increased authority to approve expenditure. Immediate access to funds, for the first three months of an acute emergency, is provided from either the Contingency Fund for Emergency (CFE) or the Regional Office's rapid response accounts.

## NO-REGRET POLICY



WHO's Incident Management System organizational structure: critical functions and sub-functions

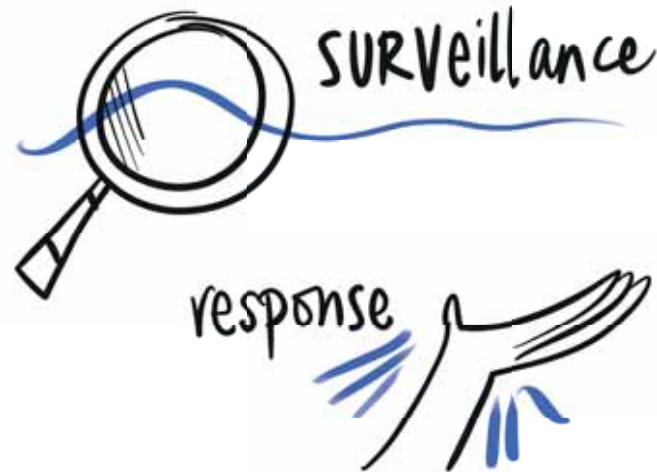


Source: Emergency Response Framework, second edition, WHO

## TOOL BOX 1

### WHO monitoring of the response: a criteria for success

- It is critical to evaluate the response to an event and learn the lessons from past responses, improving things that could have gone better and enforcing best practices.
- During grade 2 and 3 emergencies, WHO performance standards and key performance indicators are monitored.
  - Performance standards should be monitored with the ERF Monitoring Tool. The responsibility for completing the ERF Monitoring Tool is with the Country Office, with oversight from the Regional Office.
  - Key performance indicators (not more 8) are agreed upon on a case-by-case basis for each response (e.g. case fatality ratio; vaccination coverage, etc.).



### For more information:

- Emergency Response Framework:  
<http://www.who.int/hac/about/erf/en/>

# The International Coordinating Group (ICG) on vaccine provision



## What is the ICG?

- The International Coordination Group (ICG) was established in 1997, following major outbreaks of Meningitis in Africa, as a **mechanism to manage and coordinate the provision of emergency vaccine supplies and antibiotics to countries during major outbreaks.**
- The ICG monitors its vaccine security global stock levels for Cholera, Meningitis and Yellow fever to ensure availability of sufficient supply to respond to disease outbreaks when they occur.
- The ICG brings partners together to improve cooperation and coordinating of epidemic preparedness and response.
- The ICG also works on forecasting vaccine stocks, negotiating vaccine prices through its networks or partners, evaluating interventions and standard protocols for managing diseases.

## TOOL BOX 2



### Why is such mechanism needed?

Though outbreaks of Meningitis, Yellow fever and Cholera are unpredictable events, they can each be controlled by the timely use of vaccine. Vaccine-preventable diseases typically affect people in vulnerable settings who have limited access to vaccines. But vaccines can take months to manufacture, and they are not always readily available in the amounts needed during emergencies. The resulting shortages have raised difficult issues about how limited supplies should be allocated during periods of high demand. That is why, after public health organizations found themselves unprepared to respond in a timely manner to a large-scale outbreak of Meningitis in Nigeria, the ICG mechanism was created in 1997.

### What is the ICG mandate?

- The core mandate of the ICG is to make available and ensure equitable access to vaccines for Cholera, Meningitis, and Yellow fever during outbreaks.
- The ICG mechanism seeks to ensure timely and targeted deployment so that vaccines can be used as effective outbreak responses where they are most needed.
- The ICG also manages the global emergency vaccine stockpiles and, working with manufacturers, determines their size and composition with the goal of ensuring that adequate stocks of emergency supplies are accessible for emergency response.

### What are the guiding principles of the mechanism?

Three principles guide the mechanism:

- **Equity:** distribution of vaccine based on public health priorities;
- **Rapid and timely access:** delivery of vaccine within a defined timeframe to control outbreaks;
- **Independence:** decisions made independent of any political or economic influences with the sole goal of improving public health.



## TOOL BOX 2

### Who are the ICG's partners?

The ICG is made up of four member agencies:

- **International Federation of the Red Cross and Red Crescent Societies (IFRC)** - Has strong country presence for community health promotion, local social and resource mobilization and provides support to states during disasters and epidemics.
- **Médecins sans Frontières (MSF)** - An independent, field-based NGO that provides health care to vulnerable populations in emergency settings.
- **United Nations Children's Fund (UNICEF)** - Conducts wide scale vaccine procurement and shipment, and provides technical support on campaign planning and implementation in country focusing specially on social mobilization and cold chain.
- **World Health Organization (WHO)** - Provides global public health advice and technical support to countries. During outbreaks, WHO focuses on vaccine stockpile management, surveillance, preparedness and response to disease outbreaks.

Additional expertise and technical advice is provided on a case-by-case basis from partners including: Agence de Médecine Preventive, Epicentre, GAVI the Vaccine Alliance, WHO Collaborating Centres, the US Centers for Disease Control (CDC) and the European Community Humanitarian Office (ECHO).

Vaccine manufacturers, vaccine equipment providers and financial donor institutions are also engaged in the ICG operations.

### Which vaccine stockpiles are available through the ICG?

ICGs have been established to provide access to vaccines for Cholera, Meningitis and Yellow fever.

cholera

meningitis

yellow  
fever

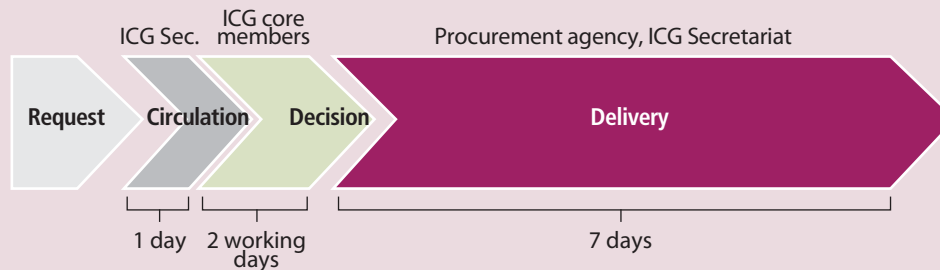


## TOOL BOX 2

### How a country can access emergency vaccine stockpiles?

- Vaccine security stocks can be accessed by ANY country facing an epidemic ANYWHERE in the world, as long as the country's request fulfills ICG's criteria for release of vaccine stocks.
- As a first step, a country must complete and submit a request to the ICG Secretariat using the standard application form.
- The ICG Secretariat at WHO then circulates this request to the partners for review and assessment. Additional requests for information are sent back to the country, if needed. Following a rapid consultation and evaluation process, the decision to release vaccines and other supplies is communicated to the requesting country within 48 hours, once all necessary information has been provided.
- If approved, UNICEF procures vaccines and injection materials and organizes delivery of vaccines to the country, ideally within 7 days.
- Requests are evaluated taking into account the epidemiological situation, vaccination strategy, pre-existing stocks in the country and operational aspects of the epidemic response.

### Lead time for request reception to vaccine delivery



### For more information:

- General information on the ICG:  
<http://www.who.int/csr/disease/icg/en/>
- Application forms and guidelines for Cholera:  
<http://www.who.int/csr/disease/icg/cholera/en/>
- Application forms and guidelines for Meningitis:  
<http://www.who.int/csr/disease/meningococcal/icg/en/>
- Application forms and guidelines for Yellow fever:  
<http://www.who.int/csr/disease/icg/yellow-fever/en/>

# Tables for laboratory diagnosis & shipment of infectious substances

TABLE 1: Specimen collection and storage

Information to be recorded: Patient information, EPID number, date of sample collection, laboratory ID number, and clinical/epi information				
SYNDROME	DISEASE	PREFERRED SPECIMEN TYPES & SPECIMEN VOLUMES (minimum)*	SPECIMEN COLLECTION MATERIALS	STORAGE OF SPECIMENS
Acute Diarrhoeal Syndrome	Cholera	<ul style="list-style-type: none"> <li>Liquid stool specimen;</li> <li>Rectal swab;</li> <li>Culture isolates.</li> </ul>	<ul style="list-style-type: none"> <li>Container for stool specimen;</li> <li>Cary-Blair transport medium for the swab;</li> <li>Filter paper if Cary-Blair is not available, liquid stool sample may be blotted on filter paper.</li> </ul>	<ul style="list-style-type: none"> <li>Room temperature up to 4hrs, refrigerated if longer;</li> <li>Sample in Cary-Blair can be stored at room temperature;</li> <li>Sample on dry filter paper can be stored at room temperature;</li> <li>Sample on moistened filter paper can be stored at room temperature;</li> <li>Isolated strains from culture:</li> <li>solid non selective culture medium in test tubes stored at room temperature for a few days;</li> <li>In Stock Culture Agar at room temperature.</li> </ul>
Acute Haemorrhagic Fever	Crimean-Congo haemorrhagic fever	<ul style="list-style-type: none"> <li>Whole blood (2.5ml) collected on EDTA (alternative serum);</li> <li>Frozen tissue specimens;</li> <li>Other: formalin-fixed tissue or paraffin-embedded tissue.</li> </ul> <p><i>For serology, testing of acute and convalescent specimens is strongly recommended.</i></p>	<ul style="list-style-type: none"> <li>EDTA tubes;</li> <li>Serum separator tubes;</li> <li>Heparin can cause interference with PCR reagents and tests.</li> </ul>	<ul style="list-style-type: none"> <li>&lt; 24 hours: room temperature;</li> <li>&gt; 24hrs-72hrs: 0-4°C;</li> <li>Long term storage: -20°C or -70°C (preferable).</li> </ul>

\* For detection, specimens should be collected during the acute phase of illness. Test results are highly dependent on timing of specimen collection in relation to disease onset; therefore, multiple specimens are required to confirm/exclude diagnosis.

**TOOL BOX 3**

TABLE 1: Specimen collection and storage, (continued)

Information to be recorded: Patient information, EPID number, date of sample collection, laboratory ID number, and clinical/epi information				
SYNDROME	DISEASE	PREFERRED SPECIMEN TYPES & SPECIMEN VOLUMES (minimum)*	SPECIMEN COLLECTION MATERIALS	STORAGE OF SPECIMENS
Acute Haemorrhagic Fever	Dengue	<ul style="list-style-type: none"> <li>Whole blood (serum/plasma – 1ml).</li> </ul>	<ul style="list-style-type: none"> <li>Serum separator tubes;</li> <li>Citrate and heparin plasma can be tested by RT-PCR;</li> <li>EDTA may cause interference of PCR reagents and testing.</li> </ul>	<ul style="list-style-type: none"> <li>&lt; 24 hours: room temperature;</li> <li>&gt; 24hrs-72hrs: 0-4°C;</li> <li>Long term storage: -20°C or -70°C (preferable).</li> </ul>
	Ebola virus disease	<ul style="list-style-type: none"> <li>Whole blood (1ml) collected on EDTA (alternative serum);</li> <li>Oral fluid collected from deceased patients;</li> <li>Other: formalin-fixed tissue or paraffin-embedded tissues.</li> </ul> <p><i>For serology, testing of acute and convalescent specimens is strongly recommended.</i></p>	<ul style="list-style-type: none"> <li>EDTA tubes;</li> <li>Heparin can cause interference with PCR reagents and tests;</li> <li>Dacron/polyester swab with flocced tip stored in universal transport medium.</li> </ul>	<ul style="list-style-type: none"> <li>&lt; 24 hours: room temperature ;</li> <li>&gt; 24hrs-72hrs: 0-4°C;</li> <li>Long term storage: -20°C or -70°C (preferable).</li> </ul>
	Lassa fever	<ul style="list-style-type: none"> <li>Whole blood (2.5ml) collected on EDTA (alternative serum);</li> <li>Frozen tissue specimens;</li> <li>Other: formalin-fixed tissue or paraffin-embedded tissues</li> </ul> <p><i>For serology, testing of acute and convalescent specimens is strongly recommended.</i></p>	<ul style="list-style-type: none"> <li>EDTA tubes;</li> <li>Serum separator tubes;</li> <li>Heparin can cause interference with PCR reagents and tests.</li> </ul>	<ul style="list-style-type: none"> <li>&lt; 24 hours: room temperature;</li> <li>&gt; 24hrs-72hrs: 0-4°C;</li> <li>Long term storage: -20°C or -70°C (preferable).</li> </ul>

\* For detection, specimens should be collected during the acute phase of illness. Test results are highly dependent on timing of specimen collection in relation to disease onset; therefore, multiple specimens are required to confirm/exclude diagnosis.

## TOOL BOX 3

TABLE 1: Specimen collection and storage, (continued)

Information to be recorded: Patient information, EPID number, date of sample collection, laboratory ID number, and clinical/epi information				
SYNDROME	DISEASE	PREFERRED SPECIMEN TYPES & SPECIMEN VOLUMES (minimum)*	SPECIMEN COLLECTION MATERIALS	STORAGE OF SPECIMENS
Acute Haemorrhagic Fever	Marburg virus disease	<ul style="list-style-type: none"> <li>Whole blood (2.5ml) collected on EDTA (alternative serum);</li> <li>Oral fluid collected from deceased patients;</li> <li>Other: formalin-fixed tissue or paraffin-embedded tissues.</li> </ul> <p><i>For serology, testing of acute and convalescent specimens is strongly recommended.</i></p>	<ul style="list-style-type: none"> <li>EDTA tubes;</li> <li>Serum separator tubes;</li> <li>Heparin can cause interference with PCR reagents and tests.</li> </ul>	<ul style="list-style-type: none"> <li>&lt; 24 hours: room temperature;</li> <li>&gt; 24hrs-72hrs: 0-4°C;</li> <li>Long term storage: -20°C or -70°C (preferable).</li> </ul>
	Rift Valley fever	<ul style="list-style-type: none"> <li>Whole blood (2.5ml) collected on EDTA (alternative serum);</li> <li>Frozen tissue specimens;</li> <li>Other: formalin-fixed tissue or paraffin-embedded tissues.</li> </ul> <p><i>For serology, testing of acute and convalescent specimens is strongly recommended.</i></p>	<ul style="list-style-type: none"> <li>EDTA tubes;</li> <li>Serum separator tubes;</li> <li>Heparin can cause interference with PCR reagents and tests.</li> </ul>	<ul style="list-style-type: none"> <li>&lt; 24 hours: room temperature;</li> <li>&gt; 24hrs-72hrs: 0-4°C;</li> <li>Long term storage: -20°C or -70°C (preferable).</li> </ul>
	Yellow fever	<ul style="list-style-type: none"> <li>Whole blood (serum – 1ml);</li> <li>Other: urine (10ml) has been recommended but is not a validated specimen type.</li> </ul>	<ul style="list-style-type: none"> <li>EDTA tubes;</li> <li>Serum separator tubes;</li> <li>Sterile urine collection tube.</li> </ul>	<ul style="list-style-type: none"> <li>&lt; 24 hours: room temperature;</li> <li>&gt; 24hrs-72hrs: 0-4°C;</li> <li>Long term storage: -20°C or -70°C (preferable).</li> </ul>
Acute Jaundice Syndrome	Leptospirosis	<ul style="list-style-type: none"> <li>Whole blood (250 uL);</li> <li>Serum (250 uL);</li> <li>Cerebrospinal fluid (CSF - 250 uL);</li> <li>Urine (10ml);</li> <li>Isolate and media inoculated with clinical specimens (blood, tissue and urine).</li> </ul>	<ul style="list-style-type: none"> <li>Blood specimens should be collected in EDTA or Sodium Citrate tubes;</li> <li>Blood specimens collected in heparin are not acceptable.</li> </ul>	<ul style="list-style-type: none"> <li>Cultures should be stored at room temperature;</li> <li>Clinical specimens to be kept frozen at -20°C;</li> <li>Serum to be stored at 4°C.</li> </ul>

\* For detection, specimens should be collected during the acute phase of illness. Test results are highly dependent on timing of specimen collection in relation to disease onset; therefore, multiple specimens are required to confirm/exclude diagnosis.

## TOOL BOX 3

TABLE 1: Specimen collection and storage, (continued)

Information to be recorded: Patient information, EPID number, date of sample collection, laboratory ID number, and clinical/epi information				
SYNDROME	DISEASE	PREFERRED SPECIMEN TYPES & SPECIMEN VOLUMES (minimum)*	SPECIMEN COLLECTION MATERIALS	STORAGE OF SPECIMENS
Acute Neurological Syndrome	Meningococcal meningitis	<ul style="list-style-type: none"> <li>• Blood (Adult: 5-10ml / Child: 1-3ml);</li> <li>• Cerebrospinal fluid (CSF – 3ml);</li> <li>• Aspirate or biopsy of any normally sterile site (e.g. cardiac fluid) and/or purpuric skin lesion.</li> </ul>	<ul style="list-style-type: none"> <li>• CSF:               <ul style="list-style-type: none"> <li>- 1 dry tube and 1 Cryotube (for PCR);</li> <li>- If dry tube cannot be processed in &lt;2 hours, inoculate into trans-isolate (T-I) medium;</li> </ul> </li> <li>• Blood: Collected blood should be diluted in blood culture broth in order to obtain blood cultures. Specimens should be immediately inoculated (within one minute) into a blood culture bottle.</li> </ul>	<ul style="list-style-type: none"> <li>• CSF in dry tube: room temperature;</li> <li>• CSF in Cryotube: stored at refrigerator temperature and transported in cold chain;</li> <li>• CSF isolates: stored frozen at -20°C to allow further testing;</li> <li>• Trans-isolate (TI) media vials should never be frozen. Before inoculation TI vials should be kept in the refrigerator. Once inoculated, TI vials should be kept at room temperature. Inoculated TI vials must be ventilated if not transported the same day;</li> <li>• Inoculated blood culture media should be protected from temperature extremes (&lt;18°C or &gt;37°C) with a transport carrier and thermal insulator (such as extruded polystyrene foam);</li> <li>• Inoculated blood culture bottles should not be placed in the refrigerator.</li> </ul>
Acute Respiratory Syndrome	Anthrax	<ul style="list-style-type: none"> <li>• Whole blood;</li> <li>• Skin lesion exudates;</li> <li>• Pleural fluid;</li> <li>• Cerebrospinal fluid (CSF);</li> <li>• Rectal swab;</li> <li>• Ascites fluid;</li> <li>• Tissues from biopsy or autopsy.</li> </ul>	<ul style="list-style-type: none"> <li>• Blood specimens should be collected in EDTA or Sodium Citrate tubes (not heparin);</li> <li>• Tissues for Immunohistochemistry (IHC) should be formalin-fixed.</li> </ul>	<ul style="list-style-type: none"> <li>• Most samples can be sent 2-8°C;</li> <li>• Fresh tissue should be sent frozen and fixed tissue can be sent at room temperature.</li> </ul>

\* For detection, specimens should be collected during the acute phase of illness. Test results are highly dependent on timing of specimen collection in relation to disease onset; therefore, multiple specimens are required to confirm/exclude diagnosis.

## TOOL BOX 3

TABLE 1: Specimen collection and storage, (continued)

Information to be recorded: Patient information, EPID number, date of sample collection, laboratory ID number, and clinical/epi information				
SYNDROME	DISEASE	PREFERRED SPECIMEN TYPES & SPECIMEN VOLUMES (minimum)*	SPECIMEN COLLECTION MATERIALS	STORAGE OF SPECIMENS
Acute Respiratory Syndrome	Influenza	<ul style="list-style-type: none"> <li>• Virus isolates;</li> <li>• Respiratory clinical specimens (i.e. nasopharyngeal swabs, nasal swabs, throat swabs, nasal aspirates, nasal washes, lower respiratory tract specimens, broncho lavage);</li> <li>• Nucleic acid. (1ml)</li> </ul> <p><i>For suspected avian influenza samples: collect lower respiratory tract specimens in addition to upper respiratory tract specimens</i></p>	<ul style="list-style-type: none"> <li>• Dacron or polyester flocked swabs with universal transport medium</li> </ul>	<ul style="list-style-type: none"> <li>• Dacron or Specimens received cold should be stored refrigerated (2°–8°C) for up to 72hrs before processing.</li> <li>• Dacron or Store any residual specimens at ≤ -70°C.</li> <li>• Dacron or Although optimal performance is met when testing fresh specimens within 72hrs of collection, performance has been demonstrated with frozen specimens:               <ul style="list-style-type: none"> <li>- If testing of a fresh specimen is not possible within 72 hours storage at 2–8°C, the specimen may be frozen at ≤ -70°C and tested at a later time;</li> <li>- Specimens received frozen should be stored at ≤ -70°C until processing;</li> <li>- Store any residual specimens at ≤ -70°C;</li> <li>- Ship extracted RNA and frozen specimen on dry ice.</li> </ul> </li> </ul>
	Plague	<ul style="list-style-type: none"> <li>• Bubonic plague: bubo aspirate plus, swabs in bacterial transport media (e.g. Cary-Blair);</li> <li>• Pneumonic plague: sputum plus swabs in bacterial transport media (e.g. Cary-Blair);</li> <li>• Blood for serology.</li> </ul> <p><i>Specimens should be collected during the acute phase of illness and ideally before commencement of antibiotic treatment</i></p>	<ul style="list-style-type: none"> <li>• Fresh or frozen: swab, biopsy, touch prep slides, formalin-fixed, paraffin block;</li> <li>• Swabs should be made of nylon, polyester, or Dacron material.</li> </ul>	<ul style="list-style-type: none"> <li>• Storage at 2-8°C</li> </ul>

\* For detection, specimens should be collected during the acute phase of illness. Test results are highly dependent on timing of specimen collection in relation to disease onset; therefore, multiple specimens are required to confirm/exclude diagnosis.

## TOOL BOX 3

TABLE 1: Specimen collection and storage, (continued)

Information to be recorded: Patient information, EPID number, date of sample collection, laboratory ID number, and clinical/epi information				
SYNDROME	DISEASE	PREFERRED SPECIMEN TYPES & SPECIMEN VOLUMES (minimum)*	SPECIMEN COLLECTION MATERIALS	STORAGE OF SPECIMENS
Acute Respiratory Syndrome	MERS	<ul style="list-style-type: none"> <li>• Lower respiratory tract:               <ul style="list-style-type: none"> <li>- Sputum;</li> <li>- Aspirate;</li> <li>- Lavage;</li> </ul> </li> <li>• Upper respiratory tract:               <ul style="list-style-type: none"> <li>• Naso-pharyngeal and Oro-pharyngeal swabs;</li> <li>• Naso-pharyngeal wash / naso-pharyngeal aspirate;</li> <li>• Serum. (1ml)</li> </ul> </li> </ul> <p><i>Collection of both upper and lower respiratory tract specimens is recommended</i></p>	<ul style="list-style-type: none"> <li>• Dacron, polyester swabs with universal transport medium;</li> <li>• Blood: EDTA.</li> </ul>	<ul style="list-style-type: none"> <li>• &lt; 24 hrs: room temperature;</li> <li>• &gt; 24hrs-72hrs: 0-4°C;</li> <li>• Long term storage: -20°C or -70°C (preferable).</li> </ul>
Acute Dermatological Syndrome	Cutaneous anthrax	<ul style="list-style-type: none"> <li>• Skin lesion exudates;</li> <li>• Tissues from biopsy or autopsy;</li> <li>• Other:               <ul style="list-style-type: none"> <li>- Whole blood;</li> <li>- Pleural fluid;</li> <li>- Cerebrospinal fluid (CSF);</li> <li>- Rectal swab;</li> <li>- Ascites fluid.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Blood specimens should be collected in EDTA or Sodium Citrate tubes (not heparin);</li> <li>• Tissues for immunohistochemistry (IHC) should be formalin-fixed.</li> </ul>	<ul style="list-style-type: none"> <li>• Most samples can be sent 2-8°C;</li> <li>• Fresh tissue should be shipped frozen;</li> <li>• Fixed tissue should be shipped at room temperature.</li> </ul>
	Monkeypox	<ul style="list-style-type: none"> <li>• Lesion fluid and/or material:               <ul style="list-style-type: none"> <li>- Vesicle/pustule skin or fluid;</li> <li>- Scab, crust;</li> </ul> </li> <li>• Optional but not preferred: blood. (0.5ml for fluids)</li> </ul>	<ul style="list-style-type: none"> <li>• Swabs without individual holders may be stored in a sterile container;</li> <li>• Dry swabs are preferred but a minimal amount of viral transport media may be added.</li> </ul>	<ul style="list-style-type: none"> <li>• Storage at 4°C, shipments within 72hrs</li> </ul>

\* For detection, specimens should be collected during the acute phase of illness. Test results are highly dependent on timing of specimen collection in relation to disease onset; therefore, multiple specimens are required to confirm/exclude diagnosis.

## TOOL BOX 3

TABLE 1: Specimen collection and storage, (continued)

Information to be recorded: Patient information, EPID number, date of sample collection, laboratory ID number, and clinical/epi information				
SYNDROME	DISEASE	PREFERRED SPECIMEN TYPES & SPECIMEN VOLUMES (minimum)*	SPECIMEN COLLECTION MATERIALS	STORAGE OF SPECIMENS
Acute Dermatological Syndrome	Smallpox	<ul style="list-style-type: none"> <li>• Cutaneous lesion scabs;</li> <li>• Pustule fluid. (0.5ml for fluids)</li> </ul>	<ul style="list-style-type: none"> <li>• Swabs without individual holders may be stored in a sterile container;</li> <li>• Dry swabs are preferred but a minimal amount of viral transport media may be added.</li> </ul>	<ul style="list-style-type: none"> <li>• Storage at 4°C, shipments within 72hrs</li> </ul>
Acute Fever and Rash	Chikungunya	<ul style="list-style-type: none"> <li>• Whole blood, serum (4-5ml venous blood);</li> <li>• Other: urine has been recommended but is not a validated specimen type;</li> <li>• CSF in meningoencephalitis cases:               <ul style="list-style-type: none"> <li>- Synovial fluid in arthritis with effusion;</li> <li>- Autopsy material – serum or available tissues.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• EDTA tubes;</li> <li>• Serum separator tubes;</li> <li>• Sterile urine collection tube.</li> </ul>	<ul style="list-style-type: none"> <li>• Storage at 0 to 4°C</li> </ul>
	Zika	<ul style="list-style-type: none"> <li>• Whole blood, serum, plasma (4-5ml venous blood);</li> <li>• Urine;</li> <li>• Cerebrospinal fluid (CSF – 0.25ml);</li> <li>• Other: semen.</li> </ul>	<ul style="list-style-type: none"> <li>• EDTA tubes;</li> <li>• Serum separator tubes;</li> <li>• Sterile urine collection tube.</li> </ul>	<ul style="list-style-type: none"> <li>• Storage at 4°C;</li> <li>• &gt;48hrs, serum should be separated.</li> </ul>

\* For detection, specimens should be collected during the acute phase of illness. Test results are highly dependent on timing of specimen collection in relation to disease onset; therefore, multiple specimens are required to confirm/exclude diagnosis.



## TOOL BOX 3

TABLE 2: Laboratory diagnosis and shipment of infectious substances

SYNDROME	DISEASE	TYPE OF TEST FOR CONFIRMATION*	AVERAGE TEST RESULTS TURNAROUND TIME	DIFFERENTIAL DIAGNOSIS	SHIPMENT CLASSIFICATION BASED ON INTERNATIONAL SHIPMENTS**
Acute Diarrhoeal Syndrome	Cholera	<ul style="list-style-type: none"> <li>RDT for field use (needs additional confirmation);</li> <li>PCR, MLVA, sequencing;</li> <li>Culture;</li> <li>Antibiotic susceptibility testing.</li> </ul>	<ul style="list-style-type: none"> <li>PCR: 24-48hrs;</li> <li>Culture and susceptibility testing: up to 8 weeks.</li> </ul>	<ul style="list-style-type: none"> <li>Amoebic Dysentery</li> <li>Cryptosporidiosis</li> <li>Giardiasis</li> <li>Shigellosis</li> <li>E.coli (enterotoxigenic and enterohaemorrhagic)</li> <li>Viral gastroenteritis (Norwalk-like and rotavirus)</li> <li>Salmonellosis</li> <li>Campylobacter</li> </ul>	<ul style="list-style-type: none"> <li>UN3373 - Biological Substance</li> <li>Packing Instruction 650</li> </ul>
Acute Haemorrhagic Fever Syndrome	Crimean-Congo haemorrhagic fever	<ul style="list-style-type: none"> <li>Reverse transcriptase polymerase chain reaction (RT-PCR) assay;</li> <li>Enzyme-linked immunosorbent assay (ELISA);</li> <li>Antigen detection;</li> <li>Serum neutralization;</li> <li>Virus isolation by cell culture.</li> </ul>	<ul style="list-style-type: none"> <li>PCR: 24hrs;</li> <li>ELISA: 72hrs.</li> </ul>	<ul style="list-style-type: none"> <li>Hantaviruses</li> <li>South American arenaviruses</li> <li>Tick-borne flaviviruses</li> <li>Chikungunya</li> <li>West Nile</li> <li>Sindbis</li> <li>Invasive Meningococcal Disease</li> </ul>	<ul style="list-style-type: none"> <li>UN2814 - Infectious Substance affecting humans</li> <li>Packing Instruction 620</li> </ul>
	Dengue	<ul style="list-style-type: none"> <li>Reverse transcriptase polymerase chain reaction (RT-PCR) assay;</li> <li>Antigen detection: IgM, IgG, RDTs;</li> <li>Serology: IgM, RDTs;</li> <li>Virus isolation.</li> </ul>	<ul style="list-style-type: none"> <li>PCR: 24hrs;</li> <li>ELISA: 72hrs.</li> </ul>		<ul style="list-style-type: none"> <li>Cultures: <ul style="list-style-type: none"> <li>UN2814 - Infectious Substance affecting humans</li> <li>Packing Instruction 620</li> </ul> </li> <li>Diagnostic clinical specimens: <ul style="list-style-type: none"> <li>UN3373 - Biological Substance</li> <li>Packing Instruction 650</li> </ul> </li> </ul>

\* Consideration must be given to the design and performance of the diagnostic products to ensure that testing is safe and effective

\*\* Safety measures remain the same for national shipments

## TOOL BOX 3

TABLE 2: Laboratory diagnosis and shipment of infectious substances, (continued)

SYNDROME	DISEASE	TYPE OF TEST FOR CONFIRMATION*	AVERAGE TEST RESULTS TURNAROUND TIME	DIFFERENTIAL DIAGNOSIS	SHIPMENT CLASSIFICATION BASED ON INTERNATIONAL SHIPMENTS**
Acute Haemorrhagic Fever Syndrome	Ebola virus disease	<ul style="list-style-type: none"> <li>Reverse transcriptase polymerase chain reaction (RT-PCR) assay;</li> <li>Enzyme-linked immunosorbent assay (ELISA);</li> <li>Antigen detection (RDT);</li> <li>Virus isolation by cell culture.</li> </ul>	<ul style="list-style-type: none"> <li>PCR: 24hrs;</li> <li>ELISA: 72hrs.</li> </ul>	<ul style="list-style-type: none"> <li>Hantaviruses</li> <li>South American arenaviruses</li> <li>Tick-borne flaviviruses</li> <li>Chikungunya</li> <li>West Nile</li> <li>Sindbis</li> <li>Invasive Meningococcal Disease</li> </ul>	<ul style="list-style-type: none"> <li>UN2814 - Infectious Substance affecting humans</li> <li>Packing Instruction 620</li> </ul>
	Lassa fever	<ul style="list-style-type: none"> <li>Reverse transcriptase polymerase chain reaction (RT-PCR) assay;</li> <li>Enzyme-linked immunosorbent assay (ELISA);</li> <li>Virus isolation by cell culture.</li> </ul>	<ul style="list-style-type: none"> <li>PCR: 24hrs;</li> <li>ELISA: 72hrs.</li> </ul>		<ul style="list-style-type: none"> <li>UN2814 - Infectious Substance affecting humans</li> <li>Packing Instruction 620</li> </ul>
	Marburg virus disease	<ul style="list-style-type: none"> <li>Reverse transcriptase polymerase chain reaction (RT-PCR) assay;</li> <li>Enzyme-linked immunosorbent assay (ELISA);</li> <li>Virus isolation by cell culture.</li> </ul>	<ul style="list-style-type: none"> <li>PCR: 24hrs;</li> <li>ELISA: 72hrs.</li> </ul>		<ul style="list-style-type: none"> <li>UN2814 - Infectious Substance affecting humans</li> <li>Packing Instruction 620</li> </ul>

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**TOOL BOX 3**

**TABLE 2: Laboratory diagnosis and shipment of infectious substances, (continued)**

SYNDROME	DISEASE	TYPE OF TEST FOR CONFIRMATION*	AVERAGE TEST RESULTS TURNAROUND TIME	DIFFERENTIAL DIAGNOSIS	SHIPMENT CLASSIFICATION BASED ON INTERNATIONAL SHIPMENTS**
Acute Haemorrhagic Fever Syndrome	Rift Valley fever	<ul style="list-style-type: none"> <li>Reverse transcriptase polymerase chain reaction (RT-PCR) assay;</li> <li>Enzyme-linked immunosorbent assay (ELISA);</li> <li>Virus isolation by cell culture.</li> </ul>	<ul style="list-style-type: none"> <li>PCR: 24hrs;</li> <li>ELISA: 72hrs.</li> </ul>	<ul style="list-style-type: none"> <li>Hantaviruses</li> <li>South American arenaviruses</li> <li>Tick-borne flaviviruses</li> <li>Chikungunya</li> <li>West Nile</li> <li>Sindbis</li> <li>Invasive Meningococcal Disease</li> </ul>	<ul style="list-style-type: none"> <li>Cultures:                             <ul style="list-style-type: none"> <li>- UN2814 - Infectious Substance affecting humans</li> <li>- Packing Instruction 620</li> </ul> </li> <li>Diagnostic clinical specimens:                             <ul style="list-style-type: none"> <li>- UN3373 - Biological Substance</li> <li>- Packing Instruction 650</li> </ul> </li> </ul>
	Yellow fever	<ul style="list-style-type: none"> <li>Reverse transcriptase polymerase chain reaction (RT-PCR) assay;</li> <li>Enzyme-linked immunosorbent assay (ELISA);</li> <li>Neutralization assays;</li> <li>Virus isolation by cell culture.</li> </ul>	<ul style="list-style-type: none"> <li>PCR: 24hrs;</li> <li>ELISA: 10 days;</li> <li>PRNT: up to 2 weeks.</li> </ul>		<ul style="list-style-type: none"> <li>Cultures:                             <ul style="list-style-type: none"> <li>- UN2814 - Infectious Substance affecting humans</li> <li>- Packing Instruction 620</li> </ul> </li> <li>Diagnostic clinical specimens:                             <ul style="list-style-type: none"> <li>- UN3373 - Biological Substance</li> <li>- Packing Instruction 650</li> </ul> </li> </ul>
Acute Jaundice Syndrome	Leptospirosis	<ul style="list-style-type: none"> <li>Serology: MAT-micro agglutination;</li> <li>Molecular: Polymerase Chain Reaction (PCR);</li> <li>Microscopy.</li> </ul>	<ul style="list-style-type: none"> <li>2 weeks;</li> <li>Primary isolation from clinical specimens takes up to 6 months.</li> </ul>	<ul style="list-style-type: none"> <li>Hepatitis A-E</li> <li>CMV</li> <li>EBV</li> <li>Other flaviviruses</li> </ul>	<ul style="list-style-type: none"> <li>UN3373 - Biological Substance</li> <li>Packing Instruction 650</li> </ul>
	Yellow fever	<ul style="list-style-type: none"> <li>Reverse transcriptase polymerase chain reaction (RT-PCR) assay;</li> <li>Enzyme-linked immunosorbent assay (ELISA);</li> <li>Neutralization assays;</li> <li>Virus isolation by cell culture.</li> </ul>	<ul style="list-style-type: none"> <li>PCR: 24hrs;</li> <li>ELISA: 10 days;</li> <li>PRNT: up to 2 weeks.</li> </ul>		<ul style="list-style-type: none"> <li>Cultures:                             <ul style="list-style-type: none"> <li>- UN2814 - Infectious Substance affecting humans</li> <li>- Packing Instruction 620</li> </ul> </li> <li>Diagnostic clinical specimens:                             <ul style="list-style-type: none"> <li>- UN3373 - Biological Substance</li> <li>- Packing Instruction 650</li> </ul> </li> </ul>

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## TOOL BOX 3

TABLE 2: Laboratory diagnosis and shipment of infectious substances, (continued)

SYNDROME	DISEASE	TYPE OF TEST FOR CONFIRMATION*	AVERAGE TEST RESULTS TURNAROUND TIME	DIFFERENTIAL DIAGNOSIS	SHIPMENT CLASSIFICATION BASED ON INTERNATIONAL SHIPMENTS**
Acute Neurological Syndrome	Meningococcal meningitis	<ul style="list-style-type: none"> <li>• Culture;</li> <li>• PCR.</li> </ul>	<ul style="list-style-type: none"> <li>• PCR: 48hrs;</li> <li>• Culture: 4-5days.</li> </ul>	<ul style="list-style-type: none"> <li>• H.influenzae</li> <li>• Strep. Pneumoniae</li> <li>• Enteroviral meningitis</li> <li>• Malaria</li> <li>• Poliomyelitis</li> <li>• Rabies and other lyssaviruses</li> <li>• African trypanosomiasis</li> <li>• Meningoencephalitis</li> <li>• Tick-borne encephalitis viruses</li> <li>• Japanese encephalitis</li> </ul>	<ul style="list-style-type: none"> <li>• UN3373 - Biological Substance</li> <li>• Packing Instruction 650</li> </ul>
Acute Respiratory Syndrome	Anthrax	<ul style="list-style-type: none"> <li>• Culture;</li> <li>• PCR;</li> <li>• Immunohistochemistry (IHC);</li> <li>• Toxin detection.</li> </ul>	<ul style="list-style-type: none"> <li>• PCR: 24hrs;</li> <li>• Culture, toxin detection: 2 weeks.</li> </ul>	<ul style="list-style-type: none"> <li>• Diphtheria</li> <li>• Hantavirus Pulmonary Syndrome</li> <li>• Mycoplasma</li> <li>• Legionellosis</li> <li>• Respiratory syncytial virus</li> <li>• Pertussis</li> <li>• Other respiratory viruses</li> </ul>	<ul style="list-style-type: none"> <li>• Cultures:</li> <li>- UN2814- Infectious Substance affecting humans</li> <li>- Packing Instruction 620</li> <li>• Diagnostic clinical specimens:</li> <li>- UN3373 - Biological Substance</li> <li>- Packing Instruction 650</li> </ul>
	Influenza	<ul style="list-style-type: none"> <li>• PCR;</li> <li>• Virus isolation;</li> <li>• HAI (Hemagglutination Inhibition Test).</li> </ul>	<ul style="list-style-type: none"> <li>• PCR: 24hrs;</li> <li>• HAI: 72hrs;</li> <li>• Culture: 1-2 weeks.</li> </ul>		<ul style="list-style-type: none"> <li>• Cultures of avian influenza and suspected avian/pandemic influenza:</li> <li>- UN2814 - Infectious Substance affecting humans</li> <li>- Packing Instruction 620</li> <li>• Diagnostic clinical specimen:</li> <li>- UN3373 - Biological Substance</li> <li>- Packing Instruction 650</li> </ul>

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**TOOL BOX 3**

TABLE 2: Laboratory diagnosis and shipment of infectious substances, (continued)

SYNDROME	DISEASE	TYPE OF TEST FOR CONFIRMATION*	AVERAGE TEST RESULTS TURNAROUND TIME	DIFFERENTIAL DIAGNOSIS	SHIPMENT CLASSIFICATION BASED ON INTERNATIONAL SHIPMENTS**
Acute Respiratory Syndrome	Plague	<ul style="list-style-type: none"> <li>• Rapid dipstick test;</li> <li>• PCR;</li> <li>• ELISA IgM;</li> <li>• culture;</li> <li>• DFA.</li> </ul>	<ul style="list-style-type: none"> <li>• PCR: 24hrs;</li> <li>• Culture: 1 week.</li> </ul>	<ul style="list-style-type: none"> <li>• Diphtheria</li> <li>• Hantavirus Pulmonary Syndrome</li> <li>• Mycoplasma</li> <li>• Legionellosis</li> <li>• Respiratory syncytial virus</li> <li>• Pertussis</li> <li>• Other respiratory viruses</li> </ul>	<ul style="list-style-type: none"> <li>• Cultures:</li> <li>- UN2814 - Infectious Substance affecting humans</li> <li>- Packing Instruction 620</li> <li>• Diagnostic clinical specimens:</li> <li>- UN3373 - Biological Substance</li> <li>- Packing Instruction 650</li> </ul>
	MERS	<ul style="list-style-type: none"> <li>• Molecular: PCR positive on at least two gene targets: Screening assay (e.g. up E or N gene NAAT) and Confirmatory assay (e.g. ORF 1a, ORF 1b or N gene NAAT);</li> <li>• Serology: immunofluorescence assays, serum neutralization assays, protein microarray technology, recombinant nucleocapsid (N) and spike (S) protein-based indirect enzyme-linked immunosorbent (ELISA), and a neutralization test based on retroviral pseudoparticles.</li> </ul>	<ul style="list-style-type: none"> <li>• PCR: 24hrs;</li> <li>• IFA: 24hrs;</li> <li>• ELISA and microneutralization: 1-3 days.</li> </ul>		<ul style="list-style-type: none"> <li>• UN3373 - Biological Substance</li> <li>• Packing Instruction 650</li> </ul>

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## TOOL BOX 3

SYNDROME	DISEASE	TYPE OF TEST FOR CONFIRMATION*	AVERAGE TEST RESULTS TURNAROUND TIME	DIFFERENTIAL DIAGNOSIS	SHIPMENT CLASSIFICATION BASED ON INTERNATIONAL SHIPMENTS**
Acute Dermatological Syndrome	Cutaneous anthrax	<ul style="list-style-type: none"> <li>• Culture;</li> <li>• PCR;</li> <li>• Immunohistochemistry (IHC);</li> <li>• Toxin detection.</li> </ul>	<ul style="list-style-type: none"> <li>• 2 weeks</li> </ul>	<ul style="list-style-type: none"> <li>• Chickenpox</li> <li>• Herpes</li> <li>• Enterovirus</li> <li>• Measles</li> <li>• Medication-associated allergies</li> <li>• Bacterial skin infections</li> </ul>	<ul style="list-style-type: none"> <li>• Cultures:</li> <li>- UN2814- Infectious Substance affecting humans</li> <li>- Packing Instruction 620</li> <li>• Diagnostic clinical specimens:</li> <li>- UN3373 - Biological Substance</li> <li>- Packing Instruction 650</li> </ul>
	Monkeypox	<ul style="list-style-type: none"> <li>• PCR</li> </ul>	<ul style="list-style-type: none"> <li>• 24hrs</li> </ul>		<ul style="list-style-type: none"> <li>• UN2814- Infectious Substance affecting humans</li> <li>• Packing Instruction 620</li> </ul>
	Smallpox	<ul style="list-style-type: none"> <li>• PCR</li> </ul>	<ul style="list-style-type: none"> <li>• 24hrs</li> </ul>		<ul style="list-style-type: none"> <li>• UN2814- Infectious Substance affecting humans</li> <li>• Packing Instruction 620</li> </ul>
Acute Fever and Rash	Chikungunya	<ul style="list-style-type: none"> <li>• PCR;</li> <li>• Serology;</li> <li>• Viral culture.</li> </ul>	<ul style="list-style-type: none"> <li>• PCR: 24hrs;</li> <li>• ELISA: 2-5 days;</li> <li>• Virus isolation <math>\leq</math> 8 days.</li> </ul>	<ul style="list-style-type: none"> <li>• Leptospirosis,</li> <li>• Alphavirus infections</li> <li>• Dengue</li> <li>• Malaria</li> <li>• Meningitis</li> <li>• Post-infectious arthritis (incl. rheumatic fever)</li> <li>• Invasive Meningococcal Disease</li> </ul>	<ul style="list-style-type: none"> <li>• Diagnostic clinical specimens:</li> <li>- UN3373 - Biological Substance</li> <li>- Packing Instruction 650</li> </ul>
	Zika	<ul style="list-style-type: none"> <li>• PCR;</li> <li>• Serology;</li> <li>• Neutralization tests.</li> </ul>	<ul style="list-style-type: none"> <li>• PCR: 24hrs;</li> <li>• ELISA: 2-5 days.</li> </ul>		<ul style="list-style-type: none"> <li>• Diagnostic clinical specimens:</li> <li>- UN3373 - Biological Substance</li> <li>- Packing Instruction 650</li> </ul>

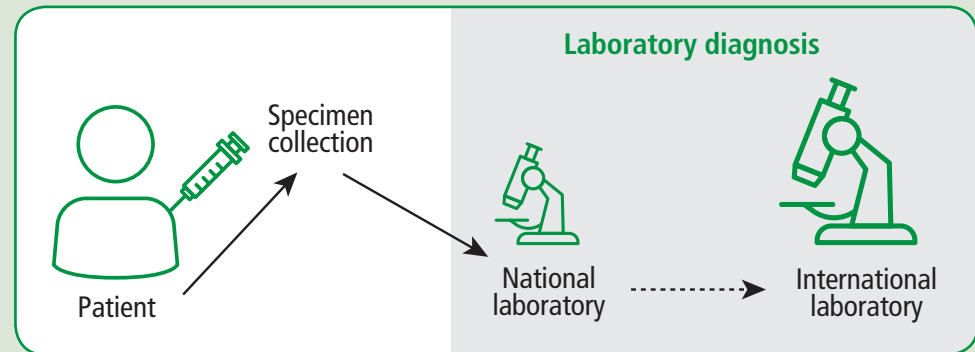
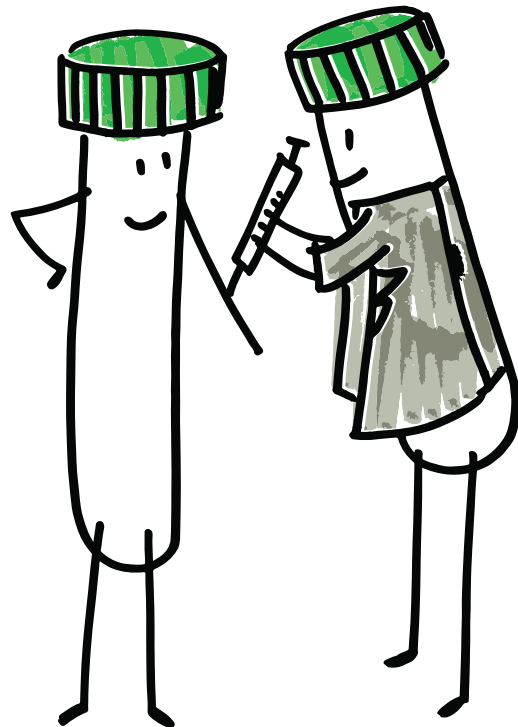
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## TOOL BOX 4

# Transport of infectious substances

This tool box highlights some important features of the *Guidance on regulations for the Transport of Infectious Substance 2017-2018*<sup>1</sup>, World Health Organization, 2017.



## Infectious substances: definition

For the purposes of transport, infectious substances are defined as substances which are known or are reasonably expected to contain pathogens. Pathogens are defined as microorganisms (including bacteria, viruses, rickettsiae, parasites, fungi) and other agents such as prions, which can cause disease in humans or animals.

The definition is applied to all specimens except those explicitly exempted:

- Cultures;
- Patient specimens;
- Biological products;
- Genetically modified microorganisms (GMMOs) and organisms (GMOs);
- Medical or clinical wastes.

<sup>1</sup> The full guidance can be found on: <http://www.who.int/ihr/publications/WHO-WHE-CPI-2017.8/en/>

## TOOL BOX 4

### Classification

Infectious substances are classified in Division 6.2 of the Dangerous Goods Regulations and assigned to proper shipping names according to their hazard classification and their composition (UN 2814, UN 2900, UN 3291 or UN 3373).

Infectious substances are divided into the following categories:

- **Category A** - *An infectious substance which is transported in a form that, when exposure to it occurs, is capable of causing permanent disability, life-threatening or fatal disease in otherwise healthy humans or animals.*
- **Category B** - *An infectious substance which does not meet the criteria for inclusion in Category A.*
- **Exemptions.**



### General preparation of shipments for transport

Because of the differences in the hazards posed by Category A infectious substances (UN 2814 and UN 2900) and Category B infectious substances (UN 3373), there are variations in the packaging, labelling and documentation requirements for the two categories.

**Note 1:** Hand carriage of Category A and Category B infectious substances and transport of these materials in diplomatic pouches are strictly prohibited by international air carriers.

**Note 2:** Inner packaging containing infectious substances shall not be consolidated with inner packaging containing unrelated types of goods.

Shippers of infectious substances shall ensure that packages are prepared in such a manner that they arrive at their destination in good condition and present no hazard to persons or animals during transport.

#### Basic triple packaging system

This system of packaging shall be used for all infectious substances. It consists of three layers as follows:

- **Primary receptacle.** A primary watertight, leak-proof receptacle containing the specimen. The receptacle is packaged with enough absorbent material to absorb all fluid in case of breakage or leakage.
- **Secondary packaging.** A second durable, watertight, leak-proof packaging to enclose and protect the primary receptacle(s). Several cushioned primary receptacles may be placed in one secondary packaging,

but sufficient additional absorbent material shall be used to absorb all fluid in case of breakage or leakage.

- **Outer packaging.** Secondary packagings are placed in outer shipping packagings with suitable cushioning material. Outer packagings protect their contents from outside influences, such as physical damage, while in transit. The smallest overall external dimension shall be 10 x 10 cm.

Each completed package is normally required to be correctly marked, labelled and accompanied with appropriate shipping documents (as applicable).

There are specific packaging, labelling and documentation requirements for infectious substances in Category A and with lesser constraints for substances in Category B.

#### Overpacks

- For both categories it is possible to use overpacks.
- "Overpack" is the term used when several packages are combined to form one unit and sent to the same destination by a single shipper. When refrigerants are used to protect contents, the overpacks may comprise insulated vessels or flasks. Whenever an overpack is used, the required marks and labels shown on the outer packaging must be repeated on the outermost layer of the overpack. This requirement applies to infectious substances in Categories A and B. Overpacks are also required to be marked with the word "overpack".
- It is very important not to reproduce UN specifications mark on the overpack.



## TOOL BOX 4

### Reusing packaging materials

Shipping packages can be reused. If the shipper plans on reusing a package, it must be appropriately disinfected. Before reusing a package, the shipper must make sure all marks and labels reflect the substances actually being shipped. If the shipper plans on shipping an empty package, all non-applicable marks and labels must be removed or covered. Before an empty package is returned to the shipper, or sent elsewhere, it must be appropriately disinfected or sterilized to nullify any hazard. Any label or mark indicating that it had contained an infectious substance shall be removed or covered.

### Refrigerants

- Refrigerants may be used to stabilize infectious substances in Categories A and B during transit.
- Packed infectious substances requiring cooling meet the appropriate requirements as described in the guidance on regulations for the Transport of Infectious Substances 2017-2018.

### Trainings

- The Dangerous Goods Regulations require all personnel involved in transport to undergo appropriate training.
- For the transport of Category A infectious substances, personnel must undergo training in accordance with the modal requirements. This can involve attendance at approved courses and passing examinations.
- For the transport of Category B infectious substances, there is a requirement that clear instructions on the use of the packaging are supplied to the user; this is regarded as sufficient “training” for the shipping of these substances. However, if such specimens are consigned with other dangerous goods (e.g. flammable liquids, radioactive materials, liquefied gases, etc.), then personnel must be trained in the proper procedures for their transport.



## TOOL BOX 4

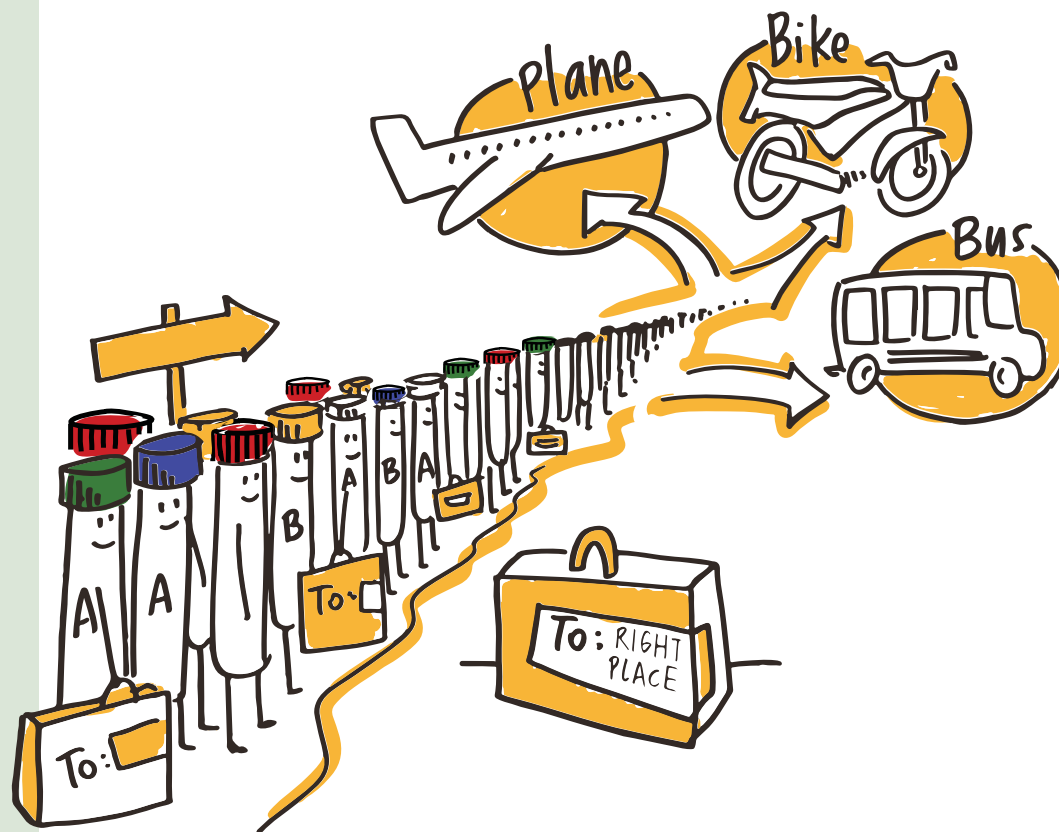
### Transport

- It is the responsibility of the shipper to ensure the correct classification, packaging, labelling, and documentation of all infectious substances destined for transport.
- The efficient transport and transfer of infectious substances requires good coordination between the sender, the carrier and the receiver to ensure that the material is transported safely and arrives on time and in good condition. Such coordination depends upon well-established communications and a good working relationship between the three parties.

Main actors in the infectious substance transport chain are:

- The shipper;
- The carrier;
- The receiver.

Descriptions of their respective responsibilities and duties can be found in the *guidance on regulations for the Transport of Infectious Substances 2017-2018*.



### For more information on the transport of infectious substances:

- Guidance on regulations for the transport of infectious substances 2017–2018, World Health Organization, 2017:  
<http://www.who.int/ihr/publications/WHO-WHE-CPI-2017.8/en/>

## TOOL BOX 5

# Vector control



## *Prevention of Vector-Borne Diseases and control measures against vectors during epidemic situations*

Some epidemic diseases are transmitted by arthropods vectors, such as ticks and insects. To prevent the transmission of these infectious diseases called Vector-Borne Diseases (VBDs), actions can be taken to protect human beings from the vectors and/or to eliminate or reduce vectors population. These actions include **community engagement**, **personal protection** and **vector control operations**.

Recommendations and deployment of the available tools are modulated according to the level of the transmission of the disease, which can range from sporadic to endemic levels and finally to epidemic level. Coordination of the deployment of the different tools at different levels is aided by having a preparedness plan and trained staff.

Countries are recommended to have **national preparedness plans** for the prevention and control of VBDs, as well as a **training program** for staff engaged in vector control activities. Regional coordination is also necessary as most of the VBDs cross borders.

## TOOL BOX 5

Below is a list of epidemic-prone VBDs that are included in the handbook. These are transmitted by different vectors but share the common transmission mode, via **the bite** (in other VBDs such as Chagas disease and Typhus, other transmission modes are found):

- The **Crimean-Congo haemorrhagic fever virus** (CCHFV) is transmitted by **ticks** of the family *Ixodidae*, mainly by *Hyalomma* genus. In the Mediterranean and Middle Asia regions, the most prominent vector is *Hyalomma marginatum*.



- The **Yellow fever** (YFV), **Zika** (ZIKV) and **Chikungunya** (CHIKV) viruses are transmitted by **mosquitoes**, through different cycles from sylvatic (wild), rural, peri-urban and urban, with different vector species according to the cycle. Zoonoses can occur in sylvatic transmission involving various vector species, whereas epidemics are found to occur in rural and urban environments, with the main vector being *Aedes aegypti*, and an emerging secondary vector being *Aedes albopictus*.



- The **Plague** is a bacterial disease transmitted by fleas into wild cycles in which rodents' fleas are playing a major role. For epidemics in domiciliary environments, the rodent's fleas, such as the most known *Xenopsylla cheopis*, are the major vectors. However, the association between the disease caused by *Yersinia pestis* and the fleas species is not very specific, thus many fleas species can act as plague vectors.



These different vectors have different ecologies, behaviors, biting times and transmission cycles. The bionomics of the vectors affects the type of actions taken to prevent and control these diseases. In all situations, there are four key actions:

- Personal protection tools:** Table 1 summarizes the biting behavior of the different vectors and the type of personal protection available.
- Vector control operations** implemented by public and/or private agencies and deployed at the community level. Table 2 summarizes vector control tools available for each vector type.
- Community engagement**, essential for outbreak response.
- Communication** of the different actions, as an essential component for success. Public Health recommendations must take into account social and cultural factors.



## TOOL BOX 5

TABLE 1: Personal protection tools according to the type of vectors

Type of vector (VBDs)	Ticks (CCHFV)	<i>Aedes</i> mosquitoes (YFV, CHIKV, ZIKAV)	Fleas (PLAGUE)
<b>Vectors bionomics</b>			
Natural environment	Forest, wild	Domestic, rural & urban	Domestic, wild
Biting time	Day	Day	All day
Need animal cycle	Yes	No	Yes / No
<b>Personal Protection tools</b>			
Bednet	-	+	-
Repulsive	++	+++	++
Window screen	+	+++	-
Insecticide Sprays	+	+++	++
Electric devices	-	++	-
Elimination of domestic breeding sites	-	+++	+++



The **vector control activities** are deployed at the community level to eliminate the vectors and larvae as much as possible, in order to prevent or control the transmission of VBDs. The operationalization of vector control varies according to the type of vector and transmission intensity.

- Vector control strategies should address all life stages of the *Aedes* mosquito from the egg, to larva and adult.
- Among the control measures, **insecticide applications** are the most frequently used, either on the animal bearing the vectors, such as the ticks and the fleas, or in the breeding places to kill vectors' larvae, and finally, as adulticide-spraying to eliminate adult female mosquitoes.
- Other vector control activities include:
  - **Environmental measures** through sanitation, habitat management and livestock management;
  - **Mechanical measures** with trapping of vectors;
  - **Biological tools** using natural enemies and biological larvicides for mosquitoes;
  - **Other chemicals** such as the use of mimics of natural hormones to stop the insect development;
  - A new generation of vector control products is also arriving with genetically modified organisms (e.g. bacteria *Wolbachia*).



## TOOL BOX 5

TABLE 2: Vector control tools according to the type of vectors

Type of vector (VBDs)	Ticks (CCHFV)	<i>Aedes</i> mosquitoes (YFV, CHIKV, ZIKAV)	Fleas (PLAGUE)
<b>Endemic situation</b>			
Insecticide against larvae	+	+++	+++
Insecticide against adults	+	+	+++
Animal sprayed	Yes	No	Yes
Physical elimination of all breeding sites (public and domestic)	+	+++	+++
Mechanical trapping	+	+	++
Environmental measures	+	++	+++
<b>Epidemic situation</b>			
Insecticide against larvae	+++	+++	+++
Insecticide against adults	+++	+++	+++
Animal sprayed	Yes	No	Yes
Physical elimination of all breeding sites (public and domestic)	+	+++	+++
Mechanical trapping	+	+++	+++
Environmental measures	+	+++	+++

- Vector control tools can be used alone or in combination, through an Integrated Vector Management (IVM) approach (WHO, 2012)<sup>1</sup>. The deployment, efficiency and results of the vector control activities require Monitoring and Evaluation (M&E), but the methods to perform this M&E, both at the level of the vector population, and in terms of disease transmission, are often lacking.
- **Mosquito surveillance** is part of vector control and helps improve timeliness of decisions to control mosquito populations and prevent disease. Both larval and adult vector populations should be targeted for surveillance. Epidemiological and entomological surveillance/indicators should be collected and analyzed in close collaboration. This surveillance will include:
  - Mosquitoes densities and geographical distribution;
  - Contacts with human hosts;
  - Effectiveness of control tools (e.g. susceptibility of resistance to insecticides).



<sup>1</sup> WHO, Handbook for integrated vector Management, 2012 [http://apps.who.int/iris/bitstream/10665/44768/1/9789241502801\\_eng.pdf](http://apps.who.int/iris/bitstream/10665/44768/1/9789241502801_eng.pdf)

## TOOL BOX 5

### Disease-specific approaches based on the vectors' ecology and control options

The *Crimean-Congo haemorrhagic fever virus* (CCHFV) is transmitted by *Hyalomma marginatum* ticks.

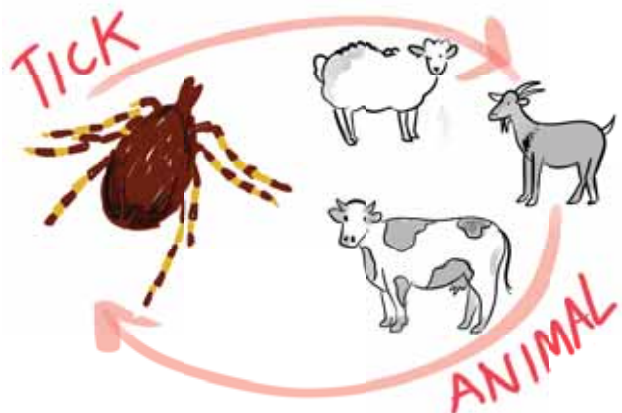
- These ticks blood feed at all stages from the 6-legged larval stage to the adult stage to complete their development and mature their eggs. In addition to being transmission vectors, ticks fulfil the role of **reservoir of CCHFV**.
- The larval stages usually feed on small animals, and the adult stages feed on larger animals such as deer, sheep and cattle. The ticks do not have feeding preference for the host and humans are considered as accidental hosts. The CCHFV circulates into animal populations without causing diseases (except in ostriches) and humans are considered as dead-end hosts.
- In the regions with transmission risks, where animals are infected by the CCHFV, the main objective is to **inform the public** and the local communities how to promote practices that decrease transmission of the disease.
  - Such practices would include preventing contacts with the blood of virus-infected animals (e.g. slaughtering activities), preventing tick bites, and preventing the transmission during care at home or during funerals.



#### Key behavioral interventions

<b>Animal settings</b>	<ul style="list-style-type: none"> <li>• Reduce ticks in the environment and decrease tick infestations on animals or in stables/barns. <i>The tick vectors are numerous and widespread and tick control with acaricides (chemicals intended to kill ticks) is only a realistic option for well-managed livestock production facilities.</i></li> <li>• Implement quarantine for animals before they enter slaughterhouses or routine treatment of ruminants with pesticides 2 weeks prior to slaughter. This activity will decrease the risk for animal to be viraemic during its slaughtering.</li> <li>• Wear personal protective equipment (masks, gloves and gowns) when slaughtering and butchering animals in slaughterhouses or at home. This will prevent skin contact with infected animal tissue or blood.</li> </ul>
<b>Home settings</b>	<ul style="list-style-type: none"> <li>• Wear protective clothing (long leaves, long pants, etc.) and light colored clothing (to allow easy detection of ticks on the clothes).</li> <li>• Avoid of areas where tick vectors are abundant, when they are active (spring to fall).</li> <li>• Regular examination of clothing and skin for ticks.</li> <li>• Use of repellents on the skin (e.g. DEET) and clothing (e.g. permethrin).</li> <li>• Remove ticks safely from the skin.</li> </ul>
<b>Health care settings</b>	<ul style="list-style-type: none"> <li>• Seek early treatment for fever after a history of tick bites or contacts with CCHF patients.</li> <li>• Avoid any direct unprotected contact with blood or body fluids when managing patients.</li> <li>• Wash hands with soap and clean water regularly.</li> <li>• Organise safe and dignified funerals.</li> </ul>

## TOOL BOX 5



- **Current vector control measures are not fully satisfactory:**

- Chemical methods produce resistant ticks, food contamination, and environmental pollution. Furthermore, chemical tick control is only realistic for well-managed and sufficiently resourced livestock production facilities that are rare in most affected countries;
  - Physical methods (e.g. heavy grazing, burning of grasslands) have an important environment negative impact;
  - Biological methods (e.g. use of hormones and growth regulators, use of predators, bacteria, nematodes, and fungi) have not demonstrated full efficacy.
- Vaccination is considered a promising alternative to control tick infestations. An **animal vaccine effective against *Hyalomma* ticks** that prevent the tick-animal-tick cycle would decrease tick population, decrease CCHF prevalence in animals, and therefore decrease human exposure, being a cost effective CCHF prevention measure.
  - The virus cannot be amplified into humans and thus directly transmitted into a human cycle. It needs amplifying hosts (domestic and wild animals) to provide blood meals to support tick populations.

The *Yellow fever* (YFV), *Zika* (ZIKV) and *Chikungunya* (CHIKV) viruses are transmitted at an epidemic level by *mosquitoes* belonging to the species *Aedes aegypti* and *Aedes albopictus*. The *Aedes* mosquitoes also transmit the Dengue virus (DENV).

- Although these viruses can be transmitted by other mosquito vectors species in sylvatic environments and potentially cause zoonoses, only the *Aedes* species are responsible for epidemics as they have adapted to urban settings and can lay eggs in any kind of recipient containing water in and around houses and other human dwellings in urban and scattered rural areas.
- The development of the larvae can be very short, less than a week, and thus the increase of the mosquito population can be exponential if the conditions are favorable (temperatures and water) in the absence of any vector or larvae control.
- It is thus strongly recommended to maintain regular control of these mosquito populations through the physical elimination of all breeding sites, in private and public spaces, and through the use of larvicides in breeding places that cannot be eliminated. The biological larvicide with *Bacillus thuringiensis* var. *israelensis* toxins are recommended because of the lack of resistance and no environmental drawback.





## TOOL BOX 5

- *During an epidemic situation, all tools to protect humans from mosquito bites (Table 1), as well as all available tools to eliminate adult mosquitoes are recommended, with reinforcement of the elimination of breeding sites, use of larvicide and use of adulticide*<sup>2</sup>.
- The efficacy of the products needs to be monitored in advance with tests on resistance and, if necessary, an integrated resistance management plan must be developed.
- The spraying of adulticides must be done on a daily basis until the mosquito populations are cut down under the necessary Breteau Index (BI) (that is the number of positive containers in 100 houses) which should be less than 1<sup>3</sup>.
- **Community engagement** is also a very important component for controlling *Ae. aegypti* and *Ae. albopictus* populations. Through participative actions, such as recommendations for personal protection in the working places and schools, elimination of breeding sites, installation of window screens, and overall surveillance of the environment to make it less favorable for mosquitoes, are some of the major actions that can be taken by communities.
- Vector control against *Ae. aegypti* and *Ae. albopictus*, the main vectors of urban arboviruses have not been reported as efficient as it is required due to many factors (including unplanned urbanization and lack of resources). However, these tools are the only ones available in many situations and will result in controlling the transmission if well applied.

<sup>2</sup> WHO, Pesticide and their application for the control of vectors and pests of public health importance, 2006. [http://apps.who.int/iris/bitstream/10665/69223/1/WHO\\_CDS\\_NTD\\_WHOPES\\_GCDPP\\_2006\\_1\\_eng.pdf](http://apps.who.int/iris/bitstream/10665/69223/1/WHO_CDS_NTD_WHOPES_GCDPP_2006_1_eng.pdf)

<sup>3</sup> Bowman LR, Runge-Ranzinger S and McCall PJ. *Assessing the Relationship between Vector Indices and Dengue Transmission: A Systematic Review of the Evidence*. PLoS Negl Trop Dis. 2014 May; 8(5): e2848. doi: 10.1371/journal.pntd.0002848

**Plague** circulates into mammals, especially rodents, in almost all regions of the world.

- The humans are affected by Plague epidemics according to two main transmission modes. At the beginning of an epidemic, rodents are affected by the disease with fleas as vectors, then the fleas leave the dying rodents and move on to humans. At this stage, the Plague is called bubonic because bubonic abscesses are the main clinical symptoms. With the spread of the bacterial into the lungs, humans can directly transmit the Plague bacteria to other human beings, and the Plague is called pneumonic.
- The fleas are host-specific and animal fleas bit human rather by accident.
- **Sanitation and rat control are the best practices to prevent human Plague. When Plague cases are reported, control measures must first target fleas and secondarily rodents**, because the use of raticide may result in the adverse effect, with fleas leaving the dead rats and moving onto humans.
- Depending on environmental context, **large deployment of insecticide baited traps for rats can be recommended**.
- Environmental measures to repel rat population as well as strong disinsectisation of places where rats are installed can also be applied.
- The **community engagement** is also very important for coordinated rat control activities, management of wastes and domestic environment.





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thank  
you





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