

# ICT<sup>®</sup>

# INFECTION CONTROL T O D A Y<sup>®</sup>

informa  
exhibitions

December 2015 • \$12.00 US

SPECIAL DIGITAL PULSE ISSUE: Emerging Infectious Diseases

EMERGING  
INFECTIOUS  
DISEASES, HOSPITAL  
PATHOGENS REMAIN  
AN ONGOING  
CHALLENGE

C. diff

SARS

DENGUE

CRE

MERS

## 04

### Emerging Infectious Diseases, Hospital Pathogens Remain an Ongoing Challenge

By Kelly Pyrek

05 Infectious Diseases: Unique Foes

06 Preparedness: Lessons from Ebola and H1N1

10 Disease Emergence and Re-emergence

11 Chikungunya

12 Dengue and West Nile Virus

12 Ebola

13 MERS-CoV

14 Zoonotic Diseases and Evolving Threats

16 Hospital Pathogens

16 Acinetobacter

17 CRE

17 C. difficile

18 Prevention and Control

18 Hand hygiene

18 Contact precautions

19 Healthcare personnel education

19 Use of devices

19 Antimicrobial stewardship

20 WHO Issues List of Top Emerging Diseases Likely to Cause Major Epidemics

20 References

22 Contacts

# Change “What Should Be” to “What Is” In Cleaning and Disinfection In The Healthcare Arena

DOWNLOAD CASE STUDY

## STERAMIST™

POWERED BY BINARY IONIZATION TECHNOLOGY

### Two Disinfecting Applications:

- SteraMist™ Surface Unit - Portable, hand-held, point & spray application
- SteraMist™ Environment System - Complete room disinfecting system



### Infection Preventionist Recommended For:

- Consistency
- Versatility
- Efficacy



### Environmental Services

- Quick Room Turnover
- High Precaution
- Contact Isolation Rooms



### Facilities & Risk Management

- Routine Maintenance
- Renovations & Repairs
- Remediation & Disaster Clean Up

### Benefits:

- Effective broad-spectrum surface disinfection
- Economical, non-corrosive, and easy to apply
- Leaves no residues
- Surface Unit: 5 second application, 7 minute contact time\*
- Environment System: configurable for multiple spaces
- Ideal for mishaps, spills, and equipment/material transfer
- Disinfects sensitive equipment and electronics\*\*



### Emergency Preparedness

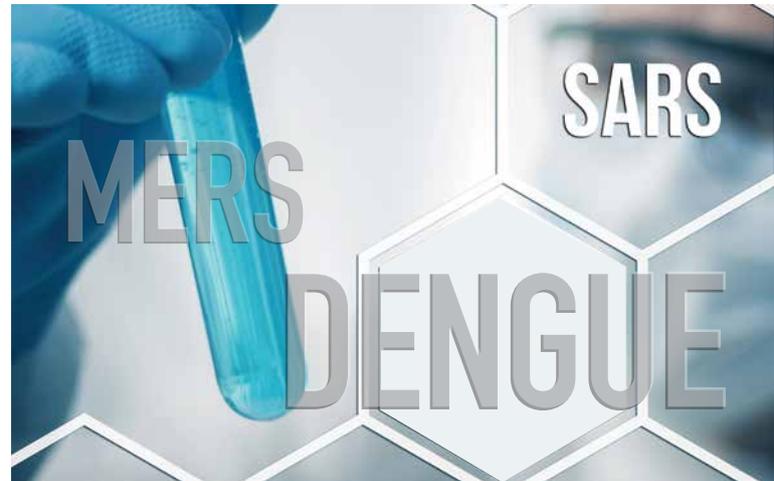
- Public Health Emergency
- Natural Disaster
- Biological Threat

\*Minimum of 5 seconds over a 1 square foot treatment area  
\*\*Disinfects hard pre-cleaned, non-porous surfaces

## DOWNLOAD CASE STUDY

An Infection Preventionist's Review of SteraMist™ BIT™ for Daily Disinfection & Emergency Preparedness

# Emerging Infectious Diseases, Hospital Pathogens Remain an Ongoing Challenge



By Kelly M. Pyrek

Emerging infectious diseases comprise a substantial fraction of all consequential human infections. They have caused the deadliest pandemics in recorded human history, including the Black Death pandemic (bubonic/pneumonic plague; 25 million to 40 million deaths) in the 14th century, the 1918 influenza pandemic (50 million deaths), and the HIV/AIDS pandemic (35 million deaths so far).

In an article published in PLOS Pathogens in July 2013, “Emerging Infectious Diseases: Threats to Human Health and Global Stability,” experts David M. Morens and Anthony S. Fauci allude to mankind’s evolving relationship with microorganisms and that “The inevitable, but unpredictable, appearance of new infectious diseases has been recognized for millennia, well before the discovery of causative infectious agents. Today, however, despite extraordinary advances in development of countermeasures

(diagnostics, therapeutics, and vaccines), the ease of world travel and increased global interdependence have added layers of complexity to containing these infectious diseases that affect not only the health but the economic stability of societies. HIV/AIDS, severe acute respiratory syndrome (SARS), and the most recent 2009 pandemic H1N1 influenza are only a few of many examples of emerging infectious diseases in the modern world; each of these diseases has caused global societal and economic impact related to unexpected illnesses and deaths, as well as interference with travel, business, and many normal life activities. Other emerging infections are less catastrophic than these examples; however, they nonetheless may take a significant human toll as well as cause public fear, economic loss, and other adverse outcomes.”



The inevitable, but unpredictable, appearance of **new infectious diseases** has been recognized for millennia, well before the discovery of causative infectious agents.

## Infectious Diseases: Unique Foes

Fauci and Morens (2012) acknowledge the uniqueness of infectious diseases, noting, “Paramount among these characteristics is their unpredictability and their potential for explosive global effect, as exemplified by the bubonic/pneumonic plague pandemic in the 14th century, the 1918 influenza pandemic, and the current pandemic of human immunodeficiency virus (HIV) infection and the acquired immunodeficiency syndrome (AIDS), among others. Infectious diseases are usually acute and unambiguous in their nature. The onset of an infectious illness, unlike the onset of many other types of disease, in an otherwise healthy host can be abrupt and unmistakable. Moreover, in the absence of therapy, acute infectious diseases often pose an all-or-nothing situation, with the host either quickly dying or recovering spontaneously, and usually relatively promptly, often with lifelong immunity to the specific infecting pathogen. Not only are some infectious diseases transmissible to others, a unique characteristic among human diseases, but their transmission mechanisms are relatively few (including inoculation and airborne and waterborne transmission), well understood, and comparatively easy to study, both experimentally and in the field. In addition, such transmission is generally amenable to medical and public health interventions. Unlike many chronic and lifestyle-associated diseases resulting from multiple, interacting risk cofactors, most infectious diseases are caused by a single agent, the identification of which typically points the way not only to general disease-control measures (e.g., sanitation, chemical disinfection, handwashing or vector control) but also to specific medical measures (e.g., vaccination or antimicrobial treatment).

The characteristics of infectious diseases that set them apart from other human diseases include:

- ◆ Potential for unpredictable and explosive global impact
- ◆ Frequent acquisition by host of durable immunity against re-infection after recovery
- ◆ Transmissibility
- ◆ Potential for becoming preventable
- ◆ Potential for eradication
- ◆ Evolutionary advantage over human host because of replicative and mutational capacities of pathogens that render them highly adaptable
- ◆ Close dependence on the nature and complexity of human behavior
- ◆ Frequent derivation from or co-evolution in other animal species
- ◆ Possibility of treatment for having multiplying effects on preventing infection in contacts and the community, and on microbial and animal ecosystems

As Fauci and Morens (2012) explain further, “Infectious diseases are closely dependent on the nature and complexity of human behavior, since they directly reflect who we are, what we do, and how we live and interact with other people, animals, and the environment. Infectious diseases are acquired specifically and directly as a result of our behaviors and lifestyles, from social gatherings, to travel and transportation, to sexual activity, to occupational exposures, to sports and recreational activities, to what we eat and drink, to our pets, to the environment — even to the way we care for the ill in healthcare environments. Moreover, microbial colonizing infections that lead to long-term carriage without disease (e.g., within the endogenous human microbiome) may influence the development of infections with exogenous microbes and also have an effect on general immunologic and physiologic

homeostasis, including effects on nutritional status. Human microbiomes seem to reflect, and may even have helped to drive, human evolution. In this struggle, infectious diseases are intimately and uniquely related to us through our immune systems. The human immune system, including the primitive innate system and the specific adaptive system, has evolved from both invertebrate and vertebrate organisms, developing sophisticated defense mechanisms to protect the host from microbes. In effect, the human immune system evolved as a response to the challenge of invading pathogens. Thus, it is not by accident that the fields of microbiology and immunology arose and developed in close association long before they came to be considered distinct disciplines.”

### **Preparedness: Lessons from Ebola and H1N1**

A number of experts in the infection prevention and healthcare epidemiology community cited Ebola and other emerging pathogens as a significant ongoing concern for 2016.

“Global threats will still be an issue, along with continued domestic threats,” says Linda R. Greene, RN, MPS, CIC, manager of infection prevention at Highland Hospital in Rochester, N.Y. and an Association for Professionals in Infection Control and Epidemiology (APIC) board member. “We learned many things from the MERS outbreak and the Ebola outbreak, including the importance of having our ears to the ground and applying lessons learned from Ebola to other issues and pathogens.”

Louise-Marie Dembry, MD, MS, MBA, president-elect of the Society for Healthcare Epidemiology of America (SHEA), concurs, noting, “Many lessons came out of SARs and Ebola but we forget those lessons when those outbreaks go away, issues like PPE and what really do healthcare personnel need in order to be safe. How do we determine that? How do we make it such that they can do their work in this PPE and do it safely? I think we are learning a lot about that through Ebola but I don’t think it is a question that has been completely answered. There will be other infections of high concern, and we never know when the next one will come along.”

These concerns are borne out by the results of a survey of infection preventionists conducted late last year by APIC which delivered both good and bad news about U.S. institutions’ state of readiness. The survey found that healthcare facilities are more prepared to confront Ebola compared to last year, with 9 out of 10 infection control leaders (92 percent) reporting that their facilities are better prepared today than a year ago to receive a patient with a highly lethal infectious disease such as Ebola, but more than half (55 percent) say their facilities have not provided additional resources to support their infection prevention and control programs as a result of the Ebola crisis.

The survey polled APIC members to determine their ongoing needs a year after the first Ebola patient was admitted to a U.S. hospital. Respondents included 981



Infectious diseases are acquired specifically and directly as a result of our behaviors and lifestyles, from social gatherings, to travel and transportation, to sexual activity, to occupational exposures, to sports and recreational activities, to what we eat and drink, to our pets, to the environment — even to the way we care for the ill in healthcare environments.

U.S.-based IPs working in acute-care hospitals. Half of respondents (53 percent) reported that there is fewer than one or just one full-time infection preventionist at their organization. Of these, 45 percent work in facilities with more than 100 beds. As a result of the Ebola crisis, 10 percent of respondents received additional personnel from their facilities, and a third (37 percent) received support for staff training programs on infection control protocols.

“We are encouraged to learn that our members feel their facilities are more prepared to handle patients with highly lethal infectious diseases, and to know that some infection prevention and control departments have obtained additional staff and resources,” says Susan Dolan, RN, MS, CIC, president-elect of APIC and hospital epidemiologist at Children’s Hospital Colorado. “But with the ongoing threat of emerging infectious diseases and antibiotic-resistant organisms, we remain concerned that many facilities are lagging behind in providing adequate support to protect patients and healthcare workers. We urge healthcare leaders to assess the needs of their infection prevention programs and dedicate the necessary staff, training, and technology resources to this critical area.”

Dolan adds, “Compared to last year, most of the IPs told us their facilities were more prepared this year, however, when you actually look at the question of how prepared they are, the majority felt they weren’t well prepared. I think Ebola raised awareness of the need to be prepared, and some IPs did actually receive additional resources — at least that’s a start. The majority did not receive additional resources and that’s an opportunity for healthcare leaders and administrators to reach out to their IPs and see what is needed in their institution’s infection prevention and control program in terms of resources. They need to assess staffing, training and PPE needs with the IPC team. I was struck by the data that showed that 1 in 4 IPs felt they did not have enough PPE in their facility to meet the CDC guidelines for Ebola care. If you are trying to impact patient safety and you don’t have the PPE you need, how do you develop staff trust about having adequate protection?”

Dolan emphasizes that the survey shined a spotlight on the resources that are needed to maintain institutional preparedness, adding that healthcare professionals have valuable take-away lessons from the H1N1 pandemic and the Ebola outbreak. “During both events there was a big burst of energy and a lot of activity, but we have to stop and reflect on what these events taught us — not only do we need to be prepared for future threats, but we have to use it as a great opportunity to return to the basics of how to put on and take off your PPE and how to perform adequate travel and symptom screening with each patient encounter,” she says. “HAI prevention is an everyday priority, so I think we need to utilize those moments to really ingrain in staff the infection control priorities. We need to develop and maintain a system not just for initial training of new employees, but for ongoing training of existing personnel because these are skill sets that can be used every single day.”

Training was a priority identified by IPs in the survey, with almost two-thirds of respondents (62 percent) reporting that they are continuing to educate and train staff on the management of patients with Ebola. But without resources, that readiness will erode.

“One of the things the survey did show was the number of IPs that could not continue to do ongoing training for PPE,” Dolan says. “That’s concerning — if you can’t maintain the training, then



We urge healthcare leaders to assess the needs of their infection prevention programs and dedicate the necessary staff, training, and technology resources to this critical area.

you are not going to be in a ready state when the next event occurs, or you won't consistently be using the processes needed on a daily basis to fight HAIs."

Dolan adds, "IPs can use the survey data to show members of their institution's C-suite that they are still not where they need to be in terms of resources that are necessary in order to not only implement day-to-day HAI prevention efforts but to be in a ready state to deal with future serious emerging threats."

"Though progress has been made toward addressing unanticipated, deadly threats like Ebola, there is still more to do to address infection prevention programs overall," says Katrina Crist, MBA, CAE, chief executive officer of APIC. "We can't wait for the next crisis to get ready. APIC recently undertook a 'mega survey' of the infection preventionist profession and looks forward to sharing key data in 2016 to better inform the dialogue about infection prevention staffing and resource levels."

Dolan concurs. "The mega survey should highlight these issues for us and inform the industry on what exactly an IPC program needs and will be a perfect complement when an IP approaches his or her C-suite to present a business case for future program plans and additional resources. Infrastructure is critical as we face both continued emerging threats and current day-to-day HAI prevention and research efforts.

According to the Ebola survey, 34 percent of respondents say their facilities have made a commitment to providing additional infection prevention and control resources as a result of the Ebola crisis, while 55 percent say their institutions have not and 11 percent were unsure. For those who did secure a commitment, assistance came in the form of additional personnel, additional resources to train healthcare workers to prepare for potential Ebola patients and others with highly lethal infectious diseases, as well as technology and equipment (such as infection surveillance, tracking, and monitoring technology to ease the surveillance burden).

Dolan points to the survey data on the low number of IPs per facility versus the number of beds in the institution, and how it can impact surveillance and readiness. "When you see that there was just one IP in a facility with more than 100 beds, you immediately think of the usual IP work-load, the regulatory requirements involved with surveillance and required reporting, and then these emerging threats on top of it. Many IPs don't have enough time to be out on the front lines, observing and educating personnel, assessing for areas that are not in compliance, sharing best practices, and looking for gaps where an organization could maybe drive the data that is still lacking. There are multiple things that IPs need to be doing and then we put Ebola or the next emerging threat on top of it, and you can see how this important work can be negatively impacted. We need to have staff maintaining competency in the basics of PPE and develop process for assessing those competencies regularly. Developing program consistency and stability is essential to ensure future infection prevention program reliability, as we cannot always accurately predict when the next event will arrive and we need staff to be prepared."



According to the Ebola survey, 34% of respondents say their facilities have made a commitment to providing additional infection prevention and control resources as a result of the Ebola crisis, while 55% say their institutions have not and 11% were unsure.

The United States has sufficient capacity for treating another outbreak of the Ebola virus, but financial, staffing and resource challenges remain a hurdle for many hospitals and health systems attempting to maintain dedicated treatment centers for highly infectious diseases, according to study released Dec. 9, 2015. The research was published online in *Infection Control & Hospital Epidemiology*.

“In the past year, the United States saw an intense effort across the country to rapidly expand the capacity for high-level isolation patient care,” says John Lowe, PhD, a lead author of the study. “Our study shows an unprecedented increase in the number of high-level isolation beds across the country and found a variety of approaches to achieving this capability.”

Following the 2014 U.S. outbreak, which killed one patient and sickened two healthcare workers, the Centers for Disease Control and Prevention (CDC) designated 55 sites to treat Ebola Virus Disease, including nine regional centers in major metropolitan areas, with total capacity of approximately 120 beds. Prior to this, the vast majority of hospitals were inadequately prepared to care for patients with suspected or confirmed Ebola. Under the direction of CDC, sites have expanded their capabilities, yet remain ‘limited’ in overall capacity. The study recommends further investigation of whether the U.S. has dedicated sufficient resources, proper staffing and training to manage a potential outbreak.

Researchers from the University of Nebraska Medical Center, Harvard Medical School, Emory University, New York-Presbyterian Hospital and Indiana University School of Public Health surveyed the capabilities and capacity of all the designated Ebola treatment centers and received responses from 47 (85 percent). The researchers found that while the development of the centers heightened nationwide preparedness levels, challenges remained in providing the necessary treatment, and often strained an institution’s capacity, especially in key areas such as waste disposal, staffing and pediatric care:

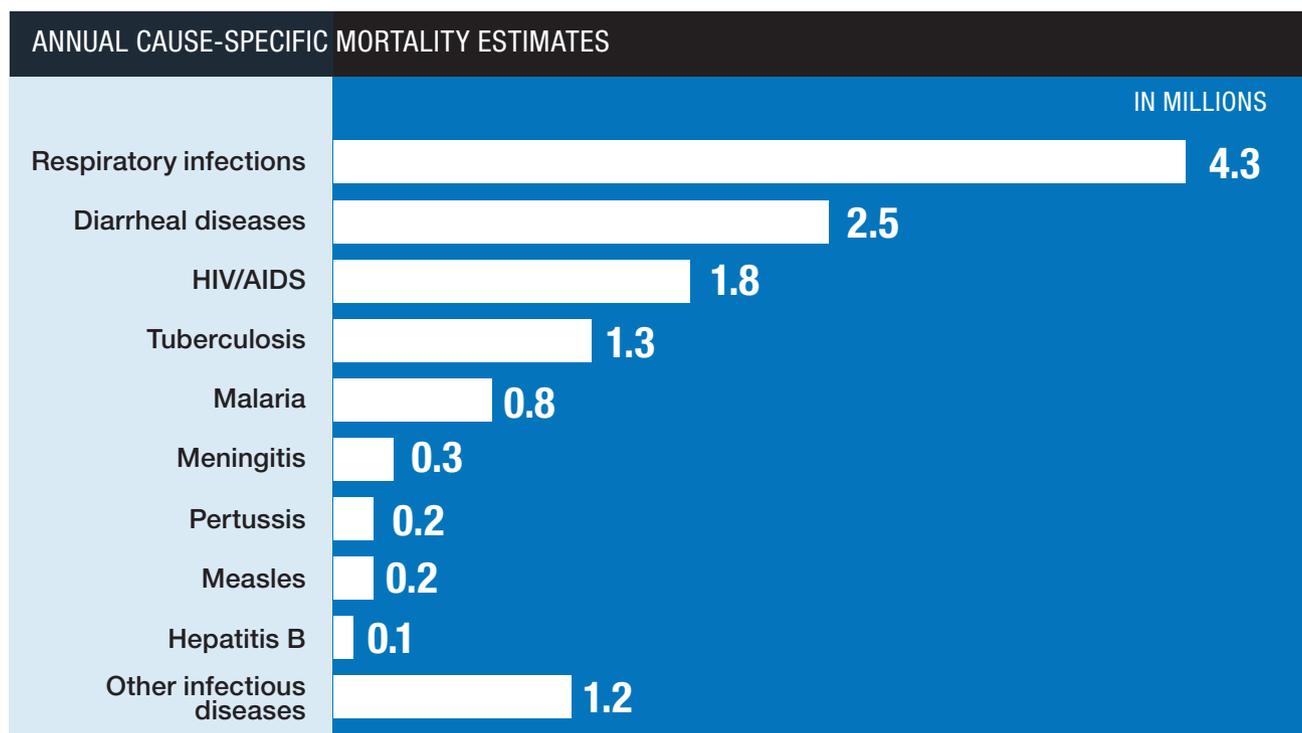
- ◆ **Waste disposal:** Responses highlight the extremely high cost of disposing of large quantities of highly infectious waste that is generated by even a single Ebola patient. The costs associated with the installation of proper onsite waste disposal equipment, including incinerators, is approximately \$100,000 and only 11 institutions reported having this capability; the remaining centers must transport the waste for disposal offsite and would have to spend millions of dollars to do so, while also increasing the risk of exposure of the pathogen to staff during the packaging and transportation process.
- ◆ **Staffing:** Large numbers of staff are needed to care for an individual patient due to the intensity of treatment, the extended need for personal protective equipment, and the necessity to limit work shifts in the patient room to 2-4 hours to combat physical and mental fatigue. Because staff participation in Ebola treatment centers is voluntary, scheduling and back-fill issues become complicated, as does the question of how to sustain a fully-trained team when a treatment unit is unoccupied.
- ◆ **Patient populations:** To date, no pediatric patients with Ebola have been treated in the U.S. Because of this, not much is known on the level of resources and staffing that would be needed. Additionally, survey responses show the majority of centers have much more capacity to handle adult patients and do not plan care for pediatric patients, highlighting the need to distinguish capacity for each population.

“We have strengthened our nation’s ability to properly contain a highly unlikely outbreak of Ebola. However, the ability to treat outbreaks of other infectious viruses which are airborne, such as Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS) would be challenging,” says Lowe.

Nearly all off the centers surveyed have also volunteered to participate in a U.S. Highly Infectious Disease Network to continue to advance this field through peer review and consensus efforts to further develop the national capacity for high-level isolation care.

## Disease Emergence and Re-emergence

The impact of infectious disease on morbidity and mortality is not insignificant. Of an estimated 58.8 million annual deaths worldwide, approximately 15 million (25.5 percent) are believed by experts to be caused by infectious diseases. The following is an example of the annual cause-specific mortality estimates from the World Health Organization (WHO):



As Fauci and Morens (2012) observe, “Because infectious pathogens are evolutionarily dynamic, the list of diseases they cause is ever-changing and continually growing. Since newly emerging infectious agents do not arise spontaneously, they must recently have come from somewhere else, usually from animal infections, as occurred with HIV infection, influenza, and the severe acute respiratory syndrome. This interspecies transmission underscores the importance of interdigitating the study of human and animal diseases and recognizing the central role that microbial reservoirs, including those in animals, vectors, and the environment, play in human infectious diseases. Preexisting or established infectious diseases also may reemerge in different forms, as in extensively drug-resistant tuberculosis, or in different locations, as in West Nile virus infection in the United States, to cause new

epidemics. Indeed, many human infectious diseases seem to have patterns of evolution, sometimes played out over thousands of years, in which they first emerge and cause epidemics or pandemics, become unstably adapted to human populations, undergo periodic resurgences, and eventually become endemic with the potential for future outbreaks.

Let's take a look at some of the infectious diseases that have emerged and/or re-emerged in the last few years.

### Chikungunya

Chikungunya is a viral disease transmitted to humans by infected mosquitoes. It causes fever and severe joint pain as well as muscle pain, headache, nausea, fatigue and rash. It is an RNA virus that belongs to the alphavirus genus of the family *Togaviridae*. The name "chikungunya" derives from a word in the Kimakonde language, meaning "to become contorted," and describes the stooped appearance of sufferers with joint pain (arthralgia). Chikungunya has been identified in more than 60 countries in Asia, Africa, Europe and the Americas. The virus is transmitted from human to human by the bites of infected female mosquitoes. Most commonly, the mosquitoes involved are *Aedes aegypti* and *Aedes albopictus*, two species which can also transmit other mosquito-borne viruses, including dengue. These mosquitoes can be found biting throughout daylight hours, though there may be peaks of activity in the early morning and late afternoon. Both species are found biting outdoors, but *Ae. aegypti* will also readily feed indoors. There is no specific antiviral drug treatment for chikungunya. Treatment is directed primarily at relieving the symptoms, including the joint pain using anti-pyretics, optimal analgesics and fluids. There is no commercial chikungunya vaccine.

As of April 2015, more than 1.3 million suspected cases of Chikungunya have been recorded in the Caribbean islands, Latin American countries, and the United States, according to the World Health Organization (WHO). One hundred ninety-one deaths have also been attributed to this disease during the same period. Canada, Mexico and the U.S. have also recorded imported cases.

As the CDC notes in the guidance Preparedness and Response for Chikungunya Virus Introduction in the Americas (2011), "Traditionally, Chikungunya epidemics have shown cyclical trends, with inter-epidemic periods ranging from 4 to 30 years. Since 2004, CHIKV has expanded its geographical range, causing sustained epidemics of unprecedented magnitude in Asia and Africa. Although areas in Asia and Africa are considered to be endemic for the disease, the virus produced outbreaks in many new territories in the Indian Ocean islands and in Italy. This recent reemergence of Chikungunya has heightened the world's public health awareness and concern about this virus."



- The virus is transmitted from human to human by the bites of infected female mosquitoes.
- Most commonly, the mosquitoes involved are *Aedes aegypti* and *Aedes albopictus*, two species which can also transmit other mosquito-borne viruses, including dengue.
- There is no specific antiviral drug treatment for chikungunya.
- As of April 2015, more than 1.3 million suspected cases of Chikungunya have been recorded in the Caribbean islands, Latin American countries, and the United States.
- One hundred ninety-one deaths have also been attributed to this disease during the same period.
- Since 2004, CHIKV has expanded its geographical range, causing sustained epidemics of unprecedented magnitude in Asia and Africa.

## Dengue and West Nile Virus

Dengue fever is a disease caused by any one of four closely related dengue viruses (DENV 1, DENV 2, DENV 3, or DENV 4). The viruses are transmitted to humans by the bite of an infected mosquito. In the Western Hemisphere, the *Aedes aegypti* mosquito is the most important transmitter or vector of dengue viruses, although a 2001 outbreak in Hawaii was transmitted by *Aedes albopictus*. It is estimated that there are more than 100 million cases of dengue worldwide each year. Today about 2.5 billion people, or 40 percent of the world's population, live in areas where there is a risk of dengue transmission, according to the WHO. Dengue is endemic in at least 100 countries in Asia, the Pacific, the Americas, Africa, and the Caribbean. WHO estimates that 50 million to 100 million infections occur annually. Nearly all dengue cases reported in the 48 continental states were acquired elsewhere by travelers or immigrants. Because contact between *Aedes* and people is infrequent in the continental U.S., these imported cases rarely result in secondary transmission.

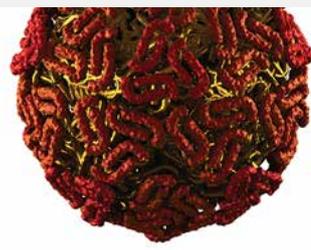
West Nile virus is an arthropod-borne virus (arbovirus) most commonly spread by infected mosquitoes. West Nile virus can cause febrile illness, encephalitis or meningitis. West Nile virus transmission has been documented in Europe and the Middle East, Africa, India, parts of Asia, and Australia. It was first detected in North America in 1999, and has since spread across the continental United States and Canada. In 2012, the CDC received reports of 5,780 cases of nationally notifiable arboviral diseases, including those caused by WNV (5,674 cases).

As the CDC (2011) explains, "Controlling the spread of arthropod-borne viruses (arboviruses) in the Americas has not been very successful. Dengue continues to ravage many areas in the Americas, reaching as far north as the United States and as far south as Argentina. During the first trimester of 2010, several dengue virus outbreaks in the Region occurred at unprecedented rates for this time of the year, especially in Central America and the Caribbean. West Nile virus, another arbovirus recently introduced to the Americas, is now endemic in the Region."

## Ebola

Ebola virus disease (EVD), formerly known as Ebola hemorrhagic fever, is a severe, often fatal illness in humans. The virus is transmitted to people from wild animals and spreads in the human population through human-to-human transmission. The average EVD case fatality rate is around 50 percent. Case fatality rates have varied from 25 percent to 90 percent in past outbreaks.

The first EVD outbreaks occurred in remote villages in Central Africa, near tropical rainforests, but the most recent outbreak in West Africa has involved major urban as well as rural areas. Community engagement is key to successfully controlling outbreaks. Good outbreak control relies on applying



- Dengue fever is a disease caused by any one of four closely related dengue viruses (DENV 1, DENV 2, DENV 3, or DENV 4).
- In the Western Hemisphere, the *Aedes aegypti* mosquito is the most important transmitter or vector of dengue viruses, although a 2001 outbreak in Hawaii was transmitted by *Aedes albopictus*.
- WHO estimates that 50 million to 100 million infections occur annually.
- West Nile virus is an arthropod-borne virus (arbovirus) most commonly spread by infected mosquitoes.
- West Nile virus transmission has been documented in Europe and the Middle East, Africa, India, parts of Asia, and Australia.

a package of interventions, namely case management, surveillance and contact tracing, a good laboratory service, safe burials and social mobilization. Early supportive care with rehydration, symptomatic treatment improves survival. There is as yet no licensed treatment proven to neutralize the virus but a range of blood, immunological and drug therapies are under development. There are currently no licensed Ebola vaccines but two potential candidates are undergoing evaluation.

Worldwide, there have been 28,637 cases of Ebola virus disease and 11,315 deaths as of late November 2015, according to WHO.

### MERS-CoV

Coronaviruses are a large family of viruses that cause illness in humans and animals. In people, coronaviruses can cause illnesses ranging in severity from the common cold to Severe Acute Respiratory Syndrome (SARS). The novel coronavirus, first detected in April 2012, is a new virus that has not been seen in humans before. In most cases, it has caused severe disease. Death has occurred in about half of cases. This coronavirus is known as Middle East respiratory syndrome coronavirus (MERS-CoV). It was named by the Coronavirus Study Group of the International Committee on Taxonomy of Viruses in May 2013. Middle East respiratory syndrome (MERS) is a viral respiratory disease caused by a novel coronavirus (MERS-CoV). Typical MERS symptoms include fever, cough and shortness of breath. Pneumonia is common, but not always present. Gastrointestinal symptoms, including diarrhoea, have also been reported. Approximately 36 percent of reported patients with MERS have died. Although the majority of human cases of MERS have been attributed to human-to-human infections, camels are likely to be a major reservoir host for MERS-CoV and an animal source of MERS infection in humans. However, the exact role of camels in transmission of the virus and the exact route(s) of transmission are unknown. The virus does not seem to pass easily from person to person unless there is close contact, such as occurs when providing unprotected care to a patient.

Globally, as of mid-December 2015, the World Health Organization (WHO) has been notified of 1,621 laboratory-confirmed cases of infection with MERS-CoV, with 584 deaths related to MERS-CoV since September 2012, and 26 countries reporting cases of MERS-CoV.

As preventive measures have become more effective and efficient, history has shown that certain infectious diseases, particularly those with a broad global health impact and for which there is no nonhuman host or major reservoir, can be eliminated, according to Fauci and Morens (2012). Such diseases include poliomyelitis, which has been eliminated in the Western Hemisphere, and smallpox, which has been eliminated globally.



■ Ebola virus disease (EVD), formerly known as Ebola hemorrhagic fever, is a severe, often fatal illness in humans.

■ The virus is transmitted to people from wild animals and spreads in the human population through human-to-human transmission.

■ There is as yet no licensed treatment proven to neutralize the virus but a range of blood, immunological and drug therapies are under development.



■ In people, coronaviruses can cause illnesses ranging in severity from the common cold to Severe Acute Respiratory Syndrome (SARS).

■ The novel coronavirus, first detected in April 2012, is a new virus that has not been seen in humans before.

■ Middle East respiratory syndrome (MERS) is a viral respiratory disease caused by a novel coronavirus (MERS-CoV).

■ The virus does not seem to pass easily from person to person unless there is close contact, such as occurs when providing unprotected care to a patient.

## Zoonotic Diseases and Evolving Threats

Morens and Fauci (2013) note that 60 percent to 80 percent of new human infections likely originated in animals, disproportionately rodents and bats, as shown by the examples of hantavirus pulmonary syndrome, Lassa fever, and Nipah virus encephalitis. Most other emerging/reemerging diseases result from human-adapted infectious agents that genetically acquire heightened transmission and/or pathogenic characteristics. Examples of such diseases include multidrug-resistant and extensively drug-resistant (MDR and XDR) tuberculosis, toxin-producing *Staphylococcus aureus* causing toxic shock syndrome, and pandemic influenza.

As Morens and Fauci (2013) explain, “Two major categories of emerging infections—newly emerging and reemerging infectious diseases—can be defined, respectively, as diseases that are recognized in the human host for the first time; and diseases that historically have infected humans, but continue to appear in new locations or in drug-resistant forms, or that reappear after apparent control or elimination.

Emerging/reemerging infections may exhibit successive stages of emergence. These stages include adaptation to a new host, an epidemic/pathogenic stage, an endemic stage, and a fully adapted stage in which the organism may become nonpathogenic and potentially even beneficial to the new host (e.g., the human gut microbiome) or stably integrated into the host genome (e.g., as endogenous retroviruses). Although these successive stages characterize the evolution of certain microbial agents more than others, they nevertheless can provide a useful framework for understanding many of the dynamic relationships between microorganisms, human hosts, and the environment. It is also worth noting that the dynamic and complicated nature of many emerging infections often leaves distinctions between emerging and reemerging infections open to question, leading various experts to classify them differently. For example, we describe as “reemerging” new or more severe diseases associated with acquisition of new genes by an existing microbe, e.g., antibiotic resistance genes, even when mutations cause entirely new diseases with unique clinical epidemiologic features. Similarly, we refer to SARS as an emerging disease a decade after it disappeared, and apply the same term to the related Middle East Respiratory Syndrome coronavirus which appeared in Saudi Arabia in late 2012.”

The most obvious example of an emerging infectious disease is HIV/AIDS, which likely emerged a century ago after multiple independent events in which the virus jumped from one primate host to another (chimpanzees to humans) and subsequently, as a result of a complex array of social and demographic factors, spread readily within the human population. AIDS was not recognized until 1981 after its initial detection among certain risk groups, such as men who have sex with men, recipients of blood products, and injection drug users. It was soon apparent, however, that the disease was not restricted to these groups, and indeed, the bulk of HIV infections globally has resulted from heterosexual transmission that has been heavily weighted within the developing world.



Morens and Fauci (2013) note that 60% to 80% of new human infections likely originated in animals, disproportionately rodents and bats, as shown by the examples of hantavirus pulmonary syndrome, Lassa fever, and Nipah virus encephalitis.

According to Morens and Fauci (2013), other examples of disease emergences include “SARS, which emerged from bats and spread into humans first by person-to-person transmission in confined spaces, then within hospitals, and finally by human movement between international air hubs. Nipah virus also emerged from bats and caused an epizootic in herds of intensively bred pigs, which in turn served as the animal reservoir from which the virus was passed on to humans. The 2009 H1N1 pandemic influenza virus emerged from pigs as well, but only after complex exchanges of human, swine, and avian influenza genes. H5N1 influenza emerged from wild birds to cause epizootics that amplified virus transmission in domestic poultry, precipitating dead-end viral transmission to poultry-exposed humans.”

Other emerging infections maintain the attention of clinicians worldwide. As Morens and Fauci (2013), explain, “Emergences of disease caused by community- and hospital-acquired *Clostridium difficile* and methicillin-resistant *Staphylococcus aureus* (MRSA) have been driven by increased and/or inappropriate use of antibiotics, and some hospital-acquired organisms such as MRSA have now moved into community transmission. The global emergence of plasmid-spread NDM-1 (New Delhi  $\beta$ -lactamase) Gram-negative pan-resistant organisms, linked to global antibiotic use and inadequate antibiotic stewardship, medical tourism, economic globalization, and other aspects of modern life, has prompted calls for development of international control mechanisms that are applicable to a number of emerging bacterial diseases in the developing and developed world. Drug resistance mutations have also caused the re-emergences of certain pathogens such as multidrug-resistant and extensively drug-resistant tuberculosis, drug-resistant malaria, and numerous bacterial diseases such as vancomycin-resistant enterococci.”

Fauci and Morens (2012) say that although antimicrobial resistance is a significant threat for the future, it is important to note the progress made in fighting infectious diseases: “Almost all the major advances in understanding and controlling infectious diseases have occurred during the past two centuries, and momentous successes continue to accrue. These breakthroughs in the prevention, treatment, control, elimination, and potential eradication of infectious diseases are among the most important advances in the history of medicine. Nevertheless, because of the evolutionary capacity of infectious pathogens to adapt to new ecologic niches created by human endeavor, as well as to pressures directed at their elimination, we will always confront new or reemerging infectious threats. Our successes in meeting these threats have come not just from isolated scientific triumphs but also from broad approaches that complement the battle against infectious diseases on many different fronts, including constant surveillance of the microbial landscape, clinical and public health efforts, and efficient translation of new discoveries into disease-control applications. These efforts are driven by the necessity of



Emergences of disease caused by community- and hospital-acquired *Clostridium difficile* and methicillin-resistant *Staphylococcus aureus* (MRSA) have been driven by increased and/or inappropriate use of antibiotics, and some hospital-acquired organisms such as MRSA have now moved into community transmission.

expecting the unexpected and being prepared to respond when the unexpected occurs. It is a battle that has been well fought for more than two centuries but that will almost certainly still be raging, in now-unimagined forms, two centuries from now. The challenges are truly perpetual. Our response to these challenges must be perpetual as well."

In an essay a year after writing those words, Morens and Fauci (2013) add, «We have many tools in our armamentarium, including preparedness plans and stockpiles of drugs and vaccines. But each new disease brings unique challenges, forcing us to continually adapt to ever-shifting threats. The battle against emerging infectious diseases is a continual process; winning does not mean stamping out every last disease, but rather getting out ahead of the next one.»

## Hospital Pathogens

Vigilance related to hospital pathogens cannot wane because attention is being maintained on these emerging infectious threats. Much work remains to be done to combat healthcare-associated infections (HAIs). Let's take a look at a few serious organisms that cause significant concern.

### Acinetobacter

Acinetobacter is a group of bacteria commonly found in soil and water. While there are many species of Acinetobacter and all can cause human disease, Acinetobacter baumannii accounts for about 80 percent of reported infections. Outbreaks of Acinetobacter infections typically occur in intensive care units and healthcare settings housing very ill patients. Acinetobacter infections rarely occur outside of healthcare settings. Acinetobacter causes a variety of diseases, ranging from pneumonia to serious blood or wound infections, and the symptoms vary depending on the disease. Acinetobacter may also colonize a patient without causing infection or symptoms, especially in tracheostomy sites or open wounds. Acinetobacter poses very little risk to healthy people; however, people who have weakened immune systems, chronic lung disease, or diabetes may be more susceptible to infections with Acinetobacter. Hospitalized patients, especially very ill patients on a ventilator, those with a prolonged hospital stay, those who have open wounds, or any person with invasive devices like urinary catheters are also at greater risk for Acinetobacter infection. Acinetobacter can be spread to susceptible persons by person-to-person contact or contact with contaminated surfaces. Acinetobacter can live on the skin and may survive in the environment for several days. Careful attention to infection control procedures, such as hand hygiene and environmental cleaning, can reduce the risk of transmission.



- Acinetobacter is a group of bacteria commonly found in soil and water.
- Outbreaks of Acinetobacter infections typically occur in intensive care units and healthcare settings housing very ill patients.
- Acinetobacter can be spread to susceptible persons by person-to-person contact or contact with contaminated surfaces.
- Acinetobacter can live on the skin and may survive in the environment for several days
- Careful attention to infection control procedures, such as hand hygiene and environmental cleaning, can reduce the risk of transmission.

## CRE

Carbapenem-resistant Enterobacteriaceae (CRE) are a family of pathogens that are difficult to treat because they have high levels of resistance to antibiotics. *Klebsiella* species and *Escherichia coli* (*E. coli*) are examples of Enterobacteriaceae, a normal part of the human gut bacteria, that can become carbapenem-resistant. Types of CRE are sometimes known as KPC (*Klebsiella pneumoniae* carbapenemase) and NDM (New Delhi Metallo-beta-lactamase). KPC and NDM are enzymes that break down carbapenems and make them ineffective. Both of these enzymes, as well as the enzyme VIM (Verona Integron-Mediated Metallo- $\beta$ -lactamase) have also been reported in *Pseudomonas*. CRE can cause infections in almost any part of the body including bloodstream infections, ventilator-associated pneumonia, and intra-abdominal abscesses. Based on information from a CDC pilot surveillance system most CRE infections involve the urinary tract, often in people who have a urinary catheter or have urinary retention. It is important to note that CRE kill up to half of patients who get bloodstream infections from them. In healthcare settings, CRE are usually transmitted from person to person often via the hands of healthcare personnel or via contaminated medical equipment. As Enterobacteriaceae can commonly be found in stool or wounds, contact with these might be particularly concerning. Ensuring the use of personal protective equipment during and good hand hygiene following exposure to the patient's immediate environment, especially when cleaning up stool or changing wound dressings, is very important. The role of transmission directly from the environment to patients is controversial and requires further investigation.

## *C. difficile*

*Clostridium difficile* is a spore-forming, Gram-positive anaerobic bacillus that produces two exotoxins: toxin A and toxin B. It is a common cause of antibiotic-associated diarrhea (AAD). It accounts for 15 percent to 25 percent of all episodes of AAD. *C. difficile* is an important cause of infectious disease death in the United States, estimated to cause almost half a million infections in the U.S. in 2011. Approximately 83,000 of the patients who developed *C. difficile* experienced at least one recurrence and 29,000 died within 30 days of the initial diagnosis. Poor prescribing practices put patients at risk for *C. difficile* infections. More than half of all hospitalized patients will get an antibiotic at some point during their hospital stay, but studies have shown that 30 percent to 50 percent of antibiotics prescribed in hospitals are unnecessary or incorrect. *C. difficile* infections can be prevented by using infection control recommendations and more careful antibiotic use. *Clostridium difficile* is shed in feces.



- Carbapenem-resistant Enterobacteriaceae (CRE) are a family of pathogens that are difficult to treat because they have high levels of resistance to antibiotics.
- CRE can cause infections in almost any part of the body including bloodstream infections, ventilator-associated pneumonia, and intra-abdominal abscesses.
- CRE are usually transmitted from person to person often via the hands of healthcare personnel or via contaminated medical equipment.



- *Clostridium difficile* is a spore-forming, Gram-positive anaerobic bacillus that produces two exotoxins: toxin A and toxin B.
- It is a common cause of antibiotic-associated diarrhea (AAD).
- *C. difficile* infections can be prevented by using infection control recommendations and more careful antibiotic use.
- *Clostridium difficile* spores are transferred to patients mainly via the hands of healthcare personnel who have touched a contaminated surface or item.

Any surface, device, or material (e.g., commodes, bathing tubs, and electronic rectal thermometers) that becomes contaminated with feces may serve as a reservoir for the *Clostridium difficile* spores. *Clostridium difficile* spores are transferred to patients mainly via the hands of healthcare personnel who have touched a contaminated surface or item.

## Prevention and Control

Following evidence-based practices related to infection prevention and control is the only way to help combat both hospital pathogens and emerging infectious diseases.

There are tenets of standard precautions and contact precautions that are appropriate for a number of multidrug-related organisms (MDROs). Proper use of contact precautions includes:

- Performing hand hygiene before donning a gown and gloves

- Donning gown and gloves before entering the affected patient's room

- Removing the gown and gloves and performing hand hygiene prior to exiting the affected patient's room

Let's view core measures:

### Hand hygiene

Hand hygiene is a primary part of preventing MDRO transmission. Facilities should ensure that healthcare personnel are familiar with proper hand hygiene technique as well as its rationale. Efforts should be made to promote staff ownership of hand hygiene using techniques like developing local (e.g., unit) hand hygiene champions. It is not enough to have policies that require hand hygiene; hand hygiene adherence should be monitored and adherence rates should be fed directly back to frontline staff. Immediate feedback should be provided to staff who miss opportunities for hand hygiene. In addition, facilities should ensure access to adequate hand hygiene stations (i.e., clean sinks and/or alcohol-based hand rubs) and ensure they are well stocked with supplies (e.g. towels, soap, etc.) and clear of clutter.

### Contact precautions

Patients in acute-care settings who are colonized or infected with a pathogen such as CRE should be placed on contact precautions. Systems should be in place to identify patients with a history of CRE colonization or infection at admission so that they can be placed on Contact Precautions if not known to be free of colonization. In addition, clinical laboratories should have an established protocol for notifying clinical and/or infection prevention personnel when CRE are identified from clinical or surveillance cultures. The CDC says there is not enough information for a firm recommendation about when to discontinue contact precautions among infected patients; however, CRE colonization in some patients identified during CDC investigations has been prolonged (> 6 months). If surveillance cultures are used to decide if a patient remains colonized, more than one culture should be collected in an attempt to improve sensitivity. The presence of CRE infection or colonization alone should not preclude transfer of a patient from one facility to another (e.g., acute care to long-term care). Facilities should ensure that Contact Precautions are used correctly by staff caring for all patients with epidemiologically important MDROs including CRE. Ensuring healthcare personnel are educated about the proper use and rationale for contact precautions is an important part of this process. In

addition, facilities should ensure that there is a process to monitor and improve healthcare worker adherence to contact precautions. This might include conducting periodic surveillance on the use of Contact Precautions and providing feedback to frontline staff about these results.

### **Healthcare personnel education**

Healthcare personnel in all settings who care for patients with MDROs, including CRE, should be educated about preventing transmission of these organisms. At a minimum this should include information on the proper use of contact precautions and hand hygiene. This intervention is applicable to both acute and long-term care settings.

### **Use of devices**

Use of devices such as central venous catheters, endotracheal tubes, urinary catheters puts patients at risk for device-associated infections and minimizing device use is an important part of the effort to decrease the incidence of these infections. Additionally, device use has been associated with carbapenem resistance among Enterobacteriaceae. Therefore, minimizing device use in all healthcare settings should be part of the effort to decrease the prevalence of all MDROs. In acute and long-term care settings, device use should be reviewed regularly to ensure they are still required and devices should be discontinued promptly when no longer needed.

### **Antimicrobial stewardship**

Antimicrobial stewardship is another primary part of MDRO control. Although the role of this activity specifically for CRE has not been well studied, multiple antimicrobial classes have been shown to be a risk for CRE colonization and/or infection. Further, restricting use of carbapenems has been associated with a lower incidence of carbapenem-resistant *Pseudomonas aeruginosa* in one ecological analysis. As part of an antimicrobial stewardship program designed to minimize transmission of MDROs, facilities should work to ensure that antimicrobials are used for appropriate indications and duration and that the narrowest spectrum antimicrobial that is appropriate for the specific clinical scenario is used. This intervention is applicable to both acute and long-term care settings.

To combat *C. diff*, measures for healthcare workers, patients and visitors include:

- ◆ Healthcare workers and visitors must use gloves and gowns on entry to a room of a patient with CDI.
- ◆ Emphasize compliance with the practice of hand hygiene.
- ◆ In a setting in which there is an outbreak or an increased CDI rate, instruct visitors and healthcare workers to wash hands with soap (or antimicrobial soap) and water after caring for or contacting patients with CDI.
- ◆ Accommodate patients with CDI in a private room with contact precautions. If single rooms are not available, cohort patients, providing a dedicated commode for each patient.
- ◆ Maintain contact precautions for the duration of diarrhea.
- ◆ Routine identification of asymptomatic carriers (patients or healthcare workers) for infection control purposes is not recommended and treatment of such identified patients is not effective.

Environmental cleaning and disinfection is critical to help prevent and control transmission of CDI and many other pathogens. Ensure adequate cleaning and disinfection of environmental surfaces and reusable devices, especially items likely to be contaminated with feces and surfaces that are touched frequently. Rigorous, proper surface cleaning and disinfection with a hospital-grade, EPA-approved disinfectant is primary; use of automated area decontamination systems have been shown in studies to be beneficial.

When it comes to a virus such as Ebola, extra precautions are in order. Healthcare workers should always take standard precautions when caring for patients, regardless of their presumed diagnosis. These include basic hand hygiene, respiratory hygiene, use of personal protective equipment (to block splashes or other contact with infected materials), safe injection practices and safe burial practices. Healthcare workers caring for patients with suspected or confirmed Ebola virus 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 meter) of patients with EBV, healthcare 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). ●

## References

Fauci AS and David M. Morens DM. The Perpetual Challenge of Infectious Diseases. *N Engl J Med.* 366:454-461. Feb. 2, 2012. doi: 10.1056/NEJMr1108296.

Herstein J, Biddinger P, Kraft C, Saiman L, Gibbs S, Le A, Smith P, Hewlett A and Lowe J. Current Capabilities and Capacity of Ebola Treatment

## WHO Issues List of Top Emerging Diseases Likely to Cause Major Epidemics

A panel of scientists and public health experts convened by the World Health Organization (WHO) met in Geneva last week to prioritize the top five to 10 emerging pathogens likely to cause severe outbreaks in the near future, and for which few or no medical countermeasures exist. These diseases will provide the basis for work on the WHO Blueprint for R&D preparedness to help control potential future outbreaks. The initial list of disease priorities needing urgent R&D attention are: Crimean Congo hemorrhagic fever, Ebola virus disease and Marburg, Lassa fever, MERS and SARS coronavirus diseases, Nipah and Rift Valley fever. The list will be reviewed annually or when new diseases emerge.

This priority list forms the backbone of the new WHO Blueprint for R&D preparedness by focusing accelerated R&D on dangerous pathogens which are the most prone to generate epidemics. As well as advocating for the initiation or enhancement of the R&D process to develop diagnostics, vaccines and therapeutics for the five to 10 diseases, the Blueprint will also consider behavioral interventions, and filling critical gaps in scientific knowledge to allow the design of better disease control measures.

The group of experts who developed the list represented a range of disciplines, including virology, microbiology, immunology, public health, clinical medicine, mathematical and computational modelling, product development, and respiratory and severe emerging infections. The conclusions of the experts were reviewed by the Blueprint's independent Scientific Advisory Group.





Centers in the United States. *Infection Control & Hospital Epidemiology*. Web, Dec. 9, 2015.

Morens DM, Fauci AS (2013) Emerging Infectious Diseases: Threats to Human Health and Global Stability. *PLoS Pathog* 9(7): e1003467. 2013. doi:10.1371/journal.ppat.1003467.

Morens DM, Fauci AS. Emerging infectious diseases in 2012: 20 years after the Institute of Medicine report. *MBio* 3: e00494–12. 2012. doi: 10.1128/mBio.00494-12.

Morens DM, Folkers GK, Fauci AS, Emerging infections: a perpetual challenge. *Lancet Infect Dis* 8: 710–719. 2008. doi: 10.1016/S1473-3099(08)70256-1.

Future action in this area includes fine-tuning of the prioritization methodology and the development of practical tools to assess any new diseases that may emerge.

Three other diseases were designated as serious, requiring action by WHO to promote R&D as soon as possible: chikungunya, severe fever with thrombocytopenia syndrome, and Zika.

Other diseases with epidemic potential — such as HIV/AIDS, tuberculosis, malaria, avian influenza and dengue — were not included in the list because there are major disease control and research networks for these infections, and an existing pipeline for improved interventions.

**Source: WHO**



[www.infectioncontroltoday.com](http://www.infectioncontroltoday.com)

## ABOUT INFECTION CONTROL TODAY

Infection Control Today, in print and online, addresses the most pertinent issues impacting the infection prevention and healthcare epidemiology community. Through its extensive educational platform ICT delivers webinars and digital summits offering continuing education for nurses, as well as special digital issues, reports, toolboxes, and immersion centers for deeper dives into key topics encompassing infection control, surgical services, sterile processing, environmental services, materials management, and quality improvement/risk management.

## informa exhibitions

PRESIDENT John Siefert  
CHIEF FINANCIAL OFFICER Kelly Ridley  
HUMAN RESOURCES DIRECTOR Sabrina Wolf

PUBLISHED BY INFORMA EXHIBITIONS LLC

3300 N. Central Ave. Ste 300, Phoenix, AZ 85012  
Tel. 480-990-1101 • Fax 480-990-0819  
Website: [www.infectioncontroltoday.com](http://www.infectioncontroltoday.com)

### EDITORIAL

#### EDITOR IN CHIEF

Kelly M. Pyrek • [kelly.pyrek@informa.com](mailto:kelly.pyrek@informa.com)

#### VICE PRESIDENT, CONTENT, HEALTH & NUTRITION

Heather Granato • [heather.granato@informa.com](mailto:heather.granato@informa.com)

### SALES/MARKETING

#### VICE PRESIDENT, HEALTH & NUTRITION

Jon Benninger • [jon.benninger@informa.com](mailto:jon.benninger@informa.com)

#### VICE PRESIDENT, SALES, HEALTH & NUTRITION

Danica Cullins • [danica.cullins@informa.com](mailto:danica.cullins@informa.com)

#### ACCOUNT DIRECTOR

Dana Armitstead • [dana.armitstead@informa.com](mailto:dana.armitstead@informa.com)

#### MARKETING MANAGER

Katie Egley • [katie.egley@informa.com](mailto:katie.egley@informa.com)

Reprints • 480-281-6724

Subscription Customer Service • 800-581-1811

### PRODUCTION

#### VICE PRESIDENT, MARKETING SERVICES

Danielle Dunlap

CREATIVE DIRECTOR Joseph DiPastena

ART DIRECTOR, MEDICAL Patti Valdez

PROGRAM MANAGER Leez May

Copyright © 2016 Informa Exhibitions LLC. All rights reserved. The publisher reserves the right to accept or reject any advertising or editorial material. Advertisers, and/or their agents, assume the responsibility for all content of published advertisements and assume responsibility for any claims against the publisher based on the advertisement. Editorial contributors assume responsibility for their published works and assume responsibility for any claims against the publisher based on the published work. Editorial content may not necessarily reflect the views of the publisher. Materials contained on this site may not be reproduced, modified, distributed, republished or hosted (either directly or by linking) without our prior written permission. You may not alter or remove any trademark, copyright or other notice from copies of content. You may, however, download material from the site (one machine readable copy and one print copy per page) for your personal, noncommercial use only. We reserve all rights in and title to all material downloaded. All items submitted to ICT Infection Control Today become the sole property of Informa Exhibitions LLC.