

Because life isn't always  
a piece of cake  
your health  
is our permanent  
concern

**KIDNEY & BONE MARROW TRANSPLANTATION  
ONCOLOGY & PEDIATRIC ONCOLOGY UNIT  
INTERVENTIONAL RADIOLOGY  
PET/CT & NUCLEAR MEDICINE  
BRACHYTHERAPY CENTER**

**OBSTETRICS & GYNECOLOGY  
NEONATOLOGY & PEDIATRICS  
BLOOD TRANSFUSION CENTER  
CATHETERIZATION UNIT  
RADIOTHERAPY UNIT**

**OBESITY & FITNESS CENTER  
GENETICS & STEM CELLS LAB  
COCHLEAR IMPLANTS CENTER  
EPILEPSY PROGRAM  
SLEEP APNEA UNIT**

The  
**MIDDLE EAST** Of  
**INSTITUTE** HEALTH

مركز الشرق الاوسط الصحي  
بصاليم، المتن، لبنان

**The Middle East Institute of Health**

Hospital in Bsalim, Metn, Lebanon

Tel: +961 4 712 111 - Fax: +961 4 711 606

Website: [www.meih.org](http://www.meih.org) - [info@meih.org](mailto:info@meih.org) - [www.facebook.com/MEIH.LB/](http://www.facebook.com/MEIH.LB/)

## Overview of Some Emerging Infectious Diseases: A New Era for New Vaccines



**Skye El Sayegh, MD**  
*Faculty of Medicine,  
American University of Beirut,  
Beirut, Lebanon*



**Inaya Hajj Hussein, PhD**  
*Department of Biomedical  
Sciences, Oakland University  
William Beaumont School of  
Medicine, Rochester, MI, USA*

Major public health concerns are rising due to several emerging diseases which in turn affect humans as well as livestock thus jeopardizing the world's economy and public health. However, there are many contributing factors to the risk of emerging diseases especially in the Middle East area where we have diversity in socioeconomic development, battles and displacement of populations, variation in availability and quality of health care, poverty and human vulnerability, in addition to many other risks of public health concern.

With the ongoing crisis in Syria and the surrounding countries, the healthcare system was the most vulnerable and susceptible structure in this region affecting many aspects of the population's health, be it access to medication and treatment, access to primary care and hospitalization, or even the access to essential and highly recommended vaccinations for several preventable diseases. "Vaccination coverage in Syria is estimated to have dropped from 91% in 2010 to as low as 45% in some regions by 2013, indicating rapid collapse of immunization systems in conditions of war" (1); which consequently led to the re-emergence of Poliomyelitis among Syrians. The Syrian crisis has a global impact on the region's health due to the increasing number of refugees who are seeking cover and shelter in Lebanon at large (1,075,637 individuals), and in Turkey (2,181,293 individuals), Egypt (127,681 individuals), Jordan (633,644 individuals) and Iraq (244,765 individuals) according to the latest updated registry in Oct.-Nov.2015 by the UNHCR (2). This has caused the uncontrolled spread of several diseases such as typhoid fever, hepatitis A, scabies, meningitis, and lice in the region (1).

A few of the emerging infectious diseases will be discussed in this article as to their impact in the Middle East area and the surrounding region. The discussion will emphasize namely on their origin, mode of transmission, their effect

### Introduction

From early history, the outbreaks and devastating consequences of several infectious diseases led to the development of vaccines as a mean for controlling and preventing the spread of these deadly diseases. Few examples of these diseases include the infamous smallpox disease, human papilloma virus, varicella, mumps, rubella, measles, hepatitis B and many other preventable infectious diseases; their burden on both the well-being and economy of the society has intrigued the scientists to develop the vaccines which proved to be of outstanding contribution to the human health.

Time passed and new emerging infectious diseases are recently leaving their own mark on the human population with significant morbidity and mortality rates. These are infectious diseases whose incidence have increased in the past 20 years and could increase in the near future. Is history repeating itself? How have these new emerging infectious diseases influence public health? Will the scientists again develop new vaccines to protect the vulnerable human being?



and impact on public health, and the status of related vaccines being developed to control their spread (3-5).

### Ebola

Previously known as Ebola hemorrhagic fever, Ebola is a rare and fatal disease caused by one of the Ebola virus species with average case fatality rate around 50% and outbreaks affecting both developed and developing countries. It causes disease in both humans and nonhuman primates.

Ebola first appeared in 1976, with 2 outbreaks occurring simultaneously, one in Sudan and the other in the Democratic Republic of Congo in a village near the Ebola River (from which the disease takes its name). The most recent and largest outbreak occurred in West Africa in March, 2014 being first case reported; with recently 3 more cases re-emerged in Liberia.

The natural reservoir is unknown. However it is thought by researchers that fruit bats are the natural hosts of the virus. Human-to-human transmission is via direct contact (through broken skin or mucous membranes such as the eyes, nose, and mouth) with the blood, secretions, organs or other bodily fluids (urine, saliva, sweat, feces, breast milk, semen, and vomit) of infected people, or with

surfaces and materials (e.g. bedding, clothing, needles, syringes) contaminated with these fluids.

The symptoms start as acute fever, fatigue, headache and sore throat; later, gets complicated with vomiting, diarrhea, rash, impaired kidney and liver functions, and sometimes with internal and external bleeding.

The only currently approved treatment is supportive care with re-hydration. No Ebola vaccine is licensed yet, however, there are 2 potential vaccines undergoing human safety testing (see table 1).

### MERS-CoV

Middle East Respiratory Syndrome – Coronavirus (MERS-CoV) is a viral respiratory disease that has caused the death of around 36% of those infected with MERS-CoV.

The disease was first identified in Saudi Arabia in 2012 and has been circulating throughout the Arabian Peninsula, affecting Egypt, Oman, Qatar, in addition to an outbreak in the Republic of Korea.

The most likely reservoir host is the camel, however, the mode of transmission is unknown and human-to-human transmission is thought to be due to unprotected close contact through respiratory secretions (coughing) from an infected person.

The symptoms start with fever, cough, and shortness of breath; some might have nausea/vomiting and diarrhea. The only recommended treatment is supportive care depending on patient's condition. Also, no vaccine is licensed yet but ongoing studies have one candidate vaccine that is still in the early phases of development (see table 1).

### Leishmaniasis

There are 3 main forms: cutaneous leishmaniasis, visceral leishmaniasis and mucocutaneous leishmaniasis; all caused by the protozoan parasite *Leishmania*. It is transmitted to humans through the bite of infected female sandflies causing annual death of 20,000-30,0000 of those infected. Symptoms and epidemiology of the disease varies from form to the other.

- Cutaneous leishmaniasis, most common form, mainly in the Americas, Mediterranean basin, Middle East and Central Asia. Infected people develop skin lesions that may end up as ulcers and non-healing scars.
- Visceral leishmaniasis, fatal if not treated, mainly in Indian subcontinent and East Africa. Infected people develop irregular bouts of fever, weight loss, enlargement of spleen and liver, and anemia.
- Mucocutaneous leishmaniasis, least common form, mainly in the Plurinational State of Bolivia, Brazil, and

Peru. Infected people develop partial or total destruction of mucous membranes (nose, mouth and throat).

Even though leishmaniasis is treatable and curable, outbreaks do occur especially with refugees from Aleppo Syria, and Iraq which consequently leads to economical and public health burden especially in vulnerable populations with limited health resources and medical treatment. Once again, no vaccine is licensed yet, nonetheless a new candidate vaccine is in the final phase until it gets approved for use (see table 1). It is also called the “Aleppo Sore”.

### Cholera

Cholera is acute diarrheal disease that can kill within hours if left untreated. It is estimated that the average death worldwide from cholera is 28,000 to 142,000 individuals annually.

The original reservoir of the cholera is in the Ganges delta in India. Subsequently, seven pandemics occurred and killed millions worldwide; and many countries are still now endemic with cholera. Also, there are very recent outbreaks as well in Iraq, Syria, Tanzania, and Hawaii.

Cholera is caused by the intake of food or water contaminated with the bacterium, *Vibrio cholerae*.

Most of the people infected are asymptomatic, however those with symptoms can have mild, moderate or even

Table 1: Development, introduction, infectious agent, and schedule of potential new vaccines.

Potential new vaccines (phase)	Infectious agent	Vaccine used	Time for vaccination
<b>Ebola and Marburg vaccine (Phase I)</b>	Ebola and Marburg viruses	Ebola DNA plasmid and Marburg DNA plasmid	18-50 years old; on Weeks 0, 4, and 8
<b>MERS-CoV Vaccine (Phase II)</b>	Middle East respiratory syndrome- coronavirus	Purified coronavirus spike protein nanoparticles	N/A
<b>Leishmania Vaccine (Phase III)</b>	Leishmaniasis parasite	Autoclaved leishmania proteins	16-60 years old; 2 doses 30 days apart
<b>Cholera vaccine</b>	<i>Vibrio cholerae</i>	Oral, inactivated, killed whole cell of <i>V. cholerae</i>	At risk population; 2 doses 1 week apart; booster every 6 months
<b>Dengue vaccine (phase III)</b>	Dengue virus	Live, recombinant tetravalent dengue vaccine	3-dose series on a 0/6/12 month schedule

Source: Ref. (7)



sever watery diarrhea that is fatal if not treated. The only recommended and effective treatment is through oral rehydration salts or intravenous fluids administration. There are currently 2 oral cholera vaccines available for high risk children (see table 1).

### Dengue

Dengue fever is a viral infection transmitted through the bite of infected *Aedes* mosquito. The virus causes severe, flu-like illness which sometimes can be fatal. Dengue (or Dengue Hemorrhagic Fever) first originated in 1950s through an epidemic that affected Philippines and Thailand. several subsequent epidemics and outbreaks occurred over the globe with recent outbreaks in Saudi Arabia and Yemen. Even though climate conditions in the Middle East do not favor the survival of the disease vector, nevertheless, the risk of Dengue outbreaks in the Middle East is increasing with the increased number of immigrant work force and travel from dengue-endemic countries (6). Once an infected mosquito infects a human, this human will be the following carrier and source for the uninfected mosquito causing the multiplication and spread of disease. Dengue fever is characterized by a high grade fever in addition to any 2 of the following symptoms: severe headache, pain behind the eyes, muscle and joint pains, nausea, vomiting, swollen glands or rash. The possible deadly complications include organ impairment, severe bleeding or respiratory distress.

There is no definitive treatment for dengue except for

symptomatic support and maintenance of body fluids. No vaccine is currently licensed; however there is a couple of vaccines being studied and in the final phases of the clinical trials (see table 1).

### Conclusion

These are only few of the emerging diseases and their impact on public health; the same thing can be seen with rotavirus which has high health and economic burden with estimated annual direct and indirect costs of around \$1 billion with “more than 400,000 physician visits, more than 200,000 emergency department (ED) visits, 55,000 to 70,000 hospitalizations, and

20 to 60 deaths each year in children younger than 5 years” (CDC, 2015).

These emerging diseases affect both humans and livestock thus threatening the world’s economy and public health. That is when the role of vaccines emerges to set control and protection from the spread of emerging viruses among populations, in particular, among people that are immunologically naïve and susceptible hosts.

### References

1. Sharara S, Kanj S. *War and Infectious Diseases: Challenges of the Syrian Civil War*. *PLoS Pathog.* 2014;10(11):e1004438. doi:10.1371/journal.ppat.1004438.
2. UNHCR Syria Regional Refugee Response. *UNHCR Syria Regional Refugee Response*. 2015. Available from: <http://data.unhcr.org/syrianrefugees/regional.php>
3. World Health Organization. *Fact sheets (2015)*. Available from: <http://www.who.int/mediacentre/factsheets/en/>
4. Centers for Disease Control and Prevention. *CDC works 24/7 to protect US from health, safety and security threats (2015)*. Available from: <http://www.cdc.gov/>
5. Hajj Hussein I, Chams N, Chams S, El Sayegh S, Badran R, Raad M, Gerges-Geagea A, Leone A and Jurjus A (2015) *Vaccines Through Centuries: Major Cornerstones of Global Health*. *Front. Public Health* 3:269. doi: 10.3389/fpubh.2015.00269
6. Amarasinghe A, Letson G. *Dengue in the Middle East: a neglected, emerging disease of importance*. *Transactions of the Royal Society of Tropical Medicine and Hygiene.* 2012;106(1):1-2. doi:10.1016/j.trstmh.2011.08.014.
7. *Clinicaltrials.gov. Home – ClinicalTrials.gov (2015)*. Available from: <https://clinicaltrials.gov/ct2/home>

PASSIONATE ABOUT MEDICINE  
 COMPASSIONATE ABOUT PEOPLE

