

HORIZON SCANNING

INFECTIOUS DISEASES

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Vaccines for A(H7N9) and A(H5N1) have been popular projects in the last year, and the development of a universal flu vaccine remains a hope.

Mers-CoV (Middle East respiratory syndrome, novel coronavirus)

MERS–CoV is a relative of SARS, severe acute respiratory syndrome, also caused by a coronavirus. SARS was first reported in Asia in February 2003 and spread to more than two dozen countries in North America, South America, Europe, and Asia before the outbreak was contained. MERS emerged in the Middle East, affecting Saudi Arabia most of all. Camels are believed to be the source of the virus, although some researchers think bats may have a role. There appears to be some human-to-human transmission, particularly in healthcare settings and to some extent families. Like SARS, it has a high morbidity rate.

Ebola Virus Disease (EVD)

This is probably the emerging infectious disease of most concern the moment. There is a very high fatality rate, no vaccine, no widely recognised successful treatment and worst of all it seems more difficult to contain this time round. The priority in healthcare is to identify patients with Ebola symptoms and isolate them. Unfortunately Ebola can take up to three weeks before symptoms appear, then it kills very quickly from uncontrollable internal and external bleeding⁵.

Ebola outbreaks have so far been rare and have mostly arisen in rural areas of poor African nations, so Ebola has not attracted much attention from profit-seeking pharmaceutical companies. Research has been largely funded by the US government. The US Centers for Disease Control and Prevention (CDC) sees Ebola as so deadly and so contagious that it poses a risk to national security. The CDC lists the virus as a Category A bioterrorism agent, alongside anthrax and smallpox

Canadian company Tekmira Pharmaceuticals Corp. (TKM), began its first human trial of its drug in January financed by the US Department of Defense⁷. Mapp Biopharmaceutical Inc., of San Diego, is developing an antibody cocktail, along with the US Defense Advanced Research Projects Agency (DARPA), the US National Institutes of Health (NIH) and the Defense Threat Reduction Agency. That cocktail prevented 43 percent of monkeys with symptoms of Ebola from dying⁸. Earlier work found this treatment, MB-003, saved all of the monkeys when given an hour after exposure to the virus, and two-thirds of the animals when administered 48 hours after exposure. Another antibody cocktail is under development at Canada's National Microbiology Laboratory, though it is not yet ready for human testing.

What treatments are available for use? "There are already candidate cocktails that can be used in an emergency," said Erica Ollmann Saphire, a professor at the Scripps Research Institute in La Jolla, California, who is leading a consortium of fifteen public and private institutions to develop treatments to fight the virus. The US National Institutes of Health has given a five-year grant of as much as \$US28 million to Saphire's group, which is collaborating on antibody cocktails to fight Ebola.

Mers-CoV (Middle East respiratory syndrome, novel coronavirus)

April 2014

- a) WHO announced that genetic data show the MERS-CoV isolates in camels and humans are closely linked and "suggest the current observed pattern of disease in humans is the result of repeated introductions into human populations from camels, with subsequent limited human-to-human transmission, rather than sustained community transmission among humans. As such, discovery of the route of transmission between camels and humans remains critical to stopping the initial introduction into human populations."
- b) From September 2012 to 1 April 2014, WHO was informed of a global total of 207 laboratory-confirmed cases of infection with MERS-CoV, including 87 deaths.

March 2014

- a) WHO's global MERS tally, updated 14 March, was 196 cases and 83 deaths. Saudi Arabia's then accounted for 157 cases, with the death toll 63.
- b) A study says the MERS virus has been "extraordinarily common" in camels for at least 20 years, and may have been passed directly to humans from the animals⁷⁰.
- c) Health experts warned that MERS-CoV infections that may be acquired in healthcare facilities illustrate the need to continue to strengthen infection prevention and control measures⁷¹.

- b) *Aedes aegypti* have been found at Melbourne airport in the plastic, water-filled bollards used for traffic management.
- c) Researchers at the University of North Carolina, in the labs of Dr Ralph Baric, and Dr Aravinda de Silva, showed that a molecular hinge where two regions of a protein connect is where natural human antibodies attach to the dengue 3 virus to disable it²³. Now Drs Baric and de Silva are collaborating with vaccine developers at two pharmaceutical companies to test potential dengue vaccines now in clinical trials. If these investigational vaccines don't bind to their molecular hinge, then they will probably be less effective than desired.
- d) De Silva and Baric are also attempting to deal with dengue's particular phenomenon called antibody dependent enhancement. People infected with one type of dengue usually develop a natural immune response that overcomes the virus and prevents a repeat infection. But if they are later infected with a second type of dengue, the virus is enhanced because of that first immune response. This can result in dengue haemorrhagic fever and death. A large clinical trial of a dengue vaccine, conducted in Thailand in 2011, therefore contained a mix of the four types of dengue then known. However the vaccine proved only partially protective. If these researchers can isolate the major epitopes (binding sites) for each dengue type, they know from their experiments so far that they could modify a virus with all the epitopes and have the basis for a vaccine against all types²⁴.

Influenza: strains, spread, prevention and treatment

The major concern round the globe in the last few months has been A(H7N9) which broke out in China and appears to be associated with live poultry markets. However for a number of countries A(H5N1) continues to kill humans who have been associated with sick poultry.

Both farmed poultry and wild bird stocks have seen major culls round the world because of illness.

The question of mutation to facilitate human to human transmission remains a concern. Genetic reassortment occurs in nature, and one of the issues under discussion is whether, since this reassortment is facilitated by mixing species at live poultry markets, such markets should be phased out. The other benefit which might occur with this is limiting the opportunities for humans to become infected with avian viruses.

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