

International Center for Enterprise Preparedness (InterCEP)

Infectious Diseases: Critical Developments and Global Forecast

Web Forum

On April 18, 2017, **Mark Keim**, CEO of DisasterDoc, professor of disaster medicine at Harvard Medical School, and professor of public health at Emory University, led a discussion on infectious diseases, including recent developments and the global forecast for 2017.

Trends in infectious disease

Understanding *emerging* and *re-emerging* infectious diseases is critical given their potential role as global disruptors of business. A *disruptor* is something that uproots and changes how we do business, and typically has a destructive impact.

Emerging diseases are those that have newly appeared or that have been around, but at very low level, and then out of nowhere become prominent. Examples include Ebola, Human Immunodeficiency Virus (HIV), Severe Acute Respiratory Syndrome (SARS), Middle East Respiratory Syndrome (MERS) and now Zika virus. These are the ones that we should be more concerned about when we talk about a global level disruption.

An example of an emerging disease as a global disruptor to business is SARS. A few years ago, SARS affected populations in China and Canada. Many businesses had very significant impacts. It killed less than 20 people but its impact was very significant. Economic impacts included loss of revenue in places such as Las Vegas, due to reduced travel for tourism and business. Reduced travel demand also resulted in a decrease in oil demand.

Re-emerging diseases have been around for a long time and come back in a different form or in a different location. An example, is measles, in places where people may not have been immunized. Another example is Chikungunya virus, which was known as a virus in Africa, and now it is affecting populations in new locations, in the Pacific Islands, Latin America, the US, etc.

In the period 1997-2009, economic losses associated with emerging and re-emerging diseases have been estimated to be at least US\$80 billion. This estimate does not include Ebola.

Measles is a re-emerging disease with recorded outbreaks in 24 states in the U.S. in 2015. These included 183 cases. The outbreak is likely to have started in an amusement park in California and the

strain matched a strain that was affecting the Philippines. This highlights the need to be aware about these infectious diseases in locations where people are likely to travel to the US, or where people from the US may go visit.

Similarly, about 500 cases of measles have been recorded in Europe since January. Immunization coverage is less 95% in some countries and this means that an epidemic is possible. Immigration is also a risk for diseases like measles, since people may not be immunized in their country of origin. Measles is passed through the air and some of the symptoms include fevers, achiness, and fatigue for a couple of weeks. Measles is one disease we should be aware of. It's on the horizon.

Chikungunya is another disease to be concerned about. It is spread by mosquitos. There were 1.2 million cases between 2013 and 2015. The good news with this disease is that the number of cases halved in 2016. But the season is ripe for another upsurge as travelers can bring it back from the Caribbean and Latin America to the US and Canada. Some of the symptoms include fever, malaise and achiness, with symptoms typically resolved after a couple of weeks.

Zika virus is another disease that poses a risk in the continental US, and depends on mosquito habitat and travel patterns. Most cases in the US have been imported from travelers. Cities denote the highest risk, since they include not only the presence of mosquitos, but also people traveling from high risk areas abroad. Zika is particularly worrisome since it has the ability of affecting the nervous system of newborns. In addition to being passed by mosquitos, Zika can also be sexually transmitted. Some of the symptoms of Zika include fever, achiness, malaise, and low energy levels.

Influenza is a disease that poses a risk for a global pandemic. In the case of a pandemic, the strains involved would be more lethal and easier to transmit than the strains that are typically observed. **H7N9** is a strain that is currently being carefully followed. There were 924 cases reported in China, where more people are likely to be exposed, especially in Eastern China and the Shanghai region, areas that have great transportation networks linked to other parts of China and the world.

Luckily, H7N9 is not transmitted from human to human. Influenza starts off in wild birds, which can then infect domesticated birds. Domestic birds may then infect a pig, and when the virus gets inside a pig, it mutates and is then able to live in a mammal and infect humans. Once it goes from pig to humans, it may be difficult to pass from human to human, unless it mutates. But these viruses can mutate quite often.

If H7N9 begins to be transmitted from human to human it would be very problematic as it could then pass through the air. Mortality rates from a global pandemic of this type could be about 30%. It would affect multiple countries, and could potentially decrease economic activity and cost trillions of dollars.

What risk are we facing? The World Health Organization (WHO) has created an alert phase. Phases I-III are preparedness phases. We are currently in Phase I. The virus is still mostly in animals. If it changes,

the alert may go to Phase IV, which means a sustained human to human transmission. Phases 5-6 would represent widespread transmission.

Ebola is another disease with a high potential for disruption and economic impacts. It has a very high fatality rate. There have been about 30,000 cases recorded and about 11,000 deaths. The countries affected during the recent outbreaks suffered very high economic losses, as reflected in percent change in GDP. These losses resulted from disruption to commerce, mobility and travel restrictions, and other restrictions that affected planting season, mining and tourism.

According to the World Bank, most of these economic losses were not as a result of direct costs of human health, but mostly from fear of contagion, border closures, and irrational and self-protective mechanisms. Even when the cases are not local, people may change their behavior.

SARS and **MERS** belong to the same group of corona viruses. There was a SARS outbreak in China and Canada that affected about 8,000 people and then it was pretty much over.

Since 2012, there have been about 2,000 cases of MERS. About 700 people have died from this disease, which represents about 36% of those affected. This should raise awareness about this disease, since it is highly lethal. Although most of these cases have been reported in the Middle East, there have also been MERS outbreaks in Europe and South Korea. It is a respiratory virus with flu-like symptoms. Patients often become dehydrated and experience high fevers. In South Korea the response was remarkable and the authorities turned to the World Health Organization (WHO) for help. About 2,500 people were quarantined, and 1,800 schools were closed. In Saudi Arabia and other parts of the Middle East, there is a decreasing seasonal trend in the number of reported MERS cases.

Disruptor Outbreak Dashboard

DisasterDoc has developed the **Disruptor Outbreak Dashboard** to summarize information about health risks from infectious diseases. The dashboard is color coded: red, yellow and green. A red color corresponds to a high level of concern. Figure 1 shows the dashboard for several diseases of concern. In terms of the overall outlook, 2017 is probably one of the best years in recent history.

SARS remains good. It hasn't changed. We haven't seen cases in a long time.

MERS is showing decreasing number of cases.

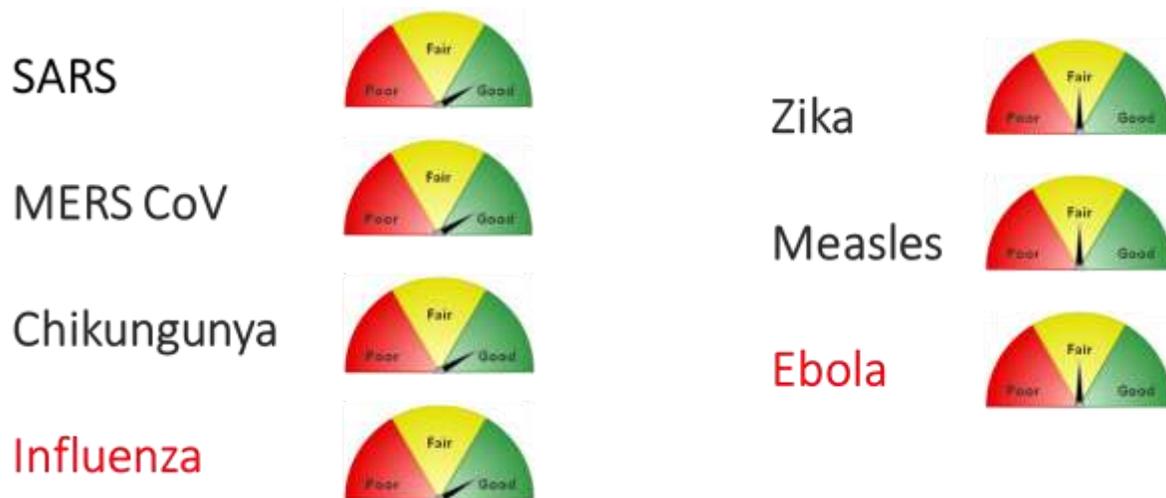
Chikungunya also shows diminishing cases.

The take-home messages from the dashboard is to watch Ebola and Measles. Ebola is not extinct. Both have the potential for disruption.

Zika virus is displayed in yellow because of its seriousness.

Influenza is of concern because of its past history and potential for global pandemic.

Figure 1. Disruptor Dashboard



Source: DisasterDoc - <http://disasterdoc.org/>

Q&A

How will social media change or impact infectious disease? For example, data mining, spreading fear or information about prevention?

Data mining has the potential to provide evidence of outbreaks early on, and there is some anecdotal evidence that it has done that. It is still in its infancy. The reason it can work is because oftentimes people talk about symptoms before they are diagnosed. For example, an increase in purchase of medications for diarrhea can point to a rise in health issues.

In the case of sentinel events, which can point to a rising threat, it is more difficult to use social media for validation.

Participatory mapping, which allows for the mapping of cases, not necessarily the victims, but others are able to put the information on a map. SMS texting can be used to provide information for this and other purposes.

People may also get a warning from outside sources and can turn to others through social media to corroborate locally.

People tend to get their traditional information from traditional sources but then use social media to respond, raise funds, etc.

What about the impact of multi-drug resistance bacteria?

It certainly is a serious issue. Anti-microbial resistance is an educational issue and also a governance issue.

Folks come into hospital and even when it's a virus, they want medication, and doctors share the blame and err on the side of prescribing antibiotics. Also people don't use antibiotics properly.

This is a potential disruptor over the longer term. Novel research approaches are being tried to develop new tools to address these concerns.

How do you view risks and consequences of natural pandemic versus a biological attack?

The big issue to consider here is that they are intentional and could have multiple origins. Point source versus multiple point sources. Aerosolized agents could be released in multiple cities/areas. These can also cover long distances, such as Anthrax.

A number of factors can affect the response, including Intentionality of threat, past history, and technological capability. The reach or impact could be even larger than what we have ever experienced in modern times, including the 1918 flu pandemic. If a city were to be attacked with an agent that can pass person to person it could have a very significant impact.

Can you share perspective on key steps organizations can take to address a pandemic?

One important factor is immunizing personnel. In particular, functional operations, where you may have a vulnerability. This is very cost-effective. Middle managers seem to be a sweet spot. Encouraging and reminding your employees and even paying for immunizations. The flu shot is cost-effective.

Breaking threshold of immunizations. It is important to keep in mind that some people are afraid of immunization.

Simple interventions are important. Using mosquito repellent when you are outdoors, bed nets when camping, avoiding standing water near homes where mosquitos can breed. Alerting your employees about these can have a significant impact. Risk communication is very cost effective.

Spread of anti-microbial gels also a problem?

It's an advertising campaign – the bottom-line is we have to use these effectively. Hand gel is no substitute for hand washing. It's better to wash agents off the skin. When you wash your hands you are rinsing, it takes things off and removes them off your skin. When you don't have the opportunity to wash your hands it's better to have a gel.

Additional Resources:

- DisasterDoc: <http://disasterdoc.org/>
- World Health Organization (WHO) – Infectious Diseases: http://www.who.int/topics/infectious_diseases/en/
- Centers for Disease Control and Prevention (CDC) – Influenza (flu): <https://www.cdc.gov/flu/index.htm>
- Centers for Disease Control and Prevention (CDC) – Measles: <https://www.cdc.gov/measles/index.html>
- The World Bank – The Socio-Economic Impacts of Ebola in Liberia: <http://www.worldbank.org/en/topic/poverty/publication/socio-economic-impacts-ebola-liberia>
- The World Bank – The Socio-Economic Impacts of Ebola in Sierra Leone: <http://www.worldbank.org/en/topic/poverty/publication/socio-economic-impacts-ebola-sierra-leone>