International perspectives on global medical challenges.

Pandemic: Controlling infectious diseases before they spread

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He's been called Patient Zero, but his real name was Emile Ouamouno. He was two years old, he lived in the Guinean farming village of Meliandou and he loved listening to his family's bright red portable radio.

Emile died in December 2013, the first victim of an Ebola outbreak that would quickly spread across Guinea, Liberia, Sierra Leone and other countries in 2014. Ebola eventually claimed 11,325 victims, including Emile's mother, grandmother and three-year-old sister, all of who died within a month of the young boy.

No one knows how Emile contracted Ebola — the virus can be spread by infected animals such as chimpanzees, monkeys and fruit bats — but how the disease moved beyond his village is clear. A midwife who attended his grandmother's funeral contracted Ebola and passed it to a health care worker treating her in a hospital 80 kilometres away in Macenta. Then the doctor treating that health care worker contracted the disease and infected relatives in Kissidougou, 133 kilometres away. The midwife and doctor both died.[1] [2]

Ebola crossed into Liberia in March 2014 and Sierra Leone in May 2014. By June 2014, Médecins Sans Frontières (MSF) was reporting that Ebola was out of control. By August, the World Health Organization had declared the outbreak to be an international emergency. In September, WHO Director-General Dr Margaret Chan reported that the number of patients was "moving far faster than the capacity to manage them."[3]

Questioning the world's response

One might ask why the world was not better prepared to deal with Ebola. Why, for example, had scientists not developed vaccines or effective treatments? After all, the virus was first identified in 1976, nearly four decades before Emile Ouamouno's tragic death.

The simple answer is that researchers, health agencies and pharmaceutical companies have had little incentive to focus their attention on Ebola. According to the U.S. Centers for Disease Control, there were just 2,361 human cases prior to the outbreak in Guinea, and many years saw no outbreaks at all. By comparison, there are 3 to 5 million cases of influenza every year.[4] [5]

But the more complex — and more important — answer is that the world should have been ready, not just for Ebola but for any potential pandemic. Many of the measures that could have contained the Ebola outbreak would be equally effective against Zika, SARS, MERS-CoV or whatever other infectious disease might dominate worldwide headlines in coming years. In fact, the more we learn from Ebola, the more we will be prepared to handle other breakout infectious diseases in the future.

Learning from the Ebola outbreak

Perhaps the most important lesson from the Ebola outbreak is that pandemics don't occur in isolation. They occur in communities, in cultures and in economies.

Community life must go on, even in the face of death, and stories from across the affected region demonstrate the lethal interplay between death and life. Consider, for example, the first confirmed case of Ebola in Sierra Leone: a young woman who arrived at Kenema Government Hospital following a miscarriage on 24 May 2014. That woman was lucky, as were the health care workers treating her. Because doctors knew of the Ebola outbreak in neighbouring Guinea, they placed her the following day in the hospital's isolation ward (the world's only isolation ward designed for victims of Lasse fever) and took steps to protect themselves. The patient survived, and no one else at the hospital contracted the disease.

Others in Kenema weren't so lucky. The young woman's infection was eventually traced to a traditional healer who had done brisk business on both sides of the border between Sierra Leone and Guinea as fear of Ebola intensified. This woman

1 https://www.theguardian.com/world/2014/oct/28/ebola-virus-guinea-first-victim-patient-zero
2 http://www.cnn.com/2014/10/28/health/ebola-patient-zero/
3 http://www.bbc.com/news/world-africa-28755033
4 https://www.cdc.gov/vhf/ebola/outbreaks/history/chronology.html
5 http://www.who.int/mediacentre/factsheets/fs211/en/

predictably became infected and died, and many of the hundreds who attended her funeral also became ill. In fact, local authorities said her funeral could be linked to as many as 365 deaths.[6]

Of course, many in the West — and in the affected regions — would argue that traditional healing and funeral practices have no place in the modern world. They would do well to remember Newton's third law, that for every action there is an equal and opposite reaction.

In August 2014, the Liberian government decreed that all corpses must be cremated to prevent Ebola's spread, a move that had two unintended effects, as noted by Umberto Pellecchia, an anthropologist with MSF. First, the decision prevented people from participating in funerals that also serve as important social gatherings where land disputes and other transactions are often worked out. "To forbid the funeral — without any form of counter-compensation, and especially without involving the communities — has meant to cut off a part of the social life, reproducing the breakdown Ebola brought in the country," Pellecchia said. Even more important from a public health perspective, the decision created a black market for funeral services. As Pellecchia reported:

> "Families in Monrovia have started burying their own deceased in private lands and cemeteries, both independently or seeking help from illegal burial teams. The latter have been operating according to unequal lines: the economic conditions of the family requesting the funeral have become the scale by which the illegal burial team offers a more or less safe burial."[7]

Ebola and other pathogens

The Ebola virus disease, which was formerly known as Ebola haemorrhagic fever, is caused by a virus transmitted to people from close contact with wild animals. While the virus originated in animals, most transmission is from person to person. Direct contact with an infected person's blood, secretions or other bodily fluids — or surfaces contaminated with these fluids — can spread the virus. Patients first experience fever, fatigue, muscle pain, headache and sore throat, but those relatively mild symptoms quickly give way to vomiting, diarrhoea, kidney and liver failure and both internal and external bleeding. About half of those who contract Ebola die from the disease, although rates vary due to the quality of care victims receive.[8]

Of course, the Ebola virus is just one pathogen that threatens humans. Already this century the world has seen outbreaks of Severe Acute Respiratory Syndrome (SARS) in 2003, H5N1 avian flu in 2009, Middle East Respiratory Syndrome Coronavirus (MERS-CoV) in 2012 and Zika virus disease in 2015. And more threats are on the horizon. In 2015, WHO Director-General Dr Margaret Chan said, "Changes in the way humanity inhabits the planet have given viruses and bacteria multiple new opportunities to exploit. New diseases are now emerging at an unprecedented rate. No one expects this trend to end. Moreover, in a world of radically increased interdependence, international travel and trade, there is no such thing as a local outbreak anymore." [9]

Research bears out Chan's warning. According to one report, North America has seen more than a dozen new viruses and pathogenic bacteria in the past two decades, while Europe and Asia have seen at least 17 each. (Africa, often thought of as the cradle for pathogens, has only seen seven.)[10]

6 http://www.who.int/csr/disease/ebola/ebola-6-months/sierra-leone/en/

7 The full report can be accessed and downloaded here: http://www.ebola-anthropology.net/case_studies/do-traditions-spread-ebola/

8 http://www.who.int/mediacentre/factsheets/fs103/en/

9 http://www.who.int/dg/speeches/2015/ebola-lessons-lecture/en/

10 http://www.npr.org/sections/goatsandsoda/2017/02/07/512634375/map-find-out-what-new-viruses-are-emerging-in-your-backyard

Ebola may have benefited the underground economy, but it devastated legitimate commerce. Meliandou, the village at the outbreak's epicentre, found that people in nearby Guéckédou no longer wanted to buy its spinach, rice, bananas and other produce. Moreover, as Chief Amadou Kamano told The Guardian, "People burnt everything out of fear … now we are even poorer than we were before." In fact, the World Bank estimated that Guinea — a country where 43 percent of residents live on less than $1.25 a day — might see its gross domestic product drop by up to 2.3 percent due to Ebola.

The WHO's one-year report on the Ebola outbreak vividly depicts the follow-on effects:

> "Under the weight of Ebola, health systems in Guinea, Liberia and Sierra Leone collapsed. People stopped receiving — or stopped seeking — health care for other disease, like malaria, that cause more deaths yearly than Ebola. In turn, the severity of the disease, compounded by fear within and beyond the affected countries, caused schools, markets, businesses, airline and shipping routes and borders to close. Tourism shut down, further deepening the blow to struggling economies. What began as a health crisis snowballed into a humanitarian, social, economic and security crisis. In a world of radically increased interdependence, the consequences were felt globally."

So if the effects of outbreaks like Ebola will be felt around the world, what should the world do to stop the next pandemic before it starts? At Aetna International we believe three steps are required: investing in well-performing health systems, strengthening disease surveillance and engaging local communities.

Investing in well-performing health systems

The WHO's one-year report on Ebola contained this startling statistic: 71 percent of those who received care in affected countries died, as compared with 26 percent of foreign medical staff who were evacuated to well-resourced countries for specialized treatment. Put another way, outsiders with access to quality care were as likely to survive Ebola as local people were to die.

One reason for this disparity is that health resources are poorly distributed between countries. According to the WHO's World Health Report 2006:

> "The Region of the Americas, which includes Canada and the United States, contains only 10 percent of the global burden of disease, yet almost 37 percent of the world's health workers live in this region and spend more than 50 percent of the world's financial resources for health. In contrast, the Africa Region suffers more than 24 percent of the global burden of disease but has access to only 3 percent of health workers and less than 1 percent of the world's financial resources — even with loans and grants from abroad."[11]

Exacerbating this situation, many countries with overburdened health care systems are witnessing an outmigration of health care workers to high income countries, where they can earn more money and enjoy better living and working conditions. Among the results: further shortages in service capacity, a reduction in government income from consumption and tax receipts, a decline in morale among remaining workers and a loss of expertise in medical schools and role models in the workplace.[12]

11 http://www.who.int/whr/2006/en/

12 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3926986/

Like houses made of cards, many local health systems are standing, but only barely. It takes just a single crisis — an epidemic, a natural disaster or even the death of a key physician who falls victim to disease — to make the whole system come crashing to the ground. As the WHO noted in its one-year report on Ebola, "The evolution of the crisis underscored a point often made by WHO: fair and inclusive health systems are a bedrock of social stability, resilience and economic health. Failure to invest in these fundamental infrastructures leaves countries with no backbone to stand up under the weight of the shocks that this century is delivering with unprecedented frequency."

Strengthening disease surveillance

Coupled with the need for better health care resources is the need for better disease surveillance. Pathogens are no respecter of national borders, so it's critically important to identify, track and report outbreaks of infectious diseases.

Adequately mapping infectious diseases requires far more than recording the incidence of outbreaks. We also need to understand the lifecycle of pathogens, their vectors, hosts and reservoirs, how they are transmitted and the impact of factors like temperature, rainfall and human migration. And we need to be able to access this data quickly instead of having to piece it together from disparate medical journals and reticent ministries of health. Unfortunately, a recent systematic review found that we have an "astonishingly poor knowledge" of most infectious diseases:

> "Less than 5 percent of clinically important infectious diseases have been mapped reliably. This presents clear obstacles to advances in determining the global burden of these conditions, our ability to differentiate outbreaks of concern in international biosurveillance and our ability to understand the geographical determinants of disease emergence, past, present and future."[13]

WHO Director-General Chan has echoed this concern: "Of the 194 countries that are member states of WHO, only 64, that is, less than a third, have core capacities for outbreak alert and response in place. That is a shocking indictment of the state of global preparedness."

In this area, technology is playing an important role in early detection. A good example is the work of the Global Public Health Intelligence Network (GPHIN), which is part of the WHO's Global Outbreak Alert and Response Network. Every day, the GPHIN analyses online news reports from 30,000 sources in nine languages to find signs of disease outbreaks. In 2003, it was alerted to the SARS outbreak by a report in a newspaper's business section that a drug company was seeing an increase in sales of its antiviral drugs. Nine years later, GPHIN became the first agency to report on MERS-CoV when it identified eight cases in Jordan of an unknown respiratory illness.[14]

Research has also demonstrated the value of social-media tools like Twitter as early-warning systems. A study of more than two million tweets related to H1N1 flu in 2009 found a close correlation with incidence data, pointing toward a future when near real-time analysis of such "infodemiology" data can be used to monitor disease outbreaks.[15]

13 http://rstb.royalsocietypublishing.org/content/368/1614/20120250
14 http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/15vol41/dr-rm41-09/ar-02-eng.php
15 http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0014118

The international health regulations

Global health made a potentially important step forward with the revision of the International Health Regulations (IHR) in 2015. A binding agreement among 196 countries, including all WHO member states, the IHR, whose new version went into effect in 2007, are intended to codify the process of assessing potential outbreaks and reporting them to the WHO.[16]

When a state receives reports of an urgent event — anything from a single case of smallpox to a new strain of influenza to a potential pandemic — it must perform an assessment within 48 hours. If an event is deemed notifiable, the state must notify the WHO within a further 24 hours.

The IHR Emergency Committee then recommends whether the event is a "public health emergency of international concern" and what steps should be taken to prevent or reduce the international spread of the disease.

While the IHR work well in theory, in practice they leave much to be desired. As The Lancet has noted, "With no additional financing in place and no proper accountability mechanism to ensure independent monitoring, this laudable vision has become a huge missed opportunity. Whereas most developed countries certainly have the capacities to implement such a framework, many low-income and middle-income countries, and especially fragile states, do not."[17]

The Lancet went on to note that Ebola was only declared to be a public health emergency of international concern on 8 August 2014. That was more than four months after the Guinean Ministry of Health first reported the outbreak and a total of 245 days after Emile Ouamouno died.

Engaging local communities

Finally, it is essential that any measures taken by health authorities — whether local ministries of health or the WHO — engage and involve local communities. Top-down decisions, such as Liberia's cremation mandate during the Ebola outbreak, can lead to unintended consequences.

A simple example of the value of local involvement occurred in the Sierra Leonean village of Mondema, when WHO field workers rightly suggested that villagers who might be infected with Ebola "self-isolate" while waiting to go to a treatment centre. The problem was that many households had 10 or more people living in a single room and sharing bedding. Since self-isolation was impossible in such conditions, the WHO and the International Federation of Red Cross and Red Crescent Societies (IFRC) brought in tents to serve as quarantine spaces, while UNICEF provided sleeping mats, bed nets and cooking equipment.

"Since we brought in the tents, we haven't had another case in Mondema and their quarantine is over," reported Dr Andrew Ramsay, field coordinator for the WHO in Kenema.[18]

A more complex example related to West African funeral practices, which can involving everything from washing and dressing a corpse to removing a foetus from a dead woman's body. Early on, health officials gave little heed to these customs, even burying bodies in unmarked graves. (This fuelled rumours that Ebola was a hoax, something easy to believe in a region where many people are deeply suspicious of their governments.) Eventually, however, health officials engaged religious leaders and paid liaisons to find approaches that were both culturally and medically appropriate. As National Geographic reported, "The liaisons try to honour reasonable requests. In some cases, that means burial workers in Tyvek suits dress the dead in outfits chosen by families

16 http://www.who.int/ihr/
17 http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(14)61697-4/abstract
18 http://www.who.int/features/2014/sierra-leone-kenema-tent/en/

before the corpses are placed in body bags. In other cases, money or jewellery is placed in body bags as a 'toll' that the deceased must pay to cross over to the village of the dead."[19]

Concerns in future outbreaks might look quite different, of course. If quarantine were required in a Western democracy, for example, there might be concerns about the economic impact of cancelling major sporting events or shutting down financial centres like Wall Street, which could have global ripple effects. Regardless of the setting, it's critically important to take steps to respect the concerns of people who are affected and to involve people on the ground at every step of the way.

Conclusion

In December 2016, The Lancet reported the exciting results of an Ebola vaccine trial in Guinea and Sierra Leone. According to researchers, vaccine efficacy was 100 percent — a stunning result. While the vaccine, known as rVSV-ZEBOV, has yet to be approved for usage, such approval could come as early as 2018.[20] [21]

That's the good news. The bad news is that chances are good that the next pandemic won't be caused by the Ebola virus.

Whatever its cause, the next major pandemic will threaten states around the globe. While fragile states face the highest risk, pandemics can have a devastating impact anywhere and at any time. That's why we at Aetna International believe governments and agencies like the WHO must redouble their efforts to invest in well-performing health systems, strengthen disease surveillance and engage local communities.

The Commission on a Global Health Risk Framework for the Future has recommended incremental annual spending of $4.5 billion to strengthen global preparedness against infectious diseases. Set beside expected losses of $60 billion per year — and indirect costs eight times as high — that level of spending seems appropriate.[22]

We live in an age of growing populism and nationalism, when many would choose to retreat within their own borders. It would be a mistake, however, to think border controls can keep pathogens at bay or that any country alone can successfully deal with a pandemic. Instead, the world community must come together to invest in solutions that benefit all.

19 http://news.nationalgeographic.com/2015/01/150130-ebola-virus-outbreak-epidemic-sierra-leone-funerals/
20 http://www.thelancet.com/pdfs/journals/lancet/PIIS0140-6736(16)32621-6.pdf
21 http://www.npr.org/sections/goatsandsoda/2016/12/22/506600875/first-ebola-vaccine-likely-to-stop-the-next-outbreak
22 https://nam.edu/initiatives/global-health-risk-framework/

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Opinion paper 2.0 — which continues to explore the topic of infectious diseases — is due out later in the summer

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