Risk Management of Emerging Pandemics

By Gordon Woo[+]

The fire in a peat bog

The London office of RMS is in Monument Street. The name refers to the monument to the Great Fire of London in 1666, which started close by and burned down most of the city of London. At that time, there was no professional fire service to control the conflagration and extinguish the flames. The monument also commemorates the introduction of fire insurance, which arose a year later from the ashes of London. It was clearly in the interests of fire insurers to have an active response to any threat of fire to an insured property, and private fire-fighting teams were sent out to mitigate this risk. This is far from being an optimal solution. If a fire broke out close to an insured property, the fire there should be put out, rather than being allowed to spread to the insured property. Fire insurers have a commercial interest in communal fire safety that extends well beyond their own insured properties, to include sources of conflagration that might be many kilometres away. Wildfire is a good example of a peril that, if not brought under control by a forest fire service, could engulf a neighbouring town.

The World Health Organization (WHO) has likened the Ebola crisis of 2014 to a fire in a peat bog 'that flares up on the surface and is stamped out, but continues to smoulder underground, flaring up in the same place or somewhere else.'[1] This graphic fire metaphor is instructive also in communicating the need for urgent emergency preparedness and response for dealing with emerging pandemics.

A pandemic is a deadly infectious disease which spreads globally via the international travel of infected persons. Especially if infected passengers show little or no signs of illness, closing borders has very limited impact other than to retard by a few weeks the spread of a pandemic. The origins of a pandemic lie in the genetic mixing of animal and human viruses, arising from the juxtaposition of animal and human populations in live animal markets, the encroachment of people deeper into wilderness territory and the consumption of bush meat. Most likely therefore, pandemics will emerge from developing countries. Expanding populations heighten the risk. The index case of the 2014 Ebola crisis was a small boy in a remote area of Guinea who played in a hollow tree infested by diseased bats. Guinea, like its afflicted neighbours Sierra Leone and Liberia, is amongst the poorest nations of the world and the most deprived in terms of social health infrastructure. These poor countries lacked the medical and financial resources to control the spread of Ebola, but how then could Ebola be controlled and eradicated from West Africa?

Unlike malaria and cholera, which were initially thought to be the most probable causes of illness in Guinea, an infectious disease like Ebola can spread internationally and put all populations at risk. But with so many stakeholders across the globe having national interests in the control of infectious disease, the willingness of the more generous and concerned donors to support the control effort has been tempered by their frustration at the apathy of other apparently free-riding stakeholders. The classic economic paradigm of the 'tragedy of the commons' explains the apparent lack of urgency of some self-interested stakeholders to commit resources to help deal with the collective international problem.[2]

When a fire is raging, those who have contributed most to financing the fire service cannot afford to wait for free-riders to make their due contribution as the hat is passed around. The longer the delay, the more fire loss there will be. Like fire, a pandemic can also spread at an exponential rate. In April 2014, WHO estimated a modest cost of USD 4.8 million to control the Ebola outbreak. By the end of July, this had risen to USD 100 million; a month later

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[+] Catastrophist, Risk Management Solutions (RMS), London, U.K.
[1] WHO (2015) 'Factors that contributed to undetected spread of the Ebola virus and impeded rapid containment'.
[2] See Hardin, G. (1968) 'The tragedy of the commons', *Science* 162(3859): 1243–1248

this was almost half a billion, and by the end of September the cost had ballooned to USD 1 billion. As of 15 October 2014, only USD 257 million had been received, with another USD 162 million pledged.

One of the greatest challenges of the Ebola crisis has been to get treatment centres fully operational and bring in more health workers. A considerable amount of money was needed to pay not just health workers, but also cleaners, funeral staff and the people assigned to trace contacts. The original outbreak in the forest region of Guinea might have been contained early, but for unseemly and counter-productive haggling over who should pay for tracing contacts, Ebola then was allowed to spread to different parts of Guinea and into Sierra Leone. WHO worked closely with governments and partners at the highest level to recruit teams and deploy resources and equipment. But, in a desperate race against time to limit the spread of the epidemic, the overall international response was far too lethargic.

Insurance solutions

Infectious disease pandemics are rare multi-decadal occurrences and thus are amenable to insurance solutions. Other than a world war, the disaster scenario of millions of excess deaths worldwide is associated by life insurers with a major influenza pandemic, such as the one that struck in 1918. Life insurers, therefore, are amongst the leading stakeholders in pandemic risk mitigation. As with fire insurers, they have a vested interest in active response measures taken early to control and suppress a societal insured peril. Pandemic viruses, like that of 1918, which struck down those in the prime of life, are of particular importance.

Another major global stakeholder in the early control of emerging pandemics is the World Bank. The economic impact of a pandemic is severe on all countries, but especially on poorer nations with extremely fragile health-care systems. It is in such countries that a new pandemic virus is most likely to take hold, because they lack the medical infrastructure capacity for disease surveillance, diagnosis and treatment. The ability of these poor nations to repay World Bank loans would be severely compromised, and indeed, their indebtedness would be increased yet further with the burden of extra loans to assist in the pandemic recovery process. According to the World Bank, the Ebola crisis has cost the three most impacted countries USD 1.6 billion in economic growth. It is fitting and timely therefore that the President of the World Bank, Jim Yong Kim, who is himself a physician rather than an economist, should openly advocate and welcome the involvement of the insurance industry in finding innovative financial solutions to the challenge of funding early action to control an emerging pandemic.

President Kim has urged increased collaboration between countries, multi-lateral institutions, corporations and donors to work together to develop a Pandemic Emergency Facility, with capital coming from the International Bank for Reconstruction and Development (IBRD) and capital markets. To help overcome traditional backsliding in cooperative initiatives, he has suggested that commercial market mechanisms be used to drive forward improvements in preparedness. Thus insurance premiums for dealing with an emerging pandemic would be reduced through the strengthening of health-care systems, improved surveillance and crisis readiness of medical response teams.

Various insurance and bond financial solutions will be needed. One initiative being explored by the African Risk Capacity (ARC), an African catastrophe insurance pool, is the provision of insurance cover for a pandemic to enable affected African countries to respond promptly to initial cases, and to mitigate the effects of a spreading pandemic. The incentive of lower premiums, if adequate actions are taken to lower pandemic risk, should improve resilience and benefit the health-care systems in African countries ridden with endemic corruption and poor governance.

Pricing of pandemic insurance

The pricing of insurance, bonds or other financial instruments for funding rapid response to emerging pandemics requires epidemiological risk analysis. This type of risk analysis has been routinely used by RMS to price excess mortality catastrophe bonds since the most recent influenza pandemic in 2009. At the core of this epidemiological risk analysis is the modelling of the spread of an epidemic through a population, and the toll of the seriously ill and dead. The two key model parameters are the measures R_0 (basic reproductive ratio) of the transmissibility of the pandemic virus from one host to another, and the death rate per case of the pandemic virus.

The ratio R_0 characterises the spread of a pandemic. This is the average number of others infected by a virus carrier. A value above unity is sufficient for the virus to continue spreading, as in a chain reaction. From the onset of the Ebola pandemic until October 2014, this was around 2, and explains the alarming growth of infections over a period of about six months. The virology of Ebola fortunately limited the reproductive ratio. Ebola is not transmitted by those infected but not symptomatic, and also the incubation period is quite long, allowing days to track contacts of virus carriers, provided resources are available for this task. These resources were notably lacking as the Ebola crisis deepened.

But R_0 depends not just on virology but also on sociology. This latter factor for West Africa tended to increase R_0. Traditional funeral customs exacerbated the risk of contagion amongst family and friends of the deceased: 60 per cent of Ebola cases in Guinea, and 80 per cent of Ebola cases in Sierra Leone were linked with touching and washing the dead. Yet, with international assistance, a reduction in R_0 was eventually achieved through a remarkable transformation in public response to the Ebola crisis. Social customs changed dramatically, partly through legally enforced cremation of the dead, and partly through non-shaking of hands and other general public hygiene improvements.

Key to the pricing of insurance for mitigating the spread of a future pandemic will be modelling in a stepwise time-dependent manner the social transformation of R_0, as population behaviour adapts to the menace of a lethal virus. Another dynamic change to be captured in the epidemiological risk modelling is the prospect of a progressive reduction in the case lethality rate, with the improved clinical care which is possible with increased international funding. This is an important factor in gaining control of an emerging pandemic. If death rates are very high, then families sceptical of the value of health care become reluctant to give up infected relatives for fear of never seeing them again. This in turn increases R_0, since family members and close friends become more likely to become infected. However, if substantial funding can be made available early to provide effective care for the sick, then the prospects for recovery in health-care centres improve, and there will be enhanced societal compliance with directives to report all cases of severe illness.

Insurance risk management

With the passing of the 2014 Ebola crisis, every living person in the world has dodged a bullet—nobody on any continent was secure from becoming a victim. The legacy of this crisis must be that the world will never again be so poorly prepared financially for controlling the spread of an epidemic. As President Kim of the World Bank has emphasised, passing around the hat for contributions whilst an epidemic is spreading is not a viable option. The insurance industry will be expected to rise to the challenge of a significant role in ensuring greater preparedness for a future pandemic. For this assignment, pandemic risk modelling will be a key part of risk management.