Are we prepared for the looming epidemic threat?

A dangerous virus, as yet unknown, has the potential to wipe out millions of us. Yet public health bodies are mired in complacency.

Somewhere out there a dangerous virus is boiling up in the bloodstream of a bird, bat, monkey or pig, preparing to jump to a human being. It's hard to comprehend the scope of such a threat, for it has the potential to wipe out millions of us, including my family and yours, over a matter of weeks or months. The risk makes the threat posed by Islamic State, a ground war, a massive climate event or even the dropping of a nuclear bomb on a major city pale by comparison.

A new epidemic could turn into a pandemic without warning. It could be born in a factory farm in Minnesota, a poultry farm in China or the bat-inhabited elephant caves of Kenya – anywhere infected animals are in contact with humans. It could be a variation of the 1918 Spanish flu, one of hundreds of other known microbial threats or something entirely new, such as the 2003 Sars virus that spread globally from China. Once transmitted to a human, an airborne virus could pass from that one infected individual to 25,000 others within a week, and to more than 700,000 within the first month. Within three months, it could spread to every major urban centre in the world. And by six months, it could infect more than 300 million people and kill more than 30 million.

This is not alarmist science fiction. It is one of several highly plausible scenarios – and far from the worst – developed by infectious disease specialists working with disease-modelling experts. Bill Gates, who funds a group that uses computer simulations to predict the spread of diseases, said: "The Ebola epidemic showed me that we are not ready for a serious epidemic, an epidemic that would be more infectious and would spread faster than Ebola did." He put the likelihood of a catastrophic epidemic at "well over 50%" in his lifetime.

Gates's model estimates that a perilous virus, carried via cars, planes, ships and trains, and spreading quickly in packed cities, could kill up to 33 million people in just over 200 days.

In the last century alone, smallpox killed 300 to 500 million people. The 1918-19

Spanish flu killed 50 to 100 million and Aids has taken 40 million lives since it was first recognised in 1981. The annual influenza outbreak still claims half a million people a year worldwide. The west African Ebola crisis took more than 11,000 lives – seven times the total of the 22 Ebola epidemics that preceded it. But widespread death isn't the only threat. For those who survive the initial infection, an epidemic leaves its own particular trail of disfigurement and disability. People who contracted smallpox suffered characteristic, sometimes horrific, scars, along with blindness, limb deformities and other disabilities. As a lifelong condition, Aids and the side-effects of treatment can affect nearly every body system, from brain to bone.

In the early stages of a new epidemic – before it has been recognised or how it spreads has been determined, and before appropriate protection measures are in place – health workers die in high numbers. As with war, where common illness can take more lives than war injuries, epidemics sometimes take more lives from disruption of primary health care than from the epidemic itself. Because health workers are diverted to emergency response centres, and health facilities are sometimes closed, epidemics can also disrupt routine public healthcare needs such as immunisation, treatment of acute illness and facility-based births.

Finally, there is the stunning financial and economic cost to households, communities, businesses and entire countries. Such a pandemic could cause a global stock market crash that obliterates the livelihoods and savings of millions of survivors. "A severe and prolonged global pandemic could … hit global GDP by as much as 5-10% in the first year," noted the authors of the Bank of America/Merrill Lynch 2015 Global Pandemics Primer report.

Oxford Economics has suggested that the cost of a global pandemic, including spillover across industry sectors, could be as great as $3.5tn – an impact far greater than the magnitude of the great financial crisis of 2008.

Every year, the world spends more than $50bn controlling epidemics such as avian influenza, HIV/Aids, malaria and polio, and responding to new threats such

as Ebola. In addition to the direct cost of preparedness, immunisation and emergency response, there's the indirect cost of disruption in travel, transport of goods, tourism, financial markets and other areas of economic activity. Wherever it has been measured, this indirect economic impact is at least equal to and usually greater than the direct cost, bringing the total cost of infectious disease epidemics close to $100bn a year. In short, even in the absence of Gates's imagined pandemic, we can expect to spend $1tn on epidemics over the next decade unless we fundamentally change course.

Scientists don't know which microbe it will be, where it will come from or whether it will be transmitted through the air, by touch, through bodily fluids or through a combination of routes, but they do know that epidemics behave a bit like earthquakes. Scientists know that a "big one" is coming because scores of new, smaller earthquakes pop up around the globe every year.

I write this not just because I'm scared. I'm also furious. Many leaders, economists and scientists believe that the risk of potentially devastating epidemics could be prevented for a fraction of the cost of battling an out of control global pandemic.

The obvious question is this: why aren't we deploying absolutely everything we have to make sure that the next disease outbreak doesn't turn into a global catastrophe? There are three broad answers.

A burial team retrieve the body of a 60-year-old Ebola victim from his home near Monrovia, Libera, in August 2014. Photograph: John Moore/Getty Images

First, there's fear. We are all afraid of death. We respond to the fear of epidemic disease by wanting to blame someone else. Any time a threat arises, we want to blame the "other", those not like "us". At the outbreak of the 1918 Spanish flu, Americans blamed "the Hun". Aids was blamed on gay men.

We want to punish those with the disease, pretending that whatever makes them other has cursed them. The most contagious behavioural reaction that affects political leaders, businesspeople and the public is panic that disproportionately exceeds the actual event. Scared people overpersonalise the news, and their worries increase. Fear is a warning system intended to alert us to impending danger, just as it is in animals. When we let it override our rationality, we make things much worse.

Second is denial and complacency, which often starts at the top, with political leaders or public health officials who reject the reality before them. Denial undermines the very trust needed to combat an epidemic. And complacency sets in when the last epidemic passes. We feel that we'll have the silver bullet vaccine in time; that technology will save us, so we don't need to spend time and money on basic prevention.

Finally, financial self-interest: how many vaccines never get developed because poor people can't pay for the drugs that pharmaceutical companies could develop? How many times do governments and leaders plead that there is no budget for preparedness? How many disease-fostering agribusiness companies line the pockets of politicians who conveniently overlook the threats bubbling up from factory farm sewage?

Not recognising these failings – and not doing everything we can in spite of them to prevent a potentially staggering loss of life and livelihood – would be not just irresponsible, but criminal.

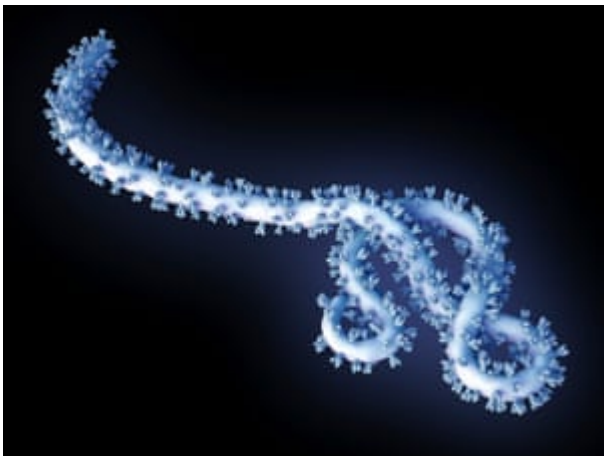
All kinds of complex and interconnected social, economic and environmental risk factors contribute to the emergence and spread of disease.

Consider how just one, population growth, leads to a whole set of others. The world's population is now more than 7.5 billion and it is projected to increase by more than 2 billion people by mid-century. More than half that number will be born in Africa, and most of them will be packed into dense urban areas where an epidemic can spread like wildfire.

The more people there are, the greater the demand for shelter, food and water. Imagine that you are a poor person living in a remote part of Guinea or the Amazon jungle, and you want to do the thing that is most instinctive for all of us: to stay alive. If you are lucky enough to procure cows, goats or chickens, you need

room for a pasture. And if you need wood for fires or to build a house, you chop down the trees. But your own personal needs are nothing in comparison to the demands of agribusiness and industry, which obliterates millions of acres of forestland each year. Between 2000 and 2010, these industries annually consumed some 13 million hectares (50,000 square miles).

Clear-cutting – cutting down every tree in an area – brings people in closer contact with primates, rodents and bats that carry dangerous pathogens. Some researchers believe that ravaged tropical forests and increased human activity in countries such as Liberia and Guinea presented an ideal opportunity for the Ebola virus to jump from its natural reservoir to humans.



Computer illustration of an Ebola virus particle. Photograph: Maurizio de Angelis/Getty Images/Science Photo Library RM

Deforestation also leads to flooding, which attracts mosquitoes. The hotter the jungle (and the planet) becomes as a result of all this deforestation, the happier mosquitoes are. If you're living near a forest in Africa and have the leisure to be focused on more than your survival, you may have begun to notice that some amphibians and birds that hunted mosquitoes have disappeared (because they are extinct). Those that are not extinct may have migrated to more northerly realms that are rapidly becoming more hospitable, thanks to global climate change.

Viruses such as Ebola, Aids and Zika aren't like fastidious plants that stay rooted in only one place. On any given day, millions of people around the world are moving around on planes, trains, boats, trucks and automobiles, some from places where undiscovered viruses are festering in the bloodstreams of wild beasts and fowls. An average of 10 million people a day take to the skies; 3.5 billion passenger flights a year.

All this creates huge opportunities for the transcontinental spread of pathogens such as Sars, Ebola or Zika. A person who has been infected in a hot zone won't feel ill for days or weeks, not until they land in Dallas, Singapore, London or New York. And the duration of the longest intercontinental flights is now greater than the incubation period of several common pathogens. A person may be asymptomatic when they get on a jumbo jet in Hong Kong, but by the time they land in New York they will have spread the virus to the crew and passengers.

In the case of Aids, the virus spread slowly at first. Then, as Africa became more urbanised and roads connected remote regions to cities, men went to the cities to look for work. Those men hooked up with infected prostitutes who spread the virus to clients.

Disease travels especially fast in west Africa, where the population is highly mobile. People move around a lot to look for work or food or to visit extended family members across borders. Also, sick people will travel to countries that have the resources to treat them when their own countries do not. One sick individual crossing a border to seek a cure could start a wave of new infections across a country that has all but succeeded in controlling an outbreak. The problem is compounded by the illegal trade of goods, animals and people; there is often no record of who or what may have entered a country, or when or where that person or animal carrying a deadly virus might have done so, making the prevention and treatment of the disease very difficult.

And like the proverbial butterfly whose beating wings can set off a hurricane somewhere far away, any single human being can do something that sets off catastrophic consequences. People need to have sex; before Aids broke out, thousands spread the disease through unprotected sex, and a few irresponsible ones continued this behaviour even after discovering they had contracted HIV.

Humans hug and kiss: during the Ebola crisis, containing the disease was made far more difficult not just because of an ancient tradition of kissing dead bodies but because people insist on touching one another. And human beings need to eat: given a choice between starvation and risking disease, most people would prefer to roast a monkey or a bat.

Ebola, Aids and Zika each arose in the first half of the 20th century and spent their first several decades in the African bush, largely unnoticed by the rest of the

world. But they are three very different examples of emerging infectious diseases. And they are just three of nearly 400 new infectious diseases that have been identified in the last 75 years. Since 1971, scientists have discovered at least 25 new pathogens for which we have no vaccine and no treatment.

Even more worrying is the rate at which emerging infectious diseases are appearing: the number of new ones has been increasing each decade, more than tripling between 1940 and 2000. During the 1980s, the number of new infectious diseases rose to nearly 100, reflecting an association with the Aids pandemic. In 2014, the World Health Organisation recorded more than 100 disease outbreaks.

What to do?

For less than $1 per year for every person on the planet (spent on the right things), we could prevent the next local disease outbreak from turning into Bill Gates's feared global pandemic. That's less than half of what Americans alone spend on video games each year and a small fraction of Gates's net worth. It's far less than the current annual cost of dealing with Aids, an epidemic the world allowed to spin out of control. And it's nothing compared with what a pandemic would cost the world in emergency response and economic disruption. Those investment funds would support innovation for prevention, strengthen developing countries' health systems, and support emergency response to ensure that microbial invaders never arrive at the gates.

There are seven essential sets of actions if we want to set about ending epidemics. These seven actions emerged out of in-depth analyses of five epidemics: smallpox, influenza, Aids, Sars and Ebola. I chose these five diseases because together they killed more than half a billion people in the last 100 years and because they reflect different types of epidemics.

- **1. Lead as though the house is on fire**

Just as firefighters race into the burning building, those responsible for protecting public health need to act rapidly and on the basis of scientific evidence, not political interests. Leaders at the highest level must put the public good above parochial interests.

- **2. Resilient systems, global security**

Strong national public health systems are the foundations for prevention and preparedness. National governments, the private sector, communities and faith-based organisations have been enormously successful when they work in concert to fight disease. Robust international agencies and non-governmental organisations are essential to support even the poorest countries in mounting successful defences.

• 3. Active prevention, constant readiness

Epidemics can be stopped by prevention through healthy self-care habits, immunisation and fighting mosquitoes; early detection of disease through surveillance at all levels; and rapid response to treat the sick, prevent the spread and maintain routine health services.

• 4. Fatal fictions, timely truths

In the face of an epidemic, terror, blame, rumours and conspiracy theories, distrust of authorities and panic can take hold simultaneously. This is why establishing and maintaining trust through honest, clear communication at local level is paramount. History continues to show us that health communication lies at the heart of epidemic control. Fighting rumour with truth is a job for professional communication teams working with local and national governments, international agencies, communities, print and broadcast media and social media.

• 5. Disruptive innovation, collaborative transformation We need to do everything we can to support the work of scientists who are applying breakthrough techniques to identify viruses and prevent them from jumping to people, and we must help those who are working to nip outbreaks in the bud. We need to do better research and development to diagnose illness quickly and treat it immediately. We must discover new vaccines, make more of them and figure out better distribution strategies.

• 6. Invest wisely, save lives

A worldwide pandemic could cost the economy several trillion dollars. But an ounce of prevention, in terms of money, is truly worth a pound of cure when it comes to stopping epidemics. By investing an average of just $7.5bn more annually for the next 20 years ($1 per person per year) in the right preventive and response measures at the right times, we can substantially reduce the chance of

epidemics and more than repay ourselves in savings.

• 7. Ring the alarm, rouse the leaders

… with local, national and international voices that track capacity, performance and resources. This is a job for citizens and concerned stakeholders. We achieve progress through a combination of good science, strong leadership and committed advocacy.

I vividly remember the debates we had among global health professionals about Aids treatment in 2000 and the sense of achievement we felt in 2010. During that decade, the unthinkable became reality before our eyes. A determined group of activists, people living with HIV/Aids, health officials and political leaders built a global movement that proved the naysayers wrong by successfully overcoming each barrier to build the largest public health treatment programme in history. That experience transformed my understanding of the word "impossible" and what we can do – with these seven essentials – to stop epidemics.

We know how to stop the next epidemic. This is no excuse for unpreparedness. If we are to save ourselves and our children we must act decisively. The threat is real. The pathway is known. The time for action is now.

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DEFINING DISEASE

Outbreak

A localised epidemic that affects hundreds or thousands of people

Epidemic

An illness or infection that is in excess of normal expectations

Pandemic

An epidemic over a very wide area, crosses borders and touches thousands or millions of lives

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