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Larry Brilliant, MD MPH, is the President and CEO of the Skoll Global Threats Fund.He heads a team whose mission is to confront global threats imperiling humanity like: Pandemics, Climate Change, Water, Nuclear Proliferation and the Middle East Conflict.

Prior to joining Skoll, Larry was Vice President of Googleand Executive Director of Google.org.Larry is board certified in preventive medicine and public health and was thefounder of The Seva Foundation, an international NGO whose programs have given back sight to more than 3 million blind people in 20 countries.Larry lived in India for more than a decade while working as a United Nations medical officer where he helped run the successful World Health Organization (WHO) smallpox eradication program in South Asia.

He recently worked for the WHO polio eradication effort as well. He was Associate Professor of epidemiology, global health planning and economic development at the University of Michigan and chairman of the National Biosurveillance Advisory Committee, created by Presidential Directive;a member of the World Economic Forum's agenda council on catastrophic risk; anda "first responder" for CDC's bio-terrorism response effort. He has worked at many levels, from villages to global policy, on smallpox, polio, blindness, disease surveillance and disasters -- and worked as a volunteer physician in Sri Lanka in the refugee camps following the tsunami. He is an international member of the Health Minister of India's rural health program. He was a senior technical advisor to the movie Contagion, and also conceived the Oscar-nominated documentary "The Final Inch" about polio eradication in India.

He is also a "techie" and holds an early patent in advanced telephone systems and was a co-founder of the Well, a pioneering digital community and has been CEO of many venture backed and public companies. His recent awards include the "TED Prize", Time Magazine's "100 Most Influential People", "International Public Health Hero" and two honorary doctorates.He is the author of two booksand dozens of articles on infectious diseases, epidemiology and global health policy.

ENDING PANDEMICS IN OUR LIFETIME REQUIRES

a One Health Approach

LARRY BRILLIANT

INTRODUCTION

Despite out best efforts, diseases jump from monkeys, pigs, birds and bats to humans. About three dozen such zoonotic diseases have newly infected humans in the past three decades: SARS, HIV/AIDS, ebola, lassa fever, West Nile, highly pathogenic avian influenza H5N1 (bird flu) and the 2009 pandemic H1N1 'swine' flu to name a handful .

In addition, insects still carry malaria, dengue, and leptospirosis. Rodents harbor the next hantavirus or plague. We live amidst pandemic potential. We can't stop this – it's nature at work.

What we can do is find every novel organism that has the potential to become a pandemic early enough to limit its spread. Digital disease detection – automated web scrubbers, infobots, self-reporting systems and social networks – together with the power of mobile phones, computers, tablets and innovative communication networks, can help us find new pandemic threats earlier than ever before.

The stakes are high. Population growth, development and human encroachment into new ecological zones increase the likelihood of viral jumps to humans. Air travel accelerates the rate of potential spread. We must build the missing links in a worldwide network of tools and practices to make it possible to eliminate pandemics.

SURVEILLANCE IS A CRITICAL TOOL

Eliminating pandemics will require intensive, coordinated action across many groups in and between countries. But one activity ranks above all others: early detection and response. In a word: surveillance. Surveillance includes detecting the threat and verifying its authenticity, identifying the causative infectious agent, and sharing information for effective first response.

While technology and improved communications help us detect disease threats faster, verifying that threat is often challenging. Accuracy is critical. False reports breed skepticism in publics and governments. Often, the capacity to rapidly verify emerging disease threats is insufficient given shortages of trained medical professionals in areas where outbreaks occur. But, in truth, we have not thought enough about how to engage those who can help and give them the tools they need. Innovative community-based models can tap into existing local know-how and networks, which often know of outbreaks before the formal health system. Conversely, local health communities are often unaware of the larger picture in which unusual or high local levels of syndromes of illness might fit.

Beyond the challenge of detecting and verifying disease outbreaks lies the third element of surveillance: a response that works. Effective prevention and control measures include having the capacity to develop, distribute and administer vaccines and other medical countermeasures. Effective response might also require social distancing, including isolation and quarantine. It certainly demands diplomacy, trans-boundary cooperation, and trust. Surveillance that includes the sharing of real time data to inform public health action is essential.

DIGITAL TOOLS OF SURVEILLANCE

Leveraging technology, the global community has significantly reduced the time it takes to detect an emerging disease outbreak. We owe much to early pioneers in the field of digital disease detection —which, of course, did not have this name 20 years ago. Event-based biosurveillance, as it is also referred to, is a scientific discipline in which diverse sources of data, many Internet-based, are tapped to prospectively provide information about infectious disease events .

Digital disease surveillance was born with the 1994 creation of the Program for Monitoring Emerging Diseases, ProMED-mail, an Internet-based reporting system that disseminates information on outbreaks of infectious diseases and acute exposures to toxins that affect human, animal and plant health. This was followed by the Global Public Health Intelligence Network (GPHIN), an infectious disease web crawler that gathers preliminary reports of public health significance in seven languages in real-time, 24 hours a day, 7 days a week. In 2006, HealthMap (an initiative of Boston Children's Hospital) introduced a visual platform for current global infectious diseases and their effect on human and animal health. And in 2008, engineers at Google expanded the field of digital disease detection to include automated analysis of search terms for detection of influenza in communities. By aggregating all search terms that correlated with the annual influenza season, we built a system that could monitor influenza activity continually . This became Google FluTrends, which surfaces influenza outbreaks some two weeks before official public health data.

Researchers at Children's Hospital in Boston found that, in 1996, it took up to 167 days from the start of an infectious disease outbreak until its discovery by health authorities. By 2009, the comparative number had been reduced to 23 days . Different countries show great variance, but the overall improvement is clear and impressive.

But can we do better? Can we find infectious disease outbreaks soon enough to prevent their global spread?

Today, social media promises to expand digital disease detection. Twitter is a natural candidate, with its open data and built-in geo-location. SMS, blogs and Facebook are other potential sources of data signals for disease outbreaks. Leveraging these tools will require new techniques to allow anonymity and/or privacy of individual data. Public/private partnerships must develop clear rules for capturing and sharing the data needed to manage public health as a common public good.

ENGAGING THE PUBLIC DIRECTLY

New communications tools also allow us to

directly engage the general public in surveillance. Some early projects show promise. Australia's Flutracking system has been working since 2006 to engage volunteers to submit weekly reports on symptoms related to influenza , with over 10,000 people participating each week. In a similar vein, Influenzanet tracks self-reported influenza in twelve countries in Europe .

In 2011, our organization, the Skoll Global Threats Fund, partnered with HealthMap as technical experts and the American Public Health Association as a trusted public health community to build a self-reported surveillance system, Flu Near You, to track symptoms of influenza in the United States. It is easy to participate, requiring only five to ten seconds once each week to complete the email survey. Flu Near You participants report if they have any of ten symptoms related to influenza and if they've had a flu shot. As important, the system allows participants to report they did not have any symptoms of the flu, potentially giving us information about the level of wellness in communities; numerator and denominator data is coming from the same geo-location. The system is new but shows promise.

ONE HEALTH SURVEILLANCE - THE NEXT STEP

Today, technology allows us to cost-effectively apply research to drive innovation on all fronts in the battle against disease. We can monitor everything on our planet, including our atmosphere, on an ongoing basis. One Health surveillance is detecting, verifying and reporting information on the health of humans, animals and the environment in which they live, work and recreate. It means monitoring wild birds, rodents, bats and insects for infectious agents capable of spreading to livestock, humans or food. It means diligent health monitoring in humans and domesticated animals, and protecting against the introduction of new pathogens by banning illegal wildlife trade and discouraging bush meat hunting in response to the growing global demand for animal meat as protein.

On the environmental front, local tracking of weather patterns can be merged with regional data to better understand the impact of climate and weather on disease emergence and spread. The same is true with water security and its impact on health. Adding factors related to global travel patterns, mass gatherings, migratory patterns of birds and animals, and shipping of goods will help us better predict and prevent the spread of disease.

In the not too distant future, people, animal and environmental health information will be a public good shared in emails, SMS, blogs and almost any online activity will be scraped to find its public health value (with the aforementioned privacy protections in place!).

BUILDING THE INFRASTRUCTURE

So how do we move forward? How do we ensure accuracy of the systems we are building for tomorrow? Are we collecting the right data? What sort of institutions do we need to make all this happen?

We have the technology we need. But we're lacking systems and decision-support mechanisms that ensure the information gets where it needs to be. Despite better bird flu surveillance in recent years, the WHO reports it still takes, on average, two weeks after the onset of symptoms for human cases to be identified

and notification sent to the WHO. Laboratory confirmation of suspect cases can add several days to weeks more to verify the threat. We need a better system, across the globe, with institutions designed from the ground up for this approach.

Ending pandemics will require trust-based regional public health governance models that are innovative, multi-sectoral and leading the charge for faster detection and verification through cooperation and data sharing. Connecting Organizations for Regional Disease Surveillance (CORDS) is a move in this direction through shared practices and trust . In cooperation with WHO, the World Organization for Animal Health (OIE), and the Food and Agricultural Organization (FAO), CORDS is bringing regional networks together for knowledge sharing and training to implement best practices for early detection, verification and reporting on emerging infectious diseases.

CONCLUSION

Can we end pandemics in our lifetime? Yes, we can. The global public health community eradicated smallpox, beat polio back to a handful of niches, and has made dramatic progress against river blindness and Guinea worm. Nature – including the bugs that bring us infectious disease – has an inexorable imperative to evolve to survive. So theoretical pandemic risk will never disappear. But we have reached a point in the evolution of technology and medical advances that we can realistically aspire to prevent actual pandemics. We now need to develop the infrastructure to support early detection and verification, and to ensure that the information needed to combat threats is shared rapidly and accurately.

Stopping smallpox required millions of feet on the street and billions of house calls . Today, clues from, and the tools of, the information cloud mean we can move faster, more efficiently and more cheaply than ever before. Engaging the public in this public health challenge will accelerate the process. It's in our power to sideline infectious disease as a pandemic threat and reduce the overall burden of suffering from infectious diseases across the globe.

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