Vaccination alone will not halt the next global pandemic

A combination of strategies are required to save lives

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A US\$1-billion initiative was launched in January 2017 with the aim of having vaccines ready in order to prevent the next global pandemic. The *Coalition for Epidemic Preparedness Innovations* (CEPI) was launched at the World Economic Forum in Davos, Switzerland, with US\$460 million in backing from Norway, Germany, Japan, the Wellcome Trust and the Bill & Melinda Gates Foundation.¹⁻³ The organization expects to raise the full US\$1 billion that it needs for the next 5 years by the end of this year.¹⁻³ Moreover, CEPI has selected 3 pathogens on which to focus their initial vaccination efforts.¹⁻³ However, the vaccines for these pathogens are in the very early stages of development (preclinical stage) and may take decades before they are ready for use in an epidemic.² Despite Bill Gates' claim that DNA/RNA vaccines (third-generation vaccines) can serve as a 'vaccine pipeline' to accelerate vaccine development against other pathogens, there is no licensed DNA or RNA vaccine approved by the US Food and Drug Administration for human use.⁴ There is no Th1-adjuvant in existence which may prove to be a vital component of a future viral vaccine. Furthermore, a vaccine, once developed, cannot be tested in a Phase II or III Clinical Trial as there are few or no cases outside an epidemic for most of the potential pathogens. I believe CEPI's focus solely on vaccination is a mistake. CEPI needs to carefully consider other innovations (passive immune therapy, antiviral drug discovery, adjuvant discovery, high-throughput viral genome sequencing) and capacity building initiatives (diagnostics, real-time reporting, zoonotic surveillance in animal reservoirs, mathematical modelling, GIS risk mapping) that will compliment vaccination.

Potential pathogens

Emerging infectious diseases are primarily zoonotic and viral (HIV, SARS, Ebola, MERS-CoV, Lassa Fever, Nipah virus), originating in wildlife populations from the tropics.⁵ WHO recently deemed 11 pathogens as the most likely to cause severe outbreaks but the rationale for this list is unclear. CEPI has chosen only 3 pathogens (Nipah virus, Lassa fever and MERS-CoV) to commence vaccination efforts but again what is the rationale for their selection? Nipah virus is a zoonotic disease with high fatality rates. Human-to-human transmission is common in Bangladesh and novel paramyxoviruses continue to emerge.⁶ Lassa fever is a viral haemorrhagic illness responsible for disease outbreaks in West Africa.⁷ It is a zoonosis with its reservoir host (the mouse *Mastomys natalensis*) distributed across sub-Saharan Africa.⁷ MERS-CoV is another zoonotic disease with pandemic potential. Like Lassa fever and Nipah virus, there is no specific drug treatment and vaccine development is still at the stage of animal experimentation.⁸ In recent years multiple zoonotic influenza A strains have emerged in humans (H5N1, H5N6, H7N9, H10N8) that have pandemic potential, but the current quadrivalent influenza vaccine (A-H1N1, A-H3N2, B-Phuket/3073/2013, B-Brisbane/60/2008) does not cover their serotypes.⁹ The U.S. Centres for Disease Control and Prevention (CDC) ranks H7N9 as the flu strain with the greatest potential to cause a global pandemic. Given the severe illness and fatalities associated with these influenza A strains clearly they should be a CEPI priority.

Building capacity

Vaccines for candidate pathogens may be decades away and new pathogens may arise from the tropics for which there is no vaccine. The recently developed Ebola vaccine (rVSV-ZEBOV) was built on the back of 40 years of research and the durability of the vaccine is questionable.¹⁰ No licensed vaccine is 100% efficacious or effective. We therefore, must have other strategies in place if a vaccine is not available. This would include building national capacities of low and middle-income countries. According to a recent report by the United Nations International Labour Organization almost half of the world's population does not have access to healthcare.¹¹ In Africa the number of rural people who don't have access to healthcare is 83%.¹¹ Most of the existing rural healthcare centres in Sub-Saharan Africa currently lack access to clean water, electricity, medical equipment, essential medicines, IT, and trained staff. During a pandemic it is these rural healthcare centres that will serve as the first line of defense.

At the World Economic Forum this year (2017) President Alpha Condé of Guinea made a passionate plea for help for improvements in national health-care systems, community health services, and technology transfer in Africa. But to date this has largely been ignored. The World Bank's new Pandemic Emergency Financing Facility does not cover pandemic preparedness or national reconstruction efforts. CEPI has put all its eggs in the vaccine basket, but vaccines may not pan out and vaccine-based solutions also ignore the underlying problem of building national capacities and surveillance in the developing world. Real solutions will come from a broader focus as advocated by Alma-Ata declaration of 1978.^{12, 13}

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