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particularly against highly invasive strains. The optimum number of doses needed to ensure herd immunity is unknown, but might be only one plus a booster or even just one dose at the optimum time without a following booster.

As the findings of Savulescu and colleagues show, use of PCVs can substantially decrease the incidence of invasive pneumococcal disease despite serotype diversity remaining high. Thus, expanded use of available PCVs should be a priority. India, China, and Indonesia have the vaccine alliance Gavi. It is hoped further government funding will be made available for supplies from local or international manufacturers within the next few years. Despite only two manufacturers having licensed PCVS so far, more than a dozen are developing PCV products, of which at least some are likely to enter the market over the next decade. Increased supply is likely to drive down costs and promote high and sustainable coverage.

The success of PCV10 and PCV13 is evident. Penetration into country-based immunisation programmes in the largest countries in Asia will further enhance the effects and affordability of PCVs worldwide.

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Enhancing preparedness for tackling new epidemic threats

New and re-emerging infectious diseases cause much human suffering worldwide. Many of these diseases are zoonoses with epidemic potential. All sub-Saharan African regions are highly biodiverse with large rural populations that are highly dependent on livestock agriculture. Movement of pathogens between animals and people increases as the domestic populations expand, creating novel ecotones and ecosystemic perturbation. With increasing food security demands, intensification of livestock and agriculture is required and further evolution and spill over of novel zoonoses to humans is inevitable. The emergence this century of previously unknown zoonotic respiratory tract infectious diseases with epidemic potential, such as Avian influenza, Severe Acute Respiratory Syndrome (SARS), and Middle East Respiratory Syndrome (MERS), highlights an urgent need to change the current global status quo. The 2015 west African Ebola virus epidemic illustrated that once an infectious disease
takes hold locally, the originating region and rest of the world is put at equal risk due to ease of international travel, global food systems, livestock trade, and inadequate capacities to identify and respond to outbreaks.

Several lessons were learnt from the Ebola virus outbreak that could help guide development of more effective and appropriate response capacities. Much of the spread and devastating impact of Ebola virus in west Africa was rooted in the emerging environmental, socioeconomic, and socio-anthropological changes taking place in west Africa. The highly medicalised approach and ineffectiveness of the local and regional surveillance mechanisms delayed appropriate socioecological management of the epidemic. Absent were effective active disease surveillance, early diagnosis using rapid diagnostic tests, rapid communication of data for health systems, and engagement and awareness of communities to implement intervention measures for health systems, and engagement and awareness of communities, to control spread. Behavioural factors also contributed to rapid outbreak spread. Improved understanding of eco-epidemiological, socio-cultural, anthropological, and political determinants that drive the emergence and spread of disease is crucial to preventing epidemics. Furthermore, the lack of local capacity and preparedness in affected west African countries to conduct comprehensive, multidisciplinary and well-coordinated research was also evident during the Ebola virus epidemic. Foreign aid workers and research groups aroused local anxieties among communities due to ignorance of, or insensitivity to, cultural norms. Research studies to assess and determine optimal management protocols and trial new treatments and vaccines were slow to start, and were dominated by foreign groups, with scant involvement of African scientists or local policy makers. Newer treatments in development and those with compassionate-use regulations were available but their use and evaluation to inform optimal evidence-based management, were slowed down by the absence of rapid ethical review processes for research in emergency situations.

A more collaborative, inclusive, and strategic ONE HEALTH partnership between the human, environmental, and animal health sectors is now essential to address recurrent and emergent zoonotic threats effectively and to improve national capabilities on disease preparedness, surveillance, and response for preventing another major epidemic in Africa. This partnership will also enable issues around the growing global threat of antimicrobial resistance to be tackled. Although antibiotic resistant bacteria have spread globally due to increased travel and population movement, the scale of the problem of antimicrobial resistance in Africa remains largely undefined. The WHO recommendations on antimicrobial resistance points out the lack of surveillance data and highlights the need for coordination between human and animal surveillance systems.

Based on a comprehensive inter-epidemic work programme, a ONE HEALTH partnership for emerging diseases and preparedness needs to develop and strengthen suitable sites and regional networks to enable resolution of administrative, regulatory, disciplinary, ethical, and cultural barriers; harmonise clinical case definitions and management guidelines; pre-approve adaptable protocols; and introduce mechanisms to rapidly exchange high quality data and samples. Such a partnership would ensure the readiness to immediately perform coordinated basic science research, to define the source of outbreak and transmission dynamics, and to conduct large-scale multisite clinical studies. It will enable establishment of regional high quality laboratories incorporating rapid diagnostics for multiple pathogens, and proactive surveillance systems providing latest real-time information. Replication of the mobile laboratory model in all African regions will also enable to take forward the important agenda of establishing effective rapid response teams for outbreaks with support of national governments and public health services.

New opportunities to take this ONE HEALTH concept forward comes from several promising developments. The newly established Africa Centers for Disease Control and Prevention (Africa CDC), through five regional centres will perform disease surveillance, investigation, and tracking of infection trends to help African Member States detect and respond to public health emergencies. Four research and capacity development networks of excellence exist across central, west, east, and southern Africa with extensive experience of work on tuberculosis, HIV, malaria, and viral haemorrhagic fevers. With a critical mass of political support and resources of public health, veterinary, wildlife health, and clinical laboratories will ensure the timeliness and quality of surveillance, research, and response to zoonoses and the fractious issues of antimicrobial resistance in Africa. Benefits will not only accrue to public health but also food security and biodiversity conservation. Existing links with ongoing initiatives on emerging infections such as USAID Emerging Pandemic Threats Program, WHO-Global Outbreak Alert and Response
For more on GLOPID-R see http://www.glopid-r.org

For the PANDORA-ID-NET consortium see http://www.unza-uclms.org/pandora-id-net

See Online for appendix

Network (GOARN). Global Research Collaboration for Infectious Disease Preparedness (GLOPID-R), World Organisation for Animal Health, and other stakeholders could ensure implementation of findings into optimal health guidelines, standards, and policy recommendations. Importantly, the future of public health services in Africa will depend on empowering a whole generation of young African health-care workers, scientists, and technical staff to take leadership of emerging and re-emerging infections through high quality training and mentorship. The time is now for Africa to take bold steps (appendix) to develop its own capabilities and capacities to rapidly identify and respond quickly and effectively to potential outbreaks.

The challenge is for African scientists, public health personnel, and national governments to take leadership of developing a new vision through a ONE HEALTH strategy for the emerging and re-emerging infectious diseases and antimicrobial resistance portfolio across the continent.

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Deteriorating respiratory health in Nepal: a call for action

Urban areas of Nepal have been grappling with increasing levels of air pollution in the past 5 years. The extension of road networks throughout the city and installation of water distribution pipes for the long-awaited Melamchi drinking water project in most parts of Kathmandu valley have worsened air pollution levels in the capital city. The authorities have been criticised for not taking measures to contain the dust generated from these projects. The latest report about environment performance index (EPI) by Yale University ranked Nepal 177 of 180 countries in terms of air quality. The effects of air pollution on human health are immense. Additionally, people with existing morbidities like cardiovascular diseases and chronic obstructive pulmonary disease (COPD) face increased risk of exacerbations. A report published by WHO in 2016 revealed that outdoor air pollution causes more than 9000 deaths every year in Nepal, mostly due to ischaemic heart disease, stroke, and COPD.

Increasing levels of air pollution could detract from Nepal’s recent gains in health. The average life expectancy...

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