



## Editorial

## Planning for the Next Global Pandemic



## A B S T R A C T

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In order to mitigate human and financial losses as a result of future global pandemics, we must plan now. As the Ebola virus pandemic declines, we must reflect on how we have mismanaged this recent international crisis and how we can better prepare for the next global pandemic. Of great concern is the increasing frequency of pandemics occurring over the last few decades. Clearly, the window of opportunity to act is closing. This editorial discusses many issues including priority emerging and re-emerging infectious diseases; the challenges of meeting international health regulations; the strengthening of global health systems; global pandemic funding; and the One Health approach to future pandemic planning. We recommend that the global health community unites to urgently address these issues in order to avoid the next humanitarian crisis.

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## 1. Introduction

The West African Ebola virus pandemic has shown us yet again that the world is ill prepared to respond to a global health emergency. This follows similar statements that were made after the H1N1 outbreak in 2009 that “The world is ill prepared to respond to a severe influenza pandemic or to any similar global, sustained and threatening public health emergency”.<sup>1</sup> Our response to the Ebola zoonotic ‘spillover’ was delayed and as a result 11,158 people lost their lives in nine countries.<sup>2</sup> The direct financial cost of the Ebola pandemic was estimated to be in the vicinity of six billion US dollars and global economic losses over 15 billion dollars.<sup>3</sup> Clearly there are lessons to be learnt from the Ebola outbreak.

In 2005, following the Severe Acute Respiratory Syndrome (SARS) pandemic, the International Health Regulations (IHR) were modified. While two thirds of the 194 World Health Assembly countries have failed to comply with the regulations as of 2015, and for the one third who say they did, there are serious concerns about the reliability of their self-assessment.<sup>4</sup> Now, with Liberia declared free of Ebola and declining incidence in Sierra Leone and Guinea, these same regulations are once again being revisited after more than a decade.<sup>4</sup> Is this a futile exercise and should the IHRs be abandoned if they cannot be enforced by WHO and fulfilled by the World Health Assembly (WHA) member nations? The national health systems in West Africa, and for most low and middle income countries (LMICs), would not meet IHR standards (despite claims by some member WHA nations) and it is unlikely that following the Ebola pandemic much will change.

Many have stated that WHO failed to respond to the current Ebola epidemic in a timely manner<sup>4</sup> but even if they did, would the

outcome have been really that different? There were no drugs or vaccines available to treat and prevent the disease, thus quarantine, isolation and safe burials were the primary methods utilized to halt the spread of disease and were initiated by the afflicted nations themselves.<sup>5</sup> It typically takes years if not decades to develop a vaccine or drug that will have public health impact. One only has to look at the countless billions that have been spent on trying to develop a vaccine for HIV, thus far without success. Moreover, weak, malnourished, immunosuppressed populations living in poverty with little or no hygiene, sanitation or running water will always be highly susceptible to new emerging or re-emerging infectious diseases.<sup>6</sup> At ‘ground zero’ of the Ebola epidemic it was believed that in 2013, hungry children living in the remote Guinean village of Meliandou killed and ate infected fruit bats.<sup>7,8</sup> Thus, what can realistically be done to prevent and contain future national epidemics from becoming global pandemics? We discuss a number of issues that urgently need to be addressed in order to plan, and possibly prevent, the next global pandemic.

## 2. Emerging and Re-emerging Infectious Diseases

If one looks at the history of emerging or re-emerging infectious disease pandemics globally, on average they have appeared every decade but now, worryingly, the frequency between pandemics seems to be disturbingly shorter as evident with Severe Acute Respiratory Syndrome (SARS) in 2003, Influenza A H1N5 (bird flu) in 2007, H1N1 (swine flu) in 2009, Middle East Respiratory Syndrome (MERS) in 2012 and Ebola in 2014.<sup>9</sup> Overpopulation and poverty are the primary contributing factors that have brought about this change and are strongly linked with global warming, environmental degradation, habitat destruction, and increased



**Figure 1.** The breeding grounds for the next global pandemic: left panel illustrates slums in Metro-Manila, The Philippines; the middle panel shows slums in Dhaka, Bangladesh, and the right panel displays slums in Kibera, Kenya. Note photographs are available on public domain.

human/host/reservoir interaction.<sup>10</sup> Weak malnourished populations in LMICs serve as the breeding grounds for future pandemics (Figure 1). For example, in metro Manila, the most densely populated city in the world, approximately six million people live in slums with no piped water or toilets. According to WHO, 137 million people in urban centres have no access to safe drinking water and over 600 million lack sanitation.<sup>10</sup> The UN predicts that the world's urban population will double to over six billion by 2050 and most of the increase in density will occur in LMICs.<sup>10</sup> Population density is directly correlated with the rate of transmission of respiratory and faecal-oral pathogens (e.g. *Mycobacterium tuberculosis*, influenza, cholera, rotavirus, helminths).<sup>10</sup>

Between 1940 and 2004 there were 335 emerging infectious disease (EID) origins reported globally.<sup>9</sup> Figure 2 illustrates some of the most recent EID epidemics. EIDs are primarily zoonotic (60%), originating in wildlife populations (e.g. HIV, SARS, Ebola, West Nile Virus, Lyme Disease) but bacterial pathogens have become increasingly of concern due to antibiotic resistance especially in the developing world.<sup>9,11</sup> Multidrug-resistance (MDR) to *Mycobacterium tuberculosis*, *Streptococcus pneumoniae* and *Staphylococcus aureus* are a global concern and gram-negative bacteria resistance to  $\beta$ -lactams is widespread.<sup>11</sup> Drug resistance to enteropathogens has also become a major global health challenge. MDR *Salmonella enterica* Typhi and *S. enterica* Paratyphi are common in Asia and sub-Saharan Africa, and there are increasing reports of reduced susceptibility to fluoroquinolones.<sup>12</sup> *Campylobacter jejuni* resistance to fluoroquinolones has become a concern in Southeast Asia, with rates of resistance of 80% reported from Thailand.<sup>12</sup> Viral pathogens (e.g. Ebola, Makona variant (EBOV), MERS-CoV, H1N1) are also of concern due to their high rates of nucleotide substitution, poor mutation error-correction rate ability and capacity to quickly adapt to human hosts.<sup>9</sup>

Table 1 displays some potentially pandemic pathogens that should be under active global surveillance. The current outbreak of MERS-CoV in South Korea is of grave concern given the case fatality

rate is over 10%. Surveillance of zoonotic diseases is largely based on detecting illnesses in humans who often serve as the sentinel species and dead-end hosts.<sup>13</sup> Apart from rabies, most national surveillance systems in the world do not monitor zoonotic diseases appearing in wildlife, yet 72% of zoonotic EIDs (e.g. Anthrax, Nipah virus, Hantavirus, type A influenza, SARS, MERS-CoV, Ebola) come from this source.<sup>9,13</sup> Many RNA viruses have emerged and dispersed globally such as Chikungunya virus, West Nile virus and dengue virus. These three arboviruses alone have morbidity and mortality rates that far exceed those of the combined rates of SARS, Ebola and MERS-CoV.<sup>14,15</sup> Thus, EID discovery efforts need to be directed toward reservoirs and vectors at the human-animal interface.<sup>16</sup> The integration of human, veterinary, and agricultural medicine, as proposed by the 'One Health' approach, should result in earlier warning of EIDs and provide us with a better opportunity to respond to potential spill-over threats.<sup>13,17</sup> Moreover, targeting surveillance to regional hotspots of EIDs provides an evidence-based rationale for more appropriate allocation of global resources.<sup>16</sup>

### 3. International Health Regulations (IHR)

The 2014 outbreak of Ebola once again tested the revised 2005 IHR. According to Gostin and Friedman (2015) "WHO fell short of its leadership responsibilities, and the IHR – the governing legal framework – displayed deficiencies".<sup>3</sup> The three West African countries involved (Guinea, Liberia, Sierra Leone) in the pandemic failed to comply with the IHRs capacity-building mandate and, to date, two thirds of WHA member countries have failed to comply with the same regulations.<sup>3,4</sup> Of the one third of the WHA member nations that said they did comply, there has been no evaluation to verify their claims.<sup>3,4</sup> Like the outbreak of H1N1 in 2009, the response raises questions regarding the extent to which the IHR can serve as a framework for global pandemic responses.<sup>3,4,18</sup>

If the WHA member nations (194) do not take the IHR core capacity-building requirements of disease surveillance, reporting,

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