

Emerging Infectious Diseases Other Than Influenza

Summary

Emerging Infectious Diseases (EIDs) with pandemic potential represent a major worldwide risk to global health security. Though there is no single universally agreed upon definition, EIDs can be understood either as new recognized diseases or “re-emerging” or “resurgent diseases” which are known and may have been previously controlled but are now reappearing with increasing occurrence, or threaten to increase over previously endemic or new population or geographic areas. This also includes pathogens that have developed new attributes such as increased resistance or virulence. Of most concern are EIDs which have possible global pandemic risk where limited or no readily available therapeutic counter-measures are available. Leaving governments to rely on enhanced mass public health infection control practices such as protective travel and commercial restrictions, closing schools, or in worst case scenarios enforced quarantine for the affected population. If it is scientifically proven that a particular EID resulted from an accidental or deliberate release, then it could be anticipated that the U.S. government, private critical health care infrastructure stakeholders, as well as foreign governments will take countermeasures commensurate with the nature and scope of such a threat. Such a scenario may result in additional and unforeseen geopolitical consequences depending on the scale and scope of the event or incident.

Not including influenza outbreaks such as H1N1, examples of recent notable EIDs have included: Ebola; Severe Acute Respiratory Syndrome (SARS); Middle East Respiratory Syndrome (MERS). Combined, these EIDs resulted in the loss of millions of lives and billions of dollars. Causal factors include: microbial adaptation and evolution; demographic migration; new technology and industry; increased economic development and changing land use; greater contact between people and animals; international travel and trade; and the lack of adequate global public health infrastructure to carry out surveillance and control measures. Added to this list is the potential for bio-engineered EIDs resulting from future military conflict or terrorism. In addition to the human and economic toll, the Ebola epidemic in West Africa is very instructive of the risk that EIDs have to destabilize governance processes, ferment social unrest, overstress critical national health infrastructures, and restrict international commerce and travel.

Discussion

An emerging infectious disease (EID) is defined as an “infectious disease that is newly recognized as occurring in humans; one that has been recognized before but is newly appearing in a different population or geographic area than previously affected; one that is newly affecting many more individuals; and/or one that has developed new attributes.”⁴⁵² New and naturally occurring attributes can include changes in mode of transmission, incubation periods, severity of morbidity and mortality rates, etc. Additionally, there is the risk of man-made bio-engineering to be

⁴⁵² Institute of Medicine IOM, *Microbial Threats to Health: Emergence, Detection and Response*, 2003; and Fineberg and Wilson, “Emerging Infectious Diseases,” International Risk Governance Council (IRGC), 2010.

deliberately or inadvertently misused to create new or change existing pathogen characteristics sufficient to result in the direct or indirect endangerment of humanity.⁴⁵³

According to the Centers for Disease Control and Prevention (CDC) “approximately 75% of recently emerging infectious diseases affecting humans are diseases of animal origin; approximately 60% of all human pathogens are zoonotic.”⁴⁵⁴

Causes involved in the emergence of infectious diseases can be broadly categorized as “(1) genetic and biological aspects; (2) physical environmental factors; (3) ecological factors; and (4) social, political, and economic factors”.⁴⁵⁵ These complex and interdependent categorizations can be further defined into the following thirteen points:

1. Microbial adaptation and change
2. Human susceptibility to infection
3. Climate and weather
4. Changing ecosystems
5. Human demographics and behavior
6. Economic development and land use
7. International travel and commerce
8. Technology and industry
9. Breakdown of public health measures
10. Poverty and social inequality
11. War and famine
12. Lack of political will
13. Intent to harm⁴⁵⁶

The National Institute of Allergy and Infectious Diseases (NIAID), under the U.S. National Institutes of Health (NIH), defines EIDs as infectious diseases that have newly appeared in a population or existed but are rapidly increasing in incidence or geographic range, or that are caused by one of the NIAID Category A, B, and C Priority Pathogens. Category A pathogens are those organisms/biological agents that pose the highest risk to national security and public health because they:

- Can be easily disseminated or transmitted from person to person
- Result in high mortality rates and have the potential for major public health impact

⁴⁵³ BioMed Central/Genome Biology. "On The Trail Of Rogue Genetically Modified Pathogens." Science Daily. , 18 March 2008. www.sciencedaily.com/releases/2008/03/080317191441.htm

⁴⁵⁴ Centers for Disease Control and Prevention - National Center for Emerging and Zoonotic Infectious Diseases “*Emerging and Zoonotic Diseases — At a Glance*” at <http://www.cdc.gov/ncepid/>

⁴⁵⁵ Institute of Medicine IOM, Mark S. Smolinski, Margaret A. Hamburg, and Joshua Lederberg, editor(s); “*Microbial Threats to Health: Emergence, Detection and Response*,” pages 53-54, 2003. Committee on Emerging Microbial Threats to Health in the 21st Century, Board on Global Health. National Academy of Sciences

⁴⁵⁶ Ibid

- Might cause public panic and social disruption
- Require special action for public health preparedness⁴⁵⁷

Examples include: *Bacillus anthracis* (Anthrax); *Clostridium botulinum toxin* (Botulism); *Yersinia pestis* (Plague); *Variola major* (Smallpox) and other related pox viruses; *Francisella tularensis* (Tularemia); Viral hemorrhagic fevers (Arenaviruses, Bunyavirus, Flaviruses, Filoviruses-Ebola); etc.⁴⁵⁸

Category B pathogens are the second highest priority organisms/biological agents because they are:

- Moderately easy to disseminate
- Result in moderate morbidity rates and low mortality rates
- Require specific enhancements for diagnostic capacity and enhanced disease surveillance⁴⁵⁹

Examples include: *Burkholderia pseudomallei* (Meliodiosis); *Coxiella burnetii* (Q fever); Brucella species (Brucellosis); *Burkholderia mallei* (Glanders); *Chlamydia psittaci* (Psittacosis); *Ricinus communis* (Ricin toxin); *Clostridium perfringens* (Epsilon toxin); Staphylococcus enterotoxin B (SEB); *Rickettsia prowazekii* (Typhus fever); etc.⁴⁶⁰

Category C pathogens are the third highest priority and include emerging pathogens that could be engineered for mass dissemination in the future because of:

- Availability
- Ease of production and dissemination
- Potential for high morbidity and mortality rates and major health impact⁴⁶¹

Examples include: Nipah and Hendra viruses; Tickborne hemorrhagic fever viruses; Tickborne encephalitis complex flaviviruses; Yellow fever virus; Tuberculosis, including drug-resistant TB; Influenza virus; Other Rickettsias; Rabies virus; Prions; etc.⁴⁶²

Emerging Infectious Diseases are an evolving and constant risk. However, the ability to significantly mitigate this risk is also progressing through the leadership provided by the Department of Health and Human Services in spearheading U.S. efforts in meeting the global challenges related to public health surveillance and detection, critical health care capabilities for timely and effective and response. This includes sufficient resources and training to develop efficient information-sharing and research leading to the advancement of new diagnostics, vaccines, and pharmaceuticals which to address EID.

In conclusion, “The health of the American people and that of the people around the world are more closely linked than ever before. In such an interconnected environment, the best way for a country to protect its population is to prevent a health threat from emerging and spreading in the

⁴⁵⁷ National Institute of Allergy and Infectious Diseases (NIAID) - “Biodefense and Emerging Infectious Diseases - NIAID Category A, B, and C Priority Pathogens” - February 2015. <http://www.niaid.nih.gov/topics/BiodefenseRelated/Biodefense/Pages/CatA.aspx>

⁴⁵⁸ Ibid

⁴⁵⁹ National Institute of Allergy and Infectious Diseases (NIAID) - “Biodefense and Emerging Infectious Diseases - NIAID Category A, B, and C Priority Pathogens” - February 2015. <http://www.niaid.nih.gov/topics/BiodefenseRelated/Biodefense/Pages/CatA.aspx>

⁴⁶⁰ Ibid

⁴⁶¹ Ibid

⁴⁶² Ibid

first place. This means addressing threats early and at their source, before they spread more widely within and across borders; it also means that other countries, including the United States, should prepare for the arrival of such trans-national threats within their own borders.”⁴⁶³

⁴⁶³ U.S. Department of Health and Human Services (HHS)-Assistant Secretary for Preparedness and Response, “*National Health Security Strategy and Implementation Plan 2015-2018*” - February 2015. <http://www.phe.gov/Preparedness/planning/authority/nhss/Documents/nhss-ip.pdf>