UNIT NO. 1

EMERGING INFECTIONS AND ROLE OF FAMILY PHYSICIAN

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ABSTRACT

Emerging infections may be defined as infectious diseases whose incidence in humans has increased in the past 2 decades or threatens to increase in the near future. They include: new infections resulting from changes or evolution of existing organisms; known infections spreading to new geographic areas or populations; previously unrecognised infections appearing in areas undergoing ecological transformation; and old infections re-emerging as a result of antimicrobial resistance in known agents. Emerging infections occur as the result of four groups of factors: novel zoonotic emergence factors; climate change; non-zoonotic emergence factors; and human practices. As frontline doctors, family physicians have at least five roles that they must perform well: participate in global and local surveillance of emerging infections; assist in societal learning; pandemic preparedness; legislation compliance; and antibiotic stewardship.

Keywords: Novel zoonotic emergence, non-zoonotic emergence, climatic change, human practices, surveillance, societal learning, pandemic preparedness, legislation compliance, antibiotic stewardship, multidrug resistant organisms (MDROs)

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DEFINITION OF EMERGING INFECTIONS

Emerging infections may be defined as infectious diseases whose incidence in humans has increased in the past 2 decades or threatens to increase in the near future.[1]

These diseases respect no boundaries. They include:

- New infections resulting from changes or evolution of existing organisms.
- Known infections spreading to new geographic areas or populations.
- Previously unrecognised infections appearing in areas undergoing ecological transformation.
- Old infections re-emerging as a result of antimicrobial resistance in known agents.

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EXAMPLES OF EMERGING INFECTIONS

New infections

Previously unrecognised infections have continued to emerge. These include infections from the variable Creutzfeldt-Jakob disease/bovine spongiform encephalopathy (vCJD/BSE), severe acute respiratory syndrome (SARS) corona virus, the influenza virus A/H1N1 pandemic 2009, the Middle East respiratory syndrome (MERS) corona virus in 2012, and the influenza virus A/H7N9 infection in 2013. (Mores & Fauci, 2012)[2]

A modern day emerging infectious disease with the greatest global impact has been the HIV/AIDS. It is also one example of an emerging infection that is spread far and wide by human practices. It is thought that that humans were first infected with HIV through close contact with chimpanzees, perhaps through wildlife hunting, in isolated regions of Africa. It is likely that HIV then spread from rural regions into cities and then internationally through air travel. Further factors in human behaviour, as for example, intravenous drug use, sexual transmission, and transfer of blood products before the disease was recognised, aided its rapid and extensive spread worldwide.[1] HIV/AIDS was first clinically diagnosed as a new disease in 1981.

Known infections

Known infections may also spread to new geographic areas where they were previously not known to exist. In the late summer of 2007, more than 100 residents of the town of Ravenna in Italy suffered from a mysterious disease that produced fever, exhaustion and severe bone pain.

The outbreak was eventually shown to be caused by the chikungunya virus, previously found in the tropical regions around the Indian Ocean. Due to warming and globalisation, the Aedes mosquito which transmits the chikungunya virus has been able to move north and thrive in areas across southern Europe, with resultant spread of the virus.[1]

Previously unrecognised infections

Previously unrecognised infections may appear in areas undergoing ecological transformation and cause localised outbreaks. The Ebola virus infection in Sudan, the Nipah virus in Singapore and Malaysia, and the H5N1 avian influenza in Hong Kong, China, and Vietnam occurred this way. The movement of livestock or wildlife to the hitherto unoccupied areas was the starting point. Infection of the new animal reservoir of livestock or wildlife occur and man becomes infected eventually.

The nipah infection that occurred in Malaysia and Singapore in 1998 - 1999 can be used to illustrate very nicely this mode of

genesis. Now the nipah virus is a paramyxovirus closely related to the Hendra virus. In contradistinction to pigs where encephalitis and respiratory disease occur but with a relatively low mortality rate, in man, the encephalitis is severe and has a high mortality, The nipah outbreak first occurred in the northern part of the Malaysian peninsula in 1998. It subsequently spread to various regions of the country, and also to Singapore in the south due to movement of infected pigs. How did this happen?

Fruitbats of the Pteropid species were identified as cause due to ecological transformation. These fruitbats are the natural reservoir hosts. Evidence suggested that climatic and people driven ecological changes caused by slash-and-burn of forests in Indonesia led to active reduction of the flowering and fruiting forest trees for fruitbats in their already shrining habitat. This led to unprecedented encroachment of fruitbats into cultivated fruit orchards in the initial outbreak area in the suburbs of Ipoh. The location of piggeries in orchards and the design of piggeries in Ipoh allowed the spill-over of this novel paramyxovirus from its reservoir host namely, the fruitbats into the domestic pigs and ultimately to humans and other animals.(Chua, 2001)[3].

By mid-June 1999, more than 265 encephalitis cases – including 105 deaths, had been reported in Malaysia, and 11 cases of encephalitis or respiratory illness with one death had been reported in Singapore. (Chua, 2001)[4].

Old infections

Old infections also re-emerge as the result antimicrobial resistance in known infective agents. Examples of note are MRSA, multiple-drug-resistant and extensively drug-resistant (MDR and XDR tuberculosis (Morens & Fauci, 2012)[2].

FACTORS FOR EMERGENCE

Emerging infections occur as the result of four groups of factors:

- Novel zoonotic emergence factors.
- Climate change.
- Non-zoonotic emergence factors.
- Human practices.

Novel zoonotic emergence factors

No less than 73% of emerging infectious diseases are zoonoses (van Doorn)[5]. This underscores the human-animal interface to be all important. As human beings encroach on to the habitats of wild life, it is inevitable that some zoonotic infections will spread to man as the alternative host.

Fortunately, not all zoonotic infections spread efficiently to man. Two factors are necessary for the emergence of pandemic zoonotic disease namely, vulnerable human population; and pathogen capable of human-human spread. (Morse et al, 2012)[6].

Global hot spots for emerging infectious diseases that originate in wildlife have been identified in South and South East Asia, Central and South America, and Sub-saharan Africa. (Morse et al, 2012)[6].

Climatic change

This can result in migration of insect vectors to new areas. The story of Chikungunya infections appearing in Southern Europe has been alluded to earlier on[1]. Climatic warming can also result in faster maturation of insect vectors of arborviruses.

Non-zoonotic emergence factors

Known infectious diseases may silently emerge to threaten mankind. We need to be vigilant to such silent threats before it is too late. Three non-zoonotic emergence examples are described here:

Antimicrobial drug resistance (AMDR). This can occur in bacteria and other organisms. The rise of HIV, malaria, tuberculosis multidrug resistance is threatening. Rise of hospital and community acquired infections from "normal" Gram positive and Gram negative bacteria is already escalating. Will we move back to the pre-microbial era? (van Doorn, 2014)[5].

Failure of vaccination programmes. Bad press, religious convictions, complacency can result in resurgence of infectious diseases once under control. The emergence of measles or rubella within years in the UK and in the Netherlands are cases in point.

Global food production and distribution processes. Such processes can result in widely disseminated foodborne infections. This is nicely illustrated by the E coli O104:H4 in and out of Germany. In 2011, a large outbreak caused by a Shiga toxin producing E. coli (STEC) occurred in Northern Germany, with a satellite outbreak in Western France, including the highest number of hemolytic uremic syndrome (HUS) cases ever encountered during a STEC outbreak. The outbreak was eventually traced to a food handler who supplied the sprouts used to garnish the salad served in the dinner parties. The outbreak imposed huge challenges on clinicians, microbiologists, and epidemiologists but also provided important new insight for the understanding of STEC infection. (Hauswaldt et al, 2013).[7]

Human practices

Human practices can cause or aggravate emerging infections as can be deduced from the discussion so far. Unsafe sexual practices can spread HIV/AIDS. Poor antibiotic stewardship of antibiotic use in humans can result in multidrug resistant organisms (MDROs). Poor infection control measures can result in spread of MDROs in the hospital and in the community.

ROLE OF FAMILY PHYSICIANS

As frontline doctors, family physicians have many roles to play a in emerging infection control. There are at least five roles that they must perform well.

Surveillance

Family physicians need to "tune in", and participate in global and local surveillance of emerging infections. Opportunities may arise in the course of novel disease outbreaks. One example was the participation of 23 family physicians in a pilot surveillance scheme during the H1N1 pandemic in the 2009 outbreak by reporting influenza like illnesses (ILI) as they occur. From the data gathered, we were able to forecast the course and end of the pandemic in Singapore. (Ong et al, 2010)[8]

Assist in societal learning

Teaching patients in personal protection equipment (PPE) and early intervention of possible pandemic infection help to reduce infection rate.

Pandemic preparedness

The lessons from SARS and the H1N1 infections are useful in preparing and dealing with future pandemic infections. There are many lessons.(Koh & Sng, 2010)[9]. From the macro-perspective, the following were useful lessons gleaned from the SARS of 2003 outbreak:

- Recognise that infectious diseases are here to stay and new diseases will continue to surprise mankind.
- Being proactive is necessary to pre-empt escalation of pandemic.
- Joint effort by all – including the public as stakeholder – needs transparency and timely information; prompt sharing builds trust, reduces speculation, fear and panic.
- Legislation is necessary for compliance of everybody.

Legislation compliance

There is a need to comply with the provisions of the Infectious Disease Act 2008 on prompt reporting of infectious disease cases.

Antibiotic stewardship

There is a need for proactive antibiotic stewardship to reduce multidrug resistant organisms (MDROs)

TAKE HOME MESSAGES

Emerging infections are here to stay. Know the factors for their emergence. Participate in surveillance and infection control.

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LEARNING POINTS

- **Emerging infections may be defined as infectious diseases whose incidence in humans has increased in the past 2 decades or threatens to increase in the near future.**
- **Emerging infections include: new infections resulting from changes or evolution of existing organisms; known infections spreading to new geographic areas or populations; previously unrecognised infections appearing in areas undergoing ecological transformation; and old infections re-emerging as a result of antimicrobial resistance in known agents.**
- **Emerging infections occur as the result of four groups of factors: novel zoonotic emergence factors; climate change; non-zoonotic emergence factors; and human practices.**
- **As frontline doctors, family physicians have at least five roles that they must perform well: participate in global and local surveillance of emerging infections; assist in societal learning; pandemic preparedness; legislation compliance; and antibiotic stewardship.**