

## Glossary for Chapter 2

*Antigenic drift*: the process whereby microorganisms change their genes gradually by mutation, deletion or insertion of new genes. In the flu virus, these sorts of minor changes in their genes result in changes in *antigenicity*. Hence the half-yearly need to prepare new vaccines for the protection of the world's population. This type of change may also produce local epidemics.

*Antigenic shift*: the process whereby microorganisms change their genes drastically by swapping large segments of the genome with another member of the same species. In the case of the flu virus, antigenic shift may result in a pandemic.

*Antigenicity*: The ability of an agent, be it a large biological chemical or a nanoparticle, to produce a specific local or systemic immunological reaction in a host.

*Asymptomatic cases*: individuals who have been infected with a pathogen but do not exhibit symptoms of their infection.

*Asymptomatic transmission*: the spreading of a pathogen to other people while showing no signs or symptoms of the infection.

*Avian (bird) flu*: an influenza virus that lives parasitically in migratory birds or domesticated fowl. The virus may “jump the species barrier” to become a chief agent of an epidemic or pandemic.

*Bacillus, bacterium*: a microorganism that can live independently or inside a host body. Larger than a virus, it still needs a microscope and staining to be seen.

*Bubonic plague*: one form of plague whose most prominent signs are round to oval swollen lymph nodes in the neck, armpits, groin or intestinal mesenteries.

*Coronaviruses*: a group of viruses whose genomes are made of single-stranded RNA, showing proteins embedded in a lipid bilayer membrane. They include cold viruses, SARS-CoV-1, MERS, and the present pandemic virus SARS-CoV-2. The coronavirus gets its name from its shape, which under an electron microscope is a sphere studded with spikes. Half of the sphere looks like a crown, hence “corona”.

*Cross immunity*: immunity in a person induced by one virus or pathogen that extends to a closely-related virus or pathogen.

*Cytokine storm*: an over-reaction of the immune system to pathogen intrusion in which the body releases excessive amount of cytokines into the blood too quickly. Cytokines play an important role in normal immune responses, but having a large amount of them released in the body all at once can be harmful.

*Emergent virus*: refers to a virus that has emerged for the first time to infect humans though it already exists in the natural environment.

*Epidemic, outbreak*: the occurrence of an infection or disease in a geographic locality or community that affects more people than the usual expected occurrence.

*Epicentre*: the locality in which an epidemic or pandemic starts.

*Excess deaths (excess mortality rate)*: it is often difficult to distinguish between deaths due to an epidemic and deaths due to seasonal flu because the testing and specific diagnosis of new virus infections can only be partial. The excess death rate is calculated by using total deaths—for example, due to respiratory disease—for the epidemic year(s) minus those of non-epidemic years, to derive an estimate of the mortality rate due to the epidemic or virus.

*Fatality rate, or case fatality rate*: Epidemiologists prefer to use the latter term, which refers to the proportion of deaths due to a specified disease, usually within a specified period.

$$\text{Case fatality rate} = \frac{\text{Number of deaths due to disease}}{\text{Number of diagnosed cases of that disease}}$$

*Herd immunity*: when a large proportion of the population of a community or a country is infected or immunized, the virus or causative agent of the infection will have its chain of transmission broken. This stops the transmission of the infection in the community or country. In childhood communicable diseases, vaccination establishes herd immunity by achieving 85 per cent immunization rates of infants or toddlers in a country or area.

*H5N1 avian flu*: influenza viruses change so rapidly by *antigenic shift* that the WHO deals with them with simple unambiguous terminology. H refers to the hemagglutinin protein on the surface of the virus, N is another surface protein, neuraminidase. H enables the entry of the virus into human cells. N is used by the virus to cleave (cleave here means cut) sticky mucus proteins, allowing new virus particles to leave the mother cell to infect others. The definition using these two viral molecules, thus define the flu virus genes (of two proteins). Not all H5N1 viruses are exactly the same, as the genes inside the flu virus mutate as the years go by. The numerals following H and N denote the specific *genotype*, as defined by these two proteins alone. The subtype of

virus is further defined by including the place and year when it was first found. Added to that, types A or B will then completely define a particular flu virus.

For example, A/Melbourne/457/2005 (H3N2) is the hypothetical complete name of a strain of flu virus, first discovered in Melbourne in the year 2005. Bird flu means that birds, either wild or domestic fowl, are the primary hosts of the virus. The virus occasionally becomes zoonotic to become an epidemic or pandemic.

*H1N1 pandemic*: the swine flu virus that turned up in 2009 and caused a pandemic. Please see the previous item for explanation of the H and N notation.

*Host*: a person or other living animal including birds and arthropods that provides residence and enables an infectious agent to thrive and reproduce under natural conditions. It can act as an intermediary in the chain of zoonotic transmission.

*Influenza (flu) virus*: a virus of a single-strand RNA, characterized by eight segments in its genome. This allows for the rapid swap of one segment with a neighbouring virus. The rapid genomic change is known as *antigenic shift*. The WHO has to estimate which four subtypes of flu virus will predominate for the next half year of each season, so that appropriate vaccines can be prepared.

*Isolation*: in public health, this refers to the isolation of person(s) infected with communicable diseases, in order to prevent that person from transmitting the disease to the healthy.

*K*: a measure of dispersion. It describes how a virus spreads, whether in a steady manner or in big bursts (clusters). The lower the number attributed to K the more it spreads in clusters, with a few people or events responsible for most of the spread. For example, one study estimates COVID-19 has a K of as low as 0.1, meaning that probably 10 per cent of cases are responsible for 80 per cent of the spread.

*Mortality rate (death rate)*: measured as the proportion of people dying in a single year, expressed as a percentage, or as per 10,000 population.

*Mutation*: a heritable change in a genome or chromosome.

*Occupational disease*: diseases that are closely associated with people's occupations. For example, Nipah virus encephalitis occurred in pig farmers, pig transport workers and pig-slaughtering abattoir workers.

*Oseltamivir (Tamiflu)*: almost the first drug discovered to retard the progression of influenza virus infection. It acts by inhibiting the action of viral *neuraminidase* (see *H5N1 avian flu*), thereby preventing new virus particles from leaving the host cells to

infect other cells. It was the only drug that the WHO urged all countries to stockpile in preparation for a coming flu pandemic.

*Pandemic*: when an epidemic spreads over a wide area, crossing international borders, to reach multiple countries and affecting a large number of people.

*Pneumonic plague*: plague infections whose organisms predominantly infect the lungs. The disease manifests itself as fever, cough and haemoptysis (spitting blood). Pneumonic plague is an airborne communicable disease transmitted through the air by spitting, talking, sneezing, coughing and shouting.

*Pre-symptomatic transmission*: transmission of an infectious disease to other individuals, when the infected person is still in the incubation period and has yet to exhibit any symptoms.

*Quarantine*: a restriction of the movement of healthy people or animals that may have been exposed to patients or animals with communicable diseases. This is to prevent disease transmission during the incubation period of the disease concerned. Originally for forty days, from the Italian *quaranta* (forty) hence *quarantine*.

*Reassortment*: see also *Antigenic shift*. This typically refers to influenza viruses, which in zoonotic fashion, jump from one species to another. The drastic genomic change which allows this to happen is the process of exchanging a whole segment of the genome with that of a neighbouring virus, in a manner similar to the shuffling of playing cards.

*Reproductive number  $R_0$* : this is pronounced as “R nought”. It is an attempt to quantify the transmissibility of an infectious agent. Generally, when  $R_0$  is  $<1$ , the disease has not been spreading effectively and therefore the outbreak will soon peter out. When  $R > 1$ , the infection will become an outbreak.

*Reservoir*: the natural habitat of an infectious agent. A host animal in which an infectious agent naturally parasitises without causing significant disease, but where the agent may re-emerge from time to time to infect humans and other host animals. Various species of the bat family are found to be the reservoirs for some pathogenic forms of coronaviruses and the Malaysian Nipah virus.

*Swine flu*: types of flu viruses having used pigs as hosts, before jumping the species barrier to infect fowl or humans. Also see H1N1 above.

*Tarbagan*: zoological name: *Arctomys bobac*. Tarbagan is the Russian for a type of marmot, a mammal belonging to the rodent family, found in the Steppes of Siberia and present-day Inner Mongolia. They build nests by burrowing into the ground. In 1911, Dr Wu Lien Teh and other scientists found evidence that they were the reservoir for

the plague bacterium. Hunters who hunted them for food and pelts might have been infected by being bitten by infected fleas parasitizing the tarbagans.

*Transmissibility*: a qualitative description of the ability of an infectious agent to transmit itself from an infected individual to other non-infected individuals.

*Vector*: in infectious disease, refers to insects, such as mosquitoes or fleas, that carry the pathogen from one infected vertebrate host to infect another. Mosquitoes are vectors for the pathogens of malaria, dengue fever, Zika virus, yellow fever and many other infectious diseases.

*Vertebrates*: animals that have backbones or spines, belonging to the *phylum of chordates*, excluding animals without backbones such as shellfish, insects. Examples of vertebrates are cows, deer, pigs, chicken, frogs and bats.

*Virus*: a tiny infectious agent that reproduces inside the cells of a living host. They are even more tiny than bacteria, visible only by electron microscopy. Viruses have no life once they leave a living cell. Those still capable of infecting new hosts are described as “active”, while those no longer infectious, because of disruption of part of their structure, are described as “inactive”.

*Zoonosis, zoonoses (plural)*: an infective agent that change its genes to “jump” from any vertebrate animal species to infect humans. Examples of zoonoses are plague, anthrax, bird flu and swine flu.

