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**WHO Report on Global Surveillance of Epidemic-prone
Infectious Diseases**

World Health Organization

Department of Communicable Disease Surveillance and
Response

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CHAPTER 7

INFLUENZA

Background of the disease

Influenza, commonly known as the flu is an acute respiratory illness caused by influenza viruses A and B. It occurs all over the world and causes considerable morbidity and mortality each year. The name influenza was given by eighteenth century Italians, who blamed the disease on the influence of heavenly bodies.¹ New strains of influenza for which people have no immunity appear periodically, at irregular intervals, causing worldwide pandemics affecting vast numbers of people within short time-spans. There have been 31 documented influenza pandemics, since the first well-described pandemic of 1580, including three pandemics during the twentieth century (1918, 1957 and 1969). The pandemic of 1918-1919 called the 'Spanish flu' was particularly virulent, and killed an estimated 40 million worldwide.

The influenza virus is a complex, constantly changing virus. The physical structure of the influenza virus makes it particularly prone to small surface changes in antigens² during replication, which make it possible for the virus to evade the host's immune system.³ This makes it possible for someone who has already been infected with influenza to become re-infected in subsequent years.

There are two main types of influenza viruses of public health importance,⁴ namely influenza A and influenza B. A minor change in one or both surface antigens (H and/or N) of a virus may cause epidemics, because most people do not have enough antibody protection from past exposure to similar viruses. These small changes are known as antigenic drifts. A major change in one or both surface antigens (antigenic shift) occurs only in type A influenza. This type of change is most probably due to genetic recombination among influenza A viruses. An antigenic shift may cause a pandemic if the virus is easily transmitted from person to person.

Because of the changes in the influenza virus, immunity to flu is short-lived, and therefore large segments of the population are susceptible to influenza every year. Influenza is a seasonal illness in temperate climates. The flu season in the temperate zones is during the winter months – November to March in the northern hemisphere, and May to September in the southern hemisphere. A pie chart showing the influenza isolates from October 1997 to September 1998 and from October 1998 to September 1999 is presented in Fig. 7.1.

Influenza A viruses infect several different animals including pigs, horses, other mammals, and aquatic birds as well as humans, whereas influenza B virus only infects humans. From time to time, influenza A viruses in animals and birds jump species and infect humans. The virus that caused the pandemic of 1918 is believed to have originated in pigs, while the pandemics of 1957 and 1968 are believed to have originated in birds. Places where birds, pigs and humans live in close proximity are thought to play a particularly important role in creating a favourable environment for antigenic shifts and drifts. It is important to have excellent surveillance in such areas.

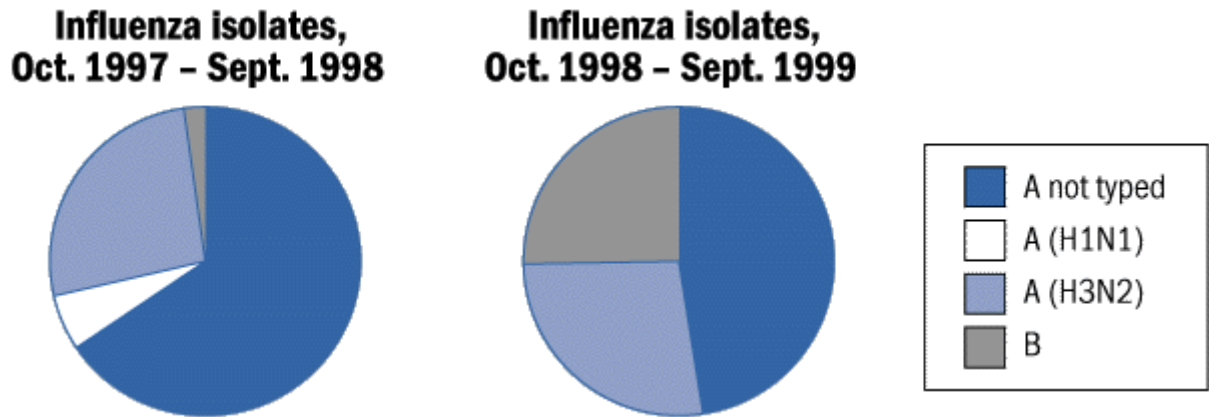
¹ Crosby AW, Influenza. In: Kiple KF. ed. *The Cambridge history of human disease*, Cambridge, Cambridge University Press, 1993.

² Antigens are protein or carbohydrate substances capable of stimulating an immune response.

³ Variations occur when the virus replicates using cells which are infected with two different strains of influenza virus. The replication process for influenza viruses uses the machinery of infected cells to replicate. If two different viruses simultaneously infect the same cell, the result of replication will produce a new virus with characteristics that are a combination of the two original viruses. Thus there is constant reassortment of influenza viruses.

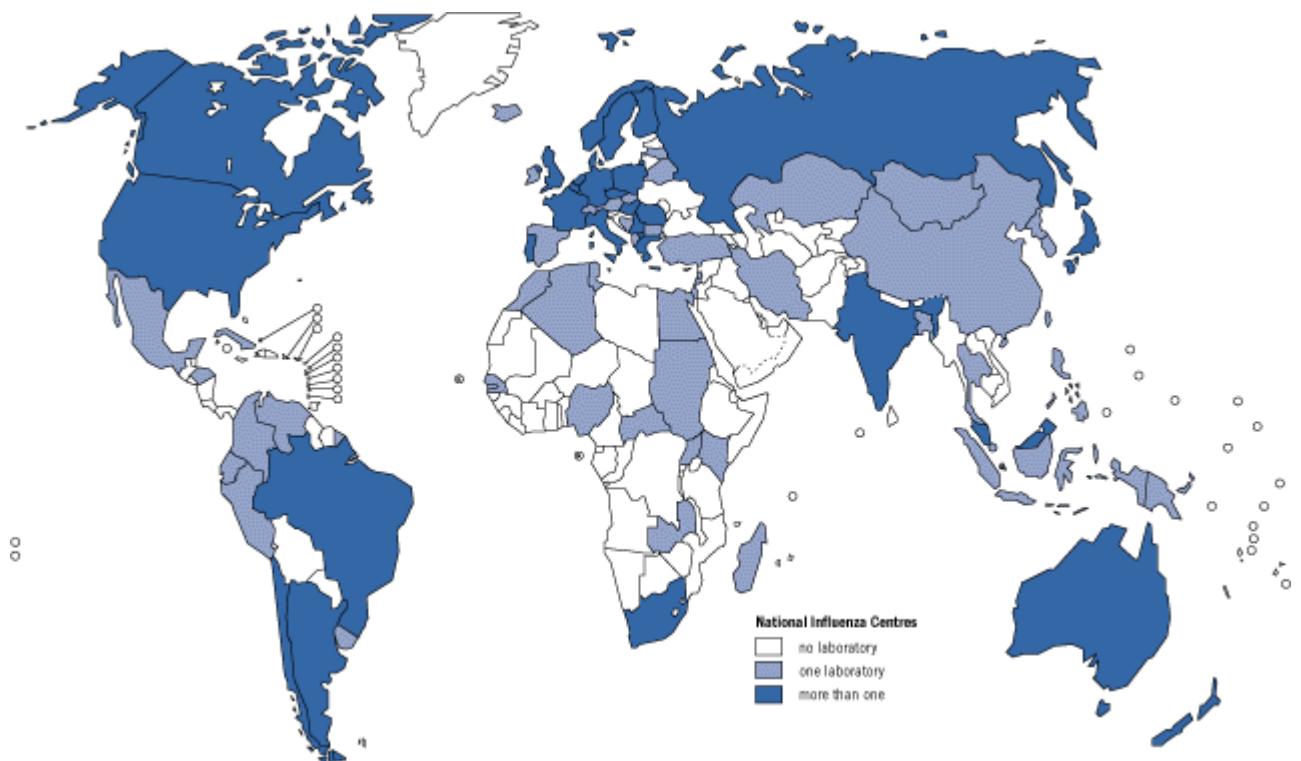
⁴ There is also a type C influenza virus, but this causes a much milder disease not considered to be of major public health importance.

Fig 7.1 Influenza isolates from 1997-1998, and 1998-1999 flu seasons



Symptoms of influenza include fever (often higher in children), chills, cough, sore throat, runny or stuffy nose, headache, muscle aches, and often extreme fatigue. Its spread is primarily airborne, especially in crowded enclosed spaces. Most people recover completely within 1-2 weeks, however, severe complications can occur, particularly in children, elderly people, and other vulnerable groups. Bacterial pneumonia is the most common potentially fatal complication. Viral pneumonia, which is less common but more severe, is another complication of influenza.

Map 7.1 WHO Influenza Surveillance Network, 1999



Vaccination is one of the main influenza prevention methods. However, due to the constantly changing composition of the flu viruses in circulation, the influenza vaccine must be modified each year to match the current viruses. This entails having detailed knowledge about the circulating strains of influenza viruses. In order to do this, an international network for influenza surveillance was created, and WHO became responsible for its administration in 1948. The network now consists of 110 national influenza centres in 82 countries, and four WHO Collaborating Centres for Reference and Research on Influenza located in Atlanta, USA, London, UK, Melbourne, Australia and Tokyo, Japan. The distribution of the network of national centres is shown on Map 7.1.

This network helps to monitor influenza activity in all regions of the world and ensures that virus isolates and information are sent rapidly to the WHO Collaborating Centres for Virus Reference and Research for immediate strain identification. Some collaborating centres also deal with animal specimens. Results from the influenza network are reviewed each February and September, and a recommendation for the antigenic composition of next year's influenza vaccine is made by WHO and passed on to vaccine manufacturers. The recommendations from the February review relate to the composition of vaccines intended for the forthcoming winter in the northern hemisphere, whereas the recommendations from the September review relate to vaccines that will be used for the winter in the southern hemisphere. Table 7.2 presents the recommendations adopted by WHO from 1968 to 2000.⁵

Description of the data

WHO has developed a web-based database called FluNet, (<http://oms2.b3e.jussieu.fr/flunet>) on which data from centres in the influenza network are entered. The data consists of weekly reports of influenza activity in each location, categorized as no activity, sporadic, local, regional and widespread outbreaks. It also includes the numbers of influenza specimens isolated by type, subtype and prototype. There is a cumulative seasonal summary included in the database, providing a description of recent and current influenza activity around the world. The data are geographically referenced at the country level, and charts, maps and tables are available for view on the FluNet website, which has an average of over 4000 hits per day. The database dates from 1997, and it includes data from countries in all continents.

Strengths and weakness of the surveillance system

The WHO network of collaborating centres for influenza is a long-running surveillance system, that has provided important information on strains of influenza since its inception in 1947. The system ensures collection and immediate transport of influenza virus isolates to WHO Collaborating Centres together with epidemiological data for rapid virus characterization, which is the basis of the biannual updated recommendations for vaccine composition. The network has proven to be a reliable and successful system. However, it is important to increase worldwide coverage. There are many countries not included in the network, and other countries where there are too few centres to cover large geographic areas. Particular attention needs to be paid in those areas where animal hosts and humans live in close proximity, since those areas are considered to be the most likely places for new antigenic changes to take place.

Concerning dissemination of data on recent and current influenza activity, the web system has increased the access to information about current and recent influenza activity. In addition, information on current outbreaks of influenza is presented in the *Weekly Epidemiological Record*.

⁵ Until 1998 reviews were held only once a year.

Trends

- Influenza continues to cause considerable morbidity and mortality each year.
- Epidemiological characteristics of influenza viruses, such as attack rate and virulence are unpredictable, and change from year to year.
- There was an epidemic of avian influenza in chickens and ducks in Hong Kong Special Administrative Region, (SAR) in 1997 that was transmitted to humans. Fortunately, the virus did not transmit from person to person, and soon died out after the reservoir of domestic birds was completely depleted by the killing of approximately 1.6 million chickens, ducks and geese by Hong Kong (SAR) authorities. This type of jump in species is not a rare occurrence for influenza viruses and continued vigilance is necessary. The fact that the genetic analysis of this new strain was done in a timely manner is a positive indication for the functioning of the influenza surveillance network.
- The influenza virus constantly mutates, and periodically causes worldwide pandemics to which almost everyone is susceptible.
- No one knows when the next pandemic will occur.

Conclusions

1. The WHO influenza surveillance network is functioning well, but needs to maintain constant surveillance over influenza viruses.
2. Because of the potential of new strains of influenza to cause widespread morbidity and mortality, influenza pandemic planning is of utmost importance. A WHO pandemic plan exists, and its implementation is vital.

References

Publications and Documents

Influenza Pandemic Preparedness Plan. The role of WHO and guidelines for national and regional planning. World Health Organization, 1999, WHO/CDS/CSR/EDC/99.1.

Web pages

The WHO Influenza Programme fact sheet:
<http://www.who.int/emc/diseases/flu/index.html>

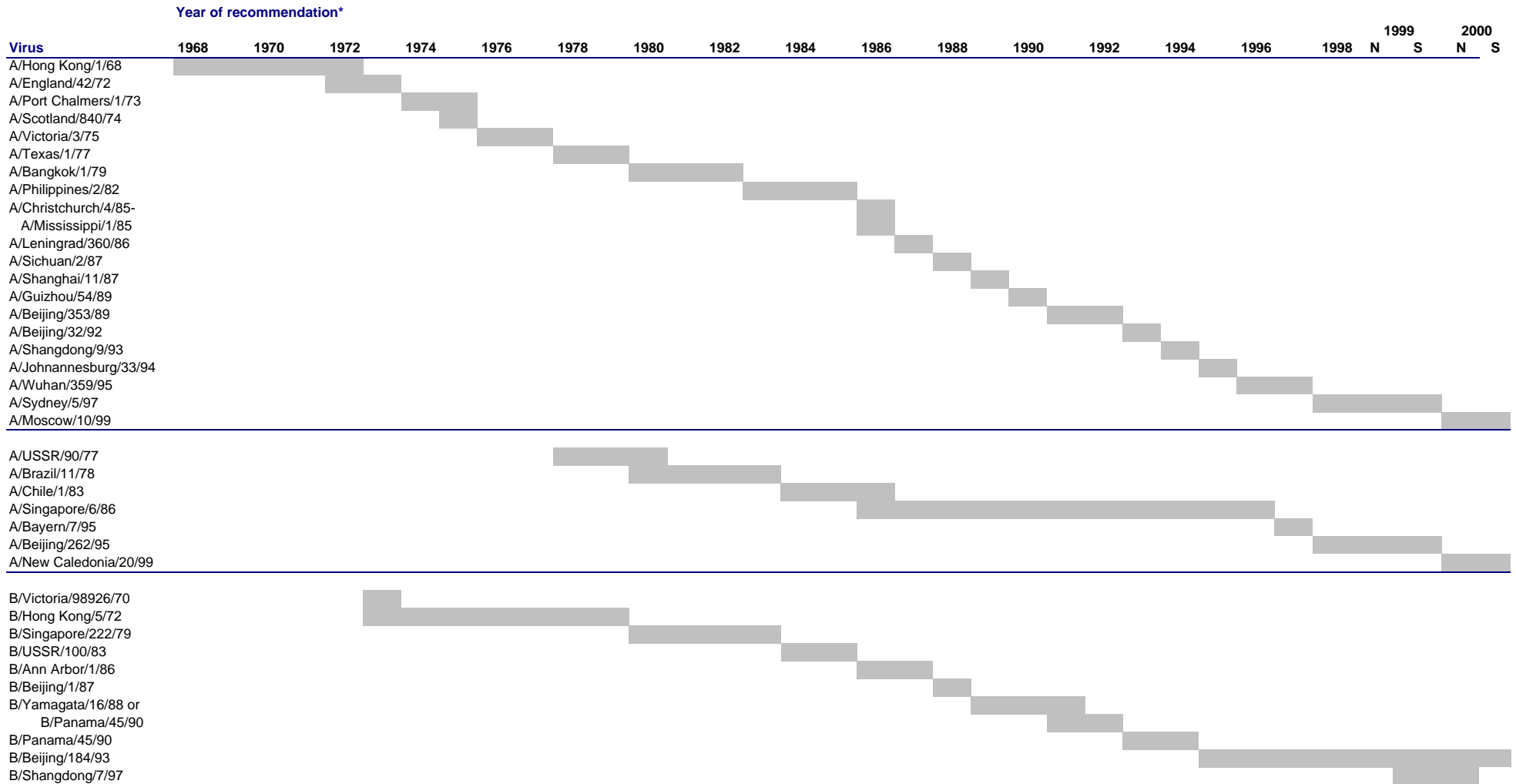
Influenza fact sheet:
<http://www.who.int/emc/diseases/flu/index.html>

Influenza A(H5N1) fact sheet:
<http://www.who.int/emc/diseases/flu/index.html>

FluNet:
<http://www.oms2.b3e.jussieu.fr/flunet/>

WHO influenza web pages
<http://www.who.int/health-topics/influenza.html>

Fig. 7.2 Viruses recommended for inclusion in the influenza virus vaccines, 1968-2000



*Formal WHO recommendations first issued in 1973; beginning 1999 there have been two recommendations per year, one for the northern hemisphere (N) and the other for the southern hemisphere (S).