Table 14.12 Terms Used to Classify Infectious Diseases

Term	Definition
Acute disease	Disease in which symptoms develop rapidly and that runs its course quickly
Chronic disease	Disease with usually mild symptoms that develop slowly and last a long time
Subacute disease	Disease with time course and symptoms between acute and chronic
Asymptomatic disease	Disease without symptoms
Latent disease	Disease that appears a long time after infection
Communicable disease	Disease transmitted from one host to another
Contagious disease	Communicable disease that is easily spread.
Noncommunicable disease	Disease arising from outside of hosts or from opportunistic pathogen
Local infection	Infection confined to a small region of the body
Systemic infection	Widespread infection in many systems of the body; often travels in the blood or lymph
Focal infection	Infection that serves as a source of pathogens for infections at other sites in the body
Primary infection	Initial infection within a given patient
Secondary infection	Infections that follow a primary infection; often by opportunistic pathogens

Importance of Studying Communicable Diseases Epidemiology

- Changes of the pattern of infectious diseases
- Discovery of new infections
- The possibility that some chronic diseases have an infective origin.

Endemic - Epidemic - Pandemic

- Endemic
  - Transmission occur, but the number of cases remains constant
- Epidemic
  - The number of cases increases
- Pandemic
  - When epidemics occur at several continents – global epidemic

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Hyperendemic and holoendemic

- **The term "hyperendemic" expresses that the disease is constantly present at high incidence and/or prevalence rate and affects all age groups equally.**

- **The term "holoendemic" expresses a high level of infection beginning early in life and affecting most of the child population, leading to a state of equilibrium such that the adult population shows evidence of the disease much less commonly than do the children (e.g. malaria)**

Sporadic

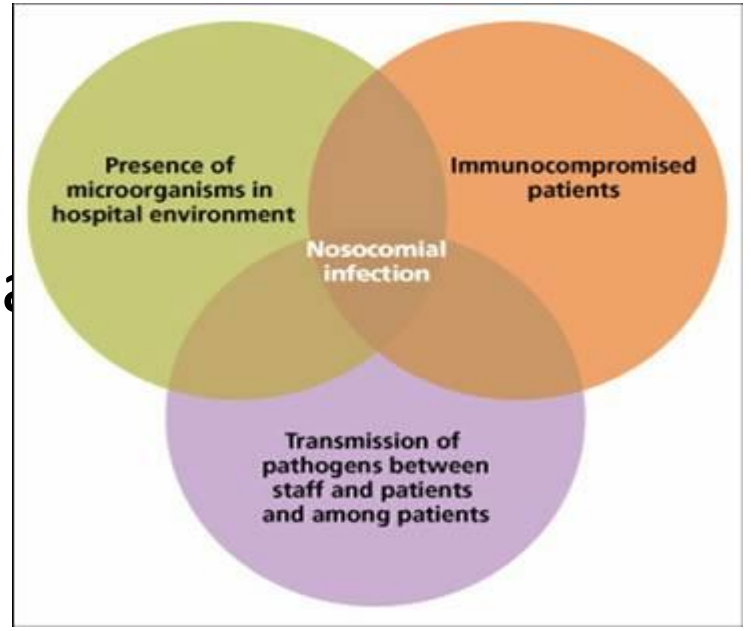
- The word sporadic means “scattered about”.
- Cases - irregularly, haphazardly and generally infrequently.
- Cases - few and separated widely in time and place e.g. polio, meningococcal meningitis, tetanus….
- May be starting point of an epidemic

Exotic

- **Exotic diseases** are those which are imported into a country in which they do not otherwise occur, as for e.g., rabies in the UK, Yellow fever in India

Nosocomial infections

- Nosocomial (hospital acquired) infection is an infection originating in a patient while in a hospital or another health care facility. It has to be a new disorder unrelated to the patient's primary condition. E.g. infection of surgical wounds, hepatitis B and urinary tract infections.

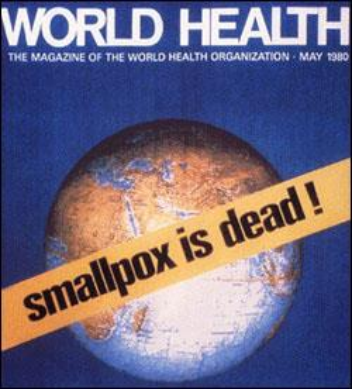


Opportunistic infection

- This is infection by organisms that take the opportunity provided by a defect in host defense (e.g. immunity) to infect the host and thus cause disease.
- E.g., opportunistic infections are very common in AIDS. Organisms include Herpes simplex, cytomegalovirus, M. tuberculosis etc.

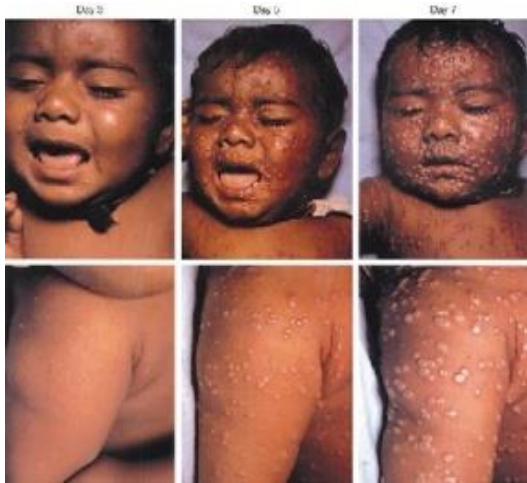
Iatrogenic (Physician induced) Disease

- Any untoward or adverse consequence of a preventive, diagnostic or therapeutic regimen or procedure that causes impairment, handicap, disability or death resulting from a physician's professional activity or from professional activity of other health professionals.
- E.g., hepatitis B infection following blood transfusion.



Eradication

- Termination of all transmission of infection by the extermination of the infectious agent through surveillance and containment. Eradication is an absolute process, an “all or none” phenomenon, restricted to termination of infection from the whole world.



Elimination

- The term elimination is sometimes used to describe eradication of a disease from a large geographic region. Disease which are amenable to elimination in the meantime are polio, measles, leprosy and diphtheria.

Cases

- A case is defined as “a person in the population or study group identified as having the particular disease, health disorder, or condition under investigation”

- **Index Case**
  - Person that comes to the attention of public health authorities
- **Primary Case**
  - Person who acquires the disease from an exposure
- **Secondary Case**
  - Person who acquires the disease from an exposure to the primary case
  - Secondary attack rate

Secondary attack rate

- The number of exposed persons developing the disease within the range of the incubation period, following exposure to the primary case.
- SAR = $\frac{\text{No. of exposed persons developing the disease within the range of incubation period}}{\text{Total no. of exposed / susceptible contacts}}$ **X 100**

Virulence and Case Fatality Rate

- **Virulence**
  - Degree of pathogenicity; the disease evoking power of a micro-organism in a given host.
  - Numerically expressed as the ratio of the number of cases of overt infection to the total number infected.
  - When death is the only criterion of severity, this is the case fatality rate.

- **Case fatality rate**
  - Proportion of infected individuals who die of the infection. This is a function of the severity of the infection.

Case Fatality Rate

$$\text{Case fatality rate (\%)} = \frac{\text{Number of deaths due to disease}}{\text{Number of cases of disease}} \times 100$$

Epidemiologic Triad-Related Concepts

Infectivity (ability to infect)

(number infected / number susceptible) x 100

Pathogenicity (ability to cause disease)

(number with clinical disease / number infected) x 100

Virulence (ability to cause death)

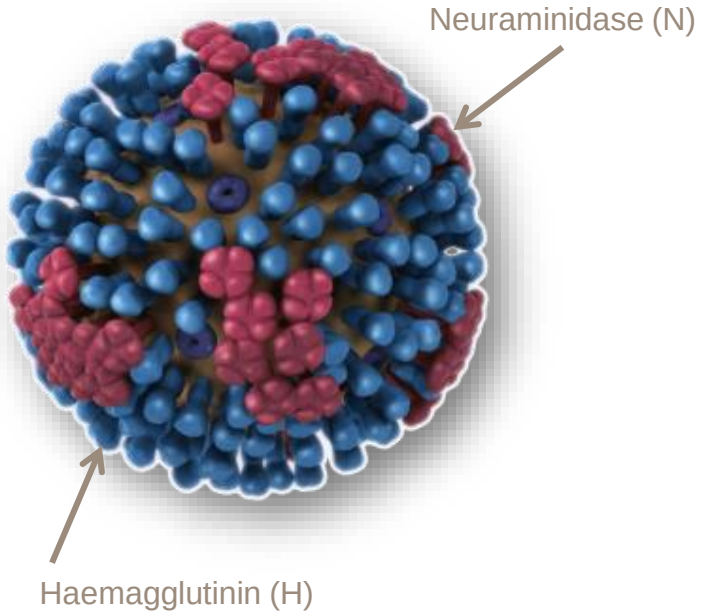
(number of deaths / number with disease) x 100

All are dependent on host factors

Influenza as a cause of disease

- **Type A** influenza virus
  - Affects both humans and animals
  - Divided into subtypes, based on two surface proteins: haemagglutinin and neuraminidase
  - Main circulating strains are H1N1 and H3N2
- **Type B** influenza virus
  - Affects predominantly humans
  - Not divided into subtypes, but split into two lineages: Victoria and Yamagata
- **Type C** influenza virus
  - Rarely reported in humans, and most cases subclinical

Influenza A virion showing the two major surface glycoproteins

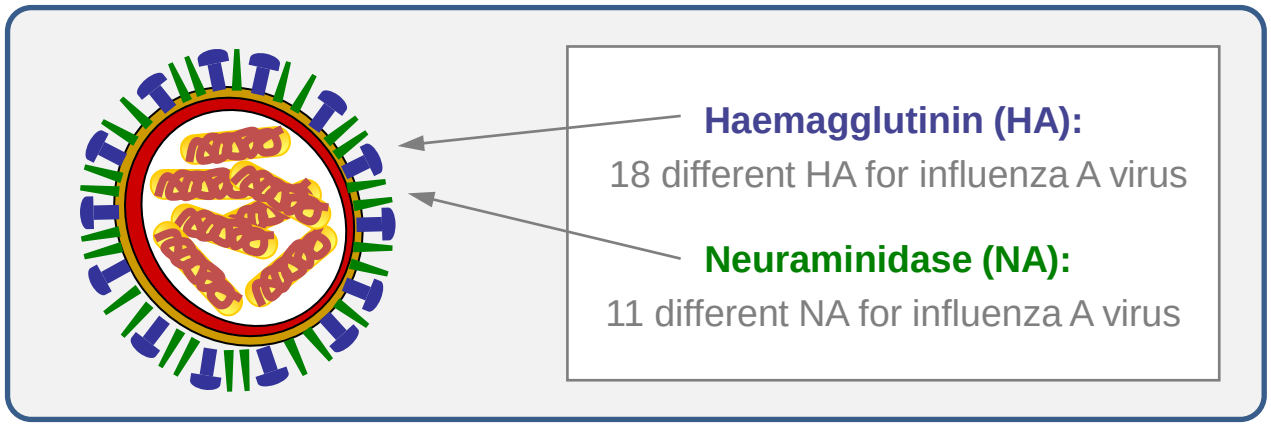


- CDC, Centers for Disease Control and Prevention
US CDC. The pink book: influenza. 2012 (accessed April 2014); Nelson MI, Holmes EC. *Nat Rev Genet* 2007;8:196–205.

Constant and rapid genetic evolution of influenza[1]

Surface antigens of influenza viruses change:

- Antigenic **drift**:
  - **Minor changes** associated with annual outbreaks or epidemics
  - **<u>Impact : updating vaccine yearly to match predicted strains that will be circulating</u>**
- Antigenic **shift**:
  - **Major changes** resulting in new subtype with a new HA protein (and sometimes NA)
  - Can lead to pandemics



Reference: 1. ECDC Fact Sheet for Health Professionals http://ecdc.europa.eu/en/healthtopics/seasonal_influenza/basic_facts/Pages/factsheet_professionals_seasonal_influenza.aspx

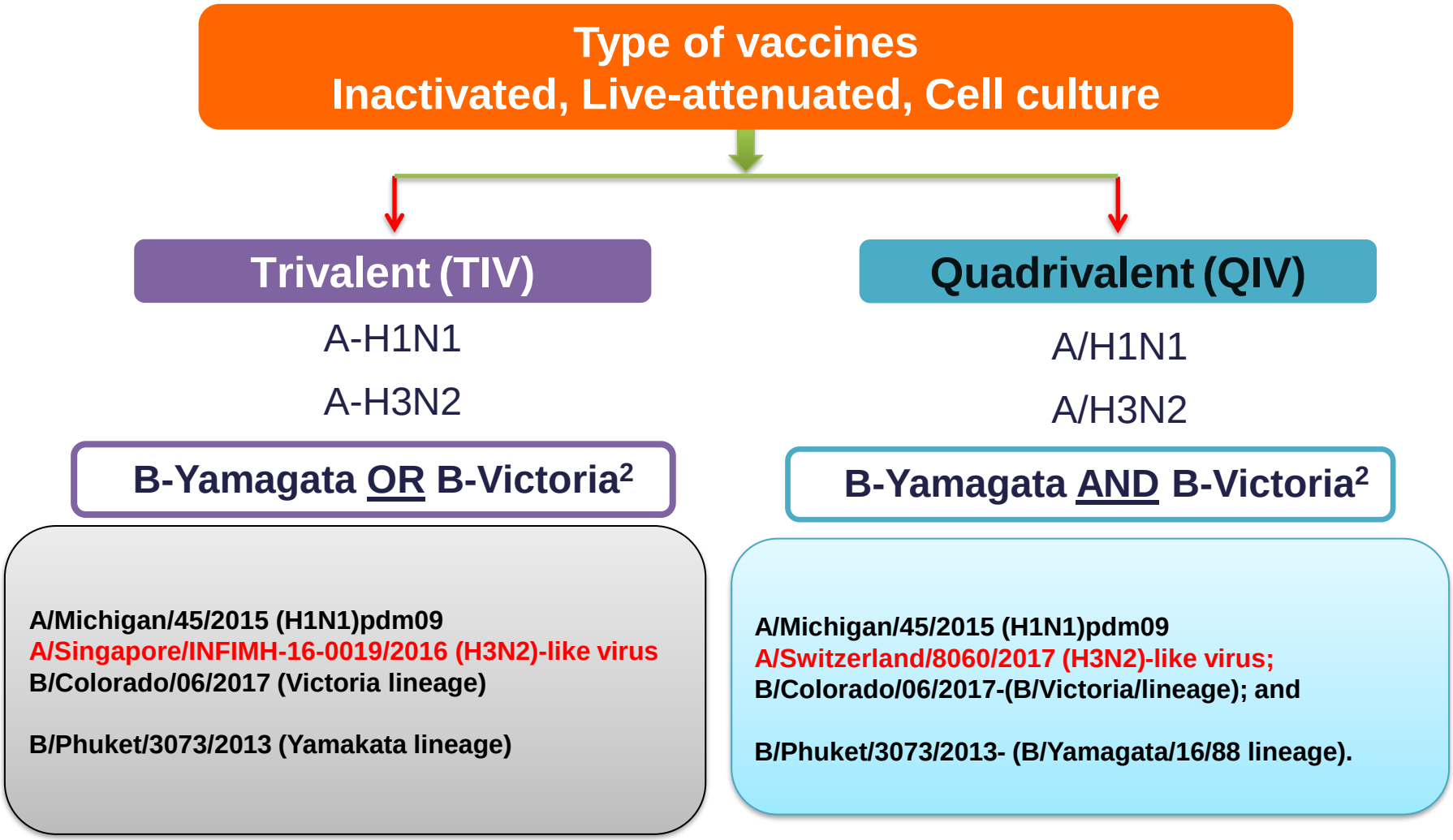
WHO recommendations for influenza vaccination

WHO Recommends[1]

- People at high risk of complications:
  - Pregnant women (highest priority)
  - Children aged 6 months to 5 years:
    - Children aged 6–23 months of age
    - Children aged 2–5 years of age
  - Elderly people (≥65 years of age)
  - People with underlying health conditions (diabetes, asthma, chronic heart or lung diseases, HIV/AIDS)
  - International travelers with any of the above
- People at high risk of exposure and/or capable of transmitting influenza to those at high risk of influenza related complications:
  - Healthcare workers

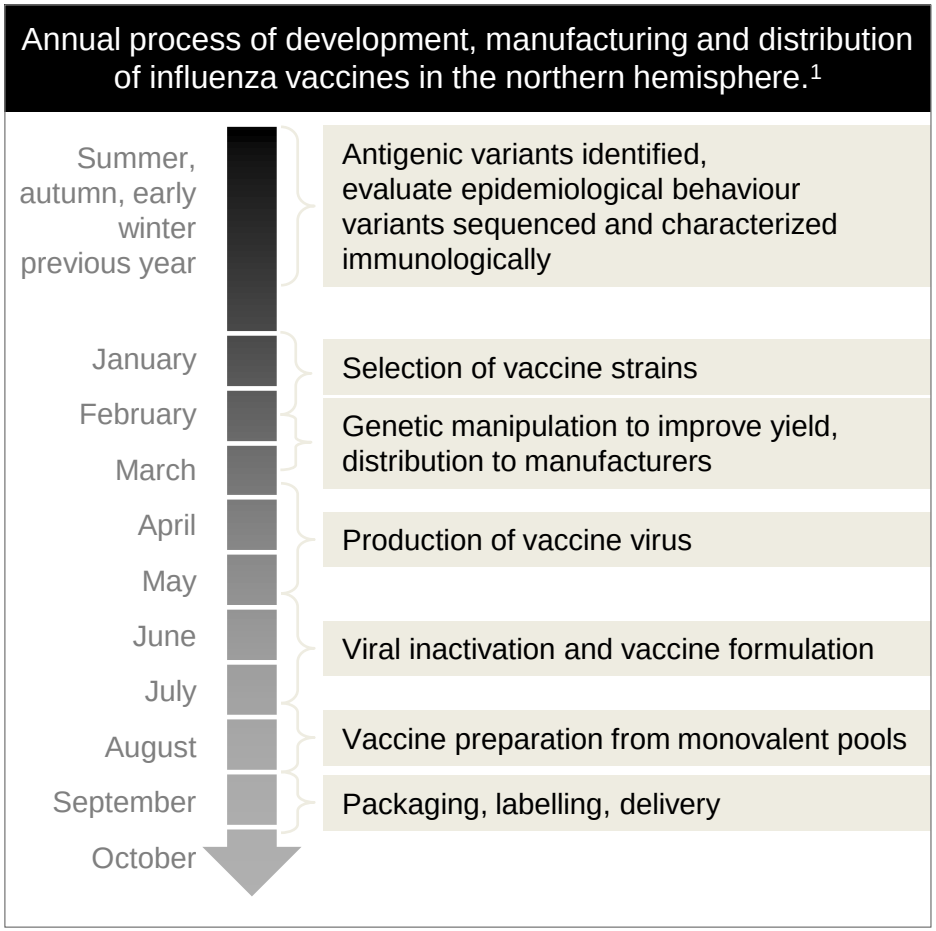
Reference: 1. WHO. Weekly epidemiological record No. 47, 2012, 87(47):461 (http://www.who.int/wer/2012/wer8747.pdf.)

Types of seasonal influenza vaccine



1. ACIP. *Morb Mortal Wkly Rep* 2014; **63**: 691–7; 2. Ambrose CS, Levin MJ. *Hum Vaccine Immunother* 2012; **8**: 81–8; 3. WHO recommendation. Access from http://www.who.int/influenza/vaccines/virus/recommendations/ Last accessed 30 October 2017

Annual process of development, manufacturing and distribution of influenza vaccines in the northern hemisphere

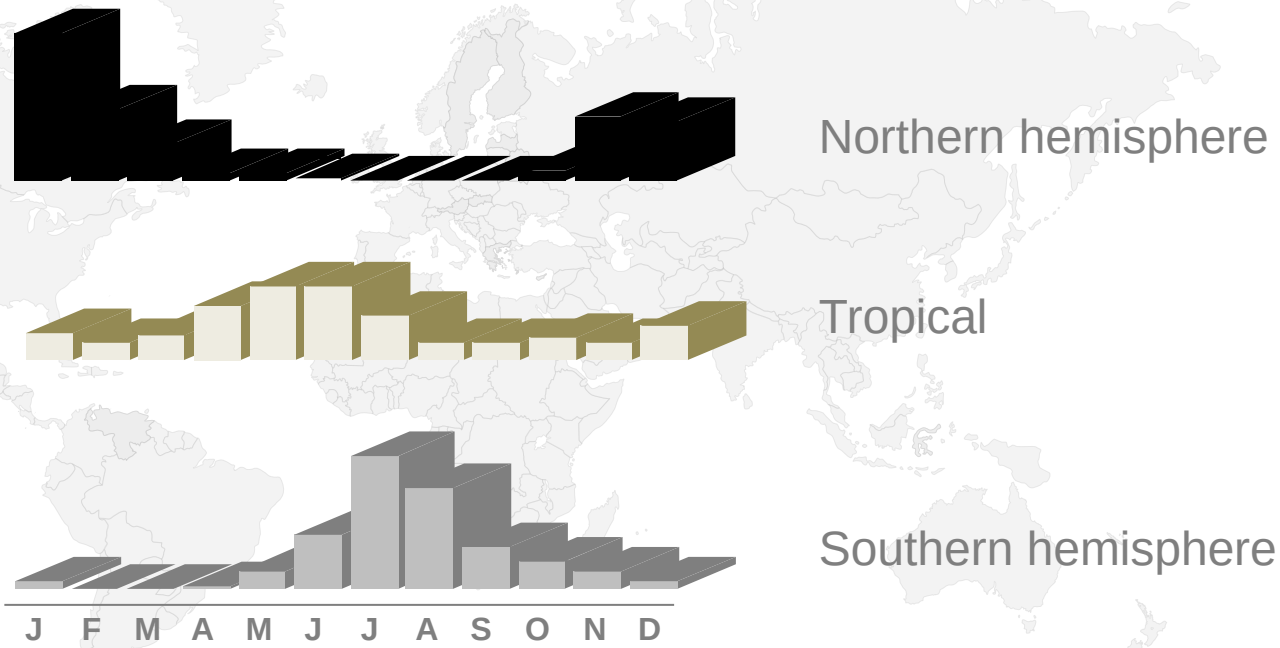


- Since 1999, two vaccine compositions recommended annually:[2]
  - Mid-February – recommendation for the following northern hemisphere
  - September – recommendation for the following southern hemisphere
- WHO provides guidance on which B strain, based on epidemiological data[1]
- The choice does not always reflect the circulating strain in the following season, leading to mismatch[1]

References: 1. Hannoun C. *Expert Rev Vaccines* 2013; 12(9):1085. 2. WHO Weekly Epidemiological Record, No. 40, 2 October 1998, 73, 305 [www.who.int/docstore/wer/pdf/1998/wer7340.pdf]

Influenza seasonality

Influenza activity and occurrence in different climates[1]



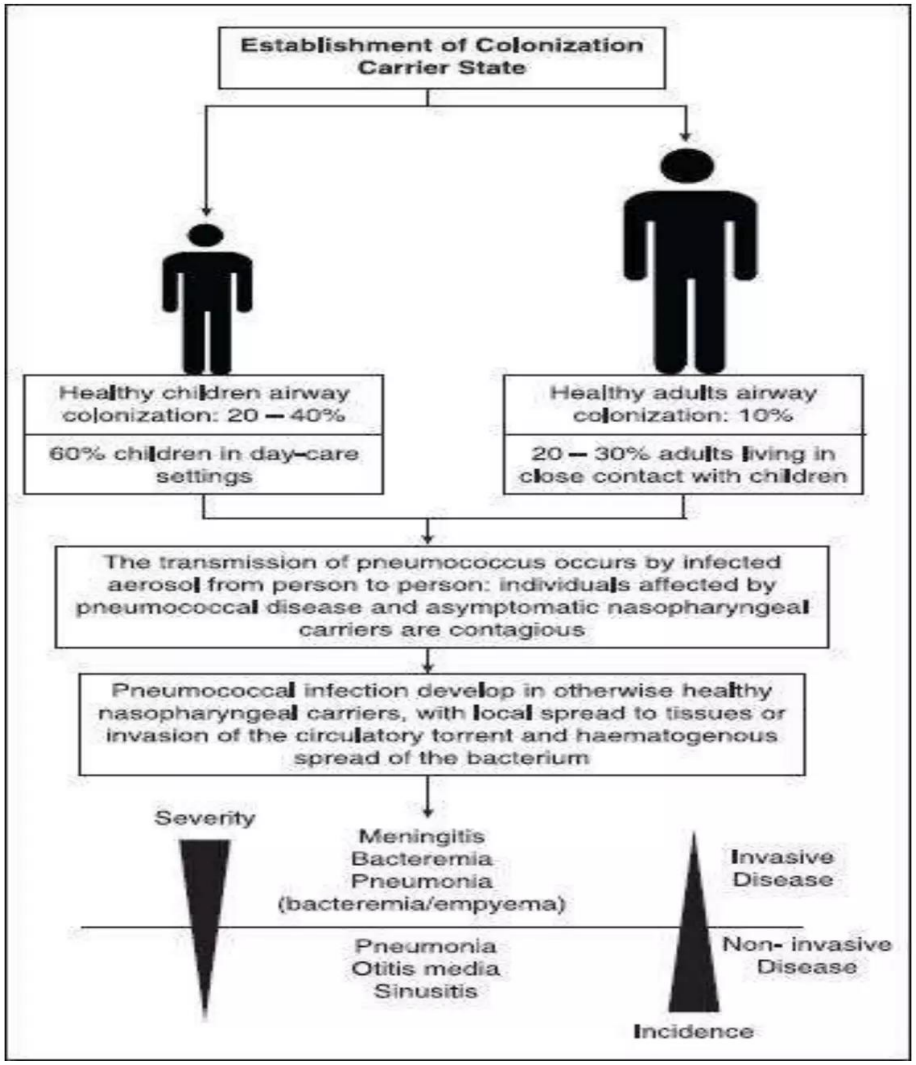
Temperate climates: yearly winter epidemics

Tropical climates: year-round transmission with several peaks

Reference: 1. WHO. Influenza (Seasonal). Fact Sheet No. 211 http://www.who.int/mediacentre/factsheets/fs211/en/

Pneumococcal infections

- Continuous burden


Establishment of Colonization
Carrier State
Healthy children airway colonization: 20 — 40%
60% children in day-care settings
Healthy adults airway colonization: 10%
20 — 30% adults living in close contact with children
The transmission of pneumococcus occurs by infected aerosol from person to person: individuals affected by pneumococcal disease and asymptomatic nasopharyngeal carriers are contagious
Pneumococcal infection develop in otherwise healthy nasopharyngeal carriers, with local spread to tissues or invasion of the circulatory torrent and haematogenous spread of the bacterium
Severity
Meningitis
Bacteremia
Pneumonia
(bacteremia/empyema)
Pneumonia
Otitis media
Sinusitis
Invasive Disease
Non- invasive Disease
Incidence

Pneumococcal colonisation

- Pneumococcal disease may take place when two situations coincide:

1. The host is colonized with a pneumococcal strain against which immunity has not yet been established .

2. An alteration of the natural barriers or host immune system has occurred.

Table 1 - Diseases caused by pneumococcus

Non-invasive diseases	Invasive diseases*
Acute otitis media	Bacteremia
Sinusitis	Bacteremic pneumonia / empyema
Conjunctivitis	Meningitis
Bronchitis	Sepsis
Pneumonia	Peritonitis
	Arthritis / osteomyelitis

* Invasive diseases: isolation of pneumococcus from usually sterile sites (blood, cephalorachidian, pleural or sinovial liquid).

Conditions That Increase Risk for Invasive Pneumococcal Disease

Table 2. High-risk conditions for severe or recurrent pneumococcal disease in childhood and adolescence	
Risk group	**Disease or condition**
Immunocompetent children	Chronic pulmonary disease: severe asthma, bronchopulmonary dysplasia, cystic fibrosis, α1-antitrypsin deficiency, bronchiectasis
	Chronic heart disease, especially congenital cyanotic heart disease or conditions that can lead to heart failure or hemodynamic alterations
	Down syndrome[1]
	Diabetes mellitus
	Chronic liver disease
	Subarachnoid space fistulas
	Children with cochlear implants
Children with asplenia[2] (anatomic or functional)	Sickle-cell anaemia and other hemoglobinopathies
	Congenital or acquired asplenia, or splenic dysfunction
Immunocompromised children[2]	HIV infection
	Primary immunodeficiencies (excluding isolated IgA deficiency)
	Chronic kidney failure and nephritic syndrome
	Diseases that require treatment with immunosuppressive drugs or radiotherapy (including leukaemia, lymphoma, bone marrow or solid organ transplant)

ACIP risk groups for pneumococcal infection

- (ACIP) recommends vaccination of:
  - All adults aged 65 years and over
  - Adults aged 19-64 years with the following underlying medical conditions:

1- Immunocompetent persons
- Chronic heart disease
- **Chronic lung disease**
- Diabetes mellitus
- Cerebrospinal fluid leaks
- Cochlear implant
- Chronic liver disease
- **Cigarette smoking**

2- Functional or anatomic asplenia
- Sickle cell disease
- Splenectomy
- congenital or acquired asplenia

3-Immunocompromised persons
- Congenital or acquired (HIV) immunodeficiet
- C R F & Nephrotic
- Leukaemias & Lymphomas
- Generalised malignancy
- *Diseases treated with immunosuppression(steroids >1 m or Biologics*
- Solid organ transplantation

1. Centers for Disease Control and Prevention. MMWR. Prevention of Pneumococcal Disease. ACIP Recommendations 2010;59:1102–1106.

Incidence of IPD in Adults Aged 18-64 Years with Selected Underlying Conditions, United States, 2009